Risky business: Moral arguments against the Nuclear Waste Policy Act Amendments of 1987 Can consent be engineered?

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RISKY BUSINESS: MORAL ARGUMENTS AGAINST THE NUCLEAR
WASTE POLICY ACT AMENDMENTS OF 1987
CAN CONSENT BE ENGINEERED?

by

Mary Manning Whitaker

A thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Arts

in

Ethics and Policy Studies

Institute for Ethics & Policy Studies
University of Nevada, Las Vegas
May 1995
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ABSTRACT

Risky Business: Moral Arguments Against the Nuclear Waste Policy Act Amendments of 1987, Can Consent Be Engineered? asks the moral and ethical questions of assigning risk. In a democracy a fundamental principle for imposing risk is obtaining the consent of the governed. In the case of a proposed high-level nuclear waste repository at Yucca Mountain, Nevada, Congress has ignored this basic principle. An unwilling population in a politically weak state has been forced to bear the burden from highly radioactive spent fuel from nuclear power reactors operating in the majority of states. The State of Nevada does not reap the benefits from nuclear power generation and does not operate a nuclear reactor. Should a single state bear the current and future impacts and costs from such an unwanted risk? Is there a democratic solution to nuclear waste management?
Dedicated To Larry and Michelle

Who Spread My Wings
"The mountain breathes."

Daniel Dreyfus, Director
Office of Civilian Radioactive Waste Management
Las Vegas SUN, November 14, 1994

They call it regional, this relevance --
the deepest place we have: in this pool forms
the model of our land, a lovely one,
responsive to the wind. Everything we own
has brought us here: from here we speak.

William Stafford
Poet
`Lake Chelan'"
After covering the nuclear waste management issue as a journalist for more than two decades, I began to focus on the approach to high-level nuclear waste taken by the United States government as the subject for a Master’s Degree thesis in Ethics and Policy Studies at the University of Nevada, Las Vegas. The research has been disturbing, especially Congressional action on the Nuclear Waste Policy Act Amendments of 1987. The focus of my thesis for the degree program concerns the moral and the ethical issues surrounding these actions that led to the proposed Yucca Mountain repository.

Specifically, the Nuclear Waste Policy Act Amendments raise the basic issues of equity concerning whether a risk is imposed or one that is voluntary, and the issue of states’ rights. The Amendments pose a threat in each area. The first question here is whether a risk, such as a high-level nuclear waste repository, is voluntarily accepted or whether it is involuntarily imposed. The land designated for the repository is claimed by the Western Shoshone Indian Tribe and affects
23 other tribes. Under the original Nuclear Waste Policy Act and its Amendments, the tribes must be treated as sovereign nations and their voices heard in deliberations on the repository. To date, the tribes believe they have been ignored by the U.S. Department of Energy (DOE) and could sue the federal government as affected governments. The Indian peoples do not want this risk, and a majority of Nevada residents, nearing eighty percent, do not want the repository which is on a site owned by the public today (Bureau of Land Management and the U.S. Air Force). Since Nevada has no nuclear power plants, and neither do any of the Tribes, nor do they wish to accept the burden of radioactive waste, the repository is a discriminatory risk. However, this is hardly the first time in American history that the federal government has forced unwanted burdens on a state (for example, the Emancipation Proclamation).

As Dr. Arjun Makhijani, Ph.D., President of the Institute for Energy and Environmental Research in Takoma Park, Maryland, pointed out in remarks before the Committee on the Technical Basis for the Yucca Mountain Standards (a panel of the National Academy of Sciences) the imposition of risk on tribal peoples should be considered under President Clinton's February 11, 1994 Executive Order on Federal Actions to Address Environmental Justice In Minority Populations and Low-Income Populations. The threat from an involuntary risk must also consider the global population.
impact from the radioactive gas Carbon-14, released from an unsaturated repository. Yucca Mountain, Nevada was the only unsaturated site considered in the nation as a high-level nuclear waste repository. It failed to meet the standard for radiation in the air set by the federal Environmental Protection Agency. Congress has sent the issue to the National Academy of Sciences, in an effort to force an acceptable standard for Yucca Mountain, which is the only location under consideration as a high-level nuclear waste repository. Furthermore, any radiological safety standard, in regard to involuntary risk, must also consider future generations, who will inherit the waste residues. (Makhijani, Dr. K.S. Shrader-Frechette).

Since Nevada is a state, it enjoys certain sovereign rights under the U.S. Constitution. Congress established a veto for a state chosen as the site of a high-level nuclear waste repository in the original Nuclear Waste Policy Act of 1982. That veto remained intact in the 1987 Amendments, but it is considered by political experts easy to override with a two-thirds vote of Congress. That raises a second moral issue, the limited participation in the decision-making process by the State of Nevada. The financial benefits are capped in the Amendments, thus appearing more a bribe than an incentive.

In 1990 the State of Nevada sued then-Energy Secretary James Watkins. The heart of Nevada’s argument was that
Congress did not have constitutional authority to enact the 1987 NWPA Amendments, which created a conflict between the Property Clause and the Tenth Amendment. The Ninth Circuit rejected Nevada’s argument, because Yucca Mountain is on federal land. However, the Ninth Circuit did recognize that the federal government’s authority is limited (Ninth Circuit Court decision, 1991). The heart of Nevada’s argument rests in the Tenth Amendment, since the court rejected the state’s five other arguments, including Equal Footing. The state’s claim lies in the policy process, since Nevada was singled out in the 1987 Amendments to accept a burden from forty-nine other states. The federal government assumes all accidents or externalities will only occur on federal land, i.e., the Yucca Mountain site. Aside from the safety issues, Nevada will bear both socio-economic and psychic burdens of having the repository within its borders, and it will suffer these risks involuntarily.

The third issue centers on the argument made by the federal government that a high-level nuclear waste repository solves the problem for future generations. This is neither ethical nor moral. That claim ignores future advances in technology, future use of the so-called "wastes" for beneficial purposes, and future threats to the environment from the buried radioactive materials. (Shrader-Frechette) The issues that Nevada has raised so far pose a legitimate question as to the scientific process through which Yucca
Mountain was chosen and the coercion federal officials and agencies applied to the state itself. Former DOE geologist Jerry Szymanski criticized the site as flawed because it could allow upwelling water deep in the Earth to enter the repository. A June 29, 1992 earthquake at Little Skull Mountain, about ten miles from Yucca Mountain, raised further scientific questions about the safety of the site. And the U.S. Geological Survey has discovered major earthquake faults, namely, the Ghost Dance and Sundance fault zones, crisscrossing the repository site. At this time the safety issue has not been resolved either scientifically, or to the satisfaction of a skeptical public.

In the management of nuclear wastes, Congress turned a scientific process into a politically risky decision that has not and cannot be proven sound. In addition, the public does not trust the Department of Energy, either those living in Nevada or in other states. The Ninth Circuit Court decision did not claim that Yucca Mountain was good for a repository, merely that the federal government had the right to be in Nevada to study the site.

To acknowledge those who have been thoughtful enough to contribute and comment on this work, I wish to begin by recognizing the Greenspun family -- Barbara, Brian, and Danny -- who so generously allowed me to pursue this subject at a depth unheard of in modern journalism; former Governor Mike O’Callaghan, who kept my resolve intact; Dr. Hal Rothman, Dr.
Dina Titus and Dr. Richard Soule, who nursed the author and the chapters through each revision; James Flynn; Roger Kasperson; Paul Slovic; Kai Erikson; Donald Weigel; Dr. K. Shrader-Frechette; Dr. Alan Zundel, all of whom gave so generously of their time, and Dr. Craig Walton, the mentor who helped give the words wings, and last, but by no means least, my long-suffering and always loving family.

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May 1995
TABLE OF CONTENTS

ABSTRACT ....................................................iii
ACKNOWLEDGEMENTS ..........................................x-xi
CHAPTER 1 INTRODUCTION .....................................1
CHAPTER 2 A BRIEF HISTORY ....................................34
CHAPTER 3 THE MYTHOLOGY OF TECHNOLOGY .....................64
CHAPTER 4 AN ANALYSIS: ETHICAL PROBLEMS ....................97
CHAPTER 5 CONCLUSION: ALTERNATIVE APPROACHES ............122
BIBLIOGRAPHY ................................................160
CHAPTER I
AN INTRODUCTION

Although the United States has recognized the problem of containing, storing, and disposing of nuclear wastes since the mid-1950s, it was not until the 1980s that Congress chose to act on a final solution to its radioactive enigma. First, elected officials outlined an avenue for low-level radioactive wastes, most produced by hospitals, universities, laboratories and, to a lesser extent, from nuclear power reactors, by passing the Low-Level Nuclear Waste Policy Act during 1980. Then two years later the Congress proposed the Nuclear Waste Policy Act based on deep geological disposal for the most radioactive substances produced during nuclear power generation, spent fuel rods. Yet, as this thesis attempts to discover, thirty years after the federal government began to consider solving the problem of nuclear wastes, progress has faltered in a quagmire of politics, bureaucratic bungling, overwhelming costs, and science engineered by the abuse of the political process. After the 1987 Amendments were approved by Congress, the democratic principles and the usual accompanying struggle to reach a
decision evident in the 1982 Act had been cast aside. While the issue appears to be pragmatic and utilitarian on the surface, our nuclear waste management policy has failed because the Congressional process ignored fundamental moral and ethical principles, namely, discourse, equity, and human rights.

Current federal actions taken for the management of high-level nuclear waste have failed since the demise of the 1982 Act. These actions can be considered a failure because they have been plagued by public opposition, conflict between branches of government, poor management, unanswered scientific questions and concerns, and exorbitant costs. Congress believed the entire process of characterizing three sites, two at federal installations existing for nuclear weapons development, could be accomplished for less than $1 billion per site. By 1987 the DoE’s program managers estimated spending nearly $2 billion per site. To date, the DoE has spent $3 billion on Yucca Mountain alone, and estimates it will cost more than $6 billion to decide if it is suitable. As this thesis and other critics are attempting to explain, there are problems with the program from the beginning which never were resolved.

When Congress enacted the 1987 Amendments, there was no time provided to consult with Nevada, the state in which the Yucca Mountain site is located, or with the public at large who will live with trucks and trains loaded with spent
nuclear fuel passing their homes and businesses for more than thirty years, if Yucca Mountain in Southern Nevada is declared suitable. The 1987 Amendments were passed by Congress as part of an essential omnibus bill at the very end of the session. Nevada senators and representatives did not have the political power or the time to stop a major piece of legislation, namely the nation's budget, at the time the Amendments were tacked on to the bill. There were no public hearings or extensive public debate in the usual manner of major legislation. The Amendments, in addition to narrowing investigation to one site, canceled a search for an interim storage facility and a second repository site in the eastern states under the "geographical equity" contained in the 1982 Act.

The Yucca Mountain program is a troubling and high-risk effort if one views it in the most optimistic light. "The federal government is gambling that the tuff mountain, 90 miles northwest of Las Vegas, will be suitable," (1) and then accepted by the U.S. Nuclear Regulatory Commission which must license the facility. Although it is possible the DoE will be successful, serious problems stand in the way of progress toward opening a repository under the current process and there is no alternative site for the federal government to develop in case Yucca Mountain fails. Since the U.S. Department of Energy has no backup plan, it must return to Congress for new instructions on managing nuclear waste if
Yucca Mountain fails. Taking a practical view and a recent glance at the history of U.S. nuclear waste management, this would mean starting over, a process that could take several decades as another site is chosen, studied, and developed with no guarantee under the present system that there will be less public opposition. Certainly, if Yucca Mountain fails, there will be even more reason for the public to distrust the DoE, other federal agencies involved with nuclear waste management, and the nuclear industry itself.

State of Nevada officials and others have believed that the DOE and its allies in the nuclear energy industry and Congress will force the state to accept a high-level nuclear waste facility at Yucca Mountain, although state residents are overwhelmingly opposed to it. Even if this strategy works, and a repository or monitored retrievable storage facility is located at Yucca Mountain, there is a trail of evidence [scientific, economic and ethical] that the public policy has been a failure. How could such a program be considered successful if: 1) A repository was built at excessive cost to both ratepayers and taxpayers (through use of defense funds); 2) After a long and bitter struggle between governments at all levels; 3) In opposition to community, state, and public values for a fair and equitable process and outcome, rather than with a volunteer site; 4) If a special set of environmental, health and safety rules had to be improvised or ignored to uniquely qualify a site that
otherwise would be disqualified; and 5) With public trust eroded in federal government's management of technological hazards based on this example? These are the major concerns of this thesis and of such critics as the General Accounting Office, the Nuclear Regulatory Commission, and independent consultants working for and independently of the State of Nevada.

Since the first nuclear weapon exploded in New Mexico's desert on July 16, 1945, the federal government has claimed the exclusive right to regulate radioactive activities, especially nuclear wastes. With its long and exclusive history in nuclear weapons production, testing, nuclear power generation and radioactive waste management, the federal government can be viewed as the major player in attempting to build a high-level nuclear waste facility. In contrast, whenever the question of a site for such a facility has been raised, affected states and communities have opposed all efforts adamantly. State and local opposition is based on public opinion, perceptions, and attitudes in deep opposition to living, or even visiting, near a radioactive waste facility, especially a repository.

The heart of the public policy problem in nuclear waste management lies in the inherent opposition by the public, state governments, and local communities to the federal approach imposed upon them. That opposition is based on a number of legitimate concerns, especially risk assignment.
They include controlling health and environmental hazards from radiation exposure; distrust of the DoE, as well as other federal agencies assigned to regulatory oversight, the nuclear power industry, and the Congress; and a belief that project proponents are unwilling to address a range of potentially serious socioeconomic impacts, such as the stigma a host area [Nevada as wasteland] would bear by becoming the nation’s nuclear waste repository, or even by becoming a corridor for shipments of nuclear waste for more than thirty years, (the length of time the proposed repository will be able to accept high-level nuclear wastes).

Resistance to the federal government’s approach to nuclear waste management began almost as soon as the ink had dried on the Act, signed into law by President Reagan on January 7, 1983. The law created the Office of Civilian Radioactive Waste Management (OCRWM), which by 1987 had lost the public’s faith and trust due to a number of reasons. For example, potential first round states were located mostly in the West, and were limited to those already under investigation by the DoE. They were included in the original Act to meet a demanding and optimistic schedule to complete the first repository by 1998. In May 1986 the DoE winnowed the sites to Nevada, Washington, and Texas for formal site characterization. Three possible sites in Tennessee were identified for a Monitored Retrievable Storage (MRS) facility. The second-round eastern sites included preliminary
identification of 235 sites with an eventual narrowing to 20 locations in seven states: Wisconsin, Minnesota, Maine, New Hampshire, Virginia, Georgia, and North Carolina.

These three elements — how the first-round sites, the MRS sites, and the second-round sites were selected — were opposed by the states and the public. The final three sites selected for the first-round repository concentrated this criticism and focused it on the DoE decision-making process. Two House subcommittees discovered several documents from the DoE files, including draft DoE methodology reports and the energy secretary's recommendation to the president. After review, subcommittee leaders wrote to Secretary of Energy John S. Herrington, accusing the DoE of manipulating data and analytic techniques leading to a "predetermined set of sites," and "tailored the methodology report to justify the final decision." (2) Herrington denied any manipulation.

In early 1986, about 18,000 people attended public briefings and hearings on the second-round sites, and more than 60,000 comments were offered to the DoE for review. Congressional office holders from the seven second-round states running for re-election in 1986 felt threatened by association with the second-round selection process. DoE suspended further work on these sites in May 1986, explaining that revised and lower forecasts for high-level nuclear wastes meant that a second repository could be delayed. The head of the OCRWM said that politics was not a part of the
decision. (3) But internal DoE documents specifically identified "immediate political relief" as an important benefit of ending the second-round site work, so it appears there was duplicity from the start.

The widespread failure of relations between federal and state governments emerged during these early years of the program. States filed numerous lawsuits against the program. This legal barrage in the courts was followed by more suits filed by public advocacy, community-based, and industry groups. In 1986 the U.S. General Accounting Office began to include a listing of legal actions with subsections in its quarterly reports to Congress. At one point more than 20 cases were active. (4)

A number of other problems surfaced by 1987. The DoE's management and administration of the program was widely considered to be inadequate. The OCRWM reorganized in July 1984, and continued top level changes in September 1985, according to the GAO quarterly reports, reassigning responsibilities and revising administrative lines of reporting. The organization continued changing in 1986 and 1987. The GAO reported that the reason for the slow progress was that program officials said they had a difficult time hiring personnel meeting quality standards, partly blaming it on the non-competitive federal salary schedule.

Then the DoE's schedules began to slip. The Mission Plan, intended as the guide for the entire program, was
delayed from August 1984 to July 1985. By April 30, 1985, President Reagan followed a DoE recommendation and exercised an option to combine defense high-level nuclear wastes with those from civilian nuclear power reactors as part of the OCRWM program. In effect, by putting all U.S. nuclear eggs in one basket, this action put the program into isolation as the lone avenue for solving the high-level radioactive waste problem. Combining waste streams makes sense because the DoE is responsible for both defense and commercial wastes, and it focused the federal agency on a single program, instead of two separate directions, both time- and cost-consuming. The combination did compound the problem because some defense wastes are liquid and must be treated and solidified before geological burial can take place. In addition, complexity reigned in the DoE’s nuclear waste management program. Besides a lack of flexibility of scientific alternatives to disposing of the radioactive materials, there was no provision for exploration of alternative sites or methods for storage and disposal.

However, in the public mind, the weapons’ radioactive waste linked with commercial nuclear spent fuel rods left a poor impression as past practices at government weapons installations across the country became sensational headlines. Hanford, Washington. Fernald, Ohio. Nevada Test Site. Rocky Flats, Colorado. Savannah River, S.C. Detailed news accounts following radioactive releases, deliberate and
accidental, during the Cold War were uncovered by "Tiger Team" experts sent in by then Energy Secretary Retired Admiral James Watkins. The media focus on the secrecy of the events and the poor handling of radioactive, hazardous and toxic liquids, solids, and dust at the facilities eroded public confidence further, damaging the DoE's claims that it provided the most technically advanced means to manage all things radioactive.

Then the issue of quality assurance emerged as a major stumbling block to the way the DoE was overseeing its contractor work. The NRC warned the DoE in 1985 that its quality assurance plan did not meet regulatory requirements, followed by warnings in 1986 and 1988, according to the GAO reports. By 1987 the DoE had issued stop-work orders to its major contractors, such as the national laboratories, the U.S. Geological Survey and private managers and consulting companies. The DoE then rescheduled opening its first repository from 1998 to a target date for initiating operations in 2003 and full operations by 2008. The original optimistic repository schedule had been approved by Congress in the 1982 Act, so rescheduling the opening indicated another DoE management failure. It also underscored the DoE's pending failure to accept high-level nuclear wastes in 1998, based on the 1982 Act and contracts the agency had signed with nuclear utilities in 1985. The DoE had also failed other mandates within the Act, such as negotiating cooperation and
consultation agreements with potential host states. These contracts have never been negotiated.

The DoE also faced other problems, such as the states' role in program oversight and decision processes, written into the original Act by Congress. The steps desired by Congress were written vaguely and have remained vague. The GAO report for 1987 minimized the DoE's decision to abandon the search for a second eastern repository site, but in the midst of elections, this decision appeared to protect the political interests of populous eastern states under consideration as repositories, while treating states in the West as colonies. This particular decision clearly angered political leaders in the three western states with sites selected in the first round for study.

The DoE alone cannot be blamed for its limitations, culture, history, and public reputation. The real failure of the nation's nuclear waste management is rooted in congressional policy that failed to approach its task with a realistic schedule, experimental science, sensitivity for public opinion, failure to realize the public's hostility to the DoE's roots in secret nuclear weapons development, and the limits imposed by such widespread opposition in a democratic form of government.

The first failure of the original policy decision in 1982 is the lack of authority provided to states, tribes, and other major players to participate in major program
decisions. While Congress mentioned these participants in the Act, it failed to relinquish any decision-making role to other than federal authorities or propose a clear-cut avenue of participation for affected parties. Those authorities included Congress, the DoE, the EPA, and the NRC, but do not include affected parties such as sited states, corridor states, communities or Indian tribes. While the state selected as a permanent repository site has a veto, its exercise is an act of frustration for a sited state, since the veto can be overcome with a two-thirds majority vote of the Congress. Thus, the final decision, it was clear after the Amendments were passed, rested with Congress.

Second, Congressional representatives from the beginning relied on an optimistic and unrealistic schedule to accomplish a task to solve a problem that was three decades old when faced. Scientific studies, in the case of a project such as a high-level nuclear waste repository, are experimental at best and filled with uncertainties. The Congress chose to ignore the scientific process with its uncertainties inherent in such experiments for expediency and a political solution to an ongoing problem which will not disappear in a political lifetime, or in most lifetimes of existing nations.

Third, the Congress misread the public's opposition to its mandate for the DoE to manage the high level nuclear waste program. Representatives believed the public would
accept the original law, but when it failed by 1987, the Congress then chose to ignore a solution, namely, an in-depth review to examine the experiences of successful opposition by first-round and second-round states selected, as well as those opposing the MRS project. By failing to address its own weaknesses, strengths, and mistakes in formulating the original Act, Congress perpetuated its errors in judgment.

Not everyone balked at a second opportunity to revisit the first policy and write a new law when 1987 came. Representative Morris Udall of Arizona proposed a moratorium on the repository program and a thorough policy review by Congress. By halting the program for eighteen months to two years, a significant delay in finding a solution for nuclear waste loomed. On the other hand, by modifying the 1982 Act in some way, the program could be resurrected without delay. Senator J. Bennett Johnston of Louisiana, author of the 1987 Amendments, chose the second approach. Since Nevada is a politically weak state, with less clout than either Washington or Texas, selecting Yucca Mountain as the lone study site was not surprising. Congressional members such as Johnston also believed Nevada residents would be easier to convert than those of other states because of the thirty-year history of nuclear weapons experiments at the Nevada Test Site.

A most important change brought by the proposed Amendments to U.S. nuclear waste policy was the selection of
Yucca Mountain as the single study site. By terminating all work at Hanford, Washington and Deaf Smith County, Texas, Congress instructed the DoE to return for further directions only if the Nevada site fails. A second repository east of the Mississippi River was also canceled, neutralizing the political opposition from midwestern, southeastern and northeastern states. Interim storage, namely a Monitored Retrievable Storage (MRS) facility in Tennessee was also eliminated, although the state had lost a court decision against it and the Oak Ridge community, a major national nuclear weapons facility, supported the temporary MRS. An MRS could be revived only after the President approved a site for developing the permanent repository. Under the Amendments, Nevada could not be considered as an interim storage site, since it was the major permanent repository study area.

The Amendments endorsed the DoE as the agency in charge of nuclear waste management, clearly weakening efforts for cooperation and consultation with Nevada. The Amendments offered participation and funding to "affected units of government," which include Nye County, where the site is located, as well as nine contiguous counties, including Clark County where the largest population in Nevada is located, and Inyo County in California, which could become affected by contaminated ground water. While the Amendments force Nevada to accept the site, Congress agreed to a voluntary program for the MRS, setting up an Office of the Nuclear Waste
Negotiator to find a willing host state or Indian Tribe. The idea was proposed by Udall.

The Congress also initiated the Nuclear Waste Technical Review Board, a group of scientists and engineers selected to evaluate the technical and scientific validity of the DoE’s activities. Since its creation, the Board has raised criticisms of the process, similar to the GAO’s and the NRC’s reports, but has no authority to declare the site unsuitable. All of these review panels have recommended independent studies and examinations of the nuclear waste management program since the Amendments were passed in 1987.

By eliminating plans for a second repository, the congressional actions in the Amendments effectively ignored fairness and equity, cooperation and consultation with the state, public opposition and participation in the debate, scientific risk and uncertainty, other waste management options, and endorsed the DoE while its own management problems and relations with other agencies mounted. Rather than enabling the nation to solve its nuclear waste problems on a sound basis with public trust, Congress had become the creator of a program plagued with flaws and problems from the start. "In retrospect, the NWPAA (Nuclear Waste Policy Act Amendments) was not a solution to the HLNW (High Level Nuclear Waste) program problems but merely a prolongation of an obsolete and historically failed approach." (5).

Nevada’s opposition, once subdued before the Amendments
became law, escalated in a fusilade of legislative and legal actions. Before Congress enacted the Amendments, the court cases filed by the state requested judicial review of program decisions by the DoE which Nevada considered failing to conform with the original Act or restricted Nevada's right to participate fully in the site characterization process, according to Harry Swainston, Nevada's Deputy Attorney General. Once the fairness of the process and the equitable outcome had been abandoned from the original Act, the Amendments were labeled the "Screw Nevada Bill" by those sympathetic to the state, from the public to the press.

The Nevada Legislature joined in escalating the opposition once the Amendments became law by passing Assembly Joint Resolutions (AJR) 4 and 6. AJR 4 stated "adamant opposition" to placing a high-level nuclear waste repository in the state and AJR 6 banned the federal government from establishing a repository within the state without the consent of the Legislature. This action was a reversal of the Legislature's prior endorsement of the Nevada Test Site when the state was chosen as the nation's nuclear weapons proving ground in 1951. Both resolutions passed the Nevada Legislature on April 6, 1989, and were sent to the president, the U.S. Senate and the U.S. House of Representatives on April 19, 1989.

However, the state Legislature proceeded one step further. On June 28, 1989, the Nevada Legislature passed
Assembly Bill 222, making it illegal for any person or government entity to store high-level radioactive waste in Nevada. The governor signed the bill into law on July 6, 1989.

In addition, Congress continued its failed nuclear waste management strategy by abandoning fairness and equity, and betting the entire nation's nuclear waste program on one site. This all-eggs-in-one-basket approach has been criticized by utility representatives and DoE officials alike (6). The state has regulatory authority not defined under the U.S. Constitution, such as its lands, state routes, employment regulations and its laws regulating the health and safety of its citizens. While a federal court could strike down each of the state's arguments, the legal process could take years and delay the opening of a permanent repository at Yucca Mountain.

An example of how the state can delay the DoE has already occurred. After the state Legislature passed the two resolutions (AJR 4 and AJR 6), and Assembly Bill 222, Governor Miller requested an opinion from the Nevada attorney general on the status of environmental permits requested for the Yucca Mountain project by the DoE. The governor said he believed the two legislative resolutions were a valid and effective notice of disapproval under the Nuclear Waste Policy Act (Section 116 (b)), since Congress had chosen Yucca Mountain as the single potential high level nuclear waste
repository site. The Act gives Congress 90 days to override a state veto in order to select the final repository site. On November 1, 1989 the attorney general advised the governor that the state's legislative actions and the failure of Congress to override the veto meant that the repository had been disapproved for Yucca Mountain and environmental permits for DoE were unnecessary.

Once the governor had the opinion in hand, he ordered relevant state agencies to stop any work on permit requests and to return DoE's applications without further actions. While the first lawsuit was filed in 1985 and the latest in 1994, the state's action illustrates how difficult it will be for the federal government to build a repository in an unwilling state, even one as politically weak as Nevada. Although Nevada lost its judicial review of the DoE refusal to recognize Nevada's disapproval of Yucca Mountain and its failure to stop site characterization work, it took three years for the final decision because of a series of appeals filed by the state. Once the U.S. Supreme Court denied a hearing after the Appeals Court decided against the state, Nevada agencies began processing environmental permits.

The DoE once again went on the offensive, declaring Nevada's legal maneuvers were delaying tactics under a "'scorched-earth battle plan.'" (7). After DoE testimony before the U.S. House of Representatives and the U.S. Senate, the administration moved to strip Nevada of issuing
licensing, permits, and regulatory control over the federal site characterization of Yucca Mountain. These provisions were contained in the National Energy Strategy Bill, Subtitle B of Title V. However, this power play was removed from the energy bill before passage due to the state’s processing of permits for DoE, and the fact that it was unclear whether Nevada caused the delays or whether DoE managers, funding, and administrative decisions had contributed substantially to the slowing of the project (GAO May 1992). Further, a Nevada senator threatened a filibuster at a crucial time in the legislative process unless the offensive sections canceling the state’s permitting authority were removed. They were.

The DoE had requested three permits concerning air pollution control and water use. The two relating to air pollution control were issued in July of 1991. The third, a water permit, was opposed by the state as an intervenor before a hearing conducted by the state engineer. The state’s basis for opposing the water permit rested on having no unappropriated water in the source requested by the DoE’s application, and the project was not in the public interest, a prerequisite for pumping ground water in Nevada. The state’s argument also raised the stigma that a nuclear waste repository would have on a state relying on millions of tourists per year for its economic existence. The impacts of a high-level nuclear waste repository in an economy based on
millions of visitors could have damaging effects in psychological, social and economic areas. Faced with political pressure from the Congress, the state withdrew its arguments and the state engineer granted available water for site characterization with restrictions and stipulations on March 3, 1992.

But water shortages at the repository are only one of its problems. Real scientific concerns have been raised about possible active earthquake faults, volcanism, rising water and rain water penetrating minute pores in the tuff and reaching the nuclear storage canisters. Former DoE scientist Jerry Szymanski proposed a theory that ground water could periodically rise inside the mountain, forced into the repository by a major seismic cataclysm, such as an earthquake. (8) After he presented his theory and it became public, the DoE eventually isolated Szymanski and he abandoned the project for work in the private sector. If rising water reached a repository, flooding the waste storage area, the canisters could break open or disintegrate, releasing radioactivity. A watery plume contaminated with radioactivity could have disastrous environmental consequences. (9) While there is no scientific consensus, subsequent research bolsters the possibility of such a catastrophe. (10)

Yucca Mountain's license could be halted if the possibility of strong earthquakes is believed relatively
probable. DoE and state of Nevada scientists had been arguing about the quake potential of faults at Yucca Mountain -- and then an actual magnitude 5.6 temblor occurred at Little Skull Mountain, 12 miles from the proposed repository site, on June 29, 1992. The DoE officials said that the earthquake demonstrated the mountain could withstand such a disruptive event and protect nuclear wastes contained in a repository, while Robert Loux, executive director of the Nevada Nuclear Waste Project Office, argued it was a "wake-up call' proving that Southern Nevada is geologically young and seismically active. Another 6.0 magnitude quake 100 miles west of Yucca Mountain occurring on May 17, 1993, drove the point further. The scientific debate also includes the Ghost Dance and Sundance faults which slice through the repository site itself, and scientists cannot agree on when the faults were last active. Some scientists (11) believe the two faults are actual seismic zones.

There is also evidence that two volcanoes, within 27 miles of Yucca Mountain, erupted as recently as 5,000 years ago, suggesting volcanic activity could take place within the 10,000-year time frame that the repository will remain dangerously radioactive. Besides catastrophic geologic events, human intrusion could breach the security of the repository. Future generations may seek fossil fuels, precious minerals and metals at Yucca Mountain as well. The
DoE claims there are no mineral or petroleum resources at the mountain.

Then there is the potential problem of release of Carbon-14, a radioactive gas which will only escape from Yucca Mountain because it is an unsaturated rock. A relatively large amount of the existing carbon-14 will seep into the environment (12) because the gas with a half-life of 5,730 years will be present in significant quantities when the canisters disintegrate in an estimated 300 to 1,000 years. Once a canister breaks down, the carbon-14 will convert to gas and reach the surface before its radioactivity decays to harmless levels.

The uncertainty of radiation levels at Yucca Mountain is so pervasive, the DoE could find it impossible to basically prove Yucca Mountain is suitable to become a repository. The National Research Council’s Board on Radioactive Waste Management signaled the existence of several scientifically uncertain sources making it improbable that the DoE can prove radiation releases are unlikely. The DoE's own peer-reviewed Early Site Suitability Evaluation (ESSE) in 1992 said future projections of earthquake or volcanic activity besides natural resources "will be fraught with substantial uncertainties that cannot be quantified using standard statistical models." (13) Scientists cannot even collect all relevant data necessary for a license application, the
computer model keeps evolving, and the persistent risks last such a long time. Such uncertainties make it virtually impossible to estimate the probability of releases with any precision covered by EPA standards or other federal regulations. The Congress responded in the 1982 Energy Policy Act, mandating a less stringent calculation of radiation risks at Yucca Mountain, than those proposed by the EPA. This approach applies only to Yucca Mountain. The Act also seeks to legislate the problem of human intrusion by putting the site in the hands of the DoE in perpetuity, although there is no historical evidence a society or a governmental institution has ever lasted that long.

In an effort to force the federal government to abandon the single study site, Nevada took two other legal actions against DoE's siting activities. In the 1994 *Nevada v. O'Leary* (94-70148: 9th Cir.), the state claims the Energy Department failed to adequately characterize the nature and origin of calcite-silica deposits at the mountain's Trench 14. The NWPA requires DoE to terminate all site characterization activities at any time if Yucca Mountain is found not suitable. The DoE does not have procedures for finding the site unsuitable as a result of site characterization studies. The state's argument says that DoE's decision to stop study of the possible disqualifier offered in Szymanski's model fails to meet appropriate site characterization procedures at Yucca Mountain. The action
asks the court to establish the state’s right to a credible scientific process. (14)

A second suit before the 9th Circuit Court also questions how the DoE makes its decisions and what record will be available. In Nevada v. O’Leary, the state has asked to depose 27 scientists who reviewed the Szymanski studies while their information is fresh and before the scope of work on the project changes.

Still to be tested besides scientific uncertainties are the constitutional questions about whether other states, through federal legislation, can force Nevada to host a repository against its will, or if the state has a sovereign right to protect itself, which will be considered in a chapter in this thesis. All of these paths are uncertain. While the U.S. Constitution grants the federal government seeming sweeping powers over individual states, the language also grants the states latitude in areas not specified at the federal level. Such areas as vital state interests, roads, health and safety, and environmental protection are a state’s domain. In the case of Nevada, the state also controls its ground water resources in a very restrictive manner, which could be a problem if the DoE must draw upon the underground resource for repository activities.

Following this introduction, the second chapter of this thesis will provide detailed background on the history of how the Nuclear Waste Policy Act Amendments became law. To do so
requires reviewing a short history of the 1982 Act itself, then reviewing *The Congressional Record, The Congressional Quaterly*, newspaper clippings, and any other helpful texts to sketch the passage of the 1987 Amendments. As I discovered, the record is sketchy to non-existent. While the records reveal many meetings between Sen. J. Bennett Johnston, the Democrat from Louisiana who engineered the 1987 Amendments and chaired the Senate Energy and Natural Resources Committee, and other congressional committee members outside the public forum and the Senate floor, little or no public discussion in committee hearings took place. At the time, the public distrust of the DoE either had not been considered by the congressional representatives, or was considered and so mitigated by secrecy.

The third chapter will trace the progress in thought leading to the technological myth of the Twentieth Century. Historian and philosopher Lewis Mumford provided an analogy here. In his own works on the myth of the machine, he compares the atomic weapons developers to the ancient pyramid builders, who ignored social debate and questions of economics, raising their all-encompassing projects to a concentration of power dangerous to the society as a whole. This omnipotent and omniscient attitude led to the decline of the civilization under the pyramid builders, Mumford claims. In addition, there is the question of allowing experts to run a democratic nation. Here two engineers with very different
viewpoints both ponder this trend. Besides Mumford, poet and essayist Wendell Berry and poet William Stafford contribute a humanizing approach in demystifying the language surrounding such complex problems as managing nuclear waste. Similar parallels between the ancient contractors and the current nuclear waste managers are evident: They promise jobs, economic security to those who work at the project, an everlasting solution, and prosperity for the region. Although this is a rather stark economic portrait, the founding of the United States brought into question equality and equity, rather than pure economics to run society. Although the founding fathers of the United States agreed on equity and believed equitable solutions involved public trust, there is no current way to ensure equity in the approach to nuclear waste management embodied in the Nuclear Waste Policy Act Amendments of 1987.

Furthermore, this third chapter outlines the premises (1) that relying on the technological myth -- here, that science can make Yucca Mountain safe for at least ten thousand years by engineering barriers to encapsulate the most radioactive substances known in history -- is a false premise; (2) that concerns other than scientific ones, i.e., social, economic, moral, and ethical, raised by Nevadans and others merit a place on the planning table; (3) that scientists should not have the sole power to formulate the decision on where to place the nuclear wastes; and (4) that
the nuclear waste management process conducted by the U.S. government undermines and threatens the foundations from which this democratic nation emerged.

The attitude that high-level nuclear waste disposal is simply a technical problem ready for expert solutions has to change. Any repository has an array of social and economic, health and safety, environmental and human aspects that will drastically affect communities near the site and through which waste will be transported. Many critics have argued that the burden of the stigma borne by the repository host state must be relieved through strict safety standards and negotiated benefits packages to cover the full range of such long-term socio-economic effects.

The Founding Fathers attempted a balance between natural law and laws imposed by men to govern, a balance between individual rights and enough civil order to form a union of the separate states. Today the original intent of the founders is still being argued. In the case of participation under the democratic form of government advocated in this country, however, some people feel they can no longer attempt, and in some cases feel they cannot, participate in the decision-making, since the world has become so complicated. This view leaves only the experts who can figure out the technology, which is usually wrapped in a new set of symbols or even a new language, to search for solutions. In the age of uncertainty, our present problems, such as nuclear
waste management, focus on the same dichotomies between the public and the private, between authority and expertise as the nation's founders grappled with and never believed they solved.

This state of affairs leads to the questions raised in the debate forging the Constitution of the United States. Of course, more than two hundred years ago no one could envision such a lethal risk posed by highly radioactive materials, which had not been discovered yet. Still the Founding Fathers searched for a common foundation to form the union of states without treading on the abilities and the freedoms of each individual state, and ultimately, the power to govern vested in the people. When Thomas Jefferson became President, he termed states' rights "sacred" in his inaugural address, even after such a small group of men had forged a bitter constitutional battle to create the federal government. (15) Perhaps it was Jefferson's time in France, distant from the heat of the constitutional battle, which preserved his sense of the sacred intact. In recent court cases concerning radioactive waste, a federal judge in at least one lawsuit protected individual property rights to private land owners and held the state liable for damages from perceptions of risk from federal activities which infringed on a private owner's rights. In this case, a strip of private property used for a road leading to the Waste Isolation Pilot Project near Carlsbad, New Mexico, was seized from a rancher. This
legal conclusion sets a dangerous precedent for Nevadans, or for individual states along the nuclear waste transport corridors, since the state could be held liable for any damages or dangers to the public's health and safety posed by an accident or perception of risk posed by the nuclear wastes. The case in New Mexico addressed the perception of risk, not actual harm. Since the perception was so strong, no actual harm had to exist, the court ruled. The case has been upheld on appeal.

The analysis in Chapter IV offers a view of some of the problems facing the Yucca Mountain Project if it continues on its present course, in contrast to possible alternative methods the nation might approach in solving its nuclear waste problem. After all, the DoE has plans to make the current system work, shortening scientific time to prove Yucca Mountain's suitability, asking for more funding for scientific studies, consolidating the complicated problems from reactor to repository, such as designing multiple-purpose canisters, and extending the time wastes could be retrieved from Yucca Mountain, in case anything goes wrong in the first one hundred years. Instead, others such as the state of Nevada and the General Accounting Office have requested an extensive, broad, independent review of the entire nuclear waste management program. In addition, the Nuclear Waste Technical Review Board, a scientific panel created under the 1987 Amendments, and the Nuclear
Regulatory Commission, the licensing agency for the repository, have been critical of the DoE's process of site characterization. Although Energy Secretary Hazel O'Leary began a financial review of the Yucca Mountain Project in April 1994, critics such as the state of Nevada and the GAO say it does not go far enough. Why? Because the basic policy of nuclear waste management is flawed.

In the conclusion, I suggest the outline of a series of steps with a direction for the United States to attempt a more democratic approach towards managing the nuclear waste problem. Included in this approach are alternative storage methods for the nuclear wastes, including such techniques as dry cask storage already approved by the NRC; the creation of a national energy policy, far beyond the 1992 National Energy Act, taking a look at the role of nuclear power and other alternative sources for generating electricity; and finally, the formation of an independent body to include scientists, environmentalists, state and federal representatives, Indian tribes, energy officials, ethics professionals, and most important, the public. By dealing with nuclear waste in the context of the future with its unintended consequences, the deadlines would be removed from the process, the nuclear waste problem would be treated as a scientific experiment, and the public would become part of processing a solution, even considering a voluntary negotiable siting procedure. By
approaching nuclear waste management as a multi-faceted problem, the solution might be a more equitable one, more scientifically justified, and treated in a more open policy-making manner, for all of those concerned.
ENDNOTES


8. In countless interviews with the author, and with The New York Times reporter William Broad, Szymanski, once the leading geologist for the DoE on the project, said he knew the selection of Yucca Mountain was a mistake from the first time he set foot on its tuff in 1984.


10. Shrader-Frechette, Kristin; "High-Level Waste, Low-Level


13. J. Younkers, during a media presentation in February, 1992, could not respond to reporters' questions about the seriousness of this statement on page B-2 of the ESSE. She did say that better computer models might relieve some of the uncertainty.


15. In addition to his inaugural address, Thomas Jefferson wrote a letter to William Charles Jarvis, 28 September 1820, in P.L. Ford, ed., Writings of Thomas Jefferson, vol. 10 (1899), 161. Jefferson said, "I know of no safe depository of the ultimate powers of society, but the people themselves, and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion by education."
CHAPTER II
A BRIEF HISTORY OF NUCLEAR WASTE LEGISLATION

Chronology


December, 1984: The Department of Energy selects three sites -- Texas, Nevada and Washington State -- as preferred for site characterization for the nation's first high-level nuclear waste repository.


Jan. 16, 1986: The DOE identifies 12 additional sites in seven states as potentially acceptable for a second repository.

May 28, 1986: DOE "indefinitely defers" search for second repository site.

November, 1986: Congress passes FY 87 Continuing Resolution (P.L. 99-500), prohibiting DOE from exploratory drilling at any repository site.


Dec. 21, 1987: Congress passes Budget Reconciliation Act. H.R. 3543, including in Title V major revisions of nuclear waste program. One of the most significant changes is selecting Yucca Mountain, Nevada as the sole site to study for the nation's high-level nuclear waste repository.

1990: The National Energy Bill, proposed by President George Bush, is passed by Congress.
I. History:

Forty years after scientists produced the first nuclear chain reaction at the University of Chicago, Congress passed the first legislation to specifically manage high-level nuclear waste as the Nuclear Waste Policy Act of 1982. During these four decades, first the Atomic Energy Commission, then the U.S. Department of Energy, conducted site-screening surveys and researched disposal technologies, some as exotic as transmutation that would reduce and convert radioactive wastes into less harmful material, a process as expensive and frustrating as the ancient alchemists' quest to turn lead into gold. In 1957 a panel of the National Academy of Sciences recommended that high-level nuclear waste could be buried in salt formations. It was the failure of the Lyons, Kansas salt bed in the 1970s that riveted the attention of the utilities on the problem of what to do with high-level radioactive reactor wastes. By the end of that decade, utilities clamored for federal legislation to help solve the spent fuel problem. In 1980, the Sierra Club announced radioactive waste as one of its top priorities. That same year Congress, led by Rep. Morris Udall, D-Ariz., introduced a comprehensive nuclear waste bill. The legislation did not pass.
As far as the federal government's approach to nuclear waste management, an historical review, such as that undertaken by Gerald Jacob, in his 1990 book, Site Unseen: The Politics of Siting a Nuclear Waste Repository, and Luther Carter's, Nuclear Imperatives and Public Trust, reveal very little change in the way Congress or the nuclear industry sought a solution to such a major problem for three decades. The political process and its players entered very late into a search for the solution to the problem and acted as if a crisis had developed in finding a solution that was for years considered a purely technical one. After World War II, nuclear research and development remained a federal secret, preventing the commercial market from applying nuclear technologies. Then in 1954, President Eisenhower announced the Atoms for Peace Program in an address to the United Nations. The old 1946 Atomic Energy Act that had classified reactor designs -- putting a virtual federal monopoly on the data -- was shorn of its secrecy, to some extent. The federal government was forbidden to own commercial reactors. The 1954 Act set up the federal government as subsidizer of the Reactor Demonstration Program, encouraging utilities to enter the nuclear age. The government ignored the question of nuclear waste disposal, since technicians believed the spent fuel would be reprocessed.

The utilities, however, had three key liabilities: accident potential, fuel costs, and waste disposal, according
to Jacob and Carter. The federal government quashed those barricades through a number of actions. The Price-Anderson Act limited industry liability in case of a reactor accident. The Atomic Energy Commission (AEC) supplied the reactor fuel through the federal uranium enrichment program. The AEC also proposed to accept commercial spent reactor fuel for reprocessing, thus believing little waste would be produced. With these federal assurances in place, the utilities could begin developing nuclear power. They could ignore nuclear waste disposal, for the moment. Both the federal government and the utilities still believed in a technical fix to the nuclear waste problem.

Six years before the Nuclear Waste Policy Act was introduced, the National Waste Terminal Storage Program was approved by Congress. This investigation set out to explore underground rock masses on the Nevada Test Site, the nation's nuclear weapons proving ground since 1951. It was not until 1979 that federal scientists turned their attention to Yucca Mountain, an ancient volcano which formed tuff west of the Test Site on parcels of land owned by the Bureau of Land Management and the U.S. Air Force. Basalt at Hanford, Wash., salt in the Gulf Coast, and granite in the northeast of the nation had also been explored, but were later removed from consideration when the original Nuclear Waste Policy Act was amended in 1987, because of political pressure, according to author Luther Carter. (1)
At the same time, the nuclear industry crumbled into chaos from a credibility crisis partially brought on by poor decision-making and confusing expertise, a threat to its "perceived legitimacy" of institutional authority, and a financial crisis. (2) Udall had committed to federal nuclear waste storage in 1977. "We (Congress) owe the country a decision to take the stuff and get it stored the best way we know how," he said. (3) President Carter reinforced that commitment when he refused to allow nuclear spent fuel reprocessing to prevent nuclear weapons proliferation that same year. At the same time, national economic growth slowed, recessions plagued the nation, and public fervor for energy conservation increased after the oil shortage of the early 1970s and in the wake of the Three Mile Island nuclear power plant accident, halting demand for new nuclear reactors.

The Nuclear Waste Policy Act of 1982 broke some new ground in procedures and powers to operate the nation's high-level radioactive waste program. It offered a limited veto to a state, once it was selected as a site by the president. It recognized the rights of Native Americans as sovereign nations. It required nuclear power customers to pay for the repository. It required specific site selection and environmental protection criteria. The first site had to be based on lengthy characterization studies. A Mission Plan required in the Act had to be drawn up by the Department of Energy (DoE replaced the AEC) for the repository, which then
required Congressional review. The Act also left alone federal pre-emption of local and state regulations and supervision of nuclear waste shipments. Most important, the Act sought to remove politics from solving the problem of nuclear waste disposal, a goal expounded by Udall. (4) The Act allowed a potential host state the ability to oversee the Department of Energy, using funds paid by the nuclear ratepayers, at the rate of .001 cent, called a mil, collected on each nuclear reactor kilowatt hour. At the time the original Act was passed, there was little or no public input, as Jasanoff and Nelkin noted (5). The attempt to prevent politics from intruding on a technical solution to nuclear waste disposal fragmented attempts to define social issues and settle value conflicts at the time. (6)

Although Congressman James Santini of Nevada argued in favor of an absolute veto, (7) the Act allowed the state only a "notice of disapproval," or a minor role to advise and dissent from the decision reached after the site characterization studies were completed, the final environmental impact statement done, and the President recommended a site. The state had to present its reasons for this disapproval, but Congress had final override power.

In effect, Jacob and Carter argue in their books, the Act made few changes to the established nuclear power industry or the way business was conducted by the industry with the Congress at a national level. In the end, the Act
failed to change institutional goals and processes, ignored procedures for mediation or negotiation with the affected states, and left the climate for conflict intact by seeking a purely technological solution that ignored political and public concerns such as social, geographical, or economic impacts. No ethical questions, such as free consent or responsibility to protect future generations, were raised. The Act set the stage for the amendments which followed.

II. The 1987 Nuclear Waste Policy Act Amendments:

The 1987 Amendments had a profound effect on Nevada, since Congress ordered Yucca Mountain studied as the sole site for the first high-level nuclear repository. After five years, it was obvious to Congress that the Nuclear Waste Policy Act of 1982 had failed. The original legislation was amended on the last day of the Congressional session in 1987, without committee hearings. The Johnston Amendments were packaged in the Budget Reconciliation Act, Title V, passed on December 21, 1987. They constitute twenty nine (29) pages in length. Like the Act before them, the Amendments stirred debate for months and brought the historical conflicts which nuclear waste management has fomented whenever policymakers have attempted to address it.

In the 1987 Amendments Act, the language explicitly states that the Energy Secretary is not required to consider
the need for a repository, any alternatives to geological disposal, or alternate sites to Yucca Mountain in the environmental impact statement.(8)

Early in 1987, the Congress had imposed a moratorium on studies at all three existing potential repository sites in Texas, Washington, and Nevada. At the same time, the lawmakers cut off funding for the entire federal nuclear waste program. By then, the DoE’s track record at its 110 nuclear weapons facilities scattered nationwide had erupted into a political scandal for the Reagan administration. The widespread environmental contamination spread across the nation’s conscience as major news outlets published and broadcast attempts to cover up problems by DoE officials at sites such as Hanford, Wash., and Rocky Flats, Colo.

The Amendments made some decisive changes, such as terminating the search for a second repository site in the eastern United States (9) in violation of the moral concept of "geographical equity" required by the 1982 Act. The Amendments also limited benefits to the State of Nevada once an agreement had been reached [violating economic equity].(10) Annual payments of $10 million per year while the repository was under construction would increase to $20 million per year for the 35-year life of the repository, at which time it would stop accepting spent nuclear fuel and be permanently sealed.

The 1987 Amendments also established an Office of the
Nuclear Waste Negotiator to accept voluntary offers by states or Indian tribes interested in hosting a Monitored Retrievable Storage (MRS) facility (11). Benefits to either a state or a tribe for the MRS were limited to $5 million a year before the facility accepted spent fuel, and $10 million per year as the MRS accepted shipments.(12)

A Nuclear Waste Technical Review Board was also created (13), with eleven [11] members appointed by the president from twenty two [22] scientific experts nominated by the National Academy of Sciences. This Board was alleged to be explicitly independent and none of its members could be an employee of the Department of Energy (DoE), or work for a contractor hired by the DoE. Each member serves a four-year term. The Board’s function serves to review site characterization at Yucca Mountain and activities relating to packaging and shipping high-level nuclear waste or spent fuel. In a semi-annual report, the Board presents findings, conclusions, and recommendations, but it has no authority to terminate the Yucca Mountain site characterization study. (14)

Under a "Miscellaneous" section of the Amendments Act, (15) Congress set the rules for transporting nuclear fuel and high-level radioactive waste in packages certified by the Nuclear Regulatory Commission; for notification of the state and local governments before shipping; and for providing unspecified technical assistance and Nuclear Waste Fund
monies to states for training public safety officials in case of accidents. The Amendments also banned any foreign plutonium shipments (16) by aircraft over the United States to another foreign country, unless the Nuclear Regulatory Commission certified the containers by an actual drop test from the maximum cruising altitude, and an actual crash test of a cargo aircraft fully loaded with test materials.

The issue of subseabed disposal was dealt with in a section (17) calling for a report to Congress within 270 days (report due in January, 1995), after the Amendments were enacted, based on current knowledge, costs, international aspects, environmental, health and safety considerations. An Office of Subseabed Disposal Research was created under the Office of Energy Research of the DoE. A university-based Subseabed Consortium was also established. In the subseabed report, scientists said international treaties, the law of the sea and costs outweighed such disposal as an alternative.

Dry cask storage (18) was also included for study and evaluation until such a time as the permanent geological repository was built and operating. The costs, risks to human health and the environment, and comments from the states and the public on dry cask storage were included in the considerations under the management of the Energy Department. The Energy Secretary also has to examine the money available in the Nuclear Waste Fund that can be applied to dry cask storage. (19)
III. Analysis:

The problems with amending the 1982 Act became compounded as the Congress learned of missing or hidden information. For example, Congressmen Ron Wyden of Oregon and Al Swift of Washington launched a General Accounting Office (GAO) investigation after learning of charges that the DoE’s chief contractor at Hanford hid information of groundwater contamination that could drop the site from further study as a nuclear waste repository. An earlier DoE Inspector General’s report had concluded there was insufficient evidence to support such charges.(20)

The DoE also had failed to win NRC approval of its Yucca Mountain site characterization quality assurance programs. A GAO report blamed the Energy Department itself, not the State of Nevada, for delaying progress at Yucca Mountain. By the time Congress reopened the Nuclear Waste Policy Act in 1987, it was tempted to shut down the entire federal nuclear waste disposal program. Rep. Morris Udall, the Arizona Democrat considered the father of the original Nuclear Waste Policy Act, told the U.S. House of Representatives Committee on Appropriations on June 30, 1987, that "the program was in ruins" and called on Congress to go back to square one to solve the problem (21).
Two competing proposals for solving the nuclear waste program's morass were proposed. Udall approached the solution from a fresh start perspective. He called for a halt to all DoE site-specific activities at the three candidate sites (Nevada, Texas, and Washington) for a period of eighteen [18] months. Then he proposed establishing a special commission to study the DoE's program and recommend necessary changes and redirection. Finally, he proposed an Office of Nuclear Waste Negotiator to attempt a voluntary agreement with a state or an Indian tribe for an acceptable site for nuclear waste disposal characterization studies.

The Interior Subcommittee on Energy and the Environment, chaired by Udall, approved an amended Udall bill by voice vote on Oct. 20 with a new number: HR 2967. Rep. Barbara Vucanovich, R-Nev., tacked on two amendments that lengthened a study commission's study period from six months to 12 months, and gave federal aid to state and local governments affected by site characterization. The committee also expanded the new commission's scope to include past DoE decisions and was offered by Rep. Wayne Owens, D-Utah, and supported by the finalist states. The commission would also study whether DoE should continue to run the nuclear waste program and was approved as HR 2967 on a voice vote Oct. 28 and was reported as H. Rept. 100-425, Part 1 on Nov. 5.

Simultaneously, Senators J. Bennett Johnston, a Louisiana Democrat, and James McClure, a Republican from
Idaho, introduced legislation that selected a single site -- Yucca Mountain, Nevada -- for the DoE's concentrated study. If the chosen site proved unsuitable, another one would be selected and "characterized" by the DoE from the other two locations then under scrutiny. The bill also included financial incentives to a state or Indian tribe accepting a temporary, or monitored retrievable storage facility, if opposition to the federal selection was surrendered. The Johnston-McClure proposal also stopped the search for a second repository in the eastern United States.

Congress dragged on with its routine business throughout 1987 without reaching a compromise on amending the Nuclear Waste Policy Act. The negotiations ended up in the Appropriations Committee, because Congress decided to keep control of the Nuclear Waste Fund's expenditures on an annual basis. By Dec. 17, 1987, House and Senate negotiators had agreed to put the nation's high-level nuclear waste study at Yucca Mountain over the loud protests of Nevada, its congressional delegation and state officials (22). Johnston narrowed the scope of the repository search in a three-step process to produce a written law.

First, the Louisiana senator won Energy Committee approval for the Amendments as free-standing legislation in S. 1668 on July 29 in a 7-2 vote in the Energy Committee. Here, he was opposed by Sen. Chic Hecht, R-Nev., who appeared to waiver on the issue of nuclear waste disposal earlier.
Second, he successfully attached it to the fiscal 1988 deficit-reduction law, over the vigorous objections of some House members, who did not believe settling the waste question was appropriate for a budget bill. It passed votes on Sept. 1 and 15, 1987. Third, He tacked his creation to the fiscal 1988 appropriations bill (H.R. 2700) for energy and water development. (23)

Johnston's motivation to trim the scope of the Nuclear Waste Policy Act was as a money-saver and to speed up the process of characterizing a site. He estimated characterizing a single site would save $634 million over three years ($139 million in fiscal 1988, $248 million in 1989 and $247 million in 1990). At the same time, the Energy Committee was hunting for a $730 million savings to meet its three-year reconciliation target. The narrower focus on nuclear waste site characterization filled the bill. (24) Johnston also offered benefits to Nevada, if it would give up its battle against the nuclear repository at Yucca Mountain, with $10 million a year proposed until the repository opened, and $20 million after it began operating. (25)

Nevada's Sen. Harry Reid was not helpless, however, when the legislative battle moved the energy and water appropriations bill to the Senate floor on Nov. 4, 1987. Reid launched a filibuster, calling the selection of Yucca Mountain ''wrong'' and ''unfair,''' and naming it ''The Screw Nevada'' bill. Joined by Brock Adams, D-Wash., Reid managed a
strong vote on a test Nov. 1. There, the Senate voted 55-30 to table, or kill, an Adams amendment that would have struck Johnston’s nuclear waste language from the bill. (26) But Johnston struck a separate deal with Sen. Jim Sasser, D-Tenn., to keep a temporary waste site out of his state for two years, according to an aide. (27) Sasser had aligned himself with Reid in a Sept. 15 Appropriations Committee markup, but struck out on his own when the two men failed to stop Johnston’s plan.

Reid and Adams wrangled over the appropriations bill for three weeks. Reid argued that Johnston wanted the matter on the appropriations bill, because when it went to House conference, Johnston would be head to head with Appropriations Chairman Jamie L. Whitten, D-Miss., and Energy and Water Subcommittee Chairman Tom Bevill, D-Ala., both friendly to nuclear power. (28) While Adams urged nuclear waste in a separate bill, he agreed to limit debate if Johnston’s plan was part of reconciliation. That way, two authorizing committees with different proposals, had seats at the negotiations. (29)

Both sides reached agreement Nov. 10, allowing a clear vote on a number of nuclear issues in exchange for a delay in the bill’s final passage until Nov. 18. A key element was a separate vote on whether the nuclear waste plan belonged in the bill. Johnston won that vote, 63-30. (30) Another key vote on an amendment offered by Reid to make public health
and safety foremost in considering site choice for an exploratory shaft was rejected by the Senate, 37-56. (31) Sen. John B. Breaux, D-La., demolished the final hurdle to resubmit the bill to the Appropriations Committee with instructions to add the nuclear waste provisions favored by the Environment Committee. That vote was 34-61 (32). The Senate then passed the bill by a vote of 86-9. (33)

However, conferees could not reach agreement on HR 2700, because of continued opposition by Reid and House members, so the bill was added to the Omnibus Budget Act (H.J. Res. 395 – PL 100-202) that the Senate eventually passed in December. Since Johnston's plan was part of both the reconciliation bill and the omnibus spending bill, and both measures went to conference in the waning days of the session, a set of conferees had to be selected to make the decision. The warring parties agreed reconciliation conferees would study it first, but if that failed, the decision went back to the spending bill side. The House and Senate differed to such a degree that some conferees had little hope for a compromise. (34) Texans in the House Energy Committee moved that bill closer to Johnston's proposal with Republican Jack Fields leading the way. The Texans got their state off the table, because Texas and Washington sites were both located over aquifers. By contrast, Yucca Mountain, it was claimed, lies in an unsaturated zone. And, five of 21 members of the House
Energy and Power Subcommittee were Texans. No one from Nevada served on the committee. Even Washington’s Swift could not stop the momentum by Dec. 14. Thus, the House conferees offered the Senate a new position, choosing Nevada for the first and only exploratory shaft site. But Johnston’s MRS proposal was ignored. (35)

The Senate counter-offered on Dec. 15 with the MRS included. The conferees screeched to another impasse. Then, at 2 p.m. on Dec. 16, House Speaker Jim Wright, D-Texas, Udall, John Dingell, D-Mich., Rules Committee member Butler Derrick, D-S.C., and other House conferees met to win Wright’s assurances that they would get a floor vote to substitute their own language for any Johnston provision with which they disagreed. (36) The showdown was shared with Johnston. At that point, the Louisiana senator did not want to face Dingell, Udall, Wright and Majority Leader Thomas Foley, D-Wash., whose states would be let off the hook by the House proposal. Johnston compromised on the MRS, with conditional authorization, and paved the way for passage.

IV. Evaluation:

To Texas and Washington, with larger populations than Nevada, the Nuclear Waste Policy Act Amendments were a clear victory. The Hanford, Wash., site and the Deaf Smith County, Texas location had been removed from the repository study.
list. For Nevada, it was a definite blow to the state's political fight to keep the search for a nuclear waste repository out of its borders and above politics and on a scientific basis. As Washington's Swift said after the House voted, the plan was "a goddamned outrage." (37) In the end, however, Swift voted to protect his constituents by voting in favor of Johnston's plan.

The State of Nevada has also avoided any hint of negotiating for benefits from the DoE's site characterization at Yucca Mountain. In 1989 the Nevada Legislature voted against storing high-level nuclear waste within the state's borders (AB 222). In the 1993 session, the Legislature voted by a 2-1 margin against opening negotiations with the federal government for such benefits. Unless there is a major shift in Nevada's political climate, state officials remain adamantly opposed to the Yucca Mountain project and unwilling to negotiate for benefits.

Perhaps the morass nuclear waste legislation has reached can be explained by the way the policy-makers -- in this case, the politicians -- approached a solution. The case of nuclear power reactors was explored by policy analysts Brewer and deLeon, who rejected both incremental solutions favored by Lindblom and the piecemeal approach. Instead, complex problems, they said, require more intense, theoretical approaches. Especially helpful were the comments under "Political Science," where they address the problem of
nuclear issues specifically. Both incremental and piecemeal categories should be avoided in the case of large-scale and time-bound endeavors, the authors said. Complex problems have many parts and different institutional settings. The actions by Congress may have ignored larger political and social issues, while seeming to solve simpler economic ones:

``Assuming that human beings were rational, as many economic theorists do, is not the same as confronting the observed irrationality or nonrationality that pervades individual and collective choices. Emphasizing a particular institutional or analytical milieu, the political scientist's tendency, without giving weight to or allowing for the possibility of alternative ones, can often result in a far less than comprehensive appreciation of a decision's many rich manifestations. Furthermore, a failing common to all general approaches is lack of concern for the unique qualities of each and every problem requiring analysis and decision: problems should suggest theoretical approaches; theoretical approaches do not define problems.''

(38)

However, the battle over studying Yucca Mountain is not over, if recent reports are any indication. First, Congress is facing a DoE estimate of $6 billion to characterize the Yucca Mountain site. Johnston had claimed the entire site characterization program would cost only $1 billion to $2 billion in 1987, with benefits to Nevada thrown into the pot. (39) As the DoE continues to bite into the mountain with a tunnel boring machine similar to the one that dug the English Channel Tunnel, its deadline for accepting nuclear waste keeps slipping. At the earliest, the DoE says Yucca Mountain
would be ready by 2010. These dynamics have set the stage for another consideration by Congress. Energy Secretary Hazel O'Leary announced on Friday, Dec. 3, 1993 that the earliest a repository could open would be 2013. (40)

The delays in the project itself in addressing the nuclear waste issue could lead to an impasse, despite the previous and current legislation. The ongoing internal and external reviews of the DoE itself spell trouble for the federal high-level nuclear waste program. The focus on economics and politics that Congress's approach so far has assumed may fail. The political approach has ignored technical, social and cultural aspects. An earlier lesson at Three Mile Island contained a warning about errors inherent in the time-based problem:

``With respect to highly complex technological systems, for instance those responsible for nuclear waste disposal, errors in design and performance may not become evident until many years after the system has been operational. Learning -- a fundamental tenet of incrementalism -- cannot occur until well beyond the point at which effective or efficient intervention can be undertaken. This situation presents the realistic challenge of having to design error-free institutions -- a challenge incrementalism cannot meet.''

(41)

The point being made is that complex technological systems may produce an entire spectrum of new problems, unforeseen for the designers and builders, and in the case of nuclear waste, potentially deadly for future generations. Designing error-free institutions is practically impossible
over great spans of time.

In an earlier arena, the Congress has been faulted for creating legislation that defines a need, without resources to solve it. As Elliot Richardson said, while Secretary of the Department of Health, Education, and Welfare: "There is a fallacy abroad in the land -- and rampant in the Congress -- to the effect that passing legislation solves problems. . . ." while "new legislation [often] merely publicizes a need without creating either the means or the resources for meeting it." (42) The approach to solving the high-level nuclear waste disposal problem may shift from burying it in the ground to long-term storage, if scientific, technical, social, economic and political problems continue at Yucca Mountain. There has already been another alternative proposed.

Writer Luther Carter has suggested the Nevada Test Site, neighbor to Yucca Mountain, become a retrievable storage area for the nation's high-level nuclear wastes, from spent radioactive reactor fuel to plutonium from dismantled nuclear warheads. (43) However, this solution would create another political dilemma. For Congress would have to revisit the Nuclear Waste Policy Act Amendments of 1987. As Carter notes in a recent article, "The NWPA produced not consensus but conflict." (44) The proposal Carter makes also ignores the uncertainty posed by the future of the Nevada Test Site. President Clinton has already instructed the DoE to prepare
the nuclear proving ground for further testing, after China exploded a nuclear weapon in September, 1993. (45) The Nevada Test Site is the only United States location approved for conducting underground nuclear tests. Carter urges Congress to place high-level nuclear waste storage on the surface at the Nevada Test Site, as well as continue with characterizing Yucca Mountain to see if it is suitable.

While Carter's suggestion is interesting, Energy Secretary Hazel O'Leary has undertaken an internal review and a fiscal study of the high-level nuclear waste program, which is not expected to yield results until the end of 1995. Whether Congress would be willing to reopen the nuclear waste repository issue again, so soon after the 1987 battle over amending the original act, remains unclear. The Department of Energy has come under increasing criticism for its technical management of the program. (46) The Clinton administration has had two years at the helm of this federal agency to review its direction and scope.

The State of Nevada remains opposed to hosting a high-level nuclear waste repository at Yucca Mountain. The current elected officials indicate no change from this adamant opposition. One position for the state to take would be continued opposition to the repository. Another course of action would be to bargain for social, economic and mitigation benefits for the entire state. While the 1987 Amendments limit compensation to Nevada, they could be
reopened by Congress for bargaining purposes. This option would require Nevada to relinquish its veto of the federal government's intent to build a repository at Yucca Mountain [according to two attorneys general opinions], but if the Amendments were once again addressed by Congress, the veto could be part of the bargaining package, as well as billions of dollars in federal aid and federal projects for the state. For such an experimental project, why should the state accept limited funds while bargaining away the future for 300 generations?

How could today's Nevada agree to bargain away the moral rights of future generations of Nevadans or of potential visitors to the state? How does money resolve the issue of free consent? Would the DoE or the federal government be willing to guarantee the state where the repository is sited unlimited liability protection for any accidents, illnesses, or deaths caused? The answers to these questions are that the state is not free to bargain and money does not resolve free consent. The position of current State of Nevada officials on this matter appears to be that any benefits offered so far constitute a "bribe," not a payment for the nation's nuclear troubles. The basis to resolve these dilemmas will be explored in Chapters 4 and 5.

V. Conclusion:

Based on the enormous technical, financial, and social
problems Congress is facing on the national agenda, the future of high-level nuclear waste disposal is uncertain. The November, 1994 election thrust the nuclear waste/energy problem onto the Clinton administration’s agenda. One of the ongoing problems the project has to contend with is a DoE financial review of the Yucca Mountain Project, which may produce problems for the program. The national outcome could change the course of the project 1) without any further involvement of Nevada, if the Nevada Test Site, a federal preserve, was chosen as an interim solution; 2) with Nevada’s continued opposition to the high-level nuclear repository at Yucca Mountain; 3) Nevada could sit down at the bargaining table for some high-stakes negotiating on the repository and future state benefits, if the political climate changed drastically; or, 4) the science may become competent, in which case we might learn the truth as to suitability of the lone site at Yucca Mountain. As stated earlier, there is no appetite in Nevada for offering to bargain. The stakes for the current economy of the state and its future are too high to risk. The danger for Nevada and for the program as a whole is the potential to "engineer" consent by policymakers, not independent scientists and not those affected by the project. But, more important, no matter what direction the nuclear waste program takes, the moral and ethical questions of protecting future generations and the matter of free consent remain.
1. Carter, Luther, *Nuclear Imperatives and Public Trust: Dealing With Radioactive Waste*; p. 412; Resources for the Future, Inc., Washington, D.C., 1987. An early attempt at burying nuclear wastes began on the Nevada Test Site when 17 spent fuel rods from a nuclear reactor at Turkey Point, Fla., were buried in the 1970s as an experiment in the Climax Mine. Before the rods were buried, the DoE allowed tours of the mine at the Nevada Test Site. Today the mine is closed to visitors, because it became hazardous when electrical wires frayed, the DoE said.


5. Jacob, p. 124.


17. Ibid, pps. 263-64.
19. In 1990 the Nuclear Regulatory Commission approved on-site dry cask storage of commercial spent reactor fuel for up to a century.
23. Ibid., p. 308.
25. Ibid.
28. Ibid.
29. Ibid.
31. Ibid., Vote 375, p. 64-S.
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CHAPTER III

THE MYTHOLOGY OF TECHNOLOGY: NUCLEAR WASTE MANAGERS
AS THE MODERN PYRAMID BUILDERS?

I. Introduction:

America stands as a symbol and as a goal to the rest of the world as the embodiment of a free, open, democratic society, as well as an economic force which emerged as the leader of the free world from the horrors of two world wars. The United States shines like a beacon for other countries whose people struggle to enjoy the freedom which Americans take for granted in their personal, professional, and public lives. America has emerged as a nation from pragmatic roots amid the flexibility of a government which allows for its people to create large and small enterprises, becoming one of the wealthiest countries on the face of the earth. Perhaps one of the greatest enterprises undertaken by the United States was the effort to build the nuclear bomb, beginning as the Manhattan Project in New York, San Francisco and Chicago, then eventually encompassing a network of 110 facilities nationwide from Oak Ridge, Tennessee, to the Nevada Test Site, 65 miles from Las Vegas, Nevada. Under the threat of
Germany, Japan, or the former U.S.S.R., the United States mounted an unprecedented effort in monetary resources and manpower to develop nuclear weapons to end the war and keep the peace. However, the nation failed to account for the end product of this atomic technology, the nuclear wastes which will remain radioactive for hundreds of thousands of years.

This chapter will attempt to examine the consequences of the nation's shift from defending democracy with the best technical inventions possible to becoming a victim of the mythology of its own technology by failing to consider the consequences. The myth of technology is defined here as a society which adheres to its reliance on technological inventions without question, whether these constructs serve the prevailing culture well or not. Part of the myth includes such dependence on technological solutions that public discussion is not needed prior to decision-making, nor does this dependence weigh individual or collective responsibility in the decision process. The technological myth places the blame on mechanical breakdowns or mega-bureaucracies, rather than questioning the root causes for its failures. This dependence and reliance on technological solutions leads to a degradation of the participation of the people who are affected by such expert decisions. A nation or a society no longer has to include public discussion in decision-making under these conditions, nor is individual or collective responsibility held accountable in the process.
Rather, technology drives the process, possibly engineering consent from a populace overwhelmed by technique and the unique language of technology.

The myth of technology in today's industrial society places the blame on mechanical breakdowns for its cultural and social failures. Thus, human beings are removed from the responsibility of what they have produced, and how it is used. Decisions are considered too complicated for ordinary people to ponder, so are left to the experts, the "true believers." America has become the "ghost in the machine," trapped as a country and a culture in its own myth of technical success.

Certainly, I am not the first to critically examine this phenomenon of the twentieth century. Philosopher and historian Lewis Mumford, philosopher William Barrett, poet and essayist Wendell Berry, and poet William Stafford have, each in their own genres, portrayed the trap set by technological wonders appearing each month on store shelves to accomplish tasks better, faster, and with less drudgery to humans, but divorcing humans from the decisions on how they will be engaged in the process. In this chapter, I will consider what each of these thinkers is trying to tell mankind about this modern predicament, and how it relates to one of the most unplanned projects of our time, the management of high-level nuclear waste in the United States.

In his series, Technology and Culture, Mumford
foreshadowed the plateau modern industrial society has reached when he recognized the authoritarian approach the scientific experts wield in such a culture. Its basis is an irrational, obsessive myth, according to Mumford, used by the Atomic Age scientists as well as the ancient pyramid builders who shaped their own society through the power of geometry and the gargantuan project of putting stone upon stone for decades. Mumford characterized these new scientific experts and managers, especially the nuclear weapons designers, as "the pyramid builders of our own age, psychologically inflated by a similar myth of unqualified power, boasting through their science of their increasing omnipotence, if not omniscience, moved by obsessions and compulsions no less irrational than those of earlier absolute systems: particularly the notion that the system itself must be expanded, at whatever eventual cost to life." (1)

Mumford's statement that the modern pyramid builders feed this reliance on technological omnipotence to expand their own myth is illustrated in plans for the federal government's nuclear waste management program. By allowing the nuclear industry to persuade Congress to amend the Nuclear Waste Policy Act of 1982, without public discussion, without consultation with the State of Nevada, and without debate on the Congressional floor, the pyramid builders have once again seized upon their obsessive, compulsive science to begin building a new paradigm of power. When Yucca Mountain,
Nevada, was selected as the only site for the study of constructing a nuclear waste repository which must prevent the most radioactive materials ever known from entering the environment or coming into contact with human beings for at least 10,000 years, the reaction of the residents of Nevada was predictable, and should come as no surprise. Elected Nevada officials immediately protested the decision attached to the 1987 Omnibus Bill by Senator J. Bennett Johnston, D-Louisiana, who was chairman of the Senate Committee on Natural Resources and Energy at the time (See Chapter Two). There is no trace in the congressional record of the political maneuvering Johnston employed to pass the Amendments. Nevada is a politically weak state, yet its people, like those in most other economically healthy regions, are unwilling to bear such an unfair and dangerous burden for more than 10,000 years. Perhaps Johnston falls prey to the modern American belief that since technology can solve any problem, the politicians may choose the weakest state in which to site a nuclear repository, then leave it to the engineers to design and build it.

The issue of nuclear waste had been ignored in the heat of battle to defend the free world during World War II, the Korean War, and continuing into the Cold War era. By the time President Dwight Eisenhower and the leading atomic scientists of the day began exploring peaceful uses of atomic power, America was at its peak as a producer of nuclear (and most
other) technology. It seemed the United States could do anything, from producing automobiles and appliances to reprocessing the radioactive remains of the uranium-fueled nuclear reactors. In the 1950s, some scientists were beginning to think about the nuclear waste problem. A panel of the National Academy of Sciences recommended deep geological disposal, preferably in salt, as one alternative, along with shooting radioactive packages into the sun or burying them deep in the subseabed. (2) If the scientists agreed, then why Yucca Mountain?

Nevada does not benefit from nuclear power. Its climate is too dry and harsh to harbor nuclear reactors, which require enormous amounts of surface water to control the fission reaction generating electricity. Citizens wonder why they should be forced to bear the burden of burying the nation’s (and perhaps foreign countries’) spent nuclear fuel rods for eternity? Recorded human history began in the shadows about six thousand years ago. How is a living society expected to know what will happen in the next 10,000 years? Can a majority of the population, at its most tyrannical [as the Founding Fathers feared], force an unwilling, politically weak state to accept a lethal risk?

Although the ancient Greeks grappled with the same questions concerning government, basing their direction on logic and reason, the rise of the modern megamachine in which the civilized world is trapped today began more than 300
years before the twentieth century, Mumford noted. He sounded the alarm in our present age. His example of this missed opportunity for reflection, for turning the world away from unleashing the awesome power of the atom resides in historian Henry Adams. In 1904 Adams had foreseen with uncanny insight the social consequences of increasing physical power without a commensurate increase of intellectual insight, moral discipline, social awareness, and responsible political direction.

Mumford draws the connection between that insightful need all too belatedly recognized only by a handful of nuclear scientists, such as Albert Einstein and J. Robert Oppenheimer, at the moment that "bombs of cosmic violence" (Adams' term) were finally invented. As Adams saw the prospective transformation of civilization, his insight illuminated the social dangers from the release from moral inhibitions and life-conserving taboos and practices that had proved essential to human survival from its earliest stages onward, according to Mumford. He feared that moral inhibitions divorced from the necessities of survival spelled doom for the direction of society.

By divorcing the human elements of questioning from social debate, by misplacing values and putting one's faith in technology, and by failing to foresee an emptiness at the end of the blind technological alley, humankind cannot see the upshot of this mechanical evolution and is confusing a
reliance on the products, such as computers and their models, electronic monitors, or nuclear expertise, without measuring the impacts and outcomes on people, either in the present time or in future generations. By the control of the explosive increase in energy through nuclear technology, Mumford said that paranoia becomes respectable, by giving scientific and technological backing to infantile ambitions and psychotic hallucinations. An example of this can be drawn from physicists Edward Teller and Leo Szilard, whose global vision of a world threatened by political tyrants led to unleashing the atomic force and more than four decades of the tension-filled Cold War. In recent times, Teller's idea of the Strategic Defense Initiative, popularly known as "Star Wars,' further fueled the omnipotence of the authority of expertise and technology. On the other hand, at the moment in history when the atomic bomb was created, there was the terrible threat of Hitler and his domination of the world, of a more forceful Soviet Union, a fierce Japan, and other dictators, rattling arsenals worldwide with or without the help of nuclear weapons.

As the Age of Atomic Science dawned, however, Mumford drew the parallel between the Pyramid Age achievements and those of the Nuclear Age:
`.. .A Divine King [wartime President Franklin D. Roosevelt] embodying all the powers and prerogatives of the whole community, supported by a revered priesthood [secret
enclave of scientists] and a universal religion, that of positive science, had begun the assemblage of the megamachine in a technologically more adequate and impressive forum.''

(3) This could have been avoided if more concern had been expressed over the technological marvels emerging for the previous three hundred years, Mumford said.

In the case of nuclear technology and its attendant problems, the span of time between the dawn of the Atomic Age and an emerging dependence on nuclear energy for power generation is equivalent to the blink of an eye, but the mounting problems from radioactive wastes will remain for a very long time, outlasting the technical experts who invented them. Political direction has also been shaped by this arrow of time, for national leaders fear if hostile nations or terrorist groups can gain access to nuclear fuels stored in pools of water scattered around the United States near the nuclear reactors, the greatest country on earth could be held hostage. At this point in history, the modern world has reached a plateau, beset by dilemmas of what to do with the wastes remaining from the nuclear legacy. Many believe there is a technological solution. Others are searching for the most ancient solution, burying the mess and the mistakes.

This technological dilemma created by the rise of the nuclear industry, especially the fear of not knowing where the wastes may be or where they may be going, embodies the technological approach mankind has embraced, the path that
shattered the ancient Greeks' reliance on logic and reason. The social taboos and moral constrictions have been blown up and appear to be on the verge of an ignominious burial, while mankind wanders aimlessly amid the marvels of technology, the ghost in the machine. Yet the very mechanical wonders produce unexpected dangers, unintended consequences which threaten life on earth, and ultimately, humankind's own existence.

While ordinary humans feel isolated in this technical construct, today's scientists working on the problem of nuclear waste believe technology can solve the problem. This very reliance on a technological solution raises the spectre of immense harm to the people and the environment if anything goes wrong, both in the present and in the future. People alive today cannot choose a method for storing radioactive wastes for future generations. Such a decision is unethical because the very nature of technology changes, and modern nuclear wastes may become the future's resources. In addition, technology itself will change. The more complicated the solution, the greater the risks for people to fear, now and in the future.

What about the environmental consequences of burying high-level nuclear waste? With 10,000 years as a guideline, there is no way to predict what the outcome of leaving extremely heated and radioactive materials in a mountain born from a volcano will be. The earth may heave, may belch fire and ashes, or water may rise or fall within the repository,
or the climate could change dramatically in those thousands of years. Mumford postulated on this blindness as the present attempting to peer into time. Unintended consequences are ignored or left unexplored because of our attention to the dazzling details of modern life, to the narrowest view of our daily lives, the engineer's viewpoint which often leads to the new technological wonders.

Perhaps those with enough vision left to see beyond the flash and the dazzle of the technological construct created from the Nuclear Age should heed Adams' advice. In a letter to history teachers written in 1910, Adams urged his colleagues to understand the forces at work, pool their collective intelligence to devise institutional changes necessary to turn such immense forces to human advantage, and thus under human control, and turn away from the uncontrolled "bombs of cosmic violence." (4)

Adams grasped his extraordinary insight toward caution as the radical changes of the Atomic Age approached by reading backward into the past from the contemporary applications of electricity, and forward into the future from the probable consequences of radium, bridging time's arrow from a historian's perspective. But he failed to deliver solutions out of the quagmire, or even to be heard by the leading intellectuals of the day, because the Pentagon of Power, as defined by Mumford, was emerging. Mumford defined the Pentagon of Power as Political absolutism, Power
(energy), Productivity, pecuniary Profit, and Publicity.

All of those elements exist in the latest paradigm of power embodied in the nuclear waste management project embarked on by the United States government. The site, Yucca Mountain, was chosen in an atmosphere of Political absolutism; the Power and energy driving its selection grew out of an elitist level of society; Productivity in the project, now employing more than two thousand scientists and engineers, is the work of nuclear specialists; if a repository is built at Yucca Mountain, nuclear industry leaders believe the public will gain new confidence in nuclear-generated power and allow new plants to be built for a Profit where none have existed in twenty years; and the nuclear industry is selling the idea of Yucca Mountain through a Publicity campaign filled with Nevada's desert as a wasteland, as the former continental proving ground for nuclear weapons, as a home of patriots, as the perfect solution to the annoying problem of nuclear waste that will not go away.

More than forty years ago, Mumford drew the parallel between the ancient pyramid builders and the technological advance of modern society. He based the emergence of the two paradigms on a pentagon of power. Apparently, those ancient builders are as industrious as ever, creating another pyramid based on the myth of technology, which as history demonstrates has failed in the past, and may fail again
unless the latest architects are questioned on the basis of human values, moral and ethical constrictions, and social taboos. The solution to the deeper problems remaining from the Atomic Age is not building another pyramid, but involving those affected by the consequences beyond the builders, thereby disintegrating the pentagon of power.

Before examining the changes which are necessary to the current U.S. nuclear waste management program to avoid continuing the myth of the machine, this chapter will attempt to offer a brief glance at the viewpoints of two engineers, one who sees this problem, doubts the omnipotence of the mythic technology, sees the human factor, and offers his own solution for safely storing highly radioactive spent fuel rods. Here is an experienced technologist who is not a victim of the Myth of [Omnipotent] Technology. On the other hand, another engineer sees it the other way, believing in the myth, and sees those who worry about it as unable to realize all the benefits. He downplays potential harm or unintended consequences and has a sort of faith in the future. He is a victim of the myth.

II. History: Scientific and Philosophical

The issue of nuclear waste was ignored in the heat of the battle to defend the free world during World War II, the Korean War and continuing into the Cold War era. By the time
President Dwight Eisenhower and the leading atomic scientists of the day began to explore peaceful uses of atomic power, America was at its peak as a producer of nuclear (and most other) technology. It seemed the United States could do anything, from producing automobiles and appliances, to reprocessing the radioactive remains of the uranium-fueled nuclear reactors. In the 1950s, some scientists were beginning to think about the nuclear waste problem. Such alternatives as salt, along with shooting radioactive packages into the sun or burying them deep in the subseabed.

Some engineers are concerned about a technological myth driving not only Yucca Mountain siting policy, but even more mundane aspects of daily life in a democratic society, driving public participation further apart from the democratic process. By turning over the responsibility of operations to machines, human beings face a helpless future and cannot find a role to play in the day-to-day progress of society. In interviews conducted at the University of Nevada, Las Vegas, during the spring of 1994, engineering professors expressed a conservative approach to wielding the enormous technical powers available to modern civilization. For example, Robert Skaggs, professor of mechanical engineering, has done work for the U.S. Department of Defense in the past and is conducting research into nuclear waste containers for the U.S. Department of Energy. As a graduate student at Iowa
State University, Skaggs worked along with metallurgists who extracted Uranium 238, some of whom questioned why they built the bomb. Skaggs said he went through some reflection on that question in his late 20s. He explained:

"We had 50 years of something we called peace with the bomb. But I felt, and most of the people I worked for felt, Western civilization and the United States, in particular, were in real trouble. I thought Western Civilization and Democracy were worth killing for. That's why I went to work every day. Now we sit on a giant colossus, a big, empty nothing, filled with pornography and sports. We are clever devils, but we may be too clever for our own good." (6)

As Mumford sounded the alarm in The Myth of the Machine, by divorcing the human element of questioning, by misplacing values, and by failing to foresee an emptiness at the end of the blind technological alley, humankind cannot see the upshot of this mechanical evolution and is confusing a reliance on the thing, such as computers, electronic monitors, or nuclear expertise, without measuring the impacts on, or consider the quality of action by people. Skagg's, as well as Mumford's, alarm is rooted in the lack of moral and social values applied by experts to very human problems. Certainly, some scientists and engineers are also concerned about this point.

Skaggs particularly worries about the lack of social values and society's increasing dependence on technology. "That's what scares me, our dependence on technology and the shrinking portion of the population that can handle it," he said. While working his way through school, Skaggs set pins
in a bowling alley, caddied, and ushered in a movie theatre. But today, "the society has no room for ditch diggers anymore," he said. Machinery sets bowling pins automatically, golfers carry their own bags in electric carts and advertisements greet moviegoers, instead of human ushers. Humans have been replaced in mundane tasks. Could this harm the value placed on the struggle to complete a task? Skaggs believes such a reliance on the machines degrades the values of the work which is passed on to electronic marvels.

Skaggs believes that the declining values of the jobs once available for unskilled workers within the society erodes the middle class and the middle ground that was once America's democratic core. The technological emphasis in the nation has invented a two-class society divided between those who possess the skills necessary to participate in this brave, new world, and those who cannot function in an arena relying more and more on machines and procedures which demand greater technological skill, such as automated factories and nuclear power plants.

There is another problem modern mankind fails to face, and that is the question of time. The span of time between the dawn of the atomic age and an emerging dependence on nuclear energy for power generation is equivalent to the blink of an eye, but the mounting problems from radioactive wastes will remain for a long time, outlasting the technical experts who invented them. For a short span of time, spent
nuclear fuel rods can sit in "swimming pools" or dry casks all over the country. In the long term, the nuclear wastes from reactors and defense activities have to be gathered in one place for safekeeping, Skaggs said. Otherwise, "We'll lose that stuff," Skaggs said. "We won't know where it came from." As a scientist, Skaggs follows the process of trying to find the best solution to a problem that had been defined within a geographical "equity" in the Nuclear Waste Policy Act. The original Act called for a study of nine sites, searching for one repository in the western states and one in the eastern states. After the 1987 Amendments passed, only one site remained for study, that is at Yucca Mountain.

Skaggs' and the nuclear industry's dilemma, especially the fear of not knowing where the wastes are, embody the technological approach mankind has embraced, the path beyond the ancient Greeks' self-questioning and reason. Like a ghost, modern mankind wanders aimlessly amid the marvels of technology, with that self-knowledge, yet our very mechanical wonders produce unexpected dangers, unintended consequences which threaten life on earth. Is it any wonder that humanity feels isolated? This alienation is addressed by William Barrett in The Illusion of Technique. (7)

In order to halt the ceaseless pyramid building, Barrett offers some insight into the illusion of technique that has been created in modern society. Barrett addresses the problem of language, a barrier constructed in an engineered age with
ways of communicating beyond the capacity of the average citizen to understand. In a sense, he offers us a humanistic approach through philosophy and a return to the poets in our society, who can translate the technological into words and images understandable to those in a democratic society willing to take the responsibility and make the effort to conduct knowledgeable discussions leading to a consensus-based decision on such a complicated problem as nuclear waste management.

Today's scientists working on the problem of nuclear waste believe technology can solve the problem. Yet this very reliance on a technological solution raises the spectre of immense harm to the people and the environment if things go wrong. The more complicated the solution, the greater the risk, Skaggs said. Placing the nation's nuclear wastes in multiple-purpose casks, the solution the Department of Energy has chosen most recently, is not the answer, Skaggs said. Putting twenty-one spent fuel rods in one canister raises several problems, according to Skaggs:

* Eliminating heat from the spent, still radioactive, fuel. Heat building up inside the repository could turn water captured in rocks to steam, creating a possible explosion, or contribute to melting waste containers, providing an avenue for radioactivity to enter ground water.

* Criticality, or the problem of the fuel melting from intense heat and causing a nuclear chain reaction.
*Handling problems* for human workers. The workers could be exposed to higher radiation levels than current standards allow.

Skaggs is faced with trying to persuade the establishment at the Energy Department to retreat to "square one" and place the nuclear fuel rods, one by one, in single canisters. First, Skaggs suggests, let the fuel rods sit for 50 years, then fill each canister with cement and magnesium, the rods, more cement and magnesium, let it harden, and then weld the top. The idea is 2,000 years old, invented by the Romans when they ground volcanic ash and seashells, he said. Once the spent fuel is secured, and cooler after 50 or 100 years, then drop it into deep geological burial. Skaggs said one of his students was worried about trying to persuade the DoE to switch to single canisters for the fuel rods and feared that the university team might lose its argument and the contract. Skaggs said he told him, "Losing is not the problem, being wrong is the problem. The important thing is doing the best you can." In the case of nuclear waste management, doing the best that can be done is a necessity, since the threat of radiation to human health and the environment extends across thousands of years and several generations.

From another engineer's viewpoint, however, technology allows people to do the best they can in any age, said David Jones, associate professor of engineering at the University
of Nevada, Las Vegas. Humanity makes and uses tools with whatever is available at the time. The North American Indians, for example, had few skills for working in metals. On the other hand, many tribes were very, very sophisticated with plant and animal tissues. "I could not make a basket, or a sinew bow string," Jones said. "Those people lived very well, they knew how to live well in their environment."

While Native American tribes may disagree with him (because their culture has nearly been destroyed), Jones believes life is better on today's reservation with a pickup truck, color television set, and a refrigerator in which to store food. Still, people react against technological progress, he said. Perhaps technology is not the answer, if recent public debate is any indication. A tribe or neighbors in a poor area threatened by a refinery band together to force industries to clean up stack emissions or reduce airport noise. Political activity such as this is democracy in action. However, many people do not consider the economic consequences of forcing such environmental issues as noise and air pollution, Jones said. Jones's view is another indicator of the technological myth, relying on a single factor, such as economics, for justification. "McCarran International Airport is a source of employment and an economic benefit to Southern Nevada," he said. "That airport is our economic engine. A lot of the time people
don't think of economic consequences, but only what impacts them.''

But what about environmental consequences and whom do they "impact"? Jones exemplifies the narrowness, the blindness that Mumford and Barrett so helpfully explore in their works. Unintended consequences are ignored or left unexplored because of our attention to details, to the narrowest view of our daily lives, to the new technological toys. This scientific grasping, as it is driven by technological progress, has distracted the public to believe, against its own reason, that mechanical marvels will keep the world safer. At what price and for how long will technology last in the moral and ethical sense? Beyond the will and its freedom -- so extended by modern technology -- questions of limits to freedom arise. Through consequences of technological acts, we may become no longer free to do the kind of thinking that would redeem us from the world we ourselves have created. If, by dependence on the technological myth, we make it impossible to contemplate real problems, then we destroy our own culture in the process. Our culture was based on democratic principles, yet we may have rendered ourselves incapable of the serious reflection necessary for sustaining a thoughtful, caring society. The danger signs are all there, Barrett notes. When technology gets too noisy, pollutes our air, or is about to drive
another superhighway through our living room, we rant against it. Yet we consume its products without question and come to see them as irreplaceable. Negotiating the high wires where technology triumphs, we fail to ask what preconditions of this technical world exist and how they bind us to its framework. We have forgotten to ask what to do when we fail.

And then reason, like a ghost, appears with the unasked and unanswered questions of Why? What is it for? What is the meaning of it all? The answers to these questions are not forthcoming from the engineers. These questions come from the realm of citizenship, a sense of limits, fallibility, critical thinking, and deliberation. And so, the appropriate answers await in the same realms. The technological viewpoint coming from arrogance, tyranny and limitlessness is unexamined by our society; we face an abyss seemingly created by the twentieth century's myth of technology and its false promises. Technology has dazzled us coming from a world lit by our own imaginations, to one where very few people understand the basic underpinnings of the process which brought us to this plateau. While the public longs for a safer, cleaner, quieter environment, usually through technology, the risks created by man in the past century or two cannot be eliminated.

There are no avenues to reaching zero-risk tolerance, the standard which is the basis of so much of what the public believes today, Skaggs, Jones and other technical
experts maintain. Yet this very reliance by the public who call on experts to control such dangers as toxics and nuclear wastes removes the ability of such ordinary people to participate in setting acceptable risks. A society allowing experts, engineers, and scientists to have the control over risk assessment, or more importantly, risk assignment, has given up its reason.

Essentially, the Yucca Mountain Project is the ultimate example of man's attempt at mastery over the world of objects, an engineering feat to control the powerful forces mankind unleashed in this century and that appear out of control. The safety of the future depends on how reliable Yucca Mountain's engineered containment will be. The public has been largely ignored in the search and study for a solution. However, it appears Barrett is attempting to bridge this narrow world view of the engineers to a more humanistic one by turning to language, the world of words. In an effort to progress from this dark, ironic position in which technology has put the modern world, he turns to the sphere of the poet, an antithetical figure to the engineer. This philosopher's thinking revolves around the confrontation of these two worlds. Poetry in this sense is not an artifice of culture, Barrett points out, not an elegant, esoteric concoction of words, removing art to the periphery of common life. Barrett struggles to recall poetry to its primal dwelling among us on this earth and under the sky, touching
the daily round of existence. If it does not, warns Barrett, "then we ourselves have become homeless on this earth." He contrasts the two worlds of the poet and the engineer:

"The poet walks through the woods lost in its rapturous presence. The engineer adds up the bulldozers needed to clear the trees. At some point in our lives, follow the poet’s 'wise passiveness,' learn to let it be, or we may never break free of the cloying clutch of our own willfulness." (9)

In this brief passage, the wisdom of the poet to let it alone, leave the spent nuclear reactor fuel rods where they are, until they are less dangerous to the humans who will have to package, transport, bury and watch them for millenia, appears to be a reasonable and sensible solution.

In this way, humanity may once again connect with nature and recover the roots of existence buried in the Earth, the natural environment. As the twenty-first century approaches, two poets stand out for their attention to the environment and the individual’s voice crying from the wilderness wrought by technology. They, too, attempt to widen the narrow technological vision. Wendell Berry, who wrote poems from the heart of his daily chores as a farmer, has become an essayist who put technocratic language and its originators under a moral microscope. In Standing By Words, Berry probes the Nuclear Regulatory Commission (NRC) experts (who will pass judgment on Yucca Mountain, as to whether it is found scientifically suitable for a nuclear waste repository), who
routinely eliminate themselves and representative human beings from consideration, according to the prescribed "objectivity" of their discipline. "What is remarkable, and frightening about this [technical] language is its inability to admit what it is talking about," Berry says. (10)

For example, the NRC regulators and nuclear experts alike, refer to the Code of Federal Regulations as "CFRs," or those who protest their actions as "NIMBY (Not-In-My-Backyard)" types. By their language, these technical hostages of the NRC and others similar to them cannot admit to each other, much less the public, that nuclear problems involve extreme danger to many people. Their language disguises the dangers by euphemisms and acronyms. The "will to power" has become absolute power reflected in language such as the NRC uses, Berry says. "The commissioners speak a language that is diminished by inordinate ambition: the taking of more power than can be responsibly or beneficently held." (11)

William Stafford is another poet who attempts to measure everything by a careful choice of words, selecting the boundaries within his imagination to bring a little life into the technical shaping of a poem. To deal with the terrible potential destruction unlocked in the nuclear age, Stafford wrote a poem about the Nevada Test Site where atomic weapons which exploded above the desert sands rivaled the sun for
heat and light. He never speaks of "mushroom clouds" or "radioactivity." Instead, he concentrates on the image of a lizard:

_At the Bomb Testing Site_

At noon in the desert a panting lizard waited for history, its elbows tense, watching the curve of a particular road as if something might happen.

It was looking at something farther off than people could see, an important scene acted in stone for little selves at the flute end of consequences.

There was just a continent without much on it under a sky that never cared less. Ready for a change, the elbows waited. The hands gripped hard on the desert. (12)

The awful anticipation of the atom's destructive power is captured in the image of the lizard's "hands gripped hard," allowing the reader to detach for a moment and contemplate the unthinkable. Stafford avoids overwhelming the reader with political statements or shrill diatribe. The unthinkable comes home in the image of a lizard interrupted by something not right in its environment. Like Stafford, it seems that Barrett is pleading for humanity to listen to its poets for providing a map to the path leading out of the technocratic maze and toward a synthesis with nature. By attempting to bring humanity into the engineering equation, Barrett arrives at the moral will and its practice in freedom.
Freedom is the insatiable subject of our quest, he says. Technique and technology loom today as the negative and opposing face to freedom, or the perfect example of free will with no limits. The "perfect example," however, contains no values. The philosophical task for our own day appears to be the search for a positive conception of freedom. Without a positive sense of freedom, we cannot respond to the original question of what led us on this philosophical quest. If the cosmos and ecology are important, then limits must be known and acknowledged. Heidegger stressed that the great philosophers of the past were always consumed by a single vision:

"To think is to confine oneself to a single thought that one day stands still like a star in the world's sky." (13)

Heidegger's Being, his one idea, shines like a brilliant star, but Barrett points out Heidegger's one area of ignorance, deliberate or not, above his insights that gave subjectivistic constructions to modern aesthetics. That is the matter of ethics itself. To reclaim the ethical ground, people living in a democracy must practice citizenship to regain a sense of limits, fallibility, and deliberation.

From its beginning when Aristotle introduced ethics, the will has been central as "deliberative desire," Barrett said. (14) It is the place in our psychic landscape where reason and appetite meet. Where our wishes and emotions
submit to reason, reason in turn is activated by desire. Here, Barrett said, is the human being as practical agent. (15)

Barrett defines this moral will as wrongfully transformed by the myth into the will to self-assertion and dominance, the will to power. (16) Here is the point where technological mythology could step in to fill the gap left by those existing in the seeming floating, rootless world of technology. Here humans may abdicate their individual and collective responsibilities by relying on the machines. If the computer is down, how am I responsible for working, thinking, learning? If the scientists can create artificial intelligence, then why not hand over the messy and mundane tasks to robots? If nuclear energy is available as a seemingly limitless source of electrical power, then why not let the engineers design a container for the endless wastes from that fuel cycle? But, Barrett asks, if the matter of ethics is inseparably involved with the will, and if the will has been compromised and even polluted at its source, how can one go ahead and develop an ethics?

Freedom enters. "Freedom is the condition of truth itself, for unless we are free to let be, to let things show themselves as what they are [within limits], we will only force our willful distortions upon them." (17) Barrett suggests that modern philosophers have ignored the moral will as the center of the personality. At the same time, modern
philosophers have left the soul out of the argument that the truth, disclosure, the Aletheia, brings the imminence of death with it, something the poets have known all along. To be free toward one's death! Here Barrett means the death of ideas, as well as the end of physical existence. He insists we have to listen to nature:

"The history of science abounds in cases of scientists who cling tenaciously to their pet theory, refuse to be dislodged from it, twist facts to fit into it, or remain resolutely blind to whatever facts resist such twisting. The pet theory has become such an ingrained part of their vision of things that they cannot see it for what it is because they are always seeing everything else through it." (18)

The "pet theory" in the modern age is the technological mythology that drives the scientist and the engineer into a moral blindness. Freedom, however, lies within each of us as the way we let the world open before us. With a definition of freedom as opening the world to us, Barrett attempts to define the moral will as one beyond values and imperatives, one that carries its own light to guide us. He urges us to let be, as Heidegger defined it by the word Gelassenheit. (19) And we move within this light in the most ordinary traffic of daily life, as well as within gigantic projects such as Yucca Mountain, that tend to dwarf human perspective and engulf its feeble attempts to understand. Heidegger saw our age as the night of the world, where the old gods fled and a new god has not arrived. While some engineers hope to replace the old gods with technology, the moral will of the human being should be the guiding
principle here. The United States with its democratic foundations is poised to take the moral path within a sense of its freedom.

In our position as the nation which upholds freedom more than any other, the people have become blind and deaf to the corruption of the technological myth. There are so many other distractions in this world, most of them based on a breathtaking experience provided by technology. Why turn off the hair dryers, air conditioners, television sets, computers, monitors, or the tools of this age's trade? Mastering the on/off switch is easy, almost built into the modern human from incubator to resuscitator. The moral will decides the position of the on/off switch. Technology can push the fear of death into the future, but it can also spread the word about freedom, helping America to find herself again. Barrett notes that humans will stop being free only when the species loses the idea of freedom.

III. Conclusion:

Technology has failed its human masters if, at the end of a half-century of transforming the destructive power of the atom into a source of energy and light, the best solution to the remains of this nuclear dawn is buried in the shifting ground, the oldest and the most primitive method to erase mistakes, to bring eras to an end, to close an individual
life. However, the current proposed final solution cannot be discovered within technological mythology. Some engineers and some scientists have the knowledge and the skill to ask the hard questions and throw some skepticism on technology, while others tell us technology is our salvation. To solve modern problems people need more than technical expertise. There is a question, perhaps formed by the philosophers and the poets, that humanity needs to ask before it loses its ideal and meaningful perception of freedom: Where does technology take us?

That question leads to another one: does the public have the moral will to pursue such a path of inquiry and the patience to recognize the freedom within limits, which we would bear in the asking? If the American people fail to question the expertise of technicians, to dare question the power they have invested in technology and engineering, the principles of freedom, balance of power and the protection of human rights, fundamentals on which the nation was founded, are threatened. Indeed, by forcing a nuclear waste repository on a single state, albeit a politically weak one, the tyranny of the majority which the Founding Fathers feared may weaken the democratic foundation of the United States.
ENDNOTES


4. Adams, Henry, "Letter to Teachers of History," *The Education of Henry Adams*, Limited edition. Boston: 1918. Popular edition. Boston: 1927. Adams was a determinist and he called the attention of his colleagues to the changes then in progress, suggesting they work together to understand the forces at work and pool their collective intelligence in an effort to devise necessary institutional changes to harness such immense forces of energy production toward human advantage; uncontrolled, he warned, "the bombs of cosmic violence" could bring civilization itself to an end.


11. Ibid., p. 39.


15. Ibid.

16. Ibid.


CHAPTER IV
AN ANALYSIS OF THE INHERENT ETHICAL PROBLEMS

In his closing summary, after successfully attaching the Nuclear Waste Policy Act Amendments onto the 1987 Omnibus Bill, Senator J. Bennett Johnston, D-La., said: "I think it's fair to say we've solved the nuclear waste problem with this legislation. The problem with nuclear waste has never been scientific, it's always been emotional and political." (1) Indeed, Senator Johnston won the legislative battle to restart the stalled nuclear waste management program, since his bill removed all other alternatives and singled out Yucca Mountain as the lone site for study as the nation's proposed high-level nuclear waste repository. However, scientific and democratic issues of site selection remain unresolved. The 1987 political decision stripped science of its fundamental role of experimentation and raised the stakes on the value of fairness, placing scientists in the role of proving the site suitable since it is the only one (politically) available. However, the legislation failed to link science and politics,
meaning there is no equitable method of making this decision without confronting the issues of fairness, equity, the rights of states and sovereign nations, and intergenerational justice during the process. In a democratic government, the participation of the people is fundamental to the process and the 1987 NWPA Amendments effectively eliminated such involvement, ensuring a NIMBY (Not-In-My-Backyard) reaction from Nevada residents and Indian tribes.

A brief survey of the reasons why Johnston's legislation failed to solve the nuclear waste dilemma may be helpful at this point. Many distinguished nuclear experts have correctly noted that public acceptance is the most consistent obstacle to acceptance of nuclear power within the United States, and the case would also apply to nuclear repository siting. A U.S. Nuclear Regulatory Commission task force concluded in 1978 that failures in radioactive waste management stemmed from neglecting non-technological components in the system. (2) In the same year, the Deutch Report warned that nuclear waste policy and programs must be credible to the American public. (3) An interagency review group reported to the president in 1979 that institutional issues could be harder to solve than the technical problems. (4) President Jimmy Carter observed in a 1980 message that government had failed to solve the nuclear waste problem in the past because the federal level failed to involve state and local governments, as well as the public, in policy decisions. (5)
Federal efforts to manage increasing nuclear wastes at individual reactors had failed before the 1980s when those earlier attempts concentrated on only the one medium of underground salt mines for permanent disposal. The research and development at the time, discussed in the reports previously noted in this chapter, cited inadequate funding, few sites to study and inadequate ideas for technological and scientific capabilities which compounded the problem of managing nuclear waste. Although the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Nuclear Regulatory Commission had primary responsibility for nuclear waste management before 1980, a new institution, the State Planning Council, might have approached the problem in a more equitable manner, with consideration of social and economic impacts. Created by President Carter, it was composed of eight governors, five other state and local officials, an Indian tribe representative, and the heads of the EPA, DoE, the Departments of Transportation and Interior, but failed to survive the Reagan era when most of the current nuclear waste management legislation has been approved by Congress. Clearly, there was a pattern of failure in nuclear waste management before the latest approach became law.

All along the federal government could have exercised its preemption of state authority, such as creating a nuclear waste disposal site on the Nevada Test Site, a federal reserve since 1951. However, in the 1980s Department of
Defense and Department of Energy officials sought an expansion of underground nuclear testing at the Nevada site during the Reagan era of Strategic Defense Initiative, popularly known as "Star Wars" space defenses, and the DoE's nuclear waste managers began seeking other ground for waste burial. Yucca Mountain, adjacent to the Test Site on its western flank, is owned by the U.S. Bureau of Land Management and the U.S. Air Force. While federal radiological regulations and the Interstate Commerce Clause appear to preempt state efforts to regulate bringing nuclear waste shipments into Nevada or another involuntary site, a state or local government could exercise control over such an industrial development as a repository within the state and regulate intrastate transport, protect worker health and safety, collect state taxes, preserve scarce ground water, or impose zoning regulations as well. The Yucca Mountain solution is based on an instrumental decision with a faith in technological solutions which perhaps are not as well developed as the general public may accept. If Congress wishes to escalate the argument further, to an authoritarian stage, imposing the site on an unwilling state, it could preempt any state claim by storing or disposing of nuclear waste at the Nevada Test Site or another federally-owned facility. This, in turn, could trigger a lengthy, unpalatable legal war. Perhaps that is why, up until this point, preemption has been avoided by the federal government.
Senator James McClure, D-Idaho, also attempted to place a pre-emptive clause in the original 1982 Act. It was rejected by Congress.

Whether federal scientists proclaim Yucca Mountain suitable to safely dispose of high-level nuclear waste for 10,000 years and more, or another site must be chosen, there is currently no acceptable resolution to the disparate values posed by these difficult ethical questions. Public responses to such questions as who pays in terms of money or health and safety, who benefits, who bears the burden of cleanups after accidents, and who enjoys what rights are serious problems which have not been considered in the process of nuclear waste management. Most Nevadans (6) as well as the populations of other states along major transportation routes on which truckloads and trainloads of nuclear waste would travel, refuse to accept the unknown risks to human populations and the environment from such a long commitment as permanent geological disposal at a distant location requires. Proposed waste sites with long histories of bearing a nuclear burden from weapons development, i.e., Hanford, Wash., and Southern Nevada, questioned the additional burdens of hosting nuclear repository sites, after participating in the Cold War atomic weapons production and nuclear testing both above and below ground for more than 40 years. The residents of these areas, who consider themselves "downwinders" after living near nuclear facilities for so
many years, believe they would assume a disproportionate share of nuclear energy's hazards, without substantial benefits. Nevada does not produce any of its electricity from a nuclear power reactor. None of the state's power companies contemplate building a nuclear power plant, according to public plans filed with the Public Service Commission of Nevada.

Another example of this failure of the federal government from applying equity to nuclear waste management concerns its treatment of Native American tribes who claim the land in and around the proposed Yucca Mountain high-level nuclear waste repository. Indeed, tribes shared the Yucca Mountain site as sacred ground for hunting and ceremonies as long as 1,700 years ago, state studies indicate. Leaders of the Western Shoshone Nation and the Las Vegas and Moapa Valley Band of Paiutes have repeatedly asked the DoE for a participatory role in the siting and transportation of nuclear wastes. They have been ignored. They have never received federal funding from the DoE for independent studies, although the 1982 Nuclear Waste Policy Act defined Indian tribes as affected, sovereign nations and therefore able to enter cooperative agreements with the federal agency to receive full benefits as an affected entity. The twenty-four tribes within Nevada are threatening lawsuits against the DoE unless recognition and funding are forthcoming (7). The federal government has yet to respond to any state,
community or tribe’s perception of socio-economic risks.

Instead, responsible governmental agencies have considered overall safety based on existing radiation exposure standards as a method in determining equity. Whether it be the amount or distribution of such risks, the issue of how those risks are assigned remains the basic problem in terms of public acceptance, and this premise is unclear under both the law and the guidelines by which the DoE operates. While President Carter stated in 1980 that the major objective in determining equity is that all costs of storage should ultimately be borne by the beneficiaries of nuclear power, the decision by President Ronald Reagan in 1985 to combine defense nuclear wastes and commercial radioactive reactor spent fuel rods in one repository further muddies an equitable funding process. Since 1993 the Department of Energy has contributed $130 million per year of its defense funding for nuclear weapons to the Yucca Mountain Project, further confusing the equitable funding issue since the defense funds are taxpayers’ dollars. (8) By 1996, if Congress approves the DoE’s proposed budget, nearly $500 million in defense dollars, will have been spent on the management of nuclear waste (in addition to the fees contributed by nuclear power ratepayers). While Carter’s underlying principle appeared to be balancing benefits and costs, later political decisions ignored this important
equity issue of the ratepayer-beneficiaries paying for the risks.

Unfortunately, even Carter's premise for placing the economic burden of permanent storage of nuclear wastes on ratepayers applied only to intragenerational policy. The principle apparently included financial losses, but not bodily harm, such as health risks. If balancing benefits and costs is applied to interim storage and the final repository, the gap between those losing and those benefiting widens further. At this point several equity issues emerge.

Nuclear energy benefits only a few, namely the current and the immediate next generation, with substantially reduced benefits available to succeeding generations as reactors shut down and are decommissioned. There is an argument considered in risk assessment that says the allowable risk should diminish over time rather than remain constant or increase. Yet in the case of high-level nuclear wastes, the radiation risks run into the tens of thousands of years with hardly any reduction in risks for 20 millenia (20,000 years according to DoE studies of heat and radiation from spent nuclear fuel). In future cultures the people may not be willing to tolerate such hazards or such uncertain technologies over time, and there is no account in the current management program for the need to change the allowable risk level over extended time periods. In order to provide an equitable solution, any waste
management scheme should be sited and operated to avoid foreclosing future options to allow succeeding generations to recapture the wastes and make them useful, while reducing the risks to these generations. As early as 1980, the National Research Council’s Committee on Radioactive Waste Management criticized the DoE’s Environmental Impact Statement produced in 1979, saying only a "superficial discussion of equity issues" provided an inadequate basis for analysis and apparently confused equity with public acceptance. This attitude by the DoE has not changed.

The DoE’s inadequacies, as pointed out by the NRC’s committee, remained uncorrected in the final Environmental Impact Statement (EIS) issued in 1980. Every major report on the issue of nuclear waste management has identified the neglect of socio-economic issues as the central element leading to failure of attempted programs to date. Neither have equity nor intergenerational issues been given serious analysis in any of the major reports, either by federal or independent agencies. The DoE’s National Plan produced in 1981 indicates that the nuclear waste management program will be "compatible with broad social values," but the nature of these social values accompanied by a coherent plan for achieving them are missing. Based on independent reviews of how various federal agencies handled equity and social issues for nuclear waste policy and regulations to date, there are no rational and consistent principles of equity;
past and current governmental equity is piecemeal, internally inconsistent, and frequently in direct conflict with other agencies or with Presidential policy. In addition, social, ethical, and economic issues in nuclear waste policy are poorly understood. (10)

Public disenchantment with nuclear wastes, in my opinion, does not originate with the parochial "Not-In-My-Backyard" (NIMBY) syndrome. Rather, the general public identifies the nuclear waste issue with the nuclear power debate in general, which intensified after the 1979 Three Mile Island nuclear accident in Pennsylvania, followed by the Chernobyl nuclear reactor catastrophe in 1986. While the public appears to many scientists and engineers to be overly critical of nuclear power, there is a genuine concern for safety issues and the uncertainty is understandable. Nuclear scientists generated atomic weapons first, before radiation was harnessed to produce electricity. The two are inextricably bound in the public mind. In addition, the Atomic Energy Commission and the DoE have caused and perpetuated a continuing public distrust with the recent revelations of human radiation exposure experiments on patients without their consent, dating back more than 50 years, and seeming callous disregard for and mismanagement of nuclear safety at the weapons facilities, which resulted in radiation exposures to the public off those sites.

The risks inherent in nuclear power make evaluations by
either experts or the public difficult. There is uncertainty in predicting the probability of risk because, 1) there is no long-range experience with disposal, 2) there are only computer models and simulations able to portray catastrophic events, and 3) risk assessments -- given the changing technology and the time span for nuclear waste management -- create an impossible hurdle for gauging risks to future generations, even among the experts. Nuclear energy and the attendant wastes raise public fears because of their very natures: radiation is cumulative, it’s invisible, and its harmful effects occur many years after exposure in the form of cancer, a particularly horrifying illness dreaded by people for its way of killing. It is a major source of social anxiety, as Paul Slovic and his associates at Decision Research discovered how fearfully the public reacted to nine characteristics of thirty technologies. When Decision Research conducted a 1979 study people put nuclear power at the extreme high end as risky for most of the characteristics. (11)

In addition to its roots in the mass weapons of destruction, nuclear power operates in a centralized system, needs complex technology, is managed by a few elite experts who do not understand public fears, and is a mystery to most ordinary people. This same mystique applies to nuclear energy’s endproduct, nuclear waste. Several factors have converged to jeopardize the development of nuclear power,
besides the U.S. and former Soviet Union reactor accidents. First, the rise of the environmental movement brought a call for scaled-down technologies and grass-roots participation in decision-making. The radioactive element plutonium -- a man-made pollutant with the potential for poisoning from within the human body from an invisible speck and a long radioactive half-life of 24,000 years -- galvanized those who argue for caring for the Earth to prevent spoiling it for future generations. Those nuclear scientists who created plutonium in the modern world appear to be contrary to and at the opposite extreme of an ecologically sound social spectrum. The political arena, however, is forever in motion. In the 1990s there has been a conservative political shift to disband big government, a refusal of accepting major industrial leaders in scarce seats at the table of power, to a newer, cleaner, information age as embodied in the philosophy of Alvin and Heidi Toffler. (12) The new 1995 Congress also appears to be attempting to bring the federal government into a more fiscally conservative operation by trimming what is perceived as wasted tax dollars. While the nuclear industry has enjoyed a benefit of spreading its risk over ratepayers and taxpayers alike, as noted with the shift in DoE's funding at the Yucca Mountain Project, not to mention the risk from operating and managing its facilities nationwide, the more cautious approach by Congress may signal a closer scrutiny of the business of nuclear power, its costs
to society, and to the risks involved in the current approach to waste management (13).

In addition to the dismal history of nuclear energy and its failure in acceptance by the public in the past 50 years, even newer threats to the integrity of public acceptance for its future loom on the immediate horizon. As the Cold War fades into history, nuclear accidents or acts of terrorism at the 110 operating U.S. nuclear reactors and those 250 nuclear power plants around the world will inevitably occur. Combined with the announced slowdown of cleanup at the DoE's weapons sites, (14) the public may become alarmed once again at the lack of environmental sensitivity displayed by the DoE, a federal agency which has controlled the development of the atom since its inception as both a weapon and an energy source. The American people's fears will not be put to rest in the current approach to nuclear waste management. To date, the DoE has approached public participation as an educational process bordering on propaganda, rather than allowing the public to play a critical role in its operations. The latest pamphlet produced by the Yucca Mountain Project Office in Las Vegas, Nevada, is a prime example.

Titled "Nevada and the Yucca Mountain Project," the materials inside the beige folder appeal to "Nevadans' Heritage: All for Our Country," which "reflects Nevadans' loyalty to President Lincoln and the Union during the Civil War. Although Nevada was still a territory at the onset of
the war, Nevadans contributed hundreds of thousands of dollars to the war effort, well above what was required by law. Much of it was generated by the wealth of the Comstock Lode.''

(15) The conclusion to this bit of Nevada history in the brochure is that 87 percent of the state is owned by the federal government. In addition to Nevada's silver, Lincoln also needed the state's voters to win the 1864 election. Nevada became the 36th state one week before that crucial election. And, it has been a vital base to military as well as nuclear weapons operations since that time, much to the dismay of disgruntled ranchers and miners who formed the Sagebrush Rebellion in 1970 in an effort to snatch the land out of the tentacles of federal control and bring it under state jurisdiction. A second wave of these protesting citizens has formed today, as the discontent spreads beyond Nevada's borders. These rebellious citizens are demanding the federal government give up its hold on so much of the lands in the western states. Six Nevada state senators are leading the efforts today. (16) This slice of Nevada historical perspective is not new, but the DoE's approach to selling it may not be as successful as a simple appeal to patriotism. Nevadans and other westerners consider themselves besieged by federal government activities and their inability to control their own destiny fuels public frustrations.

Clearly when it comes to nuclear power and its wastes, Nevadans are not the only U.S. citizens to feel a certain
wariness toward federal solutions. The historical pattern of false starts and mismanagement by both Congress and the DoE in nuclear waste management heighten the sense of mistrust toward the Yucca Mountain solution by the federal government. The people have become wary because they believe neither nuclear industry officials nor federal leaders have told the truth about the risks from this complex technology, and the public considers its representatives have failed to protect them at the expense of the nuclear power enterprise. (Senator J. Bennett Johnston, D-La., author of the 1987 NWPA Amendments, received $300,000 in 1994 campaign contributions from the nuclear industry, according to the Congressional Record). This threat to well-being perceived by the current generation poses a moral problem for nuclear waste policy over time in that the level of mistrust only increases. Another issue raised here concerns the longevity of social institutions. Since civilization with written records as we know it has existed for an estimated 6,000 years, how can today's political institutions expect to continue protecting the public for at least 10,000 years, the minimum radioactive lifespan of the spent fuel rods in the nuclear repository? Which institution would or could exist for so many years?

If the potential harm from nuclear wastes threaten both current and future generations, then the intergenerational inequity seems less urgent, since the risks are spread across long time spans. Yet this very lengthy time span makes the
very nature of the moral dilemma unclear. Current perceptions of moral issues include our concern for the consequences of our actions, the certainty (or uncertainty) of those consequences, and our ability to control them. But the more time that passes between the decision and the consequences, the more uncertain these outcomes become. Reasonably, it can be argued that the intergenerational moral issue is a major stumbling block in proceeding to formulate nuclear energy and waste policy. By failing to agree on what risks we can justifiably leave for future generations, we are unable to confront the technical solutions for nuclear energy problems. This uncertainty in assigning risk has also led American leaders to a flurry of political activity in the form of legislation in less than 10 years, after the issue of nuclear waste had been ignored, diminished, or poorly handled for nearly five decades.

Although the atom offers the public a source of energy, medical diagnosis, and advanced industrial processes, its meaning within the social structure is not clear. The radioactive wastes remaining from nuclear activities put further strain on defining a social solution for dealing with spent fuel rods, weapons materials, diagnostic and industrial sources indefinitely. Obstacles to maintaining the safety of these materials include the disarray in today's institutions responsible for nuclear waste management, the resources to continue safe maintenance and the changing political climate.
within America's democratic form of government. Before long-term security and monitoring is considered, the waste disposal project encompasses design, construction, operation and closure, followed by continued research into operations after closing the repository, a time span which may extend for 100 years or more. During the first century, in order to have a safe repository, a formal organization must oversee each step. The first 35 years of trying to address nuclear waste management has proven how difficult this will be, since the federal government has given three different agencies the responsibility and critics of the current program have called for yet another independent organization to oversee long-term management. Those three federal agencies to date include the former U.S. Atomic Energy Commission, the Environmental Protection Agency, and the DoE.

Once a deep geological site opens, it would need the most technically knowledgeable nuclear experts, as well as those at the top of their professions in physical and social sciences, to monitor and protect the grounds. How such a diverse group of experts would maintain a mission of guardianship for more than 100 years remains unresolved. Alvin Weinberg in 1972 suggested a "nuclear priesthood" to secure the high-level nuclear waste site. (17) Along with monuments, international symbols for danger and radioactivity, and presumably fencing, Weinberg urged nuclear scientists to train specialists as "high priests" to pass
on the knowledge about the site from one generation to the next. This approach to protecting future generations from today's dangers has been criticized by sociologist Kai Erikson, who has written and lectured about the fragility of social institutions, as well as the impermanence and irrelevance of such invented, engineered systems. Erikson has noted that pharaohs' curses did not stop treasure hunters from looting Egyptian tombs and temples for buried riches. In addition, the world's languages change roughly every 500 years, making warning signs difficult to maintain over the life of a nuclear repository. (18)

To complicate this long-range perspective, the DoE has operated under its nuclear waste program plan according to a rigid schedule and inflexible ``milestones'' to open a repository as soon as possible. These two major roadblocks are neither reasonable nor scientific, and the approach was criticized in 1990 by the National Research Council's Board on Radioactive Waste Management, which recommended that the Nuclear Regulatory Commission revise its detailed licensing requirements to a more flexible approach for the DoE to follow. By adopting a qualitative approach, the DoE could incorporate surprises, so models, designs, and planning may be changed as problems arise. However, competing external forces such as public demands about lowering risk to the lowest level possible in long-term nuclear disposal and congressional laws, entrap the DoE from adopting the more
experimental approach to the project, while Congress has mandated the disposal of the wastes in a single site, and the repository study schedule is driven by unrealistic deadlines.

The NRC's Board even offered an avenue for the DoE to try through developing a risk communications system. Instead of dictating or trying to alter the public perception of the extent of risks, the DoE and the other nuclear waste managers would communicate with the public about the risks, both those which cannot be avoided and those which may be avoided, listen to people's concerns, then incorporate those perceptions into the design, construction and maintenance of any nuclear waste solution. This approach is contrary to the large, entrenched organization in place to manage the radioactive waste repository over the long term, but vital in a democratic form of government. Resistance to further progress in nuclear waste management by the public is certain, unless the DoE bureaucracy or another institution replacing it work to correct perceptions of risks, health, safety, inequity, environmental threats, and accidents, and correct their errors in the open. The uncertainty of this approach is a healthy one, as experimental as the normal practice of science. Without dealing with the public's perceptions, no long-term, stable monitoring institution is possible.

Another approach nuclear managers should consider goes beyond public participation. Demands for greater public
control in the nuclear energy debate began with the old Atomic Energy Commission and its rigidity led to its downfall. Public involvement and increasing control over nuclear issues will continue to grow as the program unfolds. The DoE has followed in the AEC's footsteps by ignoring expansion of public participation in policy analysis and decision-making. Rather than continuing an authoritarian and paternalistic approach to nuclear waste management, the organization charged with nuclear management should approach it from a shared authority and control. By expanding the basis for gathering information, without attempting to control the flow of information or color it the way DoE has attempted (the appeal to patriotism in the pamphlet cited), nuclear waste managers may expand the knowledge which will form the basis to an intelligent and a reasonable approach. Uncertainty cannot be entirely eliminated. For any management program, however, uncertainty cannot be ignored and should not be minimized to the public who perceives nuclear wastes and their disposal as among the highest risks.

In the final chapter, I will offer some suggestions for further consideration in an effort to avoid a catastrophic solution to what has been an ongoing problem. First, here is a summary of the failures of the current nuclear waste management program:

I. Assurances that relevant social and institutional obstacles have been fully identified and assessed by
responsible governmental agencies have not been fulfilled because of 1) institutional fragmentation existing in planning, 2) these agencies do not understand the systematic or site-related social and economic consequences of the waste facilities and transportation, 3) the uncertainty and failure to date of consulting and concurring with states, Indian tribes and other governments on a voluntary basis for acceptance of waste, 4) inadequate equity analysis and the lack of an institutional basis for overcoming inequities, 5) failure to propose contingency plans for dealing with unexpected, "surprise" events during site characterization, and 6) failure to set a realistic and flexible schedule for studying any proposed repository site.

II. There is no assurance that institutional and financial resources will be available or have been committed to overcoming present and future obstacles to this unpalatable project. With the addition of defense wastes in a proposed repository which had been planned only for commercial spent reactor fuel, it is uncertain how great the burden on the taxpayers, as well as the ratepayers, will be in the future. Although the Interagency Review Group and the DoE had furnished a generalized perspective and plan with a program, the detailed analysis has not been completed to date.

III. The public remains as uncomfortable and as deeply distrustful today over nuclear power and its attendant
nuclear wastes, putting risks and concerns over nuclear technology near the top of the list of perceived risks, above other involuntary behaviors. Officials cannot brush aside these concerns, since they are rooted in the nature of the risks, the social and political history of nuclear power itself, and the neglect of the nuclear establishment in the past to the ethical questions and the environmental problems. The issue of transporting nuclear wastes through 43 states has gained special attention and has raised fears among residents living in these corridor states. (19)

At the beginning of this chapter, it was conceded that Senator Johnston won the legislative battle in 1987 with passage of amendments he authored, narrowing nuclear waste repository site selection. He may win the war to build the repository at Yucca Mountain, although his retirement in 1996 from Congress will diminish his political base within the Capitol. However, fundamental moral, ethical, scientific and democratic issues have not been resolved. There is no socio-economic link between the science and the politics of nuclear waste, and until a fair, impartial and voluntary solution to the nuclear waste dilemma occurs, the foundations of the U.S. political system deserve careful observation, in case cracks not unlike those in nuclear reactor pipelines threatening the safety of the entire power plant begin to emerge in the nation's democratic base.
ENDNOTES


4. U.S. Interagency Review Group on Nuclear Waste Management: 1979a, 87. The *Report to the President* said: "the resolution of outstanding technical issues and problems," and that such resolution "may well be more difficult than finding solutions to remaining technical problems."

5. U.S. President: 1980, 5. Past governmental failures "... have failed to involve successfully the states, local governments, and the public in policy or program decisions," Carter said.

6. *Las Vegas SUN*, February 8, 1995, P.1, "Yucca Opposition Hardens," indicating more than 64 percent of Nevada residents oppose the proposed high-level nuclear waste repository.

7. *Las Vegas SUN*, January 12, 1995, "Indians Seek Hearing," p. 8A. To date, no tribe has filed a lawsuit, although some are still deliberating whether to vote on the matter.


119


13. Las Vegas SUN, February 10, 1995, "No Speedup At Yucca Mtn.," p. 1. Both Sen. Frank Murkowski, R-Alaska, Chairman of the Senate Natural Resources and Energy Committee, and Sen. Pete Domenici, R-N.M., Chairman of the Senate Budget Committee, were extremely critical of the DoE's scheme to remove the nuclear waste fund from the federal budget, eliminating much congressional oversight and allowing large amounts of money to be spent at Yucca Mountain. Murkowski said the DoE's plan to free vast amounts of ratepayer funds had no chance to pass Congress. Domenici was equally blunt about keeping congressional oversight on the project.


16. Las Vegas SUN, "Senators Take Aim at Feds," February 10, 1995, p. 12A. Senator Dean Rhoads, R-Tuscarora, is the primary sponsor of Senate Joint Resolution 1, declaring the state's sovereignty under the conditions of the U.S. Constitution's 10th Amendment. That is, all powers not delegated to the federal government should rest in the hands of the state. Ten states have already passed similar resolutions. However, the U.S. Supreme Court has upheld the federal government's sovereignty in national cases before it since the Civil War.


recent interview, his views had focused on the impossibility of warning future generations about what is buried in Yucca Mountain. In his article, Erikson noted, "If the repository goes on-line and if people continue to feel toward it as they do now, the effects on the Nevada economy will be devastating. Tourists will be less likely to visit and their images of the state will become far more negative. Conventions will move elsewhere and businesses will relocate. Fewer people will migrate into the state to assume new jobs or raise families or retire. The clearest finding to emerge from all these studies is that people are astonishingly apprehensive about things nuclear." (p.40)

19. *Las Vegas SUN*, "Everyone Becomes a Nevadan," Judy Treichel, interview with author, Feb. 2, 1995. Treichel said she received more than 300 phone calls as a result of the release of the proposed transportation routes through corridor states, other than Nevada.
CHAPTER V
CONCLUSION: ALTERNATIVE APPROACHES TO
U.S. MANAGEMENT OF NUCLEAR WASTE

I. Introduction:

The current system proposed for managing the nation's most radioactive waste remaining after fifty years of the Cold War was initiated by the Nuclear Waste Policy Act of 1982, and, as amended in 1987, appears to be failing in economic, social, ethical, and scientific terms. In the past year, the General Accounting Office (GAO) and the Nuclear Regulatory Commission (NRC) have both become the latest in a long list of agencies issuing reports critical of the way the U.S. Department of Energy (DoE) has handled the Yucca Mountain Project, the site characterization study to determine if a volcanic mountain made of tuff can safely store highly radioactive wastes for more than 10,000 years. Since the GAO is the investigative arm of Congress and the NRC is the agency responsible for licensing the first high-level nuclear waste repository in the world and both have
expressed critical views of the current program, it appears the time has come to take stock of other approaches to the nuclear waste problem, including public discussion about the current solution and possible alternatives. This final chapter will offer some suggestions for alternatives to the current nuclear waste management approach undertaken by the United States.

II. History:

There is a history of calls for an independent review of DoE's approach to its nuclear waste management program and the Yucca Mountain Project, in particular, dating from 1992. (1) The first critical report in December 1992, came from the GAO's Transition Series Report, "Resolving DoE's Nuclear Waste Disposal Dilemma," (2) followed by the March 1993 report by the U.S. Nuclear Waste Technical Review Board report to Congress and the Secretary of Energy. (3) In May 1993, the GAO issued another report, "Nuclear Waste: Yucca Mountain Project Behind Schedule and Facing Major Scientific Uncertainties," which concluded that if Congress funded the site studies at $200 million per year, it would take 23 years, or until the year 2014, and cost $2.1 billion in 1993 dollars to complete site characterization. (4) Although Congress has funded the program at $200 million or more each year, the Yucca Mountain Project is still behind schedule.
The GAO then recommended the Congress wait until 1) the Secretary of Energy had reviewed the program; 2) an independent review, similar to one recommended by the Nuclear Waste Technical Review Board, had been completed; and 3) "appropriate legislative, policy, and/or programmatic changes to the program have been implemented." (5) The GAO's report was followed by a June 1993 unanimous resolution from the Western Governors' Association, "Independent Review of the High-Level Radioactive Waste Program," also requesting such a broad, independent study of the entire DoE program. (6) Neither the Bush administration nor Congress acted on the suggestions.


Congressmen Phillip R. Sharp and Richard Lehman sent a letter to the Secretary of the DoE O'Leary in August 1993,
followed by other letters to President Clinton from various U.S. Senators and from Nevada Gov. Bob Miller, all urging an in-depth review. The Technical Review Board sent another letter report to Congress and O'Leary in February 1994, preceding the GAO's latest call for an independent review of the high-level nuclear waste program. With all of these concerns being expressed, a good question to ask is: Why has the issue failed to draw attention at the presidential level? One educated guess would be the change in White House administrations from that of Republican George Bush to Democrat Bill Clinton. Perhaps in the transition from one administration to another, high-level nuclear waste management ranks low on the list of priorities, as compared to the economy, education, health, nuclear weapons worldwide, Bosnia, Haiti, the Middle East, and other high-profile problems.

Or perhaps there are other reasons the matter did not come to official attention. One view was offered by a GAO official appearing before the Nevada Nuclear Projects Commission in October 1994. He said that despite growing concern about the program, there was no appetite in Congress or at the executive level for such a review, because conventional wisdom held that the issue of nuclear waste management had been resolved in the 1980s legislation. Dwayne E. Weigel, Assistant Director of Energy and Science Issues for the GAO, has been a policy analyst on nuclear
issues for twenty eight years. When he spoke to the Nevada Commission, he said that the GAO was not the only agency concerned with the current program's organization and management of nuclear waste. (9) The Office of Technical Assessment recommended in the early 1980s a new, single-mission agency, rather than the DoE, for solving the nation's problem of nuclear waste storage and disposal. A recent study by the Nuclear Waste Strategy Coalition, a group of state public utility commissions, also concluded that the DoE should not manage the program. The earliest any repository site could open is the year 2010, and that date is optimistic, Weigel said. Therefore, some alternatives to managing the nuclear waste stream have been offered, such as dry-cask storage at the reactor sites.

In the GAO's latest report, issued in September 1994, the Congressional investigators insisted that such a broad-based review, including social and economic impacts, was vital for the success of a national nuclear waste management program:

"Important characteristics that an independent review body should have include requisite expertise in such areas as nuclear waste and public policy and administration, clear access to DoE's records of the program's performance, and a mechanism to provide public access to the review body's findings and recommendations." (10)

The GAO also called for a funding freeze for the Yucca
Mountain Project at current levels until the independent review is complete.

First Alternative:

In criticisms by State of Nevada officials, the GAO, and other reviewers, the necessity of an independent study of the entire management process has been stressed. By drawing on scientists, economists, sociologists, utilities representatives, environmentalists, ethicists and other interested parties outside the DoE, such an in-depth review could offer a more impartial approach to the entire problem of managing nuclear wastes, both those remaining from 50 years of nuclear weapons-making and spent fuel burned up in nuclear reactors across the nation. Either the President or Congress could launch such a review before any further progress on the site characterization studies is required. [This type of independent study should proceed beyond the current financial review of the Office of Civilian Radioactive Waste Management organized by Energy Secretary Hazel O'Leary last year.] If the DoE objected to stopping site characterization work, then the agency should be limited to basic research, such as surface mapping, analysis of samples already collected, and other non-intrusive studies. For a broad, in-depth review such as I am suggesting, the President or Congress would have to initiate it. In addition
to scientific and economic reviews, the proposed study would also examine social, ethical, and constitutional issues raised under the current program; that is, the impact on hundreds of thousands of residents living near nuclear reactors now and along future nuclear waste shipping routes, the fairness of locating a nuclear waste repository in a state (Nevada) in which there is no nuclear reactor operating and no benefits received from nuclear reactors, and the equity of imposing a radioactive repository on an unwilling state or community, especially a site which has shouldered the burden of nuclear weapons testing, both above and below the ground, for the past forty years.

The constitutional issues should be of particular concern to each level of government involved in the nuclear waste program. The most important constitutional basis which Nevada has to oppose the dump resides in Amendment X:

``The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.''

James Madison clearly noted that this provision was not conceived to be a yardstick for measuring the powers granted to the Federal Government or reserved to the States. For about a century, from 1837 to 1937, the Tenth Amendment was frequently invoked to curtail powers expressly granted to Congress, especially the powers to regulate interstate commerce, to enforce the Fourteenth Amendment, and to lay and
collect taxes. The first defense of states' rights before the U.S. Supreme Court occurred in behalf of the constitutionality of certain State acts after the Civil War in a tax case, Collector v. Day. In 1939 that case was expressly overruled. In the case of Yucca Mountain, Deputy Attorney General of Nevada Harry Swainston has addressed the arguments of injury to the state if a nuclear repository is built. Swainston's argument rests on the fact that the United States is attempting to use Nevada resources, namely the health and safety of its citizens, to the benefit of 49 other states. (11)

Swainston further argues that there is no provision in the U.S. Constitution which justifies or gives authority to the federal government to force a toxic byproduct or harmful material onto one state. Further, the State of Nevada has not accepted any benefits in exchange for disposing of the nuclear wastes, and in 1989 the Nevada Legislature outlawed storing or disposing of high-level nuclear waste within the state (NRS 459.910), he said. On the other hand, if Nevada or a local affected unit of government within the state invited the DoE to do business, there would be a joint venture and equal liability for any harm or accidents related to the nuclear wastes, Swainston said. Although the Price-Anderson Act protects citizens in case of accident, it does not cover injuries or perceptions of risk or harm to the area as a result of an accident, unless there is a substantial
release of radioactivity. In fact, the federal government may not be held liable at all. In a recent case in New Mexico, City of Santa Fe v. Komis, 1992, (12) a couple sued the state after the federal government took a slice of their ranch for a road leading to the Waste Isolation Pilot Project, near Carlsbad, N.M. The Supreme Court of New Mexico held the state liable for the perception of the loss in value of the Komis property, because the road led to a nuclear waste repository. The case and its $1 million compensation awarded by a jury has been upheld on appeal.

Meanwhile, the federal government is opposing any broad-based independent review of its nuclear waste management program. In response to the GAO and the NRC criticisms, Daniel Dreyfus, the director of the DoE's Office of Civilian Radioactive Waste Management, said he did not support an independent review of the disposal program because such a review would almost certainly put the repository project at a "serious disadvantage in maintaining progress and competing for funds." (13) Each year Congress parcels out monies for research at Yucca Mountain from a mil, or .001 cent per kilowatt hour, fee paid by customers of nuclear power plants. Although the Yucca Mountain project had been estimated to cost between $1 billion and $2 billion in 1982 by Sen. Bennett Johnston, D-Louisiana, the projected cost today, according to Dreyfus, is $6.3 billion to characterize the site alone. Dreyfus has asked Congress to take the repository
study off the federal budget so that the DoE can spend sufficient funds in the next two years to meet the licensing process required by the NRC in early 2000, thus keeping the repository on schedule to open in the year 2010 if Yucca Mountain proves suitable. Dreyfus said he did not discount scientific uncertainty, since the project is complex and researchers could run into more problems to explore.

However, the GAO said in its report that the benefits of an independent review may be worth the risk of smaller funding packages from Congress. With less funds while an in-depth review took place, federal monies would not be wasted. Since the makeup of Congress has changed so drastically in the November 8, 1994 election, whether the members will be willing to consider Senator Johnston's plan to give the DoE more money to do its site characterization work during 1995 is uncertain. Already the Senate Natural Resources and Energy Committee has told DoE Energy Secretary O'Leary there is no chance to amend the 1982-87 legislation to deliver more money to the Yucca Mountain Project. With more Republicans in Congress, the appetite to solve this lingering waste problem may push faster studies at Yucca Mountain and even prompt a move to store high-level nuclear waste at the Nevada Test Site. Whether energy policy or the issue of nuclear waste management will have a place set at the Congressional table beside such bread-and-butter issues as the economy, crime, welfare reform, job training, health care, and defense
readiness remains to be seen.

Nuclear utilities are, naturally, furious about the delays in repository siting. In June 1994, a number of utilities, states, and state utility commissions filed two separate suits in federal court, asserting the DoE has not complied with waste acceptance provisions of the Nuclear Waste Policy Act of 1982, as amended. Their suits were brought to force the DoE to accept spent nuclear fuel rods in 1998, the date the federal agency had promised to open the first repository. The suits seek not only acceptance of the wastes by January 31, 1998, but a declarative ruling that the DoE's decision not to begin accepting waste by that date was not in accord with the law.

The GAO had recommended in 1991 that the DoE develop plans in case it could not accept spent fuel by 1998. That is why the Office of the Nuclear Waste Negotiator was created in the 1987 amendments, to try to reach a voluntary solution to temporary storage in case of major delays with studies at the Yucca Mountain site. The failure of this portion of the 1987 amendments was acknowledged by the Energy Secretary in early 1994, when the DoE announced its intent to develop by 1998 a system of waste containers, the multipurpose canister system, that could be used for storing, transporting and disposing of the wastes. This proposal is expected to cost an extra $254 million over four years to develop, but the DoE would have a partial solution for encapsulating the spent fuel rods by
1998. However, there is no basis for designing such multipurpose containers, the GAO and the Nuclear Regulatory Commission have argued, because Yucca Mountain studies have not proceeded far enough to determine how the safest casks should be made. There are not enough soil studies completed to decide on what materials might be used in a container, and the site itself has not been deemed suitable. Whether Yucca Mountain is determined suitable or unsuitable as a disposal site, the DoE could be forced to spend more money to develop yet another container for disposal, if the multipurpose canister cannot do the job, depending upon how complex the mountain is, or whether another location is chosen, according to the DoE's own scientists.

In the meantime, the Mescalero Apache Indian tribe voted 490-362 on January 31, 1995 not to accept temporary nuclear waste storage on their New Mexico reservation near Carlsbad, but in a dramatic turnaround, on a second vote taken March 9, 1995 the tribe voted 593-372 to negotiate with the Energy Secretary. The Office of the Nuclear Waste Negotiator is no longer in existence. It was abolished by law at the end of January, 1995. In the case of the Mescaleros, the tribe now would negotiate with Energy Secretary O'Leary. However, the State of New Mexico is objecting to the temporary site on Indian lands, including an appeal to the federal government.
Second Alternative:

As a second alternative, perhaps it is time for the nuclear utilities to initiate some short-term solutions on their own, in case of further DoE program delays or the court does not agree with them about the federal government's responsibility for taking the spent fuel rods by 1998. If they must keep the waste, there is a method of on-site storage already approved by the Nuclear Regulatory Commission in 1992. That is dry cask storage, a method some utilities have already initiated and which is simpler than waiting for the proposed multipurpose containers. Instead of leaving the radioactive rods in pools of water at the reactors, they would be removed and placed in sealed containers above ground and kept dry while air circulation would cool them and radiation would be monitored. The NRC said in 1992 this temporary storage method could continue from thirty years to one hundred years.

The advantages to this approach include: 1) Since the waste would be stored on site, public fears over transporting high-level nuclear waste across country to a repository are eliminated for at least a century; 2) Removes the deadline of the year 2010 for opening a national repository; 3) Allows time for a review of the DoE, initiated either by the President or the Congress, to determine the course of the national nuclear waste management program. The
major disadvantage, from the utilities' viewpoint, is the expense. While study costs at Yucca Mountain could continue to rise sharply, at the same time the nuclear energy companies would have to buy storage containers and maintain them on site for an indefinite period of time. Another disadvantage from the DoE’s perspective is that with 110 reactor sites scattered around the country, the spent fuel rods sitting in dry casks could also be terrorism targets. However, the dry casks could be guarded or camouflaged, similar to those areas containing nuclear weapons today.

Although the DoE has proposed a multiple-purpose canister system to contain the waste from the time it leaves the reactor, through shipping, storage, and to placement in the final repository, success of the proposal is not assured. Public hearings on the multipurpose container project began in November 1994. By the time the containers are ready to be manufactured it could be another two to four years. The DoE has proposed to bundle twenty-one spent nuclear fuel rods into one canister that ultimately could weigh from seventy-five tons to one hundred twenty-five tons. The weight of the containers themselves poses transportation problems if Yucca Mountain is pronounced suitable as a nuclear waste repository. Heavy shipments across the nation’s existing highways or rail tracks could cause accidents or breakdowns, or create de facto storage sites across the country if a loaded truck or train stalls. Another disadvantage at this
time is the fact that the Southern Nevada repository site has no rail line to it. It has been estimated by the DoE that building tracks to Yucca Mountain from existing rail routes could cost $1 million a mile, adding further costs to the already expensive nuclear waste program as it exists today. There are other uncertainties with the proposed canisters themselves. Problems with such an arrangement as proposed in the multipurpose canisters solution include exposing packaging workers or shipping drivers to harmful radiation if the shield failed, the container melting from the heat of the packed rods, or a nuclear criticality, where a radioactive chain reaction could be initiated on the road, in storage or at a repository site. A final decision on the containers will not be announced by the DoE until 1996, if it can be proven to safely store the wastes.

The DoE’s Dreyfus has told Congress alternative storage plans need to be explored. When Congress convened in 1995 the ideas of on-site storage in dry casks, or regional temporary repositories chosen by negotiating with the Energy Department, had not been considered, although the Office of Nuclear Waste Negotiator ceased to exist on January 31. The DoE has proposed in its 1996 budget to save $1 million a year by eliminating the negotiator’s independent position. The DoE could offer to help the utilities buy dry cask containers for storage, or Congress could allocate monies from the Nuclear Ratepayers Trust Fund to help pay the utilities for purchase.
of the dry casks. Another temporary solution offered by the nuclear industry is to store the spent nuclear fuel at the Nevada Test Site, former location of the nation’s continental nuclear weapons experiments for forty years. The Test Site, it is argued, is already a federal reserve, and would require no negotiations with the State of Nevada to provide storage. (14) However, it is certain that the state would sue the government to keep the high-level nuclear waste some place else. Once again, there is no rail line leading onto the Nevada Test Site or Yucca Mountain. Besides, the current Nuclear Waste Policy Act does not allow storing nuclear wastes temporarily at a site under consideration as a permanent geological burial ground.

Third Alternative:

A third alternative would allow Congress to re-open the Nuclear Waste Policy Act as amended, while putting any further research at Yucca Mountain and its attendant funding on hold. Under this scenario, the Congress would return to the basic questions blocking solutions to nuclear waste management as well as amending the current national energy policy, namely:

1. Should the United States invest in more alternative energy resources, such as natural gas development, solar power, geothermal production, or wind farming? The Clinton
Administration has already favored natural gas development. The technology for solar energy, in particular, has taken a quantum leap since the 1982 NWPA or its 1987 amendments, and converting sunlight to electricity has become much faster and less expensive. A public-private partnership at the Nevada Test Site has been proposed by Enron Corp., of Houston, Texas, with the DoE. The solar project was initiated by the Nevada congressional delegation, notably Sen. Richard Bryan, D-Nev., who has been a consistent opponent of the high-level nuclear repository and supports finding alternative uses for the Nevada Test Site. Most of the technological progress in solar technology has occurred since 1992, as solar cells themselves have been transformed into more efficient and more inexpensive collectors. Geothermal resources are bound by the location and the availability of underground hot springs in the earth. Wind farming has been tried on an experimental basis in Hawaii and California, and the state of Illinois is trying it on a small scale. Meanwhile, with the shift in parties in Congress after the November elections, more domestic development of oil may be sought. These and other resources offer options to be explored.

2. Should the nation continue to produce more nuclear power? This question depends on the public's appetite for nuclear energy. In dozens of polls taken over the past fourteen years, people want the reassurance of power on demand, but do not support nuclear energy because of its
waste products. Since this nation is still based on democratic principles, if the public is serious about finding and supporting energy alternatives and national leaders are equally serious about putting the United States on a firm foundation independent of Mid-East oil, then a discussion to resolve such alternatives is due. This is a question requiring public participation, and the people should realize how the nation already subsidizes the nuclear fuel cycle through enriched uranium subsidies, insurance to the nuclear industry (the Price-Anderson Act), and the support for burying nuclear wastes. All of these subsidies are paid in whole or in part by taxpayers, as well as contributions from nuclear ratepayers. The debate also encompasses finding a temporary solution to managing nuclear wastes, since the nation is not approaching a final solution for disposing of them, whether in Yucca Mountain or at another site.

3. How can the nation wean itself from fossil fuels? Once again, this discussion needs to be opened and broad enough so comparisons among energy sources such as oil vs. nuclear vs. solar vs. natural gas vs. geothermal may be fully explored. The advantages and disadvantages vary with each source. For example, is it possible to produce oil domestically? How much does it cost to import foreign oil? Are taxpayers willing to pay more for solar energy at first, when collectors and distribution systems are necessary? Are taxpayers willing to pay for oil spill cleanups?
4. How much are the taxpayers willing to pay for any energy source? This is a very important issue, since voters nationwide in the November 8, 1994 election seemed to have sent a clear message they want less government, but are not willing to give up some entitlement programs, such as Social Security. The question at the national level is who leads the revolution for providing enough energy to keep up with the power demands of U.S. society? After the energy crisis of the 1970s, Americans became aware of how precarious the oil pipeline can be, but in the 1980s and 1990s the pain of lengthy gas lines has almost been forgotten. Normally, an alternative energy source costs more to initiate, whether it is solar or wind-driven. The costs over time should diminish. In the case of nuclear power, to clean up hazardous radioactive wastes, the DoE is preparing to ask Congress to provide more funding sooner, rather than later, to rid the nuclear industry of its end product and the concurrent liability. The industry's strategy seems to be once the government takes charge of the nuclear waste, it will be able to revive the research necessary to sell a new generation of nuclear reactors to the public. First, however, the nation's leaders should ask the public for help in managing nuclear wastes, and whether to continue relying on nuclear power generation. The basic question to the American public is which energy resources should the nation develop and at what cost? These other considerations I have offered should be
carefully compared and each alternative explored from scientific, economic, ethical, and social positions before the nation comes to a final decision.

5. Is geologic disposal scientifically sound? Critics such as philosopher-scientist K.S. Shrader-Frechette and Nevada elected officials and their consultants have urged the DoE to leave the spent nuclear fuel at reactor sites in dry-cask storage until the radioactivity cools off. Physicist Charles Bowman of the Los Alamos National Laboratory advocates transmutation for the nuclear wastes to remove dangerous plutonium, or, as an alternative to Yucca Mountain -- which he believes could explode in a nuclear chain reaction -- to bury radioactive wastes in granite formations found in New England and Canada.

Although I consider three alternative approaches to nuclear waste management above, it would not be a realistic analysis without reviewing a "no action" alternative, an avenue required under the federal National Environmental Policy Act as well. If the nuclear utilities allowed the spent fuel rods to continue accumulating in "swimming pools" of water at the reactors operating across the nation, executives and researchers estimate they will run out of capacity. How soon this might happen remains uncertain, since scientists may be able to discover ways to keep more spent fuel rods closer together in the pools, or stack them on dry land in a different configuration than they are currently
kept. The Nuclear Regulatory Commission, which licenses nuclear reactors in the United States, may also allow older reactors to continue operating until the nuclear waste issue is resolved for the interim.

Along with the no action alternative, utilities themselves could begin dry cask storage on land, away from the aging storage pools. As mentioned above, the Nuclear Regulatory Commission has already approved of above-ground, dry cask containment for up to a century. In turn, the utilities have been unwilling to begin massive temporary on-site storage of the fuel rods, because it is expensive. The DoE has agreed to investigate ways to possibly help fund dry cask storage at the sites, although this is not a preferred national alternative. President Jimmy Carter abandoned on-site storage of spent fuel rods, leading to reprocessing the fuel and reinstalling it in the reactors, for fear of nuclear materials proliferation or acts of terrorism could spread nuclear materials around the world used in nuclear weapons. The danger would be if terrorists could hold the free world hostage with such weapons built from U.S. nuclear materials.

III. Analysis:

It is apparent, even from a basic and cursory review of the controversy surrounding the U.S. approach to managing its nuclear wastes, that an independent review is needed immediately. By February 1994, twenty seven members of the
The House of Representatives had written to the President, urging him to appoint a presidential commission to conduct a comprehensive review of the nation’s needs, policies, and programs on the issue of nuclear waste management. In March 1994, the Senate introduced Senate Bill S. 1928, the "Second Generation Nuclear Waste Act," to, among an array of actions, ensure adequate nuclear waste disposal capacity. A dozen Senators proposed, in a letter to the President, an independent review by a presidential commission of all nuclear waste programs and policies. All of the above proposals point out the fundamental need for a review independent of the DoE. Not only is the DoE’s credibility tarnished, but the financing of the project has raised deep concerns from all quarters, including all Energy Secretaries serving under the administrations of Presidents Ronald Reagan and George Bush.

Besides independence from the DoE, a review of nuclear waste management should include characteristics such as required expertise in such areas as nuclear waste, public policy, administration, socioeconomic impact, risk assessment, and the ethics of risk assignment. In addition, any such review must be able to access the DoE’s records concerning the program’s performance, an important point made by the GAO. Finally, and most important, the independent review process must provide public access to the review body’s findings and recommendations, and a mechanism allowing
public criticism and comments on its conclusions. The main task of such a policy analysis is not to determine theoretical solutions, but to raise issues, question assumptions, stimulate debate, and especially educate citizens to distinguish between good and bad reasons so they may make an informed choice. I believe the DoE has failed to educate the public about the range of alternatives for storage, options for long-term storage or disposal, hazards attached to each course of action, and limits to the current nuclear waste management approach. (15) Perhaps this should not be the DoE’s responsibility, but an independent scientific-economic-ethics-and-policy review body instituted for the sole purpose of public education about nuclear waste management.

When the Director of DoE’s Office of Civilian Radioactive Waste Management commented on a similar proposal by the GAO, he said he did not support such an independent review. However, if a review is to be launched, it should be done by Congress and/or the President. Any significant policy changes will depend on Congressional authorization and funding, according to Daniel Dreyfus, the OCRWM Director. Some of the policy issues may be addressed by the Congress during the 1995 session. However, a piecemeal approach is not recommended here. The House Committee on Appropriations, in its report on the appropriations for energy and water development for fiscal 1995, cited the Nuclear Waste
Technical Review Board’s recommended independent review of the management and organizational structure of DoE’s civilian radioactive waste management program. This House report recognized that the NWTRB repeatedly expressed its concern about the lack of progress in studies at the Yucca Mountain site. In its latest report, the committee called progress on site characterization "dismal at best." (16)

Purely from an economic viewpoint, an independent review is warranted. While the House Committee recommended $434 million, or about $99 million less than the DoE requested (but about $54 million more than it had received) in fiscal year 1994 for waste management, the Senate Committee on Appropriations recommended the DoE’s full requested amount of about $533 million. A subsequent conference committee bill recommended and the Congress approved about $523 million, or about $143 million more than appropriations for the program in fiscal year 1994. On August 26, 1994, the President signed the Energy and Water Development Appropriations Act for fiscal year 1995 (P.L. 103-316), providing the compromised amount of about $523 million for the program for fiscal year 1995. Of the total, about $392.8 million has been appropriated from the Nuclear Waste Fund collected from nuclear utility ratepayers; another $129.4 million appropriated for Defense Nuclear Waste Disposal; and about $0.7 million is available for Civilian Waste Research and Development. An obvious question is, has the money been well
spent? This is a central question for a broad, independent review of the entire program.

Although Congress recognizes a need to complete scientific investigations at Yucca Mountain as expeditiously as possible, it is also aware that changes are needed to ensure scientific investigations are effective and efficient. These concerns are displayed in congressional budget action, as noted above. The GAO has shared the concerns of Congress, and pointed out in previous reviews, that from 1991 through 1994, about 65 cents of every $1 has been spent on the Yucca Mountain Project. Of that amount, some 28 cents of every $1 spent at Yucca Mountain has been dedicated to scientific study, while the rest of the money has supported administration, contractors, and facilities, or overhead costs rather than scientific studies, although the disparity between the DoE’s budget requests and actual levels of appropriations have been at great odds. The DoE acknowledged its high infrastructure costs, maintaining they occurred, in part, because the agency could not predict future appropriations with certainty when planning future work. The DoE’s budget is mapped out two years in advance, but should be no excuse for continuously submitting budgets that are too ambitious. This high cost of infrastructure is another good reason for an independent review of the program.

To counteract its high levels of projected funding, the DoE has developed a more modest approach to its planned
activities at Yucca Mountain, complete with funding targets and estimates of the project’s schedule and costs. While the DoE would meet its deadline for accepting waste by 1998 under its latest plan, scientific studies would continue long after the repository was open in 2010 and accepting waste. To do this, the DoE has requested Congress to amend the NWPA as amended and allow retrieval of the radioactive waste for up to 100 years, rather than the current 50 years. Under its proposed program approach, the DoE would accomplish its goals by deferring some of the scientific work and testing originally planned until after a repository construction authorization was received from the Nuclear Regulatory Commission. The work, according to the DoE, is relatively lower priority site investigations that would not prevent licensing the repository by the NRC. The State of Nevada has objected to this shift in scientific studies and the accelerated funding approach, especially on delaying surface-based studies of the mountain and its pneumatic characteristics. The U.S. Geological Survey is still mapping faulting characteristics on the surface of the mountain, and the porosity of Yucca Mountain’s volcanic rock, allowing it to "breathe," has raised scientific concerns that radioactive Carbon-14 gas may escape from the repository (See Chapter One).

The DoE’s proposed approach has raised concerns and questions about how to balance costs, schedules, public
health and safety issues. Both the Nuclear Regulatory Commission and the Nuclear Waste Technical Review Board have concluded, based on the limited information available from the DoE, that the Energy Department's proposal for a fast-track, pre-license schedule would increase technical and scientific uncertainties inherent in determining whether the site is suitable and whether it could be licensed for use as a permanent geological repository. Since such a project has never been accomplished before, the DoE's approach must be classified as a scientific experiment, and treated as such. There is no certain outcome under a realistic approach. Here is where the wheeling and dealing of the political arena has overcome the scientific approach, as Rosemarie Tong pointed out in *Ethics in Policy Analysis*. (17) When the Nuclear Waste Policy Act of 1982 was amended, the scientific search for a suitable site was pushed aside as Yucca Mountain, Nevada was the single site chosen for study as a nuclear waste repository. The legislation forced federal scientists into an untenable position, as they have to prove the site is suitable, since there are no alternative locations under consideration. As I argued in Chapter Four, politics abrogated any true scientific approach to nuclear waste disposal, and the 1987 Amendments themselves eliminated the need for public participation, just as public debate by the elected representatives was eliminated during the time the policy was fashioned in Congress by Senator Johnston. It is
time to broaden the political and technical basis of these decisions, for the way by which legislation has been enacted makes it appear that public consent has been "engineered" by the political process.

Since there is evidence of scientific uncertainty and an increasing need for funding for the Yucca Mountain nuclear waste repository program, it seems a broad, independent review of the policy basis underpinning nuclear waste management is long overdue. Coupled with growing congressional and public concern about the current program's pace, cost, and direction, a comprehensive review, such as I have outlined in the first option appears reasonable. Barring such a sweeping study, I would choose the third option, to address the immediate and future energy resources and program concerns. Key issues already identified by the Congress, the GAO, the NRC, the NWTRB, and others include storing waste, either onsite or within regions, until a permanent solution is agreed upon, providing adequate funding for scientific studies to find a solution, reorganizing the DoE's program administration and management or replacing the DoE with an independent organization, and regulating a repository's development in full accord with the nation's health, safety and environmental laws. Whatever options are proposed, to implement such fundamental changes will require changes to the Nuclear Waste Policy Act of 1982, as amended. In third place, I would choose the second option, but this one, in my
opinion, does not go far enough.

Daniel Dreyfus, the Director of the Office of Civilian Radioactive Waste Management does not support an independent review of the DoE's disposal program and policies, because he believes the program and its repository project would be effectively relegated to a sort of caretaker status and lose time and funding during a lengthy review. Then the reviewers might recommend major redirection of the entire project, according to the director, putting the current project at a serious disadvantage in its competition for funding with other federal programs, and maintaining scientific progress. The director warned Congress that if an independent review is undertaken, it may affect site characterization work at Yucca Mountain. Depending on how far Congress is willing to change courses, the Yucca Mountain Project should either be delayed or eliminated. Since 300 generations of Americans are involved in this debate, such delay should not be rejected out of hand.

The benefits from an independent review, accomplished in a balanced, objective and sophisticated way and independent of the DoE, appear to benefit the goals the Congress is seeking, and may be worth the risk of reducing funds available for the Yucca Mountain Project during the review process. This balancing act between health and safety, funding, progress, and reaching sound solutions are an example of the difficult choices facing both policy analysts.
and decisionmakers in proceeding to solve problems in an efficient and effective way. Whatever avenue is chosen, however, technology and an engineered solution made in Congress by political elites or outside of the public's view, do not satisfy the democratic process that such an enormous problem demands.

In my opinion, the most important element in any of the alternatives I have suggested is public participation. Is there an avenue for including spirited public debate, with an informed people, on the issue of nuclear waste management, and beyond that, a national debate on U.S. energy policy? I believe there are at least two methods to enhance public access and accountability to this enormous task. Once these ideas become public, it is hoped that more avenues for contributing to the public debate will appear.

Instead of the DoE or nuclear funded groups calling public meetings and workshops where the information is presented from a single viewpoint alone, perhaps a consultant or independent group skilled at fostering public debate could organize regional "Town Hall" events, places where people could meet face-to-face to ask questions, gain information both pro and con on the government's plans for nuclear waste management, discuss the issues and offer opinions on the basis of what they have learned. First, by removing the DoE and the nuclear industry from the responsibility and control of the content of the meetings, discussions might be more
informative and free-flowing. Second, the meetings would be open to serious suggestions, debate and deliberations, if enough ideas were offered. Third, these meetings must be on a small enough scale so participants know one another, yet their comments or consensus must be taken seriously, another reason to choose an independent party rather than the DoE for organizing the meetings. Here is a chance for such broad-based and neutral groups as the League of Women Voters or the American Association for the Advancement of Science to supply the resources and a solid foundation for the public debate.

Another option is opening the channels of communication through network television, cable television, computer bulletin boards, and radio. Most important in this mix would be how to record comments from as many people as might care to participate. For any of these media, responders could be given a mailing address or a telephone number with a recorder on it to take comments. For computer users, an e-mail address would be appropriate. The stumbling block here is how to offer information to people so they may comment with some intelligence. Once again, I believe the sources must be divorced from the DoE or other interested parties involved in the current nuclear waste program. This does not mean that I am opposing participation by the DoE or the nuclear utilities, only that an independent organization offer the information in a straightforward and balanced manner. After comments are received, then an independent organization
should gather and review the comments, seek appropriate replies to them, and publish them for the general public to consider, including responses from the DoE to appropriate questions. This entire endeavor could take as little as a year to complete from information output until a final report is issued for public review, or up to two years, depending on the variety of media chosen to participate in this electronic public forum.

Unless and until the public becomes active in this important debate on the future of energy resources and nuclear waste management, I do not believe there will be a solution to the U.S. nuclear waste problems. If the current course of legislation and its attendant revisiting of previous legislation, along with current DoE management practices continues, the disposal of nuclear waste could be delayed for decades in courtroom battles or never be accomplished at all, for eventually it will become too expensive over the long spans of time.

IV. Conclusion:

As Congressional concerns and public dissatisfaction continue to mount over the pace, direction, and increased funding for the nuclear waste program, an urgency surrounds the need to conduct an independent review of the entire
program and its attendant policies. Such a review should include key issues, including interim storage of nuclear waste, adequate funding for the program's objectives and goals, once they are in focus, the management and organization of the project and the program, and how the program should be regulated. While the Secretary of Energy has attempted to review the financing of the Yucca Mountain Project, a much broader and more in-depth analysis is needed to address the entire program and its future.

The DoE began to address some concerns, such as restructuring the management of the program and the organization of its contractors, which may shed considerable light on the current status of the program, but a much broader and deeper analysis of the fundamental energy issues is necessary to begin to tackle the overarching problems and issues endemic in the system. An independent review could potentially uncover basic changes necessary to accomplish the ongoing task of managing the nation's nuclear waste. Added to this perspective, the DoE's own proposal for realigning its Yucca Mountain Project has not been approved by Congress, and a new spectrum of representatives elected to that body, adds another dimension of uncertainties and risks to the entire nuclear waste management process, as well as to the current proposed solution.

Once an independent review of the disposal program is completed, its insight could support Congress through the
best possible information for evaluating the performance of the DoE's program, helping make future funding decisions, and making any necessary fundamental changes to the entire program. An independent review body should have and include the following important characteristics: expertise in the science of nuclear waste "containment", public policy (including genuine participation instead of a "pr'" approach), administration, public health and safety, socioeconomic impacts, risk analysis, and the ethical problems inherent in risk assignment. The reviewers also require total access to the DoE's records of the existing program's performance. And finally, the review must provide public access to study and critique the independent body's findings, recommendations, and conclusions.

The entire concept for such a far-reaching review of the U.S. nuclear waste program has its foundation in a true independence from the DoE and its contractors. There is no basis for trust in a review conducted by the Energy Department. For example, the limited financial review underway as a result of the Energy Secretary's initiative provides fair warning for ensuring independence in any future studies of the program. An independent review would need a high-level charter, either from the Congress or the President. A presidential review could be ably overseen by Congress, if appropriate public hearings were conducted. The GAO has suggested appropriate entities for consideration to
perform such a review, before Congress has to deal with the issue. They are a specially constituted congressional committee, a presidential commission, and/or the National Academy of Public Administration. No matter what avenue Congress takes, the discussion over these complex and serious issues ranging from energy needs to managing the nation's nuclear waste will continue for some time to come and must be accomplished in the sunlight of a democratic discussion, for the public has a right to know what alternatives are available to them now and for their future.
ENDNOTES


7. Letter to President Bill Clinton, July 4, 1993, signed by 32 public interest groups.


9. In an interview following his testimony, Mr. Weigel said neither the U.S. Department of Energy, nor past and present administrations, seemed interested enough to conduct a review of the national nuclear waste management program. He said there had been no appetite among high officials to revisit the issues, although enormous amounts of federal funding had been set aside for site characterization, both in the ratepayer trust fund and through defense funds diverted for the waste project.


12. City of Santa Fe v. John Komis and Lemonya Komis was adjudicated before the Supreme Court of New Mexico on August 26, 1992. The court said that of the total 673.77 total acres, the city took 431 acres of the property by condemning it on November 14, 1988. Following a jury trial, the Komises were awarded $884,192 in compensation, representing $489,582.50 for severance damages and $60,794.50 for severance damages to the buffer zone, and $337,815 for severance damages "for perceived loss due to public perception." The jury entered its verdict on August 1, 1991, then the Komises filed a motion to modify judgment on August 20. The city filed an appeal on August 29. The trial court granted Komis's motion on August 30, increasing the interest rate for a total of $1 million. The high court upheld the increase in award.


14. Many people do not realize that Yucca Mountain is not part of the Nevada Test Site. The mountain is owned and operated by the Bureau of Land Management and the U.S. Air Force. Both federal agencies have given the DoE permission to conduct site characterization at Yucca Mountain. Congress would have to formally withdraw the land if the mountain was deemed suitable for a nuclear waste repository. In the early 1980s, when it was mentioned as a possible nuclear disposal site, the Air Force raised strenuous objections, since Yucca Mountain is part of the flight path for training fighter pilots. By 1987 Congress gave permission for the DoE to continue studies at Yucca Mountain, but it has not been transferred to the Energy Department, which would be done if the site is found suitable as a nuclear repository. The DoE also considered its one and only "worst case" accident at Yucca Mountain as the crash of an Air Force fighter jet into the repository area. Any workers would be killed. No radiation estimates were offered, the DoE said, because no one would be there to read them.

In addition, Rosemarie Tong’s *The Role of the Expert in A Democratic Society, Ethics in Policy Analysis*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1986, Chap. 2. These suggestions of "amateur experts" (Tong’s term) and suggestions of involvement by ordinary people are extremely important on a major problem such as nuclear waste management. For too long, the public has relied on the DoE to host and conduct public meetings on the subject. If an independent "Town Hall" type of meeting could be arranged, former DoE scientists, such as geologist Jerry Szymanski and Yucca Mountain Project Deputy Manager Maxwell Blanchard, might lend their expertise to the public during the discussion, for they no longer rely on the DoE for their careers. What the public has not heard during the entire nuclear waste program as it now stands is a debate on the scientific, social, ethical and economic issues surrounding the current plan.


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