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Herbert Inhaber

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Can an Economic Approach Solve the High-Level Nuclear Waste Problem?

Herbert Inhaber*

Introduction

With the passage of the Nuclear Waste Policy Act (NWPA) of 1982,¹ Congress and the Administration thought it had solved, once and for all, the long-festering debate on what to do with high-level radioactive waste (HLRW) from the nation's civilian nuclear reactors. The fact that no national solution had been available prior to this had been used effectively by anti-nuclear forces to criticize both the industry and the technology. Many in the industry breathed a sigh of relief as President Reagan signed the legislation.

Within a short time, what was thought to be a "final solution" turned out to have vastly different characteristics. One of the major purposes of the legislation was to remove the process of finding a final resting place for HLRW from political maneuvering. That is, since it was believed that no state would, under any conceivable circumstances, volunteer for the waste repository, a scientific and objective approach to finding the location was necessary. But political considerations apparently could not be dismissed by this approach.

For example, the 1982 legislation called on the Department of Energy (DOE) to pick two sites, one in the eastern U.S. and one in the West, to assuage fears that one region of the nation would be burdened

* Dr. Inhaber is president of Risk Concepts, Inc. He has performed research on the siting of waste facilities, the relative risk of energy systems, and other energy-environment problems. He has three degrees in physics and mathematics, including a Ph.D. (experimental superconductivity) from the University of Oklahoma.

¹ 42 U.S.C. § 10101 (1988).

with all the wastes. But in 1987, DOE picked three Western sites while indefinitely postponing a decision on the Eastern site (or sites).² Members of Congress from the West accused the Administration, and particularly the Energy Secretary, John Herrington, of returning politics once again to the process.

Congress returned to the drawing board, amending the law in late 1987.³ In this new version, only one site was to be characterized, at Yucca Mountain in Nevada. According to Davis,⁴ “the investment of an estimated \$1 billion to \$2 billion to test the geological suitability of the site [was] viewed by most members [of Congress] as a virtual commitment to put the waste there.”

Again, the issue refused to die. The State of Nevada has fought a series of legal battles to prevent the repository from being sited there. Even a brief description of these arguments would take many pages. Also, concerns have been raised in influential national media about the scientific basis of the geological characterization.⁵ It is sufficient to state that, after more than three years, what was again believed to be a “final solution” has proven otherwise. Neither the nuclear industry nor ratepayers who are funding these operations have substantial assurance that a repository will be built in Nevada or elsewhere.

Is Another Approach Possible?

Fifty years after the problem of disposing of HLRW was first recognized during the Manhattan Project of World War II, it remains

² Davis, *Panel Adds Nuclear Waste Plan to Budget Reconciliation Plan*, Congressional Quarterly 1724 (Aug. 1, 1987).

³ Davis, *Nevada to Get Nuclear Waste; Everyone Else “Off the Hook”*, Congressional Quarterly 3136 (Dec. 19, 1987).

⁴ *Id.*

⁵ Broad, *A Mountain of Trouble*, N.Y. Times, Nov. 18, 1990, section 6 (Magazine, at 36).

unresolved. As a result, observers have suggested that a new approach is necessary.

Whatever the approach, it must have at least two elements. First, public health and safety must be preserved by appropriate environmental regulations. Second, the facility must actually be built. The second point might seem obvious. But previous approaches spent almost all efforts on the first, considering that the second would take care of itself. It wasn't, as the above sorry chronology indicates.

If a volunteer could be found, then all of the squabbling would end. That approach was suggested by Representative Morris Udall, chairman of the House Interior Committee and the leader of House efforts to pass a bill. He said, a few weeks before the 1987 legislation was passed,⁶ "I think the best way out of here is a voluntary agreement." But at any point in the last half-century, a volunteer state could have come forward to accept the wastes. The fact that none has done so over more than a generation suggests that this is unlikely to occur in the future. That is, unless some other inducements are added.

Proposed Financial Inducements

These inducements were also considered by Congress. Senator Bennett Johnston, heading Senatorial efforts to produce a bill, initially proposed payments of \$100 million a year.⁷ However, at the time of passage, the amount was diluted to \$10 or \$20 million annually. The first amount was to be paid until the facility was completed; the second, after it was opened for business.⁸ There is no indication that Nevada or any other state would have been or has been mollified by any of the three amounts.

⁶ Davis, *Super-Swap Possible under Nuclear Waste Bill*, Congressional Quarterly 2684 (Oct. 31, 1987).

⁷ Davis, *supra* note 3, at 3136.

⁸ 42 U.S.C. § 10173a (1988).

There are a number of reasons for this. First, there was no provision in Senator Johnston's original offer or the final legislation that the effects of inflation would be incorporated in the payment. As a result, the real value of the payment, whatever its level, would decrease over time. A 5% decrease annually would make the payment very small over a generation. Congress would always have the option of increasing the payment in later years, but there would be no guarantee, from the viewpoint of the recipient state, of that occurring.

Second, payments on a continuous basis, as enshrined in the 1987 amendments, imply a smaller "present value" than receiving the payment or payments up front. Almost all elementary economics texts demonstrate the simple fact that a payment now can be put in the bank to draw interest, whereas a payment 10, 20 or 50 years in the future will not draw interest until it is made.⁹

The present value of payments made over time will depend on expected interest rates. If we assume (a) \$10 million is paid annually to a recipient state for 20 years as the repository is being built; (b) \$20 million annually is paid for the next 50 years, then the total payments would total \$1.2 billion, a substantial sum. But if we also assume a typical interest rate of about 8%, it can be shown that the present value of these payments is about \$150 million, substantially less. While there is no indication that calculations of present value influenced Nevada representatives to reject the federal offer, the concept could not have been completely out of mind.

Financial Negotiations do not Work

As far as is known, there were no negotiations between Nevada and Congressional leaders about the precise benefits amounts. While observers¹⁰ have called for negotiations between siting bodies and

⁹ See, e.g., J. BARRON & G. LYNCH, *ECONOMICS* 149 (2d ed. 1989).

potential host communities, these give-and-take discussions may not be possible in the overheated climate of HLRW.

Further, the benefits do not offer a sufficient inducement to Nevada, whatever their present value. For example, Nevada had revenues of about \$2.4 billion in 1986.¹¹ The \$10 million annually would be about 0.4% of the state's revenues. That proportion would almost certainly decrease in later years, as the state's revenues increased but the payments remained constant.

Total federal payments to Nevada (state and local) were \$394 million in 1987.¹² Annual payments of \$10 million would be about 2.5% of total existing federal payments; \$20 million would be about 5.1%.

The level of payments can be considered from a family's viewpoint. Suppose that its income was about \$25,000, a typical level in recent years. The federal government is, in effect, saying to this family:

We propose to build a facility in your back yard that everyone else in town has rejected, for various reasons. We propose to pay you \$100 annually for the right to build this. After it's completed, we will pay \$200. The amounts are fixed by law.

The payments of \$100 correspond to 0.4% of this hypothetical family's income; \$200 corresponds to 0.8%. These are the fractions of Nevada's revenues to which the \$10 or \$20 million annual payments correspond. It is little surprise that, regardless of the merits of the other arguments in the case, Nevada paid little heed to the financial inducements.

¹⁰ See, e.g., Shrader-Frechette, *Perceived Risks Versus Actual Risks: Managing Hazards Through Negotiation*, 1 RISK: ISSUES IN HEALTH AND SAFETY 341 (Fall 1990).

¹¹ STATISTICAL ABSTRACT OF THE UNITED STATES 278 (1989).

¹² *Id.* at 271.

Other Inducements

It is possible to offer inducements for accepting LULUs (locally unwanted land uses) other than direct payments. One idea floated at the time of the debates was to offer the recipient state a major federal facility, like the superconducting supercollider, the proposed world's largest particle accelerator. According to Representative Philip Sharp, "That has been the subject of a facetious joke around the committee here — that if you take the repository, you get the supercollider. In theory, there might be something worked out." In reality, he said, it is "highly unlikely."¹³

Although the concept of trading a benefit for a detriment was treated jocularly by some members of Congress, it eventually found its way into legislation.¹⁴ The relevant clause reads: "The Secretary [of Energy], in siting federal research projects, shall give special consideration to proposals from States where a repository is sited." In principle, this section is the solution to all problems of siting HLRW. The state selected receives substantial federal funds, as research laboratory after research laboratory, with accompanying highly-paid personnel, is located there. However, this is not what took place. This clause, for all practical purposes, has remained a dead letter.

There were a number of explanations. First, with regard to the phrase "where a repository is sited," DOE has argued strenuously that Nevada has not been sited for a repository, but that only characterization activities are mandated by law. Therefore, there is no reason to give special consideration to Nevada until the final decision is made.

Second, the section applies only to activities of the DOE, not the rest of the federal government. DOE spending on research is only a small fraction of total federal expenditures. If the clause had specified future

¹³ *Supra* note 6.

¹⁴ 42 U.S.C. § 10174 (1988).

research facilities of the Department of Defense, National Institutes of Health and others, a potential repository state might have paid some attention.

Third, as far as is known, no specific regulations were drawn up to implement this section of the law. Without these regulations, there was no mechanism for the Secretary to carry the law into practice, assuming this was his wish. For example, in a ranking of a proposed research facility on a scale of 0 to 100, Nevada might have been given 5 or 10 "bonus" points under this section.

As a result, when sites for the superconducting supercollider were being evaluated, there was no indication that Nevada received any special consideration in its site selection. Nevada did not make the "short list" of eight contenders, for example.

Risk and Siting

The question of risk came up only tangentially in the Congressional debate of 1987. Nevada representatives claimed that the risk was or could be high, whereas members from other states generally dismissed these concerns. Yet the fear that many have of HLRW underlies the fact that no state has ever volunteered for these wastes, and none is likely to do so under the current siting mechanism.

Yet if the right mechanism were selected, potential hosts would be motivated to learn more about the risks of HLRW, generally believed by DOE experts to be small. As Cross¹⁵ notes, "people who are motivated to learn are more likely to be better informed than people who are merely serving time in class." At present, the people of Nevada (or any other potential repository state) have little or no motivation to learn about risk or hazards. The strategy they have adopted is to reject virtually all overtures of the federal government, delaying the characterization as long as possible.

¹⁵ P. CROSS, *ADULTS AS LEARNERS* 43 (1981).

A valid siting mechanism would provide incentives for potential hosts to understand risk. The mechanism should not be a system for convincing hosts that risks are small. This has been attempted in many public meetings,¹⁶ with much more heat than light generated. The eventual mechanism should allow citizens to make up their minds on risk, as they do every day on many other public issues.

Possible Market-Based Siting Mechanisms

We have outlined a number of deficiencies in the present system. But what should a valid and effective siting mechanism look like? The rest of this paper will describe this, and suggest how it might be fitted into existing mechanisms of the NWPA, as amended.

Three major principles might be employed. First, the process should be voluntary. Second, true social compensation for damages, real or perceived, must be paid. Third, the facility or repository must be built.

The first principle seems, at a glance, to defeat the third. If volunteers were readily available, the siting process would not have inspired heated debates on Capitol Hill and a plethora of lawsuits. But the second principle, that of true social compensation, can be used to eliminate the incompatibility between the first and third principles.

The principles of voluntarism are nothing new. In Canada, a major task force on siting low-level radioactive waste¹⁷ has stated that it will consider only volunteer communities for potential disposal sites. In the

¹⁶ A meeting on a proposed incinerator in Massachusetts was telecast on *Living Against the Odds* (PBS television broadcast, Apr. 3, 1991) (Cassette available from Films for the Humanities, Princeton, NJ.). Members of the audience denounced the siting commission in vigorous terms, calling them unpleasant names. Without the presence of armed police, there is a likelihood that violence would have broken out. If there was any calm discussion of the risks generated by the proposed incinerator, it was not recorded.

¹⁷ SITING PROCESS TASK FORCE ON LOW-LEVEL RADIOACTIVE WASTE DISPOSAL, OPTING FOR COOPERATION (Undated; ISBN 0-662-15759-1).

U.S. and many other countries, there is no draft for military forces. Volunteers subject themselves to possibly the greatest risk of all — death in battle. Yet volunteers are found.

The problem of finding the correct compensation to be paid has been a difficult one. Its difficulty lies in the divergence between what economists call “willingness-to-pay” and “willingness-to-accept.” For example, a citizen, when asked how much she would be willing to pay to have a LULU located far from her home, might respond in terms of tens or at most hundreds of dollars. When asked how much she would ask to have that same LULU nearby, she might respond with answers in the millions or billions, or even that no price on earth was high enough.

In recent years, proposals for overcoming this divergence have been forthcoming. It would take far too much space to discuss them all, but one of the pioneers has been Michael O’Hare at the John F. Kennedy School of Government at Harvard.¹⁸ In a pioneering 1977 work, he analyzed the bases of the NIMBY (not in my back yard) syndrome, and suggested possible compensation mechanisms to overcome it.

A second pioneer was Howard Kunreuther¹⁹ of the Wharton School at the University of Pennsylvania. He has carried the work forward in recent years, proposing auction systems for noxious facilities.

Out of these and other suggestions has come the concept of the *reverse Dutch auction*SM for HLRW and other LULUs.²⁰ Briefly, the

¹⁸ See O’Hare, *Not in My Back Yard: Facility Siting and the Strategic Importance of Compensation*, 25 PUB. POL’Y 407 (1977); M. O’HARE, L. BACOW & D. SANDERSON, *FACILITY SITING AND PUBLIC OPPOSITION* (1978); and O’Hare & Sanderson, *Fair Compensation and the Boomtown Problem*, 14 URB. L. ANN. 101 (1978).

¹⁹ See Kunreuther, Kleindorfer, Knez & Yaksick, *A Compensation Mechanism for Siting Noxious Facilities: Theory and Experimental Design*, 14 J. ENVTL. ECON. AND MGMT. 371 (1987); Kunreuther & Kleindorfer, *A Sealed-Bid Auction Mechanism for Siting Noxious Facilities*, 76 AM. ECON. REV. 295 (1986).

auction would have a rising price, set by the siting authority. No state would be required to bid, removing the element of coercion that potential host states and communities have felt was inextricable from the present siting system. As the price rose, citizens within various states would take a close look at the hazards and benefits of the proposed repository. The auction would have a quasi-deadline, analogous to the deadline that ensures that most labor-management negotiations conclude with an agreement. The deadline would not be artificially imposed, but lie in the fact that if a state waited too long before making a bid, it would not receive the bonus. There would be no incentive to delay indefinitely, as there is now.

Can the Reverse Dutch Auction fit into the NWPA?

If the reverse Dutch auction does have components superior to the present system, does the NWPA have to be abandoned? Not necessarily. The rest of this paper will briefly discuss how these newer concepts can be fitted into the older, command-and-control framework of the NWPA.

The NWPA is a complex document. In its original version, it spanned just under .80 pages of closely-spaced type. When it was amended in 1987, four subtitles (to the original Title I) and two completely new titles were added. Obviously, there is no mention of the reverse Dutch auction or other novel siting systems.

The main changes in 1987, in terms of an auction concept, were threefold. First, Yucca Mountain in Nevada was chosen for intensive

²⁰ The outline of the concept was discussed in Inhaber, *Triple Obstacles to Power Generation: Risk, Greenhouse Effect and Nuclear Wastes*, in POWER GENERATION TECHNOLOGY 15 (1989). Other publications are Inhaber, *Solving the Low-Level Radioactive Waste Puzzle*, 17 Empire State Report 41 (Jul. 1990); Inhaber, *Hands up for Toxic Waste*, 347 Nature 611 (Oct. 18, 1990); Inhaber, *How to Solve the Problem of Siting Nuclear Wastes*, 62 TRANSACTIONS AM. NUCLEAR SOC'Y 61 (1990); Inhaber, *Solving the Problem of Toxic and Nuclear Waste Disposal*, 41 J. AIR AND WASTE MGMT. A. 808 (1991).

investigation. All reference to other potential sites was abandoned.

Second, a nuclear waste negotiator was specified. This negotiator, David Leroy of Idaho, has been confirmed by the Senate.²¹ Third, a level of "benefits" was specified, as noted above. The 1982 legislation had no such provision, confining itself only to payments for a state to conduct environmental or sociological studies. The fact that payments of any type in addition to those for strictly "scientific" purposes were specified was itself a precedent.

The Nuclear Waste Negotiator

According to the revised legislation,²² the negotiator shall attempt to find a State or Indian tribe willing to host a repository... at a technically qualified site on reasonable terms and shall negotiate with any state or Indian tribe which expresses an interest in hosting a repository....

From the viewpoint of the reverse Dutch auction, the negotiator has considerable leeway in finding this volunteer. No specific method is prescribed for him to accomplish his task. As a result, he is not specifically prohibited from any specific method.

The phrase "reasonable terms" also does not preclude an auction. The funding for the present system is supplied by the nuclear industry. If the negotiator could find a volunteer via the reverse Dutch auction, the bonus amount would be approved by relevant courts as within executive discretion, assuming that legal action were taken.

One of the major problems the negotiator faces is not so much developing new approaches to siting, but that, to some extent, his work conflicts with the rest of NWPA. The body of the legislation concentrates on Yucca Mountain. Yet the negotiator is expected to find

²¹ *Negotiator Nominee Leroy Confirmed by Senate*, 33 NUCLEAR NEWS 97 (Sept. 1990).

²² 42 U.S.C. § 10242 (b)(2) (1988).

another site. The text makes a provision²³ for that possibility, allowing the name of a potential volunteer state to be substituted for Yucca Mountain whenever it appears.

The exact terms the negotiator will offer are diffuse enough to allow an auction to be held. He is to offer "reasonable and appropriate" terms that "contain such provisions as are necessary to preserve any right to participation or compensation of such State."²⁴

Nuclear Waste Fund

If an auction is to be held, there must be a provision for the source of funds. This is already part of the NWPA.²⁵

The Nuclear Waste Fund (NWF) collects one mill (a tenth of a cent) per kilowatt-hour from all nuclear power plants to pay for the entire storage and repository system. If a 100-watt light bulb powered by nuclear-derived electricity were burned continuously for a month (720 hours), at the average national rate of about 8¢ per kilowatt-hour, the total bill would be \$5.76. Of that, 7¢ would go to the NWF.

One of the problems of the fund from the nuclear industry's viewpoint is that, while it continues to make payments, it has no guarantee that a repository will ever be built. The reverse Dutch auction makes a firm connection between payment and construction. No funds change hands unless a volunteer with an acceptable site comes forward.

One possible objection to an auction mechanism is that, because of its nature, the size of the bonus cannot be specified in advance. While the NWPA specifies an annual payment that was obviously not agreed to by Nevada, at least it was specific. The same claim cannot be made in advance about any auction.

²³ 42 U.S.C. § 10245 (a) (1988).

²⁴ 42 U.S.C. § 10243 (d)(2) (1988).

²⁵ 42 U.S.C. § 10222 (1988).

Some data have recently been derived that shed some light on the amount that electricity ratepayers would be willing to expend to keep LULUs out of their back yard. Hubbard,²⁶ using data collected by the Bonneville Power Administration, finds that consumers in the Pacific Northwest would each pay \$13.30 annually to keep a nuclear plant somewhere else, about \$13 to avoid a fossil-fueled plant, and \$6 to avoid a hydro dam. Polls have shown that a HLRW repository is regarded as much more dangerous than these facilities, so the amounts consumers would pay to avoid having one of these facilities nearby presumably would be even greater. It does not take much arithmetic to realize that the funds that could be raised with the guarantee that the repository will not be located adjacent to communities that contribute to the bonus could be enormous.

Can these funds be raised without going back to Congress to amend the law? The NWPA has a provision²⁷ that permits the Secretary of Energy to alter the rate charged by the nuclear levy on 90 days' notice. His changes go into effect if neither house of Congress disapproves within three months.

So the concern that the Administration would have to ask for alterations in the law to increase a bonus is misplaced. It is usually much easier for Congress to do nothing than to do something.

Alternative Approaches in NWPA

While, at first reading, the NWPA seems to require a specific system for siting HLRW, there are clauses that allow for different approaches. One of them states:²⁸ "The Secretary shall undertake a study with respect to alternative approaches to managing the

²⁶ Hubbard, *The Real Cost of Energy*, 264 SCI. AM. 36 (Apr. 1991).

²⁷ 42 U.S.C. § 10222 (a)(3) (1988).

²⁸ 42 U.S.C. § 10223 (1988).

construction and operation of all civilian radioactive waste management facilities....”

Admittedly, the study was performed primarily to determine if a private corporation could perform the tasks allocated to DOE. While a report was filed, it seems to have been overlooked in the battles over siting. Nonetheless, a precedent was set: The Secretary could evaluate systems other than that set down in NWPA.

Non-Restriction of Payments

If a system of bonuses to a volunteer state is to be effective, that state must have full control over the funds. In the past, proposed payments to states or communities often had strings attached. A fixed proportion or amount was to be spent on new roads, another proportion on schools, and so on. Because one of the major feelings experienced by communities in these battles was that of helplessness with respect to a siting authority, these specifications only heightened those sentiments.

The NWPA dispenses with those rules laid down from on high. It notes²⁹ that the Secretary may not restrict the purposes to which the payments may be used. The only exception is that at least one-third of the payments to the state must go to the actual affected locality or county.

Of course, as noted above, the fact that the benefit package was specified by Congress rather than the state perpetuates the “Father knows best” attitude. The reverse Dutch auction allows the state to set its own value on accepting the repository, rather than having the federal government perform that task. It sets the true social cost of the facility, a cost which cannot be determined by other means such as polls. Still, the fact that states will be allowed to use benefits in any way they see fit makes the NWPA a precedent-setter in this area.

²⁹ 42 U.S.C. § 10173a (a)(6) (1988).

Summary

In this brief overview of the NWPA, some of its desirable and undesirable features in the light of a bonus or auction system have been described. The 1987 amendments broke new ground in that, for the first time, Congress offered benefits above and beyond direct costs to the state to perform studies. However, those benefits were rigidly prescribed. There was no flexibility to take account of differing views among states towards the repository.

While the NWPA seems to prescribe an unbending approach toward siting, there are a number of clauses which provide some malleability. In particular, the Nuclear Waste Negotiator apparently has much more leeway than does the Secretary of Energy. Whether or not that will provoke conflict between the two offices is unclear.

It is clear, after so many years of battles over siting of HLRW, that the present "decide, announce and defend" (DAD) system has produced much heat but little light. The nuclear industry, already finding it difficult to build new reactors partly because of concerns about costs, has to pay a tax for which it may never reap a return in the way of a repository.

Also, valid concerns about risks and hazards tend to be lost in the legal battles in Congress and between Nevada and the Administration. While many risk analyses of various types have been performed on the subject of HLRW, they are often used by one side or the other as tools of attack, rather than scientific documents.

Some have contended that so much work and effort have already gone into the NWPA that it simply cannot be abandoned, regardless of how many of its flaws become apparent. In response, I would contend that the situation is analogous to a monkey reaching inside a narrow-necked jar and grasping something. With his fist clenched, he cannot withdraw his hand, and he refuses to let go. A stalemate is reached.

If the monkey were wiser, he would let go and upset the jar to disgorge its contents. It remains to be seen if that wisdom will be displayed in the decades-long battle over high-level nuclear waste sites.

