A SUPPLY-SIDE APPROACH TO NUCLEAR WASTE REPOSITORIES

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ABSTRACT

The Nuclear Waste Policy Act of 1982 (NWPA) was signed into law on January 7, 1983. Its purpose was to ". . . provide for the development of repositories for the disposal of high-level radioactive waste and spent nuclear fuel, to establish a program of research, development, and demonstration regarding the disposal of high-level radioactive waste and spent nuclear fuel, and for other purposes."[1] Its goal is to have the first waste repository operational by 1998. It is believed by many that this goal cannot possibly be met. The Act is exceedingly complex with something in it for everybody. There are serious impediments to the program--not the least of which is legislation itself. The process will cost tens of billions of dollars and, even if it does succeed, will take many years to accomplish. This paper proposes a method for getting there in 7 years while saving billions of dollars. It is a summary of a more extensive research effort by the author while attending the Industrial College of the Armed Forces.

BACKGROUND

The debate over radioactive waste disposal continues in spite of recent legislation establishing a program to develop a deep geologic repository for high-level waste from civilian nuclear power plants. Over 12 percent of the electricity generated in the United States is produced in nuclear power plants. However, these plants have produced over 9,000 metric tons of spent fuel (high-level waste). By the year 2000, this figure will be about 50,000 metric tons.[2] The problem of disposing of this waste is thought by many to be the Achilles heel of nuclear power. It is currently a major rallying point for those who oppose nuclear power.

Although extreme public concern and anxiety exist about radioactive waste disposal, there is broad technical consensus that the task can be accomplished safely. In 1957 the National Academy of Sciences recommended that these wastes be disposed of in deep geologic rock formations with salt being a particularly good formation.[3] Extensive research, environmental analysis, and other studies support the concept of geologic disposal. The Nuclear Regulatory Commission (NRC) has ruled[4] that geologic disposal of radioactive waste is indeed feasible and achievable.

The Department of Energy (DOE) is now constructing a limited use repository (Waste Isolation Pilot Plant--WIPP) in a deep salt formation in southeast New Mexico. Beginning in 1988 DOE plans to actually dispose of certain wastes from nuclear weapons production.[5]

Congress agreed that waste disposal was a serious problem and in 1982 passed the Nuclear Waste Policy Act. The Act provides a framework for the Department of Energy to construct a repository for the disposal of high-level waste from civilian nuclear power plants by 1988. Specifically, the Act provides:

- Schedules, decision points, and other considerations for siting, licensing, and constructing repositories,
- Arrangements for State, Indian Tribes, public, and special interest group participation in the total process,
- Mechanisms for funding the program by establishing a fee on nuclear generated electricity, and
- Federal agency responsibilities.

Although the Nuclear Waste Policy Act provides a detailed road map for establishing a repository, many believe that the Federal Government is not likely to succeed in doing so. Even if it does succeed, it will do so at great cost and certainly long after the 1998 date required by the Act. The approach, however, is an old and tired one of throwing money and a new bureaucracy at a tough problem. The cost will be tens of billions of dollars which must be paid by the users of nuclear generated electricity.

There are serious impediments which can slow down or even stop repository construction. The complexity of the Act itself will surely create significant problems. Any nuclear issue is an institutional and political nightmare--radioactive waste disposal is no exception. The NWPA has something for everybody. Politicians, environmentalists, antinuclear groups, and the public will all have their day in court. Perhaps the most serious problem is the media role in shaping negative public sentiment. In view of the high-cost, significant schedule risk, and built-in insurmountable problems, this paper proposes an alternative approach. A supply-side or entrepeneurial approach in the private (non-Federal) sector could work more efficiently, cost less, and result in an operational repository in 7 years.

Repository Cost Considerations

The Department of Energy estimates that by the year 2002 it will spend about $6.5 billion on development and evaluation--no construction.[6] Depending on the rock medium selected, construction costs could exceed $2 billion.

Operating costs are estimated at $150 million a year. There is no provision in these figures for schedule slips or interim storage if a repository is not open by 1998. By DOE's own admission, these estimates are preliminary. Neither the Government nor the nuclear industry has a demonstrated ability to control cost.

Given the magnitude and uncertainty of these estimates, the extreme unlikelihood of meeting schedules, and the inability of Government agencies to control cost growth, utilities and ratepayers should be looking for better solutions. The cost and schedule for building the Waste Isolation Pilot Plant (in bedded salt) stand in sharp contrast to NWPA program direction. In this project located in southeast New Mexico, the Department of Energy has demonstrated a very high degree of cost and schedule discipline. WIPP is significantly below cost and ahead of schedule. Current WIPP costs estimates are identified in DOE's 1986 Congressional Budget Request:[7]

	$Million
Construction Cost	$459
R&D, Evaluation, etc.	$234
Total	$693

Yearly operating costs are estimated at $22 million in 1983 dollars. Admittedly, WIPP is an unlicensed facility and is not designed for high-level waste disposal. But, it is safe and there has been intensive technical review by the State of New Mexico, the National Academy of Sciences, and others.

DOE has established the Nuclear Waste Fund required by Section 302 of the NWPA. The Act requires that the producers (and therefore the users) of nuclear power pay for the cost of waste disposal. The initial fee of 1 mill per kilowatthour (kWh) for all nuclear-generated electricity was set by the Act. This fee is subject to annual review and revision as program funding requirements become better defined. In addition, a one-time charge was assessed for all spent fuel in storage at nuclear power plants. The kilowatthour fee is currently generating about $30 million a month. The spent fuel charge revenue will be about $2 billion.[8] Timing of the one-time payment will be negotiated with the utilities. Seventy utilities, reactor operators, and fuel vendors have now signed waste disposal contracts with DOE and have started paying into the Nuclear Waste Fund.

The kWh fee is a masterpiece of funding strategy. A charge of one tenth of 1 cent for a kWh of electric power produced by a nuclear powerplant is a miniscule charge. It is hardly felt by the ratepayer. Yet, it can, by slight manipulation, produce hundreds of millions of dollars in revenue, and still hardly be felt. It is a small charge on an incredibly large number of units! This increase in revenue could be used to develop incentives for a State and locality to cooperatively host a repository.

DOE's Electric Power Monthly reports price and consumption of electricity in 40 selected U.S. cities.[9] To illustrate the impact of slight changes in the waste disposal fee, a comparison is made in Table I.

TABLE I

The Effect of Waste Disposal Fee
On The Price of Electricity

City	Price of Electricity (¢/kWh)	Waste Disposal Fee as % of Price of Electricity		
		1 mill	2 mills	3 mills
Seattle (low)	2.03	4.93	9.85	14.78
Baltimore (median)	8.09	1.24	2.47	3.71
New York (high)	17.32	0.58	1.15	1.73

The low rate in Seattle (Bonneville Power) is shown only for reference since most nuclear power is distributed in areas where rates cluster around the median. As shown above, even if the waste disposal fee were tripled (3 mills per kWh), it would be only about 4% of the cost of power for most users.

DOE's Energy Information Administration has projected the future growth and use of nuclear power.[10] This data (Table II) is the basis for projecting yearly waste disposal fees which could be available:

TABLE II

Funds Available From Waste Disposal Fees

Year	Nuclear Power (Terawatt Hours)	Disposal Fees ($ Million)		
		1 mill	2 mills	3 mills
1983 (actual)	294	294	588	882
1985	385	385	770	1,155
1990	581	581	1,162	1,743
1995	643	643	1,286	1,929

The point to be made in all this discussion is that an efficient repository developer has virtually unlimited resources available. These resources can be translated into staggering economic benefits to the State and locality willing to accept a radioactive waste repository.

A Supply Side Alternative

The purpose of proposing a supply-side approach to constructing the Nation's first commercial repository is simply to suggest that a free market approach could accomplish what brute force and politics may not. "Supply-side" is an attempt to capitalize on the current popularity of the term and reflect the private enterprise preference of the Reagan Administration.

The supply-side economists say that the way to economic growth is to cut taxes and Government spending--let the market work freely. Lower taxes should result in savings and investment, thereby improving output and productivity. With the proper incentives, the free market is better able (than the Government) to provide more supplies at lower prices. Output and productivity will go up with a decrease in inflation.

An important point to be made in this paper is that there can be significant free market (supply-side) benefits to be accrued by a State* and the specific locality where a repository is constructed. A cooperative (nonadversarial) approach by Federal, State, and local Governments along with the nuclear power industry can solve this waste disposal problem much more efficiently. Such a cooperative effort is possible only by a creative approach and focusing on the supply-side incentives. It is widely perceived that NWPA is the Long-Term Employment Act (like WPA) for environmentalists, waste managers, and lawyers. It is time to short circuit the bureaucratic system.

Incentives

The primary incentive to hosting a repository is MONEY. If a deep geological repository were constructed for disposing of old automobile batteries, it would be a new industry welcomed with open arms. The nuclear nature of the repository, however, creates a new set of public perceptions which are not in tune with scientific reality. In fact, a facility for disposing of old car batteries might even be more hazardous than a nuclear waste repository in the long term. Money (jobs, commerce, etc.) creates the ability to move perceptions and attitudes more into line with reality.

NWPA allows DOE (absent a legislative veto) to collect whatever is required to cover the cost of disposal, and utilities must pay it. The current fee is one mill per kWh. Why not two mills? Why not three mills? From a free enterprise point of view, the money now being collected is being inefficiently spent on fighting the tidal wave of opposition and addressing every technical question imaginable. To make matters worse, there are now three tidal waves--Texas, Nevada, and Washington. Many would argue that a fourth tidal wave is the network of environmental and antinuclear interests dedicated to destroying nuclear power.

Wouldn't it be more efficient to optimize the incentives and work the problem cooperatively with a single state? Why not make an honest, fair, open, and negotiated deal? The packaging of that deal would provide the supply-side incentives to building a repository in a cooperative and efficient environment. A State could impose a highly profitable user fee which should not be looked on with cynicism. A high fee, say 3 mills, is simply a realistic charge for taking a hazardous and politically unpopular commodity for disposal. Those who accept it should indeed receive special consideration.

A second incentive is an assured significant expansion of the State and local economic infrastructure. As with any new industrial facility, local demand is created for supplies, services, and skilled labor. Permanent jobs created by a repository will have a multiplier effect in creating new demand. The potential for spinoff business and increased municipal support systems is enormous.

Perhaps an even more important incentive, would be a State's enhanced ability to demand concessions, special considerations, and further development of its economic infrastructure. These concessions and considerations should not be limited to the State-Federal deal. They should include the nuclear industry as well. In fact, the nuclear industry is in an excellent position to be truly creative and innovative without Government interference. Architect-engineers, constructors, plant operators, and equipment vendors could make their own deal with a repository host. Their participation with the host State in developing new commerce and industry may be an even more credible incentive than the State-Federal deal. Again, the possibilities are only limited by the vision and imagination of those negotiating the deal.

Significant new ancillary facilities and industries would be created by a working repository. New shipping casks, rail cars, and trailers are needed. The host could demand that they be locally manufactured. In fact, the host could demand that most goods and services be locally purchased or manufactured.

Additional facilities may be needed for spent fuel packaging or disassembly and repackaging. These facilities should certainly be located near a repository. With increased State and local

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* It should be remembered that the NWPA gives Indian tribes the same rights as States in siting a nuclear waste repository. An Indian tribe could locate a repository within its tribal boundaries and reap the same benefits as any State.

acceptance of nuclear technology, development of other nuclear-related industries could follow. Demand is then created for more skilled labor and the technical schools and university programs to train them. One suggestion has been for the Government to establish a "world class" R&D center for radioactive waste management in the host State.

Along with statewide acceptance of nuclear technology could come a fuel reprocessing plant and possibly nuclear power plants. These are multibillion dollar projects. Communities could also demand that Government nuclear R&D facilities be part of the incentive package.

A final recommendation is that DOE should consider offering the state with the first repository locality a major nonnuclear project. One example is the proposed Superconducting Super Collider (SSC).[11] SSC is a 200 trillion-electron-volt colliding beam accelerator recommended by DOE's Independent High Energy Physics Advisory Panel. The project is estimated to cost $3-5 billion and take nearly 10 years to complete.

The SSC will be 50 times more powerful than existing machines. The accelerator ring is expected to be 100 miles in circumference. Many areas of the country with good repository sites also have land ideally suited for the construction of SSC. Hosting the SSC would make a State the world center of high energy physics research. The economic and technical spinoff possibilities defy the imagination.

The SSC is an excellent example of how States and localities vie for new nonnuclear industry. February 15, 1985, headlines in the Los Angeles Times stated "California Gears up to Vie for $3-Billion Atom Smashers Site." The state has provided $500,000 for the University of California to finance the process.[3] This is one project that is "OK-in-my back yard"--not so with waste repositories. Why not link the two?

An argument could even be made for using fees collected by the repository State to fund or partially fund SSC. After all, SSC is a research tool for nuclear physics. A State, by partially funding SSC from user fees, would be a partner in its development. Right now there is no certainty of full funding of the SSC by the Federal Government. With a private sector participant, the project is significantly more viable.

A Supply-Side Proposal

As a theoretical construct, a plausible repository program is proposed. This proposal is suggested by recent DOE experience on the WIPP project and a belief that a free-market approach will be significantly more efficient. As a point of departure, a supply-side program is envisioned *which* would have the following features:

- A 1-year effort to develop the strategy, quantify and promote the incentives, solicit proposals, and get a state to accept
- Two years for site characterization and development
- Four years to construct a repository
- Cost twice as much as WIPP (or $1.386 billion)
- Cost $44 million per year to operate (twice as much as WIPP)
- Save tens of Billions of Dollars in the process

The host state and locality would be free to negotiate the deal including the degree of Federal participation (NRC, DOE, etc.). However, NRC participation could be beneficial to the State in terms of independent safety assurance. DOE has much experience in designing, constructing, and operating nuclear facilities which could be helpful to a State. The U.S. Army Corps of Engineers could manage construction as they did for WIPP. A State could also establish consulting or business enterprises to accomplish their objectives entirely in the private sector.

The Congress, DOE, and the nuclear industry should apply some new conceptual thinking to the problem. NWPA is the old solution of throwing money and a new bureaucracy at a tough problem. We are a nation of innovators and entrepreneurs--it is time to put our Yankee ingenuity to work.

A state willing to be bold enough to exploit the situation would only have to say "Stop the music (NWPA)--we are ready to do the job quickly and efficiently--here is our proposal."

Safe permanent disposal of nuclear waste is technically achievable. The evidence is overwhelming. There are, however, significant institutional and political impediments to achieving timely results, and the cost of overcoming these impediments to nuclear power users is enormous. It may even be impossible to achieve success in time to avoid serious impacts on the nuclear power industry.

A supply-side approach could short circuit the massive forces moving against the NWPA-designed program. The potential economic benefits to a State and locality hosting a repository stagger the imagination. It also staggers the imagination to think that a man set foot on the moon in a program spanning less than a decade. Yet, a spent fuel rod cannot be buried in a 200-million year old salt or granite formation, in 20 years, right on this planet.

The problem is left to the creative thinker to design a program to accomplish the objective and ensure that the economic benefits are most advantageous to all concerned. An imaginative undertaking could get an alternative to NWPA going within a year. A cooperative relationship among the parties with a genuine sense of urgency is not beyond the realm of possibility. A program to open repository doors *in 7 short years* should delight the utilities, forever silence the antinuclear forces, and solve a problem of pressing national urgency. Solutions to tough problems are available "outside the box" if we are only bold and creative enough to look for them.

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