

A R T I C L E

Solving the U.S. Nuclear Waste Dilemma

by Richard B. Stewart

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I. Introduction

Current U.S. nuclear waste law and policy is bankrupt. The 1982 Nuclear Waste Policy Act (NWPA) set a 1998 deadline for opening a deep geologic repository to receive spent nuclear fuel (SNF) and high-level waste (HLW) from reprocessing. In 1987, Congress amended the Act to designate Yucca Mountain in Nevada as the only potential site, and severely restricted the development of any federal facility for consolidated storage of nuclear waste. Nevada's unrelenting opposition to the Yucca repository eventually succeeded with the election of Barack Obama as President. The Obama Administration has withdrawn funding for Yucca and withdrawn its application for licensing by the NRC. The bankruptcy of the highly prescriptive and preemptive NWPA leaves large volumes of defense nuclear wastes and mounting inventories of spent nuclear fuel without a destination pathway. The failure of Yucca contrasts with the success of the Waste Isolation Pilot Project (WIPP) repository in New Mexico, which was developed entirely outside of the rigid NWPA framework. WIPP, the only operating deep geologic nuclear waste repository in the world, emerged over a twenty-year period through a largely unplanned process of contestation and negotiation between the federal government and the State of New Mexico. WIPP opened in 1998 and has been receiving substantial volumes of certain defense wastes from Department of Energy (DOE) facilities.

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At the same time as it cancelled Yucca, the Obama Administration has proposed massive government assistance for the construction of large numbers of new nuclear power plants. The failure of the federal government to honor its promises to dispose of spent nuclear fuel, which continues to accumulate at existing power plants, is a potentially potent political weapon for those who oppose expansion of nuclear power. Obama is looking to the distinguished Blue Ribbon Commission on America's nuclear future recently appointed by Energy Secretary Chu to solve his nuclear dilemma.

The tale of the two repositories—failed Yucca and successful WIPP—has important lessons for future policy. The development of one or more repositories for the wastes once destined for Yucca, as well as arrangements for interim consolidated storage, must be based on a step-by-step approach to decisionmaking that includes the informed assent of the public and of host localities rather than unilateral federal fiat.

II. Overview of Nuclear Waste Types, Sources, and Stocks

Nuclear waste is generally classified into six main categories: SNF, HLW, transuranic waste (TRU), low-level waste (LLW), mixed waste that is both radioactive and chemically toxic and regulated under the Resource Conservation and Recovery Act (RCRA) as well as the Atomic Energy Act (AEA), and uranium mill tailings (UMT). These categories are legal constructs that are often not based on risk-relevant differences in their radioactive and other characteristics or the treatment, management, storage, and disposal issues that they pose. This article focuses on the more highly radioactive wastes in the first three categories.

Spent Nuclear Fuel (SNF) refers to the spent fuel rods that have been irradiated in a nuclear reactor, mostly from civilian nuclear power plants. SNF includes both highly active but short-to-medium-lived fission products (principally cesium and strontium) as well as medium-active but long-lived radionuclides with half-lives of thousands of years.

High-level waste (HLW) is highly radioactive material resulting from the reprocessing of SNF to extract plutonium and uranium. Most of the nation's HLW was created in the course of nuclear weapons production. A limited amount of HLW was generated from reprocessing civilian SNF before such reprocessing was terminated in the 1970s.

Transuranic Waste (TRU). In contrast to HLW and SNF, which are defined by the processes that produce them, TRU is defined by its characteristics. TRU includes waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes with half-lives greater than twenty years per gram of waste, but excluding HLW and certain other wastes. There are two subcategories of TRU: lower radioactivity contact-handled TRU (CH-TRU), which constitutes the great bulk of TRU, and higher radioactivity remote-handled TRU (RH-TRU), which must be handled and transported in shielded casks.

Low-Level Waste (LLW) is a residual category that encompasses a wide variety of wastes, generated by defense activities, nuclear power production, and industrial, medical, and scientific applications. There are comparatively large volumes of low activity wastes, and much smaller volumes of higher activity wastes. Some of these wastes are disposed of at commercial and government landfills, others are stored at generator sites.

The focus of this Article is on the most highly radioactive wastes, HLW, SNF, and TRU. TRU is being disposed of at WIPP, while the other wastes are stored at the sites where they were generated. The current inventories of SNF and HLW in the United States amount to 73,000 metric tons in the form of heavy metal (MTiHM). Of this total, defense HLW at DOE sites amounts to 12,505 MTiHM. Another 2,500 MTiHM consists of defense activity SNF stored at DOE sites. More than 54,000 MTiHM is civilian SNF now being stored in reactor pools or in dry storage air-cooled containers at sites contiguous to the 131 civilian nuclear reactors at sixty-four locations in thirty-nine states. Further, an additional 47,000 MTiHM of civilian SNF will have been generated by 2048 even if no new nuclear power plants are built. The total of all of these categories far exceeds the statutory maximum capacity of Yucca, at 70,000 MTiHM. With the cancellation of Yucca, all of this waste now lacks any disposal pathway.

III. The Path to the Present Impasse: A Short History of U.S. Nuclear Waste Regulation

A. The First Three Decades

In 1946, Congress passed the AEA, which created the Atomic Energy Commission (AEC) to run a federal monopoly on both military and non-military applications of nuclear

power.¹ In the 1950s, the Eisenhower Administration promoted private sector use of nuclear technology for electricity production and other uses; Congress amended the AEA to authorize such use. Although the AEC's broad regulatory authority encompassed wastes,² disposal of defense HLW from weapons production was a low priority and the search for disposal sites progressed very slowly. A seminal 1957 National Academy of Sciences (NAS) report found that a deep geologic repository was the best available option for nuclear waste disposal and that bedded salt was likely the best medium in which to build such a repository.

The first serious federal effort to develop a nuclear waste repository was prompted by a 1969 fire at the AEC's Rocky Flats, Colorado nuclear weapons plant that forced removal of TRU wastes for storage in Idaho, which demanded their relocation. After an aborted attempt to develop a repository in Kansas, the federal government, in 1972, responded to an expression of interest by the economically depressed town of Carlsbad, New Mexico in hosting a repository. The eventual result was the development, over a 25-year period, of the WIPP repository for defense TRU wastes in a salt bed on federal land in southeastern New Mexico.³

Because of the desire to separate nuclear regulation from management and operations, Congress, in 1974, passed the Energy Reorganization Act, which split the AEC into the Nuclear Regulatory Commission (NRC), an "independent" agency with five members,⁴ and the Energy Research and Development Administration (ERDA), whose head answered to the President.⁵ The NRC was put in charge of licensing civilian nuclear reactors and reprocessing facilities, as well as all stages of commercial HLW and SNF management, storage, and disposal. The NRC's licensing authority did not extend to defense facilities and wastes, which were to be managed and regulated solely by ERDA. ERDA subsequently became the DOE in 1977.⁶ Also, on its creation in 1970, the Environmental Protection Agency (EPA) acquired the AEC's authority to issue radioactivity exposure standards to protect public health and the environment.

B. Opposition to Nuclear Power and the End of Civilian SNF Reprocessing

The premise of civilian nuclear power was that SNF would be reprocessed to extract plutonium and uranium for reuse as

1. 42 U.S.C. §2011.
2. *Id.* Section 2201 gives the AEC (now NRC) the power to: "establish by rule, regulation, or order, such standards and instructions to govern the possession and use of special nuclear material, source material, and byproduct material as the Commission may deem necessary or desirable to promote the common defense and security or to protect health or to minimize danger to life or property." 42 U.S.C. §2201.
3. *See, e.g.,* CHUCK McCUTCHEON, NUCLEAR REACTIONS: THE POLITICS OF OPENING A RADIOACTIVE WASTE DISPOSAL SITE 12 (2002); U.S. DOE, PIONEERING NUCLEAR WASTE DISPOSAL (2000), DOE/CAO-00-3124, at 7; Gary L. Downey, *Politics and Technology in Repository Siting: Military Versus Commercial Wastes at WIPP 1972-1985*, 7 *TECH. IN SOC'Y* 47, 53 (1985) (discussing the WIPP repository for defense TRU wastes).
4. 42 U.S.C. §5841.
5. *Id.* §5811.
6. *Id.* §7151(a).

fuel. Although reprocessing produced significant amounts of HLW, reprocessing diverted attention from disposal issues. Civilian reprocessing facilities, however, encountered serious financial, operating, and environmental problems. In 1977, President Carter applied the coup de grace by halting all federal support for civilian SNF reprocessing, due to proliferation and security concerns posed by the plutonium produced. There has been no reprocessing of civilian SNF in the US since then, although a number of other countries have carried out civilian SNF reprocessing. Meanwhile, groups opposed to nuclear power used litigation to block new plants, invoking the SNF waste issue, among others. California and a number of other states passed legislation blocking new nuclear plants until a means for disposing of wastes was demonstrated. These factors, along with economic and other factors, brought construction of new plants to a halt.

The NRC was prompted to initiate a waste confidence rulemaking to address the question of whether or not it should license new nuclear plants because of the environmental risks posed by additional quantities of SNF.⁷ Concerns that the lack of a repository would stifle the future of the nuclear power industry eventually led the industry and the federal government to press for a legislative solution.

C. *The Carter Interagency Review Group and the Push for Nuclear Waste Burial*

Seeking to engage both experts and the broader public in an effort to develop a coherent and comprehensive national nuclear waste disposal policy, President Carter, in 1978, assembled the Interagency Review Group on Nuclear Waste Management (IRG). The IRG issued a report based on the premise that the generation of citizens that has enjoyed the benefits of nuclear energy has an obligation to responsibly dispose of the waste in perpetuity.⁸ It endorsed deep geological storage, and recommended that detailed studies of specific potential repository sites “in different geologic environments” (including salt, shale and tufa) should begin “immediately” in order to identify at least two (and possibly three) repositories that could become operational by the end of the 20th century.⁹ These repositories should be located “ideally in different regions of the country.”¹⁰

D. *The Nuclear Waste Policy Act*

The political saliency of nuclear waste and the work of the IRG also led to Congress’ enactment in 1982 of the Nuclear Waste Policy Act (NWPA).¹¹ It mandated the development of permanent repositories for disposing of SNF and HLW.

NWPA places responsibility on the federal government for the disposal of commercial SNF and HLW in deep geological repositories. The Act required the utilities to pay a fee on nuclear electric generation, with the proceeds to be used to finance repository development. In return, the federal government undertook to take SNF from the utilities no later than January 31, 1998.¹² The Act also provided for disposal of defense HLW in a repository.

In an aim to promote regional equity, the Act provided for the siting and construction of two federal repositories on a tight timetable, with siting of the second repository to be conducted after the first.¹³ The Act provided for a centralized technocratic process of site selection by DOE, based on factors including geological suitability, distances from populations, transportation, and cost. In the first round of siting, DOE was required to nominate five sites suitable for characterization and, by January 1, 1985, to recommend three of these to the President for characterization as candidate sites. It was then to select one of the sites for licensing and construction of a repository with the goal of opening it to receive wastes by 1998.

A limit was placed on the capacity of the first repository (no more than 70,000 metric tons) in order to ensure that the second repository would in fact be selected. It was anticipated that the first round of siting would concentrate on sites in the West and the second round of siting would focus on sites in the East. The NWPA also provides for the development of Monitored Retrievable Storage (MRS) facilities, constructed and operated by DOE. Such facilities would be designed for indefinite storage of SNF and civilian HLW, but also allow for ready retrieval of wastes for further processing or permanent disposal. The Act authorized construction of only one MRS.

The federal government encountered strong opposition from states in which candidate sites were located, and political pushback caused DOE to cancel the search for a second repository in the eastern U.S. It eventually designated three sites in the West for the first repository, located in Nevada (Yucca Mountain), Texas, and Washington. The estimated cost of conducting detailed characterizations of these sites had mushroomed to \$1 billion per site.

E. *Congress Designates Yucca Mountain*

In 1987, Congress amended the NWPA to require that only one site be characterized, and dropped the requirement of a second repository.¹⁴ Senator Bennett Johnson of Louisiana, the powerful Chairman of the Senate Energy Committee, was concerned that escalating costs and intensified opposition from potential host states would scuttle the entire program unless Congress moved swiftly to designate the repository site. DOE’s preliminary rankings placed Yucca over the sites in Washington and Texas, but the scores were

7. LUTHER J. CARTER, NUCLEAR IMPERATIVES AND PUBLIC TRUST: DEALING WITH RADIOACTIVE WASTE 88 (1987).

8. INTERAGENCY REVIEW GROUP ON NUCLEAR WASTE MANAGEMENT, U.S. DOE, REPORT TO THE PRESIDENT BY THE INTERAGENCY REVIEW GROUP ON NUCLEAR WASTE MANAGEMENT (1979) [hereinafter INTERAGENCY REPORT] at 16, 31, Appendix H-4.

9. *Id.* at Appendix H-9.

10. *Id.*

11. 42 U.S.C. §10101.

12. *Id.* §10131(a)(4).

13. *See id.* §§10132(a), 10134(a)(2)(A).

14. *Id.* §10172(a).

all close.¹⁵ Congress' choice of Yucca was driven by the influence of powerful members from Texas and Washington. Nevada lacked clout and was steamrolled.

F. *Government and Private Centralized Storage Facilities*

Pursuant to the 1982 NWPA, DOE had proposed that a federal MRS facility be built at Clinch River, Tennessee, and also identified two alternative MRS sites in the state. But, bowing to political pressures from the Tennessee delegation, Congress, as part of the 1987 NWPA amendments, revoked the proposal to site a MRS facility in Tennessee. Congress also imposed further limitations on the DOE and MRS facilities, leading DOE to essentially abandon MRS siting.

In the absence of any federal repository or storage facility, a utility-owned Private Fuel Storage (PFS) consortium sought to build a private SNF storage facility on lands of the Skull Valley Band of Goshute Indians in Utah, with the capacity to store 40,000 metric tons of SNF, far more than would be permitted at a federal MRS facility.¹⁶ The PFS facility was granted an NRC license in 2006, following a nine-year licensing process. Construction of the PFS facility, however, has been blocked by the Department of the Interior.¹⁷ The Bureau of Indian Affairs refused to approve the tribe's lease of its land for the facility because of risk that the facility would become a de facto permanent repository, while the Bureau of Land Management also denied a right of way over federal lands for a railway line to the site. The future of the facility is currently in limbo.

G. *Nevada's Reversal of Political Fortune and the Demise of the Yucca Mountain Repository*

After characterizing the site, DOE recommended Yucca to Present Bush, who selected it for development of repository for HLW and SNF. In accordance with the NWPA, Nevada exercised its right to disapprove the repository, but this disapproval was overridden by a joint resolution of Congress. DOE developed and eventually submitted to NRC an application to license the Yucca repository, in conformity with environmental and safety standards including radioactivity exposure standards issued by EPA. Nevada opposed the repository by every means at its disposal, including litigations and efforts to halt or harass DOE's efforts to characterize the site. The election of President Obama, who had opposed Yucca during and even before the 2008 Nevada Democratic Primary, and the position of Democrat Harry Reid of Nevada as Senate Majority leader, caused a sudden turnaround in Nevada's political fortunes. The Obama Administration has terminated funding for Yucca and DOE has sought to withdraw its application to NRC for licensing the repository. However,

15. CARTER, *supra* note 7, at 175.

16. NWPA limits a federal MRS to storing 10,000 metric tons of heavy metal before licensing of a federal repository and 15,000 metric tons thereafter. 42 U.S.C. §10168(d)(3)-(4).

17. MARK HOLT, CRS REPORT FOR CONGRESS: CIVILIAN NUCLEAR WASTE DISPOSAL 13 (2007).

the NRC Atomic Safety and Licensing Board recently ruled against DOE, holding that the application must go forward for decision by NRC. The Board's ruling will be reviewed by the Commission, the courts, and possibly Congress. Even if sustained, the licensing process itself would take years, followed by appeals, and even if a license is granted, Congress would have to fund construction. Thus, the possibility that Yucca might still be built is highly remote and would occur, if at all, only after long delays.

H. *The Successful Development of WIPP*

In contrast to the centralized, top-down NWPA strategy for siting a HLW/SNF repository, the WIPP TRU repository did not develop in accordance with any mandated blueprint, but instead as a result of an iterative, often halting, step-by-step process over twenty-five years involving DOE, the State of New Mexico, Congress, the federal courts, and local environmental advocacy groups. Through litigation and leveraging its representation in Congress, New Mexico ensured that its core interests were accommodated. An independent, federally funded technical review body, established and carried out with significant state involvement, promoted state and public confidence and acceptance of key decisions regarding the facility. At various times the disposal at the site of defense HLW, defense TRU, and civilian SNF was considered. Politics in Congress and New Mexico eventually determined that the facility would be restricted to defense TRU.

After DOE was forced to obtain explicit congressional authorization for the facility following a New Mexico court victory, Congress, in 1992, enacted the Waste Isolation Pilot Plant Land Withdrawal Act (WIPPLWA) to authorize operation of the facility and establish a regulatory framework for it. Congress directed EPA to issue site-specific radioactivity exposure standards for WIPP and determine whether the facility was suitable as a long-term disposal repository for TRU. Subsequently, New Mexico also gained and exercised authority under RCRA over shipments of TRU waste to the site,¹⁸ which gave it additional leverage to ensure that its concerns were met. EPA certified WIPP in 1998, and the next year it received its first shipment of waste. EPA recertified WIPP in 2004, five years after opening. WIPP has received and deposited several thousand shipments of TRU wastes since that time without major controversy.

IV. *The Current Dilemma and the Way Forward*

Under existing law, as set forth in the NWPA, Yucca Mountain is the only candidate site for a permanent repository for SNF and HLW. Yet the Obama Administration has terminated its funding and has sought to withdraw its NRC

18. 42 U.S.C. §6901, ELR STAT. RCRA §1001, provides for federal EPA regulation of chemically hazardous wastes, and for delegation by EPA of such regulatory authority to states with approved regulatory programs. RCRA has been interpreted to grant EPA and delegated states authority to regulate "mixed wastes," including TRU, that are chemically hazardous as well as radioactive.

license application. There is no alternative in sight. Siting and developing a repository at another location will take decades. Neither a federal MRS facility nor a privately owned consolidated storage facility has been developed. Meanwhile, SNF continues to accumulate at reactor sites. Localities and states are growing restive at the prospect of indefinite at-reactor storage of SNF, especially at sites where reactors have shut down. The HLW stored at various DOE sites across the country also lacks a destination pathway. DOE will find it impossible to meet the commitments that it has made in agreements with states hosting these sites to ship the wastes out of state by specified deadlines.

What are the possible solutions to these orphan waste dilemmas? WIPP's mission might be enlarged to include some wastes other than TRU. Earlier studies of the WIPP site and facility indicated that it could well be suitable for disposal of SNF and/or HLW as well as the TRU it already receives. Congress would have to enact legislation to enlarge WIPP's mission. New Mexico could be expected to resist, and its concerns and interests would need to be accommodated. Alternatively, Yucca might possibly be revived and eventually built.

Notwithstanding these possibilities, the nation must move forward with a plan to establish at least one new deep geological repository as well as a strategy for dealing with SNF. Such a strategy should include one or more new public and/or private consolidated storage facilities for SNF that would, at a minimum, store SNF from shutdown reactors and possibly additional SNF as well, pending development of a permanent repository; the option of reprocessing SNF might be considered in the interim. What lessons can be drawn from past experience to develop a successful strategy and retrieve the bankruptcy of the NWPA?

A. *Rethinking the Ethics of Nuclear Waste*

The first step is to rethink the ethical principles embraced by the Carter IRG. It is not the case that the benefits of nuclear power and nuclear weapons have accrued only to past and current generations, and that our responsibilities to future generations require "in perpetuity" disposal of nuclear wastes as promptly as possible. At least a part of the national security and economic benefits of past uses of nuclear technology are embedded in the social and economic capital that future generations will inherit. Because carbon dioxide emissions reside in the atmosphere for centuries, the carbon emissions avoided by the use of nuclear power to date will benefit future generations for many years. Nor is it obvious that the interests of future generations are best served by burying current waste stockpiles as soon as possible. Our ability to evaluate repository sites and the technologies for containing wastes are likely to improve in the future. Moreover, nuclear fuel is a partially renewable resource. Burying this resource irretrievably will deny future generations the option to use it. While repositories can be built to permit retrieval of wastes, incorporating retrievability adds to expense and perhaps performance uncertainty. Moreover, once wastes are bur-

ied in a repository, it may be politically difficult to retrieve them even if retrieval is technically possible. Based on these considerations, a revised ethic is appropriate, along the following lines:

Our obligation is to give succeeding generations a real choice and the opportunity to shape their own decisions while at the same time not imposing a burden those future generations may not be able to manage.¹⁹ This principle points to a step-by-step approach to dealing with nuclear waste, through an iterative process of learning and public deliberation, as opposed to an immediate decision on a final solution.²⁰ This does not mean that we should not start now to develop at least one new repository and one or more consolidated SNF storage facilities. But there should be no artificial deadlines or "final solutions" mandated at the outset.

B. *Securing Informed Public Trust and Host Assent to New Waste Facilities*

The lesson of U.S. experience, confirmed by that in some other nations, including Finland and Sweden, is that nuclear waste storage and disposal must ultimately be based on informed public assent, particularly that of host localities and states. Achieving assent will require a combination of technical competence; true engagement of host local and state stakeholders in risk assessment and management; partnering with states in repository siting, design, and operation planning and decisionmaking; and steps to meet host state and local safety concerns, including those relating to waste transportation and emergency preparedness. It will also be necessary to provide economic and other benefits to the host locality and state, such as investment in economic infrastructure that will support long-term growth, government services, educational and health benefits, and priority under federal programs. Successful siting and facility development will also require a step-by-step approach, one that is flexible, open, and responsive to state and local concerns and needs, rather than a system of unilateral decisions by the federal government that presents states and localities with a fair accompli. Washington must abandon the arrogant and dysfunctional top-down strategy embraced in both the 1982 NWPA and the 1987 NWPA amendments.

This conclusion has both pragmatic and ethical foundations. Notwithstanding the federal government's plenary legal power to build a new nuclear waste repository or storage facility on its own lands, experience shows that this power is counterbalanced by deep political and institutional safeguards of federalism that make it very difficult to impose such facilities against the determined opposition of host jurisdictions. As an ethical matter, such impositions are unfair. Host jurisdictions should not have to bear the burden of other

19. I am indebted to Tom Isaacs, Director of Policy and Planning, Lawrence Livermore National Laboratories, for this formulation.

20. Canada is currently developing such an approach to nuclear waste management. See NUCLEAR WASTE MGMT. ORG., *MOVING FORWARD TOGETHER: ANNUAL REPORT 2007* (for a discussion of the newly developed Canadian approach to nuclear waste management going forward).

jurisdictions' wastes unless they have had a fair opportunity to contest, influence, and ultimately accept a facility.

Future siting decisions will accordingly require federal collaboration with states and localities, open processes, ready public access to information, and public involvement in or opportunity for review of data gathering risk assessment, site evaluation, and facility design. It is only through such processes that informed assent is likely to be secured. The federal government, after considerable prodding, eventually and grudgingly followed this approach in developing the WIPP facility after New Mexico succeeded in repeatedly blocking unilateral decisions by DOE.²¹

Informed public assent requires strong institutional assurances of facility safety and environmental protection, including (as at WIPP) host state regulatory authority over wastes transferred to the facility. It also requires credible, independent technical and scientific oversight and review, with (as at WIPP) a state role in establishing the reviewing body. Gaining host trust and assent also has critical procedural elements. The process for making siting decisions must be transparent and accessible, and include procedures through which a potential state/local host is brought in at the early stages of the planning process and is able, in a timely manner, to voice its concerns and demands and resolve them with the federal government through discussion, deliberation, and negotiation. *Informed* public assent implies full and accurate information about characteristics of the wastes, the risks posed, the site, and the facility that the government proposes to develop, as well as related arrangements such as transportation; it also implies that host states and communities are given the resources to hire their own independent experts to evaluate claims made by the proponents and perform their own investigations and gather information on issues of importance to them. An open, step-by-step process for decisionmaking on new facilities is essential, not only for the reasons discussed above, but also to provide for meaningful state input and influence as a facility develops. The legal and institutional framework for facility siting, design, and construction including state involvement in decisionmaking must secure these requisites.

In addition, the economic interests and the past experience of potential host states and localities must be considered and accommodated. These variables go a long way to explain why WIPP ultimately succeeded in meeting the State's tough requirements and is open for business, whereas Yucca has been tied up in state-generated delaying tactics. Carlsbad and New Mexico were economically needy, and had a generally positive experience with federal nuclear activities. Nevada's experience was the opposite. Long-run benefits that take the form of economic development and jobs for local communities appear to be much more significant than cash transfers, although federal grants to New Mexico were also important.

21. Host assent could take explicit form in an agreement between the federal government and a state/locality, as a memorandum of agreement under which the latter agrees to host the facility on specified terms. But it can also be manifested less formally, for example through de facto acceptance of a facility rather than active resistance to it, following a process of discussion and negotiation and concessions by federal authorities.

Reprocessing facilities and new types of reactors, as well as R&D installations to develop these technologies, are likely to offer long-run economic benefits, and could be coupled with a new repository or consolidated storage facility to help win host acceptance.

C. *Creating New Federal Waste Management and Siting Institutions and Financing Mechanisms*

The third step for dealing with nuclear wastes is to establish new federal institutional structures for nuclear waste management, siting, and regulation. DOE suffers from high turnover, erratic funding, internal stove piping and resource conflicts, a culture of secrecy, and erratic, politically directed congressional funding. The most fundamental difficulty with existing arrangements, however, may be that the task of siting new waste disposal and storage facilities (including facilities for LLW, as well as HLW and SNF) and the task of constructing and managing the new facilities, as well as managing existing waste facilities, are fundamentally different and call for different organizational skills and attributes. Accordingly, serious consideration should be given to taking both of these functions out of DOE and creating two new entities, one responsible for siting and the other for nuclear waste management. Congress, at the same time, needs to address the closely linked issues of developing new mechanisms to finance the development and operation of new and existing facilities, and the resolution of the government's liabilities for failing to take utility SNF beginning in 1998.

Nuclear waste management. Under the proposed reorganization, one new entity would be dedicated to managing nuclear waste. It would not site new storage facilities or repositories, but would be responsible for waste storage, treatment, and transportation; development and application of waste containers; construction and operation of interim consolidated storage facilities; and construction, operation, closure, and post-closure monitoring of a repository. The requisites for such an entity are a clearly defined mission, a business model of management, high-quality technically adept personnel, and assured long-term stable funding. There are several institutional forms that such an entity might take:

- A federal agency with a single head who reports to the President.
- A federal agency with a single head that reports to the Secretary of DOE but located outside DOE (on the model of the Bonneville Power Authority).
- A federal corporation owned by the federal government with a presidentially appointed board that selects a CEO to manage its operations, on the model of the TVA.
- A hybrid federal corporation owned in part by the federal government and in part by the nuclear utilities with a board selected in part by each.

A further option would be a private corporation owned by the nuclear electric utilities, regulated by the government. While this model has been adopted by some European countries, it is probably too radical a departure from the status quo to be politically acceptable in the U.S.

The advantage of a corporate form is that it would most fully realize the business model, and free the entity from federal personnel and procurement requirements, promoting flexibility and efficiency and enabling it to hire and retain highly qualified personnel.²² Continuity of funding could be assured by making a nuclear generation fee payable directly to the entity, or establishing contractual arrangement for utility funding. Alternatively, funding by Congress could be accomplished through long-term appropriations, possibly including a revolving fund separate from the unified federal budget. A further advantage of a hybrid corporate form is that it could build on the commonality of interests in successful waste management on the part of the government and the utilities; the NWPA waste management liability scheme makes them adversaries. Such an entity could assume ownership of wastes once they left the site of a reactor or reprocessing facility. A hybrid federal corporation owned by the government and the nuclear utilities would represent a sensible compromise arrangement, and such a corporation might potentially engage in reprocessing as well as waste management. The federal or hybrid corporate form, however, has disadvantages, most notably lack of clear arrangements for accountability in its policies and finances.²³ The recent financial debacles of FannyMae and FreddyMac must be carefully considered in designing a new model for nuclear waste management. A corporate model could also make it difficult to coordinate waste management decisions with the functionally related decisions of existing federal agencies.

Siting. Siting of storage facilities and repositories calls for different institutional requisites. While technical competence is essential, the NWPA experience indicates that a purely technocratic model is too narrow. Successful development of new storage facilities or repositories will require considerable engagement with states and localities and a wide variety of constituencies, and a capacity for negotiation within those various stakeholders. This will require an institution that is more open, that can represent different viewpoints and stakeholder interests, and that can develop good political connections with Congress and the states. The multimember “independent” commission form may best suit these specifications. Such agencies have typically had closer ties with Congress (and, through Congress, to local interests) than agencies with single heads who report to the President. An office of waste negotiator should be included as a component within such a commission to take the lead in exploring and negotiating siting opportunities, building on experience

gained under the now-expired provision of NWPA establishing the ONWN.

Financing. Congress should resolve the government’s past and future liabilities through statutory arrangements that will at the same time provide a more secure system of financing for SNF management storage and disposal than was achieved under the NWPA Nuclear Waste Fund. The options include the following:

- Industry-financed storage and disposal through a corporation owned and operated by the utilities, with some government/public representation in its governance and financial commitments and financing arrangements by the industry participants. This is the model followed in Canada.
- A federal corporation with utility representation in its governance that would have authority to finance its operations by fees on nuclear electricity generation.
- Funding for a special-purpose government agency funded through dedicated revenues from nuclear electricity fees placed in an escrow account in the Treasury.
- Reclassification of revenues from the nuclear generation fee as offsetting collections and receipts. Under this system, expenditures for SNF management would not be subject to the overall federal spending budget cap, and the SNF program would not have to compete with other federal programs for limited resources.

Environmental regulation. Environmental health and safety (EHS) regulation of nuclear waste and storage facilities and repositories should, of course, be independent of management and siting. But it seems questionable to have two regulators—NRC and EPA—playing this role, as is currently the case. EPA’s primary mission is pollution control, an orientation which is not well-suited for dealing with the problem of the EHS regulatory issues posed by nuclear waste management and disposal, which are based on complex geologic and engineering systems and stochastic risks of systems failures due to the interaction of multiple fault lines. Dealing with such risks, including those posed by nuclear reactors, is NRC’s central mission. While environmentalists tend to distrust NRC, and institutional redundancy can guard against “capture” of regulatory agencies by the regulated industry, duplication of function creates the potential for conflict and muddles accountability. The preferred solution is to take the necessary steps to ensure the independence and ability of a single EHS regulator. At this juncture, however, EPA standard-setting and certification of repositories (as at WIPP) have come to be accepted as an integral part of the regulatory process for disposal of the most highly radioactive wastes, and accordingly may well need to be retained to win host trust and acceptance. For similar reasons, states’ RCRA authority over the chemically toxic component of mixed wastes should be retained. States play an important role in regulating federal facilities, and the WIPP experience suggests that the

22. See A. Michael Froomkin, *Reinventing the Government Corporation*, 1995 U. ILL. L. REV. 543 (1995) (discussing the advantages of the utilization of the corporate form in this context).

23. *Id.* at 560, 594-95, 607-08.

ability to exercise such authority may be essential to states' willingness to accept future nuclear waste facilities.

D. *Instituting a More Performance-Based, Hazard-Informed Approach to Waste Classification and Management*

A final step in rethinking nuclear waste law and policy is to phase in a more performance-based, hazard-informed approach to waste policy and its implementation. Various reports by NAS and government committees have recommended this step.²⁴ The International Atomic Energy Agency has developed a classification framework that reflects practice in a wide range of countries and provides a useful point of reference. The existing U.S. waste classification/regulation represents an amalgam of various provisions in statutes and regulations that has evolved in patchwork fashion over many years. The resulting classifications and their legal consequences do not always reflect relative risks or sensible waste management policies and priorities. Many waste classifications are based not on the wastes' radiological and other characteristics and the risks that they pose, but on the processes by which they are produced. Moreover, these different categories often include a variety of different kinds of wastes posing different levels and kinds of risks and requiring different approaches to treatment, storage, and disposal.

There are a range of opportunities to reclassify wastes to achieve a better fit between hazards on the one hand and regulatory requirements on the other. For example, certain components of reprocessing wastes now managed (at great cost) as HLW could be separated, solidified, and safely disposed of as LLW. Some high-volume types of LLW with very low radioactivity levels could appropriately be disposed of in landfills without the full extent of engineered controls now required. But other LLW pose significant hazards that require even more stringent controls than now exist.²⁵ Steps to build a more hazard-informed, performance-based waste classification scheme, which would point to more stringent regulation in some cases, and less stringent controls in others, should be incremental and should be accomplished through administrative procedures that will allow full opportunity

for public participation and judicial review. The approach should take into account societal views of risk as well as scientific ones. Moving towards such a system of classification and regulation will not solve the most fundamental problems of nuclear waste in the United States, but it would make valuable contributions towards establishing a more rational system of nuclear waste regulation.

V. Conclusion

The failure of the NWPA and the ultimate success of WIPP indicate that our current orphan waste dilemmas must be solved through a patient, step-by-step approach, keeping options open to the extent feasible, learning from experience, and dealing with unforeseen developments through a strategy of adaptive management. Successful development of a new repository and of consolidated storage facilities must also be based on the informed assent of localities and states hosting waste storage and disposal facilities. This approach is radically different from the approach taken under the NWPA of establishing a detailed blueprint at the outset, pushing insistently forward with it heedless of mounting evidence of fundamental design flaws, and imposing facilities on unwilling states. Implementing the new approach will also require some basic legal and institutional changes to establish the necessary infrastructure for moving forward. The Blue Ribbon Commission should flesh out the elements of this strategy as well as the other recommendations in this article. Congress and the Administration should seize the opportunity to make a fresh start rather than tinkering with a broken system and strategy.

24. See generally Nuclear Radiation Studies Board, Committee on Improving Practices of Regulating and Managing Low Activity Radioactive Waste, *Improving the Regulation and Management of Low Activity Radioactive Waste* (2006); Committee on Improving Practices for Regulating and Managing Low-Activity Radioactive Waste, Nuclear and Radiation Studies Board, *Improving the Regulation and Management of Low-Activity Radioactive Wastes* (NAS-NRC 2006); Allen Croff, *Risk-Informed Radioactive Waste Classification*, 91 HEALTH PHYSICS 449 (2006); B. John Garrick, *Contemporary Issues in Risk-Informed Decision Making on the Disposition of Radioactive Waste*, 91 HEALTH PHYSICS 430 (2006); Linsley Gordon, *International Standards Related to the Classification and Deregulation*, 91 HEALTH EFFECTS 470 (2006); Rob Rechar, *Historical Relationship Between Performance Assessment for Radioactive Waste Disposal and Other Types of Risk Assessment*, 19 RISK ANALYSIS 763 (1999) (all discussing the possibility of the implementation of performance-based standards).

25. Nuclear Radiation Studies Board, *supra* note 24.

R E S P O N S E

NRDC's Perspective on the Nuclear Waste Dilemma

by Thomas B. Cochran and Geoffrey H. Fettus

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Geoffrey H. Fettus joined NRDC in the fall of 2001, and as a senior attorney manages all aspects of NRDC's nuclear litigation in trial and appellate courts. Mr. Fettus has spent a significant portion of his time litigating nuclear waste and cleanup issues, including as lead counsel for NRDC and other environmental groups in the successful challenge to EPA's radiation protection standards for the proposed Yucca Mountain nuclear waste repository in the U.S. Court of Appeals for the D.C. Circuit in 2004.

While we agree with Richard B. Stewart, in his Article, *Solving the U.S. Nuclear Waste Dilemma*,¹ on some crucial issues—most notably that the national process for developing a geologic repository for disposal nuclear waste is currently a mess—we have a substantially different perspective on the reasons for the mess and the path forward.

I. Background on Geologic Repositories

As Stewart describes, efforts to geologically isolate high-level nuclear waste began more than forty years ago. The National Academy of Sciences in 1957 reported that a number of geologic disposal alternatives were possible, but indicated a preference for disposal in salt. In 1967, the Atomic Energy Commission (AEC) proposed Project Salt Vault, a plan to develop a geologic repository in the Carey salt mine at Lyons, Kansas. This plan was abandoned by the AEC in the early 1970s after the Kansas Geological Survey mounted a strong campaign against the site, pointing out that the area had been subjected to extensive exploratory drilling for oil and gas deposits, and noting that an adjacent salt mine could not account for the loss of a large volume of water used during solution mining of the salt.

In 1974, the Energy Research and Development Agency (ERDA), formed out of the AEC and the predecessor to the DOE, retreated from geological disposal by proposing a Retrievable Surface Storage Facility (RSSF) for interim storage of high-level waste while pursuing geologic disposal at a more leisurely pace. This idea was rejected by environmental-

ists and the Environmental Protection Agency (EPA) on the grounds that it would delay permanent disposal.

In the mid-1970s, it also became clear that commercial spent fuel reprocessing was uneconomical, environmentally unsound and represented a serious proliferation risk. President Gerald Ford refused to subsidize the completion of the Barnwell reprocessing plant, and then President Jimmy Carter pulled the plug on reprocessing. This gave a new urgency to finding a site suitable for geologic disposal of both spent fuel and high-level nuclear waste. In the late 1970s, President Carter initiated an Interagency Review Group (IRG) process to solve the nuclear waste problem in the United States once and for all. The IRG process involved numerous scientists, extensive public involvement, and a consultation and concurrence role for the states. The outcome of the IRG effort was a two-track program. The DOE was tasked with the responsibility for identifying the best repository site in the country, and EPA and the NRC were tasked with developing nuclear waste disposal criteria against which the selection and development of the final repository site would be judged.

II. The Nuclear Waste Policy Act

In 1982, Congress enacted the Nuclear Waste Policy Act (NWPA), which embodied in law the principal recommendations that grew out of the IRG process, including a commitment to geologic disposal, two repositories, and characterization of three sites before final selection of the first repository. The NWPA established a comprehensive program for the disposal of spent nuclear fuel and high-level radioactive waste (HLW) from the nation's commercial reactors and nuclear weapons complex.

At the time the NWPA was passed nearly thirty years ago, the federal government enjoyed fairly widespread support from within Congress, the environmental community, and

1. Richard B. Stewart, *U.S. Nuclear Waste Law and Policy: Fixing a Bankrupt System*, 17 N.Y.U. ENVTL. L.J. 783 (2008). This comment is based on Stewart's original 2008 published article rather than the version that appears at 40 ELR (ENVTL. L. & POL'Y ANN. REV.) 10783 (Aug. 2010) and may refer to material that appears in the original article only.

state governments for the site selection and development process proposed by the IRG. Now, nearly three decades later, the federal government has little, if any, support from the State of Nevada, and virtually no public support from the environment and public health community for the Yucca Mountain project.

III. What Went Wrong?

We are in agreement with Stewart on a few issues, but our perspective—shared by much of the environmental community—is that the process of developing, licensing, and setting environmental and oversight standards for the proposed repository were repeatedly rigged or dramatically weakened to ensure the licensing of the proposed site rather than to provide safety for the length of time that the waste is dangerous. Here are two simple examples that Stewart failed to touch upon.

A. Site Selection

First, DOE and then Congress corrupted the site selection process. The original strategy contemplated DOE choosing the best four or five geologic media, then selecting a best candidate site in each media alternative, then narrowing the choices to the best three alternatives, and then picking a preferred site for the first of two repositories. Site selection guidelines were strongly criticized as DOE was accused of selecting sites that they had previously planned to pick and favoring sites on DOE reservations. In May 1986, DOE announced that it was abandoning a search for a second repository, and it had narrowed the candidate sites from nine to three, leaving in the mix the Hanford Reservation in Washington (in basalt), Deaf Smith Co., Texas (in bedded salt) and Yucca Mountain in Nevada (in unsaturated volcanic tuff).

Whatever equity remained in the site selection process was lost in 1987, when Congress, confronted with a potentially huge cost of characterizing three sites and managing the attendant controversy, amended the NWPA of 1982, directing DOE to abandon the two-repository strategy and to develop only the Yucca Mountain site. At the time, Yucca Mountain was DOE's preferred site. The abandonment of the NWPA site selection process led directly to the loss of support from the State of Nevada, diminished congressional support (except to ensure that the proposed Yucca site remained the sole site), and less meaningful public support for the Yucca Mountain project.

B. Radiation and Environmental Standards

The second track of the process was also corrupted. Section 121 of the NWPA of 1982 directs EPA to establish generally applicable standards to protect the general environment from offsite releases from radioactive materials in repositories, and directs the NRC to issue technical requirements and criteria. Unfortunately, it has been clear for years that the projected

failures of the geologic isolation at Yucca Mountain are the determining factor in EPA's standards.

EPA repeatedly issued standards that were relaxed to ensure licensing the site rather than establishing adequately protective standards. EPA's original 1985 standards were vacated in part because it had failed to fulfill its separate duty under the Safe Drinking Water Act² to assure that underground sources of water will not be "endangered" by any underground injection.³

EPA's second attempt at setting standards that allow for a projected failure of geological isolation was again vacated, this time by the United States Court of Appeals for the D.C. Circuit. The D.C. Circuit found that EPA's Yucca Mountain rule (and the corresponding NRC standard), which ended its period of required compliance with the terms of those rules at 10,000 years was not "based upon or consistent with" the recommendations of the National Academy of Sciences (NAS) as required by the 1992 Energy Policy Act and therefore must be vacated.⁴

Giving significant deference to the agency, the D.C. Circuit did not vacate EPA's strangely configured compliance boundary for the Yucca Mountain site. The dramatically irregular line that represents the point of compliance has little precedent in the realm of environmental protection, and its shape is perhaps more reminiscent of gerrymandered political districts. Rather than promulgate protective groundwater standards, EPA pieced together a "controlled area" that both anticipates and allows for a plume of radioactive contamination that will spread several miles from the repository toward existing farming communities that depend solely on groundwater and perhaps through future communities closer to the site.

EPA's next proposed and revised rule, issued in 2005, retained the 15 millirem/year and groundwater standards for the first 10,000 years, but then establishes 350 millirem/year standard for the period after 10,000 years and does away with the groundwater standard entirely. Because of differences in the way the projected dose rates were to be calculated, the post-10,000 year standard was about 70 times less restrictive than the 15 millirem/year pre-10,000 year standard. This two-tiered standard failed to comply with the law and fails to protect public health, especially if the repository's engineered barriers were to fail earlier than DOE predicts. On October 15, 2008, EPA published the final version of its revised Yucca Mountain rule in the Federal Register.⁵ The 2008 Yucca Mountain rule's two-tiered individual protection annual dose standard establishes an initial 15 millirem first-tier limit, but weakens that limit to 100 millirem in the period after 10,000 years, when EPA projects peak dose to occur. Peak dose could occur significantly earlier if engineered barriers fail earlier than DOE and EPA have projected.

The final status of EPA's most recent two-tiered rule is likely null and void given the current administration's cessa-

2. 42 U.S.C. §§300f to 300j-26, ELR STAT. SDWA §§1401-1465.

3. *NRDC v. Environmental Protection Agency*, 824 F.2d 1258, 18 ELR 20088 (1st Cir. 1987).

4. *Nuclear Energy Institute, Inc. v. EPA*, 373 F.3d 1251 (2004).

5. 2008 Yucca Mountain rule, 73 Fed. Reg. 61255-89.

tion of the proposed Yucca Mountain repository project. The State of Nevada had challenged EPA's 2008 Yucca Mountain rule once again, but the matter is unlikely to proceed as the administration has turned the focus of the next two years to the President's Commission on America's Nuclear Future.⁶

IV. Reprocessing: The Federal Government Should Not Encourage or Support Commercial Spent Fuel Reprocessing

While we share his belief that we are not under a current necessity to "solve" the nuclear waste problem instantly (improved hardened on-site storage is certainly adequate for the near future), reprocessing of commercial spent fuel, as it is practiced today in France, Japan, and Russia, could reduce the uranium and enrichment requirements by up to 25%, but at great economic cost and numerous disadvantages over continuing to rely on the once-through nuclear fuel cycle as practiced in the United States and most other countries with nuclear power plants. There would be increased releases from other areas of the fuel cycle and greater proliferation and safety risks. The trend in recent years has been for more countries to abandon reprocessing than to initiate reprocessing.

Relative to the existing open fuel cycle, the use of a closed or partially closed mixed-uranium and plutonium oxide (MOX) fuel cycle in thermal reactors has proven to be more costly and less safe. It leads to greater routine releases of radioactivity into the environment, greater worker exposures to radiation, larger inventories of nuclear waste that must be managed, and it doesn't appreciably reduce the geologic repository requirements for spent fuel or high-level nuclear waste.

Because reprocessing as it is practiced today does not appreciably reduce repository requirements, it is not an alternative to Yucca Mountain. Advanced reprocessing technologies, heavily promoted under the Bush Administration's Global Nuclear Energy Partnership (GNEP), are unlikely to significantly impact repository requirements. This is because the fast reactors required for efficient waste transmutation are likely to remain more costly and less reliable than conventional thermal reactors, and hence will not be commercially deployed in sufficient numbers to effect the desired reductions.

The GNEP vision of burning the long-lived actinides requires that some thirty to forty percent of all reactor capacity be supplied by fast reactors. In other words, for every hundred thermal reactors of the type used throughout the United States today, some forty to seventy-five new fast reactors of similar capacity would have to be built. The commercial use of large numbers of fast reactors for actinide burning is unlikely to occur because—to borrow observations made by U.S. Navy Admiral Hyman Rickover more than fifty years ago that remain true today—fast reactors have proven

to be "expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair."

The development of fast reactors to breed plutonium failed in the United States, the United Kingdom, France, Germany, Italy, and Japan. We would argue it failed in the Soviet Union despite the fact that the Soviets operated two commercial-size fast breeder plants, BN-350 (now shut down in Kazakhstan) and BN-600 (still operational in Russia), because the Soviet Union and Russia never successfully closed the fuel cycle and thus never operated these plants using MOX fuel.

Moreover, the advanced reprocessing technologies are even more costly than the conventional PUREX method and produce even larger inventories of intermediate and low-level nuclear wastes. The closed fuel cycle technologies required by GNEP pose greater proliferation risks than the once-through fuel cycle. Even though GNEP's ambitious vision of deploying new reprocessing plants and fast reactors in large numbers will surely fail to materialize, the partnership's research program will encourage the development in non-weapon states of research facilities well suited for plutonium recovery, that is, small hot cells and even larger reprocessing centers, as well as the training of experts in plutonium chemistry and metallurgy, all of which pose grave proliferation risks. It is for this reason that we advocate terminating the GNEP research on advanced reprocessing technologies.

The Obama Administration does not support efforts to close the nuclear fuel cycle and introduce fast burner reactors in the United States in the near term. This leaves the question of what level of long-term DOE research funding is appropriate to explore advanced nuclear fuel recycling technologies.

We hold the view that even substantial research spending in this area is highly unlikely to lead to nuclear technology breakthroughs that actually meet the stated goals of the research—cost-effective and non-proliferative techniques for reprocessing, recycling, and transmuting plutonium-based fuels. And since the proliferation risks of this cooperative international research would be ongoing and tangible, we and many others in the nonproliferation community believe that shutting down the current U.S. plutonium recycle research effort, and any support it extends to foreign efforts, is the wisest course, at least until such time as the latent nuclear proliferation risk in the world is much better controlled than it is today.

Others, including Energy Secretary Steven Chu, appear to believe that some level of ongoing advanced fuel cycle research is appropriate and has some chance of yielding the desired nuclear technology breakthrough, if pursued for perhaps a decade or more. History has not been very kind to this view, but the plutonium fuel cycle community is a lot like the fusion energy community in this respect—hope springs eternal as long as federal research dollars are within reach.

So weighing these contrasting glass half-full and glass half-empty perspectives, one might conclude that some modest long-term research program, geared to narrowing the technical and cost uncertainties surrounding the toughest unresolved technical, economic, safeguards, and prolif-

6. See January 2010 Presidential Memorandum to the Secretary of Energy directing the establishment of the Presidential Commission, available at http://www.nuclear.energy.gov/BRC/pdfFiles/FR_NoticeofPresidentialMemorandumBRC.pdf.

eration issues, would be an appropriate and prudent middle path to pursue with respect to closing the fuel cycle. We would emphasize that even more important than the particular choice of technology is a better understanding of the requirements for the international institutional setting in which a large-scale fast reactor roll-out would be attempted. This, more than the technology, is the long pole in the closed fuel cycle tent. If one is serious about wanting to minimize the risks of proliferation, one is more or less driven to consider some form of international ownership and control over nuclear fuel cycle facilities, and this is likely to prove just as demanding a task as the development of more “proliferation-resistant” strains of reprocessing. We also note that absent such an international structure for closely regulating the closed fuel cycle, we are unlikely ever to transition to a world free of nuclear weapons.

V. Conclusion

The legislative history of the NWPA of 1982 includes the following admonition:

The Committee strongly recommends that the focus of the Federal waste management program remain, as it is today, on the development of facilities for disposal of high-level

nuclear waste which do not rely on human monitoring and maintenance to keep the waste from entering the biosphere.

This wise legislative direction has been ignored over the past several years. A central problem with the process for developing a geologic repository, and especially Yucca Mountain, has been that the site conditions have driven the standard. We observed this years ago when EPA abandoned its collective dose standard when it appeared that Yucca Mountain could not meet it. We observed this in 2001 when DOE placed greater hope on engineered barriers instead of on the geology of the site. We observed this again in 2001 when EPA limited the period of compliance to 10,000 years and gerrymandered the area of site compliance to allow for a massive (and diluting) spread of radioactive contaminants. Whether we'll observe the same type of process with the Blue Ribbon Commission on America's Nuclear Future remains to be seen. It is essential that this not continue.

If we are ever to have a robust repository program that both follows the original intent of the NWPA and gains the trust of the American public, then the federal government, in both its executive and legislative incarnations, must cease efforts to weaken meaningful and protective health and environmental standards applicable to the program.

R E S P O N S E

The NWPA and the Realities of Our Current Situation

by David R. Hill

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Richard B. Stewart's article, *U.S. Nuclear Waste Law and Policy: Fixing a Bankrupt System*,¹ provides a thoughtful discussion of some of the complex scientific, policy and legal issues involved with nuclear waste generation and disposal. It is packed with useful facts, information, and history, and just the recitation of the history and circumstances of nuclear waste disposal issues and decisions in a readable, understandable form makes a useful contribution.

Stewart argues that the current system of nuclear waste law and policy, primarily as established by the Nuclear Waste Policy Act of 1982 and amendments to that Act (together, the NWPA)² is bankrupt. There are two ways of reading this thesis. The first is that the system is so broken and fraught with problems that it is essentially worthless, and therefore should be discarded (or "liquidated," to use bankruptcy terminology). The second is that while it may have significant problems and difficulties, the system is worth salvaging, perhaps with some elements put aside and others modified, but with many of the basic viable elements retained and moving forward (in bankruptcy terms, a "reorganization"). If Stewart means the former, then I strongly disagree; but if he means the latter, as I believe he does, then I agree with him.

This is not to say that I believe that the NWPA's approach and the process by which the decisions embodied in the NWPA were made represent the best possible approach, or perhaps even a particularly good one, were we only now starting to generate nuclear waste and develop a scheme for its disposal. But of course that is not our current situation. Much as it might be nice to sit quietly in our offices and libraries and think creatively for a few more decades about what to do with spent nuclear fuel (SNF) and high-level radioactive waste (HLW) without regard for the consequences of this delay, I believe that such a course of action would be extraordinarily expensive and complicated, with no prospect at pres-

ent for producing any better results than those brought about by the NWPA.

I. Some Problems with the Current System

Regardless, as I will explain below, Stewart is correct about many of the points he makes in the article, some of which, although the article was written before the Obama Administration's recent attempts to abandon the Yucca Mountain licensing process,³ serve to highlight the perilous, expensive, and I believe mistaken course being pursued by the current Administration with respect to the disposal of SNF and HLW.

I agree with Stewart that congressional short-circuiting in the 1980s of the process for selecting a nuclear waste disposal site in the United States may have helped give rise to strong opposition in Nevada and elsewhere to the selection of Yucca Mountain as the site for a nuclear waste repository. Americans often complain about the amount of time it takes to make decisions and take action in this country—witness the current hand-wringing over how fast the Chinese can move forward with building new renewable energy facilities while in many locations in the United States the construction of almost any new energy facility can be mired for years in the process of federal, state and local permitting, National Environmental Policy Act reviews, litigation, etc. But the American system involves a significant amount of permitting and review, stakeholder involvement, and approvals by different government agencies at various levels of government. The decades-long opposition to Yucca Mountain, even after Congress in 1987 designated it as the only site to be studied for a repository, demonstrates what can happen when a congressional (or judicial) desire for "action" overrides what the public has been told will be the process for making a decision. This is exacerbated because politicians of both parties often will play the "you have been wronged" card in an effort to convince the public that the other party has unfairly taken decisions from the public, short-circuited the right process, or otherwise committed process fouls. It is not hard to think of numerous examples of this phenomenon, including some in recent months.

1. Richard B. Stewart, *U.S. Nuclear Waste Law and Policy: Fixing a Bankrupt System*, 17 N.Y.U. ENVTL. L.J. 783 (2008). This Comment is based on Stewart's original 2008 published article rather than the version that appears at 40 ELR (ENVTL. L. & POL'Y ANN. REV.) 10783 (Aug. 2010) and may refer to material that appears in the original article only.

2. Pub. L. No. 97-425, 96 Stat. 2201 (1982) (codified as amended at 42 U.S.C. §§10101-10270 (2009)).

3. See *supra* note 1.

I furthermore agree with Stewart that the multiplicity of federal and state regulators under the current NWPAs system has created serious problems. Some would argue that this system of multiple regulators has put in place proper checks and balances—one regulator against another. But often this view may reflect more of a desire to see the development of Yucca Mountain, or perhaps any permanent nuclear waste disposal facility, slowed down or stopped altogether. A system of multiple regulators with competing (or perhaps even diametrically opposed) missions is more likely to result in decisional gridlock, or at least one of the required regulators saying “no” to a facility’s development. When multiple regulators have responsibility for a single facility or set of decisions, we cannot discount the fact that each regulator comes to the process with its own set of viewpoints, desires, and objectives—and a desire to “add value” by bringing those viewpoints to bear on the facility at issue. Some would view that as a positive overall, and there certainly are times when review by multiple different regulators is necessary and appropriate. But I think there can be no doubt that the existence of multiple, overlapping regulators dealing with a single facility dramatically increases the cost and inefficiency of the overall process, and increases the likelihood that the facility at issue—whether an energy production facility or a nuclear waste repository—will never be built at all.

Stewart is also correct that if we are going to re-think what to do with nuclear waste, we must confront the ethical principle that it is the present generation’s responsibility to find a permanent solution and disposal pathway for the nuclear waste and SNF we have produced. This principle of “intergenerational equity” is at the core of the NWPAs focus on the establishment of a permanent repository for SNF and HLW. I sometimes hear people question why the United States is so tied in knots with respect to the disposal of nuclear waste and the siting of a repository, while the French do not seem to have any such difficulty. But this is based on a misunderstanding of the situation in France. The French, who are heavily reliant on nuclear power for the production of electricity in their country, are reprocessing their spent nuclear fuel to produce mixed oxide fuel, but they are also trying to develop a deep geological repository because they must dispose of the radioactive byproducts of that reprocessing. Despite a very well planned, multi-decade course of action, they have run into substantial local opposition to the siting of a permanent repository, and have not yet succeeded in siting one. In the meantime, just as in the United States, radioactive waste is stored in shorter-term storage facilities in France.

There obviously are very serious issues of intergenerational equity involved when a decision is made to leave to future generations the problem of managing and disposing of nuclear waste that we generate today. The United States, in the NWPAs, decided to take care of its nuclear waste legacy by building a permanent repository, and I believe that was, and is, the most equitable and responsible course of action. But a reasonable case can be made for the alternative approach. It would be contrary to the law as it currently stands, and all who advocate for an approach that does not seek to provide

for a permanent repository should be aware of the burden we are choosing to place on future generations, but it is worth discussing if we were to decide to scrap the current NWPAs system and start over.

Finally, I strongly agree with Stewart’s statement that “[i]f Yucca is abandoned, it will be extraordinarily difficult to site a new repository, and the public perception of failure will be reinforced.”⁴ It might be different if Yucca was abandoned in favor of a viable Plan B for the permanent disposal of nuclear waste—for example, if Congress repealed the NWPAs and simultaneously authorized the construction of a repository in some other location. But abandonment of Yucca Mountain without a Plan B, and prior to the conclusion of the now-ongoing Nuclear Regulatory Commission (NRC) licensing process for Yucca Mountain, would make the siting of a repository elsewhere extremely difficult. Basically, it would teach that if you fight hard enough, and if you refuse to accept the will of Congress and of the majority long enough, you can eventually succeed in thwarting an effort that is in the common good of the country as judged by multiple Congresses and Presidents of the United States.

II. Costs of Abandoning the Current NWPAs Approach

Stewart advocates a re-thinking of the process set forth in the NWPAs for the disposal of SNF and HLW. He advocates doing so while proceeding with the licensing process for Yucca Mountain as currently envisioned by the NWPAs. This is in contrast with the approach of the current Administration, which seeks to stop the Yucca Mountain licensing process at the NRC even though there is no other existing plan for the disposal of the waste that was destined for Yucca Mountain—or, for that matter, even a process for selecting and evaluating such a plan.⁵ Thus, the Administration seeks to push the reset button without any particular knowledge of what or even if viable alternatives may exist.⁶

But leaving aside all of the discussion about whether or not it might be a good idea to think about alternatives to licensing Yucca Mountain—and I will briefly discuss some of those alternatives below—the first question ought to be, what course of action is legally required right now? There are strong legal arguments that unless Congress amends the NWPAs and repeals the current obligations that the Act imposes on the U.S. Department of Energy (DOE) and the NRC, the licensing process for Yucca Mountain must proceed, and the Administration is without the legal authority to stop it.

In contrast with what may have been a congressional short-circuiting of the process for selecting sites to be studied

4. Stewart, *supra* note 1, at 821.

5. DEP’T OF ENERGY, FY 2011 CONGRESSIONAL BUDGET REQUEST: BUDGET HIGHLIGHTS 9 (2010), available at <http://www.mbe.doe.gov/budget/11budget/Content/FY2011Highlights.pdf>.

6. Also, at this point there have been almost two years of intensive technical review by the NRC staff of the Yucca Mountain license application that DOE submitted in 2008. This review by more than 200 technical professionals at the NRC has, to my knowledge, exposed no scientific or technical showstoppers with the application or facts that would call for anything other than moving forward with the full consideration of the application.

for a waste repository, there can be no doubt that the NWPA itself sets out an elaborately detailed process for DOE to follow in evaluating the site, and for the Secretary of Energy, the President, the State of Nevada, Congress, and the NRC to follow if Yucca Mountain is to be ultimately approved for the construction of a nuclear waste repository. The NWPA addresses how the Secretary of Energy must make a recommendation, what the President must do with it if he approves of the recommendation, the actions that the State of Nevada may take if it disagrees with the actions of the President, and even the words that are to be used in the resolutions introduced in Congress if Congress wishes to “override” the objections of the State of Nevada to locating a nuclear waste repository at Yucca Mountain.⁷

All of these processes have been followed over the course of the last twenty years or so. This process resulted in the enactment in 2002 of Public Law 107-200, the entire text of which is as follows: “Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That there hereby is approved the site at Yucca Mountain, Nevada, for a repository, with respect to which a notice of disapproval was submitted by the Governor of the State of Nevada on April 8, 2002.”⁸ Rarely does Congress speak to a question with more clarity. In short, the NWPA was complied with, Yucca Mountain was designated by Act of Congress as the location of a repository for nuclear waste, DOE submitted a license application to the NRC, and the next step in the process is the now-ongoing NRC licensing process.

The NWPA requires that within ninety days of enactment of the resolution approving the Yucca Mountain site as the location for a repository, DOE must file a license application with the NRC for the Yucca Mountain facility.⁹ Notably, the Act does not say that DOE “may” file an application, or that it “should” do so. Section 114(b) of the Act states DOE’s obligation in unequivocal and mandatory terms: “If the President recommends to the Congress the Yucca Mountain site under subsection (a)” —which he did— “and the site designation is permitted to take effect under section 115” —which it was— then “the Secretary [of Energy] *shall* submit to the [NRC] an application for a construction authorization for a repository at such site not later than 90 days after the date on which the recommendation of the site designation is effective under such section and shall provide to the Governor and legislature of the State of Nevada a copy of such application.”¹⁰ It certainly is true that DOE did not manage to submit the application to the NRC within ninety days—rather, it took about six years for DOE to complete and submit to the NRC the seventeen-volume, approximately 8,600-page application after Congress approved Yucca Mountain as the site for the repository in 2002.¹¹ But once the application was submitted,

the NRC took several months to review it, and then in September 2008 “docketed” it after finding it was substantially complete and ready for NRC action.¹² That started a clock under the NWPA pursuant to which the NRC has up to four years to review and issue a decision on the application.¹³

For reasons of its own, the Obama Administration has attempted to abandon the Yucca Mountain licensing process, and DOE has sought to “withdraw with prejudice” the application that the Department submitted in compliance with the NWPA in 2008.¹⁴ The Administration has stated that it has sought to withdraw the application with prejudice because it believes the Yucca Mountain project is not a “workable option.”¹⁵ Others would say the Administration has taken this action for purely political reasons.

Regardless, there are strong arguments that there is no legal authority or basis for DOE seeking to withdraw the application. Recently, NRC’s Atomic Safety and Licensing Board issued an order that came to that conclusion. In an order issued June 29, 2010, the Board said that the NWPA “does not permit the Secretary to withdraw the Application that the NWPA mandates the Secretary file. Specifically, the NWPA does not give the Secretary the discretion to substitute his policy for the one established by Congress in the NWPA that, at this point, mandates progress toward a merits decision by the Nuclear Regulatory Commission on the construction permit.”¹⁶

Even if proceeding with the current licensing process was not compelled as a matter of law, there are compelling arguments that it is the best policy course. Abandonment of the NWPA and of the now-ongoing licensing process for Yucca Mountain would bring about consequences that have not been fully acknowledged and justified by those supporting abandonment of the process called for by the NWPA.

First of all, refusing to follow the process set forth in the NWPA and abandonment of the Yucca licensing process would not bring about just a few months or years of delay. If the experience with the NWPA and Yucca Mountain has taught us absolutely nothing else, it has demonstrated that resolving questions as to the disposal of SNF and HLW takes a very long time. It took approximately twenty years between the commencement of the process to evaluate and site a defense nuclear waste disposal facility—the Waste Isolation Pilot Plant (WIPP)—near Carlsbad, New Mexico, and that was even with strong local community support for the facility.¹⁷ Even assuming that the successful WIPP timeline would be replicated for a Yucca Mountain replacement at another location, we are not yet even to the point at

7. 42 U.S.C. §§10132-35.

8. Act of July 23, 2002, Pub. L. No. 107-200, 116 Stat. 735 (codified at 42 U.S.C. §10135).

9. 42 U.S.C. §10134(b).

10. *Id.* (emphasis added).

11. U.S. Dep’t of Energy’s Yucca Mountain Repository License Application for Construction Authorization (June 3, 2008), available at <http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html>.

12. Letter from Michael F. Weber, Dir., Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Comm’n, to Edward F. Sproat, Dir., Office of Civilian Radioactive Waste Mgmt., U.S. Dep’t of Energy (Sept. 8, 2008), available at <http://www.nrc.gov/waste/hlw-disposal/letter-to-doe.pdf>.

13. 42 U.S.C. §10134(d).

14. U.S. Dep’t of Energy’s Motion to Withdraw, U.S. Dep’t of Energy (High-Level Waste Repository), No. 63-001 (NRC Mar. 3, 2010).

15. *The President’s 2010 Budget for Dep’t of Energy: Hearing Before the S. Budget Comm.*, 111th Cong. (2009) (statement of Stephen Chu, Sec’y of Energy).

16. U.S. Dep’t of Energy (High-Level Waste Repository), LBP-10-11, 71 NRC ___, ___ (slip op. at 3) (June 29, 2010).

17. Stewart, *supra* note 1, at 791-93.

which the twenty-year clock has started to run. No new site has been selected, and for that matter, there is not even any agreement on how a process would work for selecting a new site. In addition, an entirely new statutory framework would need to be enacted by Congress, implementing regulations would have to be issued by numerous federal agencies, and inevitably many of those regulations would be challenged in the courts. Given all of this, it is optimistic to think that a permanent repository at a new location could be opened much before 2050, if even by then.

Second, there are very significant financial implications—or to put it more bluntly, costs that will be borne by the American taxpayers—if the Yucca Mountain facility is not licensed, constructed and opened. Stewart states in his article that in the NWPA, Congress imposed a liability “hammer” on DOE if it did not start accepting, by January 31, 1998, SNF from the utilities that had generated it.¹⁸ But really, of course, the “hammer” is on the American taxpayers, not DOE *per se*. The federal government—read that to mean American taxpayers—will have to pay billions of dollars to utilities for having breached the obligation imposed by law to begin picking up the utilities’ SNF starting in 1998, and that will be true even if Yucca Mountain is licensed by the NRC and opens around the 2020 timeframe, as the application currently pending at the NRC anticipated. If the licensing process for Yucca is abandoned and the government’s compliance with its obligations to accept SNF is delayed for additional years or decades, the federal government’s damages liability will likely grow by billions of dollars. These damages are paid from the Justice Department’s Judgment Fund, and not from funds appropriated to DOE. And of course, the American taxpayers are on the hook for paying the cost of Judgment Fund payments.

Third, even aside from the additional damages that will be incurred as noted above, it likely would cost tens of billions of dollars to site, characterize, study, analyze, license and construct a repository at a new location. And we currently have absolutely no idea whether at the end of that site selection and licensing process we would end up with a solution that is any better technically than Yucca Mountain, or whether the Administration that is in place at that time would decide that the alternative approach is any more “workable.” This seems like quite an extravagant expenditure of money at any time, but particularly now given the very high federal government budget deficits.

Fourth, it is unclear at best as to whether anyone has seriously evaluated the engineering, scientific, and technical implications of delaying by several more decades the opening of a permanent repository for SNF and HLW. A number of nuclear generating plants in the United States began operating more than thirty years ago and have had SNF stored on site since that time. Other reactors were shut down more than a decade ago. If we are going to delay for an additional thirty or forty years (or more) the opening of a repository while we engage in a policy re-think, it seems that at the

very least the public ought to know what additional technical complications with existing fuel might occur as a result.

Finally, I believe we ought to recognize that a legislative process happened. Congress made decisions. At some point, is it not time to put pencils down and take action? Moreover, these were not decisions made by a single Congress or by only one political party. In 1982, when the NWPA was enacted, there was a Republican president and the Republicans controlled the Senate, but the Democrats were firmly in control of the U.S. House of Representatives (holding a 244-191 majority). In 1987, when the amendments to the NWPA were enacted that “short-circuited” the site selection process, the decisions again were bi-partisan: A Republican was president, but Democrats controlled the Senate by a 55-45 majority, and also had a sizeable majority in the House, at 258-177. That margin is almost exactly the same majority as the Democrats have held in the U.S. House of Representatives in the 111th Congress in 2009-2010.

III. Are There Reasonable Alternatives to Yucca Mountain and the Current NWPA Process?

So it is clear that we have pursued the development of a facility at Yucca Mountain through various Administrations and Congresses, both Democratic and Republican, and we have spent massive amounts of money doing so. It is also clear that abandoning the process will cost the American taxpayers billions of dollars, and that proponents of abandoning Yucca Mountain have not presented a process for making repository location decisions, proposed actual sites for a repository, or explained and justified methods of dispositioning waste, that appear to be any better than our current path. But surely we have learned some things that will make our decision-making and siting processes better the next time, even if we cannot currently tell how that will be, right? I am not so sure.

I am skeptical about the value of another “blue ribbon commission” to re-think what we ought to do with nuclear waste and SNF. I suppose it is always possible that this time things will be different, but a lot of effort has already been expended in past decades about what to do with SNF and HLW in the United States. The consensus opinion both in the United States and internationally over the past six decades has consistently supported deep geologic repository disposal.

I also think it is a false expectation to believe that if we just get together and talk some more, people will eventually agree on something and everybody will go home happy. There is little precedent for results like that in the nuclear arena. And even if that happy state of affairs did come about, it is worth remembering that the State of Nevada itself passed a resolution in 1975 urging the federal government to choose Nevada for the storage and processing of nuclear materials.¹⁹ Times change, as demonstrated most recently by the Obama Administration’s effort to abandon a decades-long process and withdraw the Yucca Mountain license application that

18. Stewart, *supra* note 1, at 808.

19. A.J.R. 15, 1975 Sess. (Nev. 1975).

DOE submitted to the NRC less than two years before. We must be realistic, and appropriately skeptical, about our ability to arrive at a happy consensus where all can agree on a disposal pathway for SNF and HLW.

Reprocessing also may be a fine idea. The French do it, after all. And the Bush Administration promoted the Global Nuclear Energy Partnership, which had a reprocessing component.²⁰ It also is true that SNF from nuclear power plants still contains the vast majority of the energy content of the uranium fuel originally placed into the reactor.

But nuclear reprocessing plants and technologies are very expensive. A reprocessing plant likely would cost billions of dollars to build, and would end up producing fuel that would only be price competitive with fuel produced from natural uranium if the market price for natural uranium was around \$150 or more.²¹ The current price of uranium is around \$40-50 a pound, so enough said about that.²² If we do decide as a country that we want to reprocess SNF, reprocessing would have to be massively subsidized with public money in order for it to be even remotely economically viable. Further, to reduce our SNF inventories, we would need a significant amount of new reprocessing capacity. SNF is currently being generated in the United States at a rate of about 2,000 metric tons per year.²³ So to not only deal with that newly generated SNF but also begin to reduce the volume of SNF that already exists, we would need a very large volume of new reprocessing capability.

And even after reprocessing, nuclear waste remains that must be disposed of in a geologic repository. Therefore, reprocessing may reduce the volume of material that must be disposed of, but it does not eliminate that waste altogether. Moreover, many types of waste—such as contaminated fuel, spent fuel from the nation's nuclear submarines and aircraft carriers, the glass logs (or "vitrified" waste) into which some defense-origin liquid high-level waste has been converted, etc., cannot be reprocessed. All of that material must simply be disposed of in a geologic repository, and until it is, it will continue to sit where it currently does in states throughout the country. And the defense-related waste, of course, does not include the SNF from commercial reactors that currently is stored at 131 sites in thirty-nine states.²⁴ There is a reason that on July 6, 2010, so many members of Congress from both political parties sent a letter to Secretary of Energy Chu demanding that DOE stop dismantling the apparatus to license and build the Yucca Mountain repository, at least until legal questions about the Administration's authority to unilaterally stop the licensing and development process for Yucca Mountain are resolved.²⁵

One final thought—the Yucca Mountain repository design provides for retrievability of the SNF and HLW that is placed there until the repository is closed—which probably would not occur until the year 2150 at the earliest. As a result, the design provides for safe storage of nuclear materials in the near term while allowing future generations to remove it and do something completely different with it if technology develops that allows it to be treated or disposed of in a way that society deems more desirable. This design therefore preserves options for a considerable period of time into the future, while at the same time safely disposes of the nuclear materials created by the present generation and mitigates the financial liabilities that in the meantime the federal government is incurring every day.

IV. Conclusion

In sum, I agree with Stewart that the process established by the NWPA is far from perfect. Perhaps a less prescriptive process would have been more desirable. But can we really lament the process fouls that led to the creation of the NWPA in the 1980s, and also lament the extensive public processes called for by that Act, which were followed over the course of the succeeding twenty or so years? I believe not. If we were starting right now to both create nuclear waste and decide what to do with it, there would be a variety of processes we might use to select disposition pathways, and there are a variety of possibilities for disposing of nuclear waste. But that is not the situation in which we find ourselves, and we may as well be honest with ourselves about that.

The inability to push forward with resolve on the process that we have been embarked on for almost three decades does indeed create public doubts. This is unfortunate because nuclear power has been, and continues to be, a critical part of our nation's energy portfolio, and reliably produces massive amounts of electricity with little or no emissions of greenhouse gases and other air pollutants. Yucca Mountain has been chosen by an Act of Congress as the site for the nation's permanent repository for SNF and HLW. It has been the subject of decades of study and debate. It is now properly the subject of a licensing proceeding before the NRC. If the Administration and Congress wish to abandon that process, they should do so only if they repeal the NWPA and by Act of Congress establish an alternative site for disposing of nuclear waste. The alternative should not be years of additional study while both SNF and billions of dollars in costs to American taxpayers pile up. Thinking about what we want to do with the next repository, after Yucca Mountain is built, is just fine, but deciding to perhaps improve on the process the next time around should not be viewed as a substitute for proceeding with the process established by law, and the development and licensing process at Yucca Mountain that has now been ongoing for more than twenty years.

20. Stewart, *supra* note 1, at 800-01.

21. Stewart, *supra* note 1, at 803 (citing MATTHEW BUNN ET AL., *THE ECONOMICS OF REPROCESSING VS. DIRECT DISPOSAL OF SPENT NUCLEAR FUEL* §4 (2003)).

22. See CME Group, UxC Uranium U308 Swap Futures, http://www.cmegroup.com/trading/metals/other/uranium_quotes_globex.html (last visited July 7, 2010).

23. U.S. DEP'T OF ENERGY, *REPORT TO THE PRESIDENT AND THE CONGRESS BY THE SECRETARY OF ENERGY ON THE NEED FOR A SECOND REPOSITORY 2* (2008) available at http://www.energy.gov/media/Second_Repository_Rpt_120908.pdf.

24. Stewart, *supra* note 1, at 787.

25. Letter from Members of Congress, to Secretary Stephen Chu, U.S. Dep't of Energy (July 6, 2010), available at <http://murray.senate.gov/public/index>.

R E S P O N S E

NWPA Is Still a Viable Option for Solving the Nuclear Waste Dilemma

by Daniel T. Swanson

Daniel T. Swanson is the Senior Counsel for Environmental and Nuclear Regulatory Law for the Idaho National Laboratory. He was an attorney for the U.S. NRC, representing it in multiple licensing and enforcement proceedings for reactors, including the TMI accident hearings. He also served as the lead environmental and nuclear regulatory attorney for Battelle Memorial Inst. in the DOE SNF and HLW repository siting program, and in that capacity was invited by DOE numerous times to lecture to other U.S. agencies and repository siting contractors on NRC licensing. He is a 1974 graduate of Vanderbilt University Law School.

In his article, *Solving the U.S. Nuclear Waste Dilemma*,¹ Richard B. Stewart analyzes the history of the failure of the U.S. to manage the recycling and disposal of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) from the nuclear fuel cycle associated with the production of electricity. He then develops some insightful suggestions to rectify the problem, recognizing that our current government policy is not moving the country toward a viable solution for disposal of SNF and HLW.

Stewart is correct in concluding that the current arrangement of onsite storage of civilian nuclear waste provides a relatively safe near-term option. However, there are very real security considerations attendant to indefinite storage of waste at locations never selected or constructed to store waste, with the potential for terrorists to target well-known quantities of low-level radioactive waste (LLRW) and HLW at reactor sites. As politicians become complacent with the lack of serious security incidents resulting from their failure to take decisive action to find disposal solutions, it becomes easier for them to ignore this volatile issue.

One consequence of the failure to take responsibility for the disposal of SNF and HLW is its negative impact on the development of nuclear power. A certain portion of the population opposes any growth in nuclear power as long as there is no demonstrated disposal option for SNF and HLW. Taking responsibility for the waste with a permanent repository will advance our energy security by helping us to maintain diverse sources of energy supply with the elimination of one serious impediment—the absence of safe disposal of SNF—while increased nuclear power will reduce emissions of greenhouse gases. A repository will also advance our national security by helping to provide operational certainty to our nuclear Navy

and by facilitating the decommissioning of nuclear weapons and the secure disposition of nuclear materials.²

Based on experience obtained in the search for viable sites for a SNF and HLW repository, I have a different perspective than Stewart as to whether the law that directed the process, the NWPA, was to blame for the failure to select a viable repository site. Rather than being a failure, the NWPA was very successful in creating a process that identified potentially acceptable sites. Considerable resources were devoted to screening and exploration using a variety of media across the country, with a number of sites being identified as very promising from a geological and political perspective. The U.S. Department of Energy (DOE) initially identified nine sites as being potentially acceptable. Nine Draft Environmental Assessments (EAs) supported that decision.³ Several of the communities in proximity with the target sites welcomed the prospect of being host communities with the attendant benefits of jobs and government payments.⁴ In accordance with the NWPA,⁵ the list of nine was narrowed down to five locations representing three different rock media, for which DOE developed final environmental assessments.⁶ Yet the technical process was thwarted by Congress in selecting the Nevada site and eliminating the four other sites without

1. Richard B. Stewart, *Solving the U.S. Nuclear Waste Dilemma*, 40 ELR (ENV'TL L. & POL'Y ANN. REV.) 10783 (Aug. 2010) (derived from Richard B. Stewart, *U.S. Nuclear Waste Law and Policy: Fixing a Bankrupt System*, 17 N.Y.U. ENV'TL L.J. 783 (2008)).

2. SECRETARY SPENCER ABRAHAM, RECOMMENDATION BY THE SECRETARY OF ENERGY REGARDING THE SUITABILITY OF THE YUCCA MOUNTAIN SITE FOR A REPOSITORY UNDER THE NUCLEAR WASTE POLICY ACT OF 1982 2, 31 (Feb. 2002).

3. Draft Environmental Assessments for Lavender and Davis Canyon Sites, Utah, Cypress Creek and Richton Dome sites, Miss., Deaf Smith and Swisher Counties, Texas, Vacherie Dome, La., and Yucca Mtn., Nev., and Hanford, United States Department of Energy, Office of Civilian Radioactive Waste Management 10-17 (1984).

4. See, e.g., Environmental Assessment, Davis Canyon Site, United States Department of Energy Office of Civilian Radioactive Waste Management (1986); Environmental Assessment, Deaf Smith County Site, Texas, United States Department of Energy Office of Civilian Radioactive Waste Management (1984) (discussing a uniform lack of reluctance among communities to serve as host communities for such site in light of the possibility of federal funds and federal jobs).

5. 42 U.S.C. §10132(b).

6. Final Environmental Assessments for Davis Canyon, Deaf Smith County, Hanford, Richton Dome, and Yucca Mountain, United States Department of Energy Office of Civilian Radioactive Waste Management (1986).

allowing DOE to conduct the detailed characterization mandated by the NWPA.⁷ That backfired years later when Senator Harry Reid gained a significant amount of influence and exerted it to effectively kill the Yucca Mountain site.⁸

One important legislative action was taken that, although not mentioned in the condensed article, is discussed in Stewart's earlier published article—the empowerment of the NRC to regulate the design and operation requirements of the repository.⁹ An equally significant congressional action was to confer on the NRC licensing authority over the SNF repository site to be nominated by DOE.¹⁰ This step not only added a significant regulatory safeguard by empowering the NRC, which has years of experience licensing and regulating facilities utilizing reactor fuel, but it served the extremely valuable function of boosting public confidence in the repository selection process through an independent regulator.

As another example of Congress intervening in the government's effort to develop a complete fuel cycle, I would add to Stewart's discussion of the Carter Administration's influence that Congress, at the urging of President Carter, removed funding for the Clinch River Breeder Reactor after it had successfully undergone the first stage of licensing by the NRC.¹¹ This initiative could have made a significant contribution to the U.S. nuclear energy program and its fuel cycle by developing the country's first demonstration liquid-metal fast breeder reactor, with its potential to reduce nuclear fuel costs for reactors.

Stewart addresses the nation's pressing need to arrive at a solution for disposing of SNF from power plants. He presents five proposals to successfully solve the nuclear waste issue, from changing our ethics of nuclear waste to creating new waste siting agencies.¹² Indeed, his premise for prompting new options for achieving the national objective of siting, licensing, and operating a SNF disposal repository is sound, if Congress and the President approved. He suggests, however, that the existing legislative path forward must be abandoned in favor of an entirely new scheme, including the creation of a new nuclear waste policy commission, new waste management and siting agencies, avoidance of regulatory duplication, and other strategies.¹³ Taken together, these recommendations appear workable and manageable. The problem, as with any options involving the federal gov-

ernment in locating and regulating a repository, is that the potential exists for Congress and the President to intervene and scuttle the process as they did with the existing scheme, without allowing the selection and approval of a suitable geologic host for the repository.

Given the failure of our country's initial attempt, pursuant to the NWPA, to achieve an orderly, scientific, and defensible evaluation of potentially suitable sites for a repository without disruption by Congress and DOE, change certainly is necessary. The principal obstacle that prevented the NWPA process from identifying suitable repository sites, however, was political interference. The pressure for securing a solution beyond the current impasse should not lead us inexorably to abandon the current legislation and adopt a totally different approach to the repository siting and licensing process. The existing NWPA is a functional law, and it led the DOE Office of Civilian Radioactive Waste Management (OCRWM) and its contractors to identify locations that have the potential to be characterized as entirely acceptable waste repository sites. The NWPA demonstrated its effectiveness in guiding OCRWM to its objective of identifying nine potentially suitable sites, which were narrowed down to five sites representing three different rock media, all fully supported by final environmental assessments.¹⁴ Absent political interference, the NWPA was on track to complete the process. Finally, over \$13 billion was spent supporting the OCRWM in its data gathering and analysis of potential waste disposal sites.¹⁵ Rather than waste that money with a totally new scheme, consideration should be given to building on the work performed to date. Only if that fails should we embark in a completely different direction.

What DOE and its contractors require is to be left alone by Congress to follow the requirements of the NWPA. The potential for political interference would exist under either current law or an entirely new legislative scheme. Congress must take responsibility and not yield to individual states, such as Nevada, in arriving at a solution that will benefit the entire country—reenergizing the NWPA to arrive at the best disposal sites possible within the U.S. All that Congress should ask of OCRWM is that DOE and its contractors perform what is required of them under the NWPA, on schedule, and on budget, preparing defensible analyses.

Whatever option Congress selects for moving the SNF and HLW disposal program forward, it is critical to promptly resolve the logjam at the tail end of the nuclear fuel cycle, as there is an anticipated rise in interest in new plants generating SNF and HLW, which will add to the burden created by the existing generators. The NRC announced that since 2007, it has received twenty-one applications for approval to construct and operate thirty new nuclear generating facili-

7. 42 U.S.C. §10133(a).

8. Press conference by Senator Reid Announcing The Elimination of Funds for the Yucca Mountain Site, Feb. 1, 2010, http://reid.senate.gov/newsroom/020110_yucca.cfm (last visited June 28, 2010).

9. See *supra* note 1 and accompanying text.

10. 42 USC §5842(3).

11. See, e.g., REPORT TO THE PRESIDENT ON FEDERAL ENERGY RESEARCH AND DEVELOPMENT FOR THE CHALLENGES OF THE TWENTY-FIRST CENTURY, PRESIDENT'S COMMITTEE OF ADVISORS ON SCIENCE AND TECHNOLOGY PANEL ON ENERGY RESEARCH AND DEVELOPMENT, PRESIDENT'S COMMITTEE OF ADVISORS ON SCIENCE AND TECHNOLOGY PANEL ON ENERGY RESEARCH AND DEVELOPMENT 17, (Nov. 1997) (discussing President Carter's request to remove funding for the Clinch River Breeder Reactor).

12. See Stewart, *supra* note 1, at 10786-90.

13. *Id.* at ###.

14. See *supra* note 7 and accompanying text.

15. ANALYSIS OF THE TOTAL SYSTEM LIFE CYCLE COST OF THE CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM, FISCAL YEAR 2007, DOE/RW-0591, July 2008, at vi (value in 2007\$).

ties.¹⁶ With new technology being developed to enhance the value of nuclear power plants, the demand will only increase. Examples include high-temperature, gas-cooled nuclear plants that offer the potential to cogenerate steam for electricity production, and also heat for an unlimited number of options, including desalinization, clean coal processing, hydrogen production, enhanced oil recovery, and numerous other uses benefiting such plants as refineries, coal conversion, chemicals, and fertilizers.¹⁷

I agree with Stewart that the Obama Administration and Congress should seize the opportunity to take decisive action to move the repository program forward.

16. New Reactors, United States Nuclear Regulatory Commission, <http://www.nrc.gov/reactors/new-reactors.html> (last visited June 28, 2010).

17. NEXT GENERATION NUCLEAR PLANT LICENSING STRATEGY, A REPORT TO CONGRESS, UNITED STATES DEPARTMENT OF ENERGY 4 (Aug. 2008).