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Civilian Nuclear Waste Disposal

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Civilian Nuclear Waste Disposal

Summary

Management of civilian radioactive waste has posed difficult issues for Congress since the beginning of the nuclear power industry in the 1950s. Federal policy is based on the premise that nuclear waste can be disposed of safely, but proposed storage and disposal facilities have frequently been challenged on safety, health, and environmental grounds. Although civilian radioactive waste encompasses a wide range of materials, most of the current debate focuses on highly radioactive spent fuel from nuclear power plants.

The Nuclear Waste Policy Act of 1982 (NWPA) calls for disposal of spent nuclear fuel in a deep geologic repository. NWPA established an office in the Department of Energy (DOE) to develop such a repository and required the program's civilian costs to be covered by a fee on nuclear-generated electricity, paid into the Nuclear Waste Fund. Amendments to NWPA in 1987 restricted DOE's repository site studies to Yucca Mountain in Nevada. DOE is studying numerous scientific issues at Yucca Mountain in pursuing a license from the Nuclear Regulatory Commission (NRC) for the planned repository. Major questions about the site include the likelihood of earthquakes, volcanoes, water infiltration, and human intrusion.

The FY2009 budget request for the nuclear waste program is $494.7 million, 28% above the FY2008 appropriation. However, the FY2008 level of $386.4 million is about $50 million below the FY2007 level and more than $100 million below the Administration's FY2008 request. The House Appropriations Committee approved DOE's full request for FY2009, and the Senate Appropriations Committee recommended $388.4 million. Funding for the program is currently under a continuing resolution (P.L. 110-329).

NWPA's goal for starting to load waste into the repository was 1998, but that date has been pushed back repeatedly. The latest budget cuts are likely to delay waste shipments to Yucca Mountain until at least 2020, according to program managers. DOE submitted a license application for the repository to NRC June 3, 2008, and NRC docketed the application September 8, 2008. NWPA requires NRC to issue a licensing decision within four years of receiving DOE's application. The NRC license is to be based on radiation exposure standards set by the Environmental Protection Agency, which issued revised standards September 30, 2008.

The Administration proposed legislation on March 6, 2007, to repeal the statutory cap on the amount of waste at Yucca Mountain, reduce the scope of environmental reviews for the repository, change budget procedures so that program funding could be increased more easily, exempt nuclear waste sent to Yucca Mountain from disposal requirements under the Resource Conservation and Recovery Act, and allow preemption of state and local transportation requirements. A similar bill (H.R. 5360, S. 2589) did not pass in the 109th Congress.

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Most Recent Developments

The Department of Energy (DOE) requested $494.7 million for its civilian nuclear waste program for FY2009, 28% above the FY2008 appropriation. However, the FY2008 level of $386.4 million is about $50 million below the FY2007 level and more than $100 million below the Administration's FY2008 request. The House Appropriations Committee approved DOE's full request for FY2009, and the Senate Appropriations Committee recommended $388.4 million. Funding for the program is currently under a continuing resolution (P.L. 110-329). Under the Nuclear Waste Policy Act of 1982 (NWPA), the DOE program is developing an underground nuclear waste repository at Yucca Mountain, Nevada. DOE contends that recent funding reductions will delay the earliest possible opening of the Yucca Mountain repository to 2020 — 22 years later than required by NWPA.

DOE submitted a license application for the Yucca Mountain repository to the Nuclear Regulatory Commission (NRC) on June 3, 2008. NRC formally accepted the application for docketing and review on September 8, 2008. At the same time, NRC staff recommended that the Commission adopt DOE's environmental impact statement for the project, but with a stipulation that supplemental groundwater analysis be conducted.

The Environmental Protection Agency (EPA) issued revised radiation exposure standards for the Yucca Mountain repository on September 30, 2008. EPA's previous standards had established exposure limits for 10,000 years, but that compliance period was found to be too short by a 2005 federal court decision. EPA's final standard, which NRC must use in licensing the repository, sets an annual exposure limit of 15 millirems for the first 10,000 years and 100 millirems for the period of 10,000 through 1 million years. A separate exposure standard of 4 millirems from groundwater also applies during the first 10,000 years.

DOE updated its life-cycle cost estimate for the Yucca Mountain repository on August 5, 2008. According to the new estimate, the Yucca Mountain program will cost $96.2 billion in 2007 dollars from the beginning of the program in 1983 to repository closure in 2133. DOE's previous estimate, issued in 2001, was $57.5 billion in 2000 dollars. Major factors in the increase are inflation and a higher estimate of spent fuel to be generated by existing reactors. Spent fuel from proposed new reactors is not included in the cost estimate.

The Bush Administration on March 6, 2007, proposed draft nuclear waste legislation similar to legislation in the 109th Congress that was not enacted (H.R. 5360, S. 2589). The draft bill would repeal the 70,000 metric ton limit on the amount of waste that can be emplaced at Yucca Mountain — a limit that is expected to be

exceeded by currently operating reactors during their lifetimes. The bill also would reduce the scope of environmental reviews for the repository, change the budget scoring of waste fee receipts so that program funding could be increased more easily, exempt nuclear waste sent to Yucca Mountain from disposal requirements under the Resource Conservation and Recovery Act, and allow preemption of state and local transportation requirements. To remove a potential obstacle to new nuclear power plants posed by Yucca Mountain delays, the bill would require NRC to assume that sufficient disposal capacity will be available for waste produced by new reactors. Several of the Administration's goals are addressed by bills introduced by Senator Domenici May 23, 2007 (S. 37) and Senator Inhofe January 24, 2008 (S. 2551).

Introduction

Nuclear waste has sometimes been called the Achilles' heel of the nuclear power industry; much of the controversy over nuclear power centers on the lack of a disposal system for the highly radioactive spent fuel that must be regularly removed from operating reactors. Low-level radioactive waste generated by nuclear power plants, industry, hospitals, and other activities is also a longstanding issue.

Spent Nuclear Fuel

Under the Nuclear Waste Policy Act of 1982 (NWPA) and 1987 amendments, the Department of Energy (DOE) is focusing on Yucca Mountain, Nevada, to house a deep underground repository for spent nuclear fuel and other highly radioactive waste. The State of Nevada has strongly opposed DOE's efforts on the grounds that the site is unsafe, pointing to potential volcanic activity, earthquakes, water infiltration, underground flooding, nuclear chain reactions, and fossil fuel and mineral deposits that might encourage future human intrusion.

Despite those concerns, DOE contends that the scientific evidence indicates that Yucca Mountain is suitable and that licensing of the site by the Nuclear Regulatory Commission (NRC) should proceed. A Draft Environmental Impact Statement (EIS) completed by DOE in July 1999 and finalized in February 2002 recommended that the project proceed as planned. DOE submitted a license application for the repository to NRC on June 3, 2008. However, DOE officials now do not expect the planned Yucca Mountain repository to open until 2020 at the earliest, about 22 years later than the 1998 goal specified by NWPA.[1]

The safety of geologic disposal of spent nuclear fuel and high-level waste (HLW), as planned in the United States, depends largely on the characteristics of the rock formations from which a repository would be excavated. Because many geologic formations are believed to have remained undisturbed for millions of years, it appeared technically feasible to isolate radioactive materials from the environment until they decayed to safe levels. "There is strong worldwide consensus that the best,

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[1] Nuclear Energy Institute, Key Issues, Yucca Mountain, [http://www.nei.org/keyissues/nuclearwastedisposal/yuccamountain/], viewed April 11, 2008.

safest long-term option for dealing with HLW is geologic isolation," according to the National Research Council.[2]

But, as the Yucca Mountain controversy indicates, scientific confidence about the concept of deep geologic disposal has turned out to be difficult to apply to specific sites. Every high-level waste site that has been proposed by DOE and its predecessor agencies has faced allegations or discovery of unacceptable flaws, such as water intrusion or earthquake vulnerability, that could release radioactivity into the environment. Much of the problem results from the inherent uncertainty involved in predicting waste site performance for the one million years that nuclear waste is to be isolated.

The Bush Administration's Global Nuclear Energy Partnership (GNEP) is intended to address some of those disposal problems by reducing the volume of waste that would be emplaced in a repository and reducing its long-term radioactivity. Under GNEP, spent nuclear fuel would be reprocessed, or recycled, by separating various elements, such as plutonium, that could be made into new fuel and "transmuted" into shorter-lived radioactive isotopes. Spent fuel reprocessing, however, has long been controversial because of the potential weapons use of separated plutonium and cost concerns.

Other Programs

Other types of civilian radioactive waste have also generated public controversy, particularly low-level radioactive waste, which is produced by nuclear power plants, medical institutions, industrial operations, and research activities. Civilian low-level waste currently is disposed of in large trenches at sites in South Carolina and Washington state. However, the Washington facility does not accept waste from outside its region, and the South Carolina site will be available only to the three members of the Atlantic disposal compact (Connecticut, New Jersey, and South Carolina) after June 30, 2008. The lowest-concentration class of low-level radioactive waste is also accepted by a Utah commercial disposal facility. Threats by states to close their disposal facilities led to congressional authorization of regional compacts for low-level waste disposal in 1985, although no new sites have been opened by any of the 10 approved disposal compacts. Pursuant to a 2003 Texas statute, an application to build a disposal facility for commercial and federal low-level waste in Andrews County, Texas, was filed August 2, 2004, by Waste Control Specialists LLC. The Texas Commission on Environmental Quality issued a draft license for the facility August 11, 2008.

Nuclear Utility Lawsuits

Nuclear utilities, which pay for most of the high-level waste disposal program through a fee on nuclear power, have sued DOE for failing to begin the removal of

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[2] National Research Council, Board on Radioactive Waste Management, *Rethinking High-Level Radioactive Waste Disposal: A Position Statement of the Board on Radioactive Waste Management* (1990), p. 2.

spent nuclear fuel from storage at commercial reactors by January 31, 1998, the deadline established by the Nuclear Waste Policy Act. Industry officials contend that total damages for missing the 1998 disposal deadline could eventually reach tens of billions of dollars, assuming that no disposal ever takes place.

DOE has been negotiating with various reactor owners since 1999 on the missed nuclear waste deadline and reached its first settlement agreement with a nuclear utility, PECO Energy Co. (now part of Exelon), on July 19, 2000. The agreement allowed PECO to keep up to $80 million in nuclear waste fee revenues during the subsequent 10 years. However, other utilities sued DOE to block the settlement, contending that nuclear waste fees may be used only for the DOE waste program and not as compensation for missing the disposal deadline. The U.S. Court of Appeals for the 11th Circuit agreed, ruling September 24, 2002, that any compensation would have to come from general revenues or other sources than the waste fund.

Exelon announced a settlement with the Department of Justice August 10, 2004, in which compensation for the company's nuclear waste storage costs would be paid from the federal Judgment Fund. Exelon, which operates 17 reactors, calculates that it would be reimbursed $300 million if DOE began taking waste by its previous goal of 2010, and up to $600 million if the schedule slipped to 2015. As noted above, DOE now does not expect to begin taking waste until 2020 at the earliest.

The U.S. Court of Federal Claims has since ordered more than $400 million in payments to utilities in several other nuclear waste delay cases. TVA was awarded $34.9 million on January 31, 2006, which was paid from the Judgment Fund in August 2006. Three New England power companies were awarded $142 million on September 30, 2006, and Pacific Gas & Electric Company was awarded $42.7 million on October 13, 2006.[3] Damages of $39 million were awarded on December 4, 2006, to the Sacramento Municipal Utility District.[4] Xcel Energy was awarded $116 million in September 2007,[5] and Entergy was awarded $58.7 million in October 2007.[6]

Duke Energy announced a settlement with DOE on March 6, 2007, in which the company received an initial payment of $56 million and annual reimbursement for future storage costs.[7] Progress Energy was awarded $82.2 million on May 19, 2008.[8] More than 60 utilities have sued DOE over the waste disposal delays. By October 2007, $290 million of the awards and settlements had been paid from the Judgment

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[3] Hiruo, Elaine, "Court Awards PG&E Less Than Sought for Spent Fuel Storage Costs," *Nucleonics Week*, October 19, 2006, p. 9.

[4] "Court Awards $39 Million to SMUD," *NuclearFuel*, December 18, 2006, p. 13.

[5] Meyers, Mike, "Xcel Wins Suit Over Spent-Fuel Storage," *McClatchy-Tribune Regional News*, distributed by *Energy Central Professional*, September 29, 2007.

[6] Hiruo, Elaine, "Court Awards Entergy $58.7 Million for Damages in Spent Fuel Cases," *NuclearFuel*, October 22, 2007, p. 3.

[7] Hiruo, Elaine, "Duke Receives $56 Million in Spent Fuel Settlement Agreement," *NuclearFuel*, March 12, 2007, p. 11.

[8] "Court Awards Progress Utilities $82.8 Million," *NuclearFue*l, June 2, 2009, p. 16.

Fund, according to the Congressional Budget Office.[9] DOE estimates that the federal government's liabilities will reach as much as $11 billion by 2020, the current goal for starting waste shipments to the repository.[10]

Although some of the program's delays have been blamed on poor management, DOE contends that tight funding has been a major barrier. DOE cannot spend the nuclear industry's mandatory waste fees without congressional appropriations, and only about half the total fees collected have been appropriated to the program so far. However, some surplus in the fund may be necessary to pay future nuclear waste disposal costs after today's nuclear plants have ceased operation. The nuclear industry and others have long urged changes in the waste program's funding mechanism but have consistently been blocked by budget scoring and policy issues.

Congressional Action

Continued delays in the Yucca Mountain project have prompted proposals for a legislative redirection of the nuclear waste program. The Bush Administration proposed draft legislation on March 6, 2007, that would "facilitate the licensing, construction, and operation of the repository by 2017," according to Energy Secretary Samuel W. Bodman.[11]

The Administration's nuclear waste bill is nearly identical to legislation it submitted to the 109th Congress (H.R. 5360, S. 2589) that was not enacted. The bill would reduce the scope of environmental reviews for the repository, change the budget scoring of waste fee receipts so that program funding could be increased more easily, exempt nuclear waste sent to Yucca Mountain from disposal requirements under the Resource Conservation and Recovery Act (RCRA), allow preemption of state and local transportation requirements, and permanently withdraw the site from public lands use.

To remove a potential obstacle to new nuclear power plants posed by Yucca Mountain delays, the Administration bill would require NRC to assume that sufficient disposal capacity would be available for waste produced by new reactors (known as the "waste confidence" determination). It also would repeal the 70,000 metric ton limit on the amount of waste that could be emplaced at Yucca Mountain, a limit that is expected to be exceeded by currently operating reactors during their lifetimes. Notably excluded from the bill is an authorization for interim federal storage of nuclear waste pending disposal at Yucca Mountain. After the

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[9] Cawley, Kim, "The Federal Government's Liabilities Under the Nuclear Waste Policy Act," Congressional Budget Office, Statement to House Budget Committee, October 4, 2007, p. 8.

[10] Statement of Edward F. Sproat III, Director of the Office of Civilian Radioactive Waste Management, U.S. Department of Energy, to the House Budget Committee, October 4, 2007, p. 3.

[11] Secretary of Energy, transmittal letter for "Nuclear Fuel Management and Disposal Act," March 6, 2007.

Administration submitted the proposed legislation to the 110th Congress, DOE Office of Civilian Radioactive Waste Management Director Ward F. Sproat III warned that if Congress does not lift the Yucca Mountain capacity limit, he will have to recommend that a site search begin for a second repository.[12]

Several provisions similar to those in the Administration's bill are included in legislation introduced by Senator Domenici on May 23, 2007 (S. 37). Called the Nuclear Waste Access to Yucca (NUWAY) Act, S. 37 provides for permanent land withdrawal, repeal of the repository capacity limit, infrastructure and rail line construction, budget scoring changes, and the NRC waste confidence finding. It excludes the Administration's proposed RCRA exemption but includes an authorization for interim storage of certain waste at Yucca Mountain.

Senator Inhofe introduced a nuclear waste bill on January 24, 2008 (S. 2551) that would repeal the repository capacity limit, provide for NRC's waste confidence finding, and establish a phased licensing system for the repository. Under the phased licensing proposal, nuclear waste could be retrievably stored in the Yucca Mountain repository for up to 300 years before DOE would need to receive a license to leave the waste in the repository permanently.

The State of Nevada strongly opposes the Administration's Yucca Mountain legislation. As an alternative approach, Senator Reid introduced legislation on March 6, 2007, to require commercial nuclear reactor operators to place their spent nuclear fuel into on-site dry storage casks, which would then become the permanent responsibility of DOE (S. 784). Opponents of the proposal contend that it would leave spent fuel at reactor sites indefinitely and undermine the Nuclear Waste Policy Act. However, supporters argue that the waste would be safer in dry storage at reactor sites than if it were shipped across the country to Yucca Mountain.

Because of delays in the Yucca Mountain project, the Senate Appropriations Committee included statutory authorization for the Secretary of Energy to designate interim storage sites for spent nuclear fuel as part of the FY2007 Energy and Water Development Appropriations bill (H.R. 5427, Sec. 313). However, the 109th Congress adjourned without enacting the measure. The Senate Committee's provisions would have required the Secretary, after consultation with the governor, to designate a storage site in each state with a nuclear power plant, if feasible, or to designate regional storage facilities.

Representative Buyer introduced a broad energy bill (H.R. 6001) on May 8, 2008, that includes provisions to transfer the DOE nuclear waste disposal program to an independent authority.

President Bush recommended the Yucca Mountain site to Congress on February 15, 2002, and Nevada Governor Guinn submitted a notice of disapproval, or "state veto," April 8, 2002, as allowed by NWPA. The state veto would have blocked further repository development at Yucca Mountain if a resolution approving the site

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[12] Hiruo, Elaine, "Hoping to Push Repository Forward, DOE Resends Draft Bill to Congress," *NuclearFuel*, March 12, 2007, p. 12.

had not been passed by Congress and signed into law within 90 days of continuous session. An approval resolution was signed by President Bush July 23, 2002 (P.L. 107-200).[13]

Characteristics of Nuclear Waste

Radioactive waste is a term that encompasses a broad range of material with widely varying characteristics. Some waste has relatively slight radioactivity and is safe to handle, while other types are intensely hot in both temperature and radioactivity. Some decays to safe levels of radioactivity in a matter of days or weeks, while other types will remain dangerous for thousands of years. Major types of radioactive waste are described below:[14]

Spent nuclear fuel. Fuel rods that have been permanently withdrawn from a nuclear reactor because they can no longer efficiently sustain a nuclear chain reaction (although they contain uranium and plutonium that could be extracted through reprocessing to make new fuel). By far the most radioactive type of civilian nuclear waste, spent fuel contains extremely hot but relatively short-lived fission products (fragments of the nuclei of uranium and other fissile elements) as well as long-lived radionuclides (radioactive atoms) such as plutonium, which remains dangerously radioactive for tens of thousands of years or more.

High-level waste. Highly radioactive residue created by spent fuel reprocessing (almost entirely for defense purposes in the United States). High-level waste contains most of the radioactive fission products of spent fuel, but most of the uranium and plutonium usually has been removed for re-use. Enough long-lived radioactive elements remain, however, to require isolation for 10,000 years or more.

Transuranic (TRU) waste. Relatively low-activity waste that contains more than a certain level of long-lived elements heavier than uranium (primarily plutonium). Shielding may be required for handling of some types of TRU waste. In the United States, transuranic waste is generated almost entirely by nuclear weapons production

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[13] Senator Bingaman introduced the approval resolution in the Senate April 9, 2002 (S.J.Res. 34), and Representative Barton introduced it in the House April 11, 2002 (H.J.Res. 87). The Subcommittee on Energy and Air Quality of the House Committee on Energy and Commerce approved H.J.Res. 87 on April 23 by a 24-2 vote, and the full Committee approved the measure two days later, 41-6 (H.Rept. 107-425). The resolution was passed by the House May 8, 2002, by a vote of 306-117. The Senate Committee on Energy and Natural Resources approved S.J.Res. 34 by a 13-10 vote June 5, 2002 (S.Rept. 107-159). Following a 60-39 vote to consider S.J.Res. 34, the Senate passed H.J.Res. 87 by voice vote July 9, 2002.

[14] Statutory definitions for "spent nuclear fuel," "high-level radioactive waste," and "low-level radioactive waste" can be found in Section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101). "Transuranic waste" is defined in Section 11ee. of the Atomic Energy Act (42 U.S.C. 2014); Section 11e.(2) of the Act includes uranium mill tailings in the definition of "byproduct material." "Mixed waste" consists of chemically hazardous waste as defined by EPA regulations (40 CFR Part 261, Subparts C and D) that contains radioactive materials as defined by the Atomic Energy Act.

processes. Because of the plutonium, long-term isolation is required. TRU waste is being sent to a deep underground repository, the Waste Isolation Pilot Plant (WIPP), near Carlsbad, New Mexico.

Low-level waste. Radioactive waste not classified as spent fuel, high-level waste, TRU waste, or byproduct material such as uranium mill tailings (below). Four classes of low-level waste have been established by NRC, ranging from least radioactive and shortest-lived to the longest-lived and most radioactive. Although some types of low-level waste can be more radioactive than some types of high-level waste, in general low-level waste contains relatively low amounts of radioactivity that decays relatively quickly. Low-level waste disposal facilities cannot accept material that exceeds NRC concentration limits.

Uranium mill tailings. Sand-like residues remaining from the processing of uranium ore. Such tailings have very low radioactivity but extremely large volumes that can pose a hazard, particularly from radon emissions or groundwater contamination.

Mixed waste. Chemically hazardous waste that includes radioactive material. High-level, low-level, and TRU waste, and radioactive byproduct material, often falls under the designation of mixed waste. Such waste poses serious institutional problems, because the radioactive portion is regulated by DOE or NRC under the Atomic Energy Act, while the Environmental Protection Agency (EPA) regulates the non-radioactive elements under the Resource Conservation and Recovery Act (RCRA).

Spent Nuclear Fuel

When spent nuclear fuel is removed from a reactor, usually after several years of power production, it is thermally hot and highly radioactive. The spent fuel is in the form of fuel assemblies, which consist of arrays of metal-clad fuel rods 12-15 feet long.

A fresh fuel rod, which emits relatively little radioactivity, contains uranium that has been enriched in the isotope U-235 (usually 3%-5%). But after nuclear fission has taken place in the reactor, many of the uranium nuclei in the fuel rods have been split into a variety of highly radioactive fission products; others have absorbed neutrons to become radioactive plutonium, some of which has also split into fission products. Radioactive gases are also contained in the spent fuel rods. Newly withdrawn spent fuel assemblies are stored in deep pools of water adjacent to the reactors to keep them from overheating and to protect workers from radiation.

Spent fuel discharged from U.S. commercial nuclear reactors is currently stored at 72 power plant sites around the nation, plus two small central storage facilities. A typical large commercial nuclear reactor discharges an average of 20-30 metric tons of spent fuel per year — an average of about 2,150 metric tons annually for the entire U.S. nuclear power industry. The nuclear industry estimated that the total

amount of commercial spent fuel was 56,586 metric tons by January 2008,[15] an amount projected to reach 62,000 metric tons by 2010. Including 7,000 metric tons of DOE spent fuel and high-level waste that is also planned for disposal at Yucca Mountain, the total amount would nearly reach NWPA's 70,000-metric-ton limit by 2010.

As long as nuclear power continues to be generated, the amounts stored at plant sites will continue to grow until an interim storage facility or a permanent repository can be opened — or until alternative treatment and disposal technology is developed. DOE recently updated its estimate of the total amount of commercial spent fuel that may eventually require disposal from 105,000 metric tons[16] to 130,000 metric tons.[17]

New storage capacity at operating nuclear plant sites or other locations will be required if DOE is unable to begin accepting waste into its disposal system until 2020 or later. Most utilities are expected to construct new dry storage capacity for their older, cooler fuel. On-site dry storage facilities currently in operation or planned typically consist of metal casks or concrete modules. NRC has determined that spent fuel could be stored safely at reactor sites for up to 100 years.[18]

The terrorist attacks of September 11, 2001, heightened concerns about the vulnerability of stored spent fuel. Concerns have been raised that an aircraft crash into a reactor's pool area or sabotage could drain the pool and cause the spent fuel inside to overheat. A report released by NRC January 17, 2001, found that overheating could cause the zirconium alloy cladding of spent fuel to catch fire and release hazardous amounts of radioactivity, although it characterized the probability of such a fire as low.

In a report released April 6, 2005, the National Academy of Sciences (NAS) found that "successful terrorist attacks on spent fuel pools, though difficult, are possible." To reduce the likelihood of spent fuel cladding fires, the NAS study recommended that hotter and cooler spent fuel assemblies be interspersed throughout spent fuel pools, that spray systems be installed above the pools, and that more fuel be transferred from pools to dry cask storage.[19] NRC has agreed to consider some of the recommendations, although it contends that current security measures would prevent successful attacks. The nuclear industry contends that the several hours required for uncovered spent fuel to heat up enough to catch fire would allow ample

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[15] "Spent Fuel Inventory at 56,586 Metric Tons," NuclearFuel, January 28, 2008, p. 10.

[16] DOE Office of Civilian Radioactive Waste Management, *OCRWM Annual Report to Congress, Fiscal Year 2002*, DOE/RW-0560, October 2003, Appendix C.

[17] DOE Office of Civilian Radioactive Waste Management, *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, Summary, DOE/EIS-0250F-S1D, October 2007, p. S-47.

[18] Nuclear Regulatory Commission, *Waste Confidence Decision Review*, 55 *Federal Register* 38474, September 18, 1990.

[19] National Academy of Sciences, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report*, released April 6, 2005, p. 2.

time for alternative measures to cool the fuel. The FY2006 Energy and Water appropriations bill (P.L. 109-103) gave NRC an additional $21 million to implement the NAS recommendations.

Commercial Low-Level Waste

Slightly more than 2.5 million cubic feet of low-level waste with about 1.1 million curies of radioactivity was shipped to commercial disposal sites in 2007, according to DOE.[20] Volumes and radioactivity can vary widely from year to year, based on the status of nuclear decommissioning projects and cleanup activities that can generate especially large quantities.

Low-level radioactive waste is divided into three major categories for handling and disposal: Class A, B, and C. Classes B and C have constituted less than 1% of the volume of U.S. low-level waste disposal during the past five years but contain most of its radioactivity. For more background on radioactive waste characteristics, see CRS Report RL32163, *Radioactive Waste Streams: An Overview of Waste Classification for Disposal*, by Anthony Andrews.

Current Policy and Regulation

Spent fuel and high-level waste are a federal responsibility, while states are authorized to develop disposal facilities for commercial low-level waste. In general, disposal requirements have grown more stringent over the years, in line with overall national environmental policy and heightened concerns about the hazards of radioactivity.

Spent Nuclear Fuel

Current Program. The Nuclear Waste Policy Act of 1982 (NWPA, P.L. 97-425) established a system for selecting a geologic repository for the permanent disposal of up to 70,000 metric tons (77,000 tons) of spent nuclear fuel and high-level waste. DOE's Office of Civilian Radioactive Waste Management (OCRWM) was created to carry out the program. The Nuclear Waste Fund, holding receipts from a fee on commercial nuclear power and federal contributions for emplacement of high-level defense waste, was established to pay for the program. DOE was required to select three candidate sites for the first national high-level waste repository.

After much controversy over DOE's implementation of NWPA, the act was substantially modified by the Nuclear Waste Policy Amendments Act of 1987 (Title IV, Subtitle A of P.L. 100-203, the Omnibus Budget Reconciliation Act of 1987). Under the amendments, the only candidate site DOE may consider for a permanent

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[20] U.S. Department of Energy, Management Information Manifest System, [http://mims.apps.em.doe.gov/mims.asp#].

high-level waste repository is at Yucca Mountain, Nevada. If that site cannot be licensed, DOE must return to Congress for further instructions.

The 1987 amendments also authorized construction of a monitored retrievable storage (MRS) facility to store spent fuel and prepare it for delivery to the repository. But because of fears that the MRS would reduce the need to open the permanent repository and become a de facto repository itself, the law forbids DOE from selecting an MRS site until recommending to the President that a permanent repository be constructed. The repository recommendation occurred in February 2002, but DOE has not announced any plans for an MRS.

Waste Facility Schedules. DOE announced on July 19, 2006, that it would submit a license application to NRC for the planned Yucca Mountain repository by June 30, 2008. At the same time, DOE announced that its new goal for starting nuclear waste shipments to Yucca Mountain would be early 2017. However, Congress cut the program's funding for FY2008 by about $50 million below the FY2007 level and more than $100 million below the Administration's FY2008 request. The funding cut will force at least 500 layoffs at the Yucca Mountain Project and delay the repository's opening until at least 2020[21] — 22 years later than required by NWPA.

In preparation for filing the Yucca Mountain license application, DOE certified on October 19, 2007, that more than 3.5 million documents supporting the planned application had been made electronically available to the public as required by NRC. DOE submitted the repository license application on June 3, 2008, and over the objections of the State of Nevada, NRC formally accepted the application for docketing and review on September 8, 2008. At the same time, NRC staff recommended that the Commission adopt DOE's environmental impact statement for the project, but with a stipulation that supplemental groundwater analysis be conducted.[22]

DOE announced on October 25, 2005, that it would require most spent fuel to be sealed in standardized canisters before shipment to Yucca Mountain. This change would largely eliminate the handling of individual fuel assemblies at the site. DOE issued a Draft Supplemental Environmental Impact Statement in October 2007 to reflect the new disposal strategy.[23]

The major activity at the Yucca Mountain site so far has been the construction and operation of an "exploratory studies facility" (ESF) with a 25-foot-diameter tunnel boring machine. The ESF consists primarily of a five-mile tunnel with ramps leading to the surface at its north and south ends. The tunnel boring machine began excavating the north ramp in October 1994 and broke through to the surface at the

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[21] Rogers, Keith, "Yucca Mountain Layoffs Imminent, Official Warns," Las Vegas Review-Journal, January 18, 2008 (through Energy Central Professional).

[22] Licensing documents are posted at [http://www.rw.doe.gov/].

[23] DOE Office of Civilian Radioactive Waste Management, *Draft Supplemental Environmental Impact Statement, op cit.*

south entrance April 25, 1997. Underground studies have been conducted at several side alcoves that were excavated off the main tunnel.

DOE completed a "viability assessment" of Yucca Mountain in December 1998, which was followed by a draft environmental impact statement (EIS) for the project in July 1999. DOE issued a preliminary site suitability evaluation August 21, 2001, that found Yucca Mountain could meet EPA and NRC requirements.

Energy Secretary Abraham on February 14, 2002, recommended to President Bush that the Yucca Mountain project go forward. At the same time, the Secretary submitted the final EIS and other supporting materials. As noted previously, President Bush recommended the Yucca Mountain site to Congress the day after the Secretary's recommendation, and Nevada Governor Guinn subsequently submitted a notice of disapproval, or "state veto," as allowed by NWPA. An approval resolution passed by the House and Senate to overturn the state veto was signed by the President July 23, 2002 (P.L. 107-200).

DOE announced April 8, 2004, that it planned to transport nuclear waste mostly by rail to the planned Yucca Mountain repository. The Record of Decision on the waste transportation mode was published in the *Federal Register* along with the selection of a corridor in Nevada for a 300-mile rail spur to the Yucca Mountain site. DOE estimated that Yucca Mountain would receive 9,000-10,000 rail shipments and 3,000-3,300 truck shipments over a 24-year period after the repository opened. On October 13, 2006, DOE announced in the *Federal Register* that a second, shorter rail route to Yucca Mountain would also be considered. However, permission to use tribal land for the shorter route was withdrawn on April 17, 2007, so DOE is again focusing on the 300-mile option. The repository is to be permanently closed after about 100 years of operation, according to DOE's draft supplemental EIS.[24]

The quality of scientific work at Yucca Mountain was called into question by DOE's March 16, 2005, disclosure of e-mails from geologists indicating that some quality assurance documentation had been falsified. DOE issued a technical report in February 2006 that found that previous scientific conclusions about Yucca Mountain had not been affected by the quality assurance problems. However, DOE announced at the same time that some of the previous work would be redone or supplemented.[25] The Government Accountability Office in March 2006 found chronic quality assurance problems in the Yucca Mountain project.[26] Members of the Nevada congressional delegation and state officials have called for the Yucca

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[24] U.S. DOE, *Draft Supplemental Environmental Impact Statement*, op. cit., p. S10.

[25] DOE Office of Public Affairs, *Technical Report Confirms Reliability of Yucca Mountain Technical Work*, February 17, 2006.

[26] U.S. Government Accountability Office, *Yucca Mountain: Quality Assurance at DOE's Planned Nuclear Waste Repository Needs Increased Management Attention*, GAO-06-313, March 2006, p. 6.

Mountain project to be suspended and for an independent commission to review all of DOE's scientific work at Yucca Mountain.[27]

The State of Nevada is also fighting DOE in court. A suit filed in June 2002 charged DOE with violating NWPA by relying too strongly on casks and other engineered barriers to prevent radioactive releases, rather than on Yucca Mountain's natural site characteristics. Another suit, filed January 9, 2003, contended that Congress violated the Constitution in eliminating all candidate waste sites except Yucca Mountain. The U.S. Court of Appeals for the District of Columbia Circuit rejected those challenges July 9, 2004, but it struck down EPA's 10,000-year regulatory compliance period as too short (discussed in more detail below).

Delays in the Yucca Mountain project have prompted congressional interest in alternative nuclear waste management technologies. The FY2006 Energy and Water Development Appropriations Act[28] included $50 million for DOE to develop a spent nuclear fuel recycling plan, in conjunction with a recycling technology development plan required under the Advanced Fuel Cycle Initiative (AFCI). DOE submitted the required program plan in May 2006.[29]

The FY2006 appropriations measure also required DOE to select a nuclear recycling site in FY2007 and begin construction in FY2010. Applicants for a recycling facility were eligible for as much as $5 million per site, up to a total of $20 million, to prepare detailed proposals. DOE selected 11 sites to receive the grants on November 29, 2006, and the reports were submitted May 1, 2007.[30]

Private Interim Storage. In response to delays in the federal nuclear waste program, a utility consortium signed an agreement with the Skull Valley Band of the Goshute Indians in Utah on December 27, 1996, to develop a private spent fuel storage facility on tribal land. The Private Fuel Storage (PFS) consortium submitted a license application to NRC on June 25, 1997, and an NRC licensing board recommended approval on February 24, 2005. On September 9, 2005, NRC denied the State of Utah's final appeals and authorized the NRC staff to issue the license. The 20-year license for storing up to 44,000 tons of spent fuel in dry casks was issued on February 21, 2006, although NRC noted that Interior Department approval would also be required.

On September 7, 2006, the Department of the Interior issued two decisions against the PFS project. The Bureau of Indian Affairs disapproved a proposed lease of tribal trust lands to PFS, concluding there was too much risk that the waste could remain at the site indefinitely.[31] The Bureau of Land Management rejected the

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[27] Elaine Hiruo, "DOE Sought Help From Scientist Who Wrote E-mails," *NuclearFuel*, April 11, 2005, p. 1.

[28] H.Rept. 109-275, P.L. 109-103.

[29] DOE, *Spent Nuclear Fuel Recycling Plan*, May 2006.

[30] Cached by Google under "GNEP siting studies."

[31] Bureau of Indian Affairs, *Record of Decision for the Construction and Operation of an*
(continued...)

necessary rights-of-way to transport waste to the facility, concluding that a proposed rail line would be incompatible with the Cedar Mountain Wilderness Area and that existing roads would be inadequate.[32]

In reaction to the Interior Department decisions, Senator Hatch, a staunch opponent of the PFS proposal, declared the project "stone cold dead."[33] However, the Skull Valley Band of Goshutes and PFS filed a federal lawsuit July 17, 2007, to overturn the Interior decisions on the grounds that they were politically motivated.[34]

Regulatory Requirements. NWPA requires that high-level waste facilities be licensed by the NRC in accordance with general standards issued by EPA. Under the Energy Policy Act of 1992 (P.L. 102-486), EPA was required to write new standards specifically for Yucca Mountain. NWPA also requires the repository to meet general siting guidelines prepared by DOE and approved by NRC. Transportation of waste to storage and disposal sites is regulated by NRC and the Department of Transportation (DOT). Under NWPA, DOE shipments to Yucca Mountain must use NRC-certified casks and comply with NRC requirements for notifying state and local governments. Yucca Mountain shipments must also follow DOT regulations on routing, placarding, and safety.

NRC's licensing requirements for Yucca Mountain, at 10 C.F.R. 63, require compliance with EPA's standards (described below) and establish procedures that DOE must follow in seeking a repository license. For example, DOE must conduct a repository performance confirmation program that would indicate whether natural and man-made systems were functioning as intended and assure that other assumptions about repository conditions were accurate.

The Energy Policy Act of 1992 (P.L. 102-486) made a number of changes in the nuclear waste regulatory system, particularly that EPA must issue new environmental standards specifically for the Yucca Mountain repository site. General EPA repository standards previously issued and subsequently revised no longer apply to Yucca Mountain. DOE and NRC had raised concern that some of EPA's general standards might be impossible or impractical to meet at Yucca Mountain.[35]

The new standards, which limit the radiation dose that the repository could impose on individual members of the public, were required to be consistent with the

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[31] (...continued)
Independent Spent Fuel Storage Installation (ISFSI) on the Reservation of the Skull Valley Band of Goshute Indians (Band) in Tooele County, Utah, September 7, 2006.

[32] Bureau of Land Management, *Record of Decision Addressing Right-of-Way Applications U 76985 and U 76986 to Transport Spent Nuclear Fuel to the Reservation of the Skull Valley Band of Goshute Indians*, September 7, 2006.

[33] Senator Orrin Hatch, *Utahns Deliver Killing Blow to Skull Valley Nuke Waste Plan*, News Release, September 7, 2006.

[34] Winslow, Ben, "Gosutes, PFS Sue Interior," *Deseret Morning News*, July 18, 2007.

[35] See, for example: NRC, "Analysis of Energy Policy Act of 1992 Issues Related to High-Level Waste Disposal Standards, SECY-93-013, January 25, 1993, attachment p. 4.

findings of a study by the National Academy of Sciences (NAS), which was issued August 1, 1995.[36] The NAS study recommended that the Yucca Mountain environmental standards establish a limit on risk to individuals near the repository, rather than setting specific limits for the releases of radioactive material or on radioactive doses, as under previous EPA standards. The NAS study also examined the potential for human intrusion into the repository and found no scientific basis for predicting human behavior thousands of years into the future.

Pursuant to the Energy Policy Act, EPA published its proposed Yucca Mountain radiation protection standards on August 27, 1999. The proposal would have limited annual radiation doses to 15 millirems for the "reasonably maximally exposed individual," and to 4 millirems from groundwater exposure, for the first 10,000 years of repository operation. EPA calculated that its standard would result in an annual risk of fatal cancer for the maximally exposed individual of seven chances in a million. The nuclear industry criticized the EPA proposal as being unnecessarily stringent, particularly the groundwater standard. On the other hand, environmental groups contended that the 10,000-year standard proposed by EPA was too short, because DOE had projected that radioactive releases from the repository would peak after about 400,000 years.

EPA issued its final Yucca Mountain standards on June 6, 2001. The final standards included most of the major provisions of the proposed version, including the 15 millirem overall exposure limit and the 4 millirem groundwater limit. Despite the Department's opposition to the EPA standards, DOE's site suitability evaluation determined that the Yucca Mountain site would be able to meet them. NRC revised its repository regulations September 7, 2001, to conform to the EPA standards.

A three-judge U.S. Court of Appeals panel on July 9, 2004, struck down the 10,000-year regulatory compliance period in the EPA and NRC Yucca Mountain standards.[37] The court ruled that the 10,000-year period was inconsistent with the NAS study on which the Energy Policy Act required the Yucca Mountain regulations to be based. In fact, the court found, the NAS study had specifically rejected a 10,000-year compliance period because of analysis that showed peak radioactive exposures from the repository would take place several hundred thousand years in the future.

In response to the court decision, EPA proposed a new version of the Yucca Mountain standards on August 9, 2005. The proposal would have retained the dose limits of the previous standard for the first 10,000 years but allowed a higher annual dose of 350 millirems for the period of 10,000 years through 1 million years. EPA also proposed to base the post-10,000-year Yucca Mountain standard on the median dose, rather than the mean, potentially making it easier to meet.[38] Nevada state

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[36] National Research Council. *Technical Bases for Yucca Mountain Standards*. National Academy Press. 1995.

[37] *Nuclear Energy Institute v. Environmental Protection Agency*, U.S. Court of Appeals for the District of Columbia Circuit, No. 01-1258, July 9, 2004.

[38] Especially high doses at the upper end of the exposure range would raise the mean, or (continued...)

officials called EPA's proposed standard far too lenient and charged that it was "unlawful and arbitrary."[39]

EPA issued its final rule to amend the Yucca Mountain standards on September 30, 2008. The final rule reduces the annual dose limit during the period of 10,000 through 1 million years from the proposed 350 millirems to 100 millirems, which the agency contended was consistent with international standards. Under the final rule, compliance with the post-10,000-year standard will be based on the arithmetic mean of projected doses, rather than the median as proposed. The 4 millirem groundwater standard will continue to apply only to the first 10,000 years.[40] NRC will have to revise its repository licensing regulations to conform to the new EPA standards. (For more information, see CRS Report RL34698, *EPA's Final Health and Safety Standard for Yucca Mountain*, by Bonnie C. Gitlin.)

DOE estimated in its June 2008 Final Supplemental Environmental Impact Statement (FSEIS) for the Yucca Mountain repository that the maximum mean annual individual dose after 10,000 years would be 2 millirems. That is substantially below the level estimated by the 2002 Final Environmental Impact Statement, which calculated that the peak doses — occurring after 400,000 years — would be about 150 millirems (Volume 1, Chapter 5). The FSEIS attributed the reduction to changes in DOE's computer model and in the assumptions used, noting that "various elements of DOE's modeling approach may be challenged as part of the NRC licensing process."[41]

Alternative Technologies. Several alternatives to the geologic disposal of spent fuel have been studied by DOE and its predecessor agencies, as well as technologies that might make waste disposal easier. However, most of these technologies involve large technical obstacles, uncertain costs, and potential public opposition.

Among the primary long-term disposal alternatives to geologic repositories are disposal in deep ocean trenches and transport into space, neither of which is currently being studied by DOE. Other technologies have been studied that, while probably not replacing geologic disposal, might make geologic disposal safer and more predictable. Chief among these is the reprocessing or "recycling" of spent fuel so that plutonium, uranium, and other long-lived radionuclides could be converted to faster-decaying fission products in special nuclear reactors or particle accelerators. The spent fuel recycling provisions in recent Energy and Water Development

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[38] (...continued)
average, more than the median, or the halfway point in the data set.

[39] Office of the Governor, Agency for Nuclear Projects. *Comments by the State of Nevada on EPA's Proposed New Radiation Protection Rule for the Yucca Mountain Nuclear Waste Repository*. November 2005.

[40] Posted on the EPA website at [http://www.epa.gov/radiation/yucca]

[41] FSEIS, p. S-42. Posted on the DOE website at [http://www.rw.doe.gov/ym_repository/seis/docs/002_Summary.pdf]

Appropriations bills and the Administration's GNEP initiative, discussed above, seem to indicate continuing interest in this area.

Funding. The FY2009 OCRWM budget request was $494.7 million; the House Appropriations Committee approved the full amount, and the Senate Appropriations Committee recommended $388.4 million. Funding for the program is currently under a continuing resolution (P.L. 110-329). The FY2009 request is more than $100 million (28%) above the FY2008 appropriation of $386.4 million, but the FY2008 level is about $50 million below the FY2007 level and more than $100 million below the Administration's FY2008 request. The FY2008 funding reductions required OCRWM to reduce its workforce by about 900, according to the program's director.[42]

Funding for the nuclear waste program is provided under two appropriations accounts, as shown in **Table 1**. The Administration requested $247.4 million for FY2009 from the Nuclear Waste Fund, which holds fees paid by nuclear utilities. An additional $247.4 million was requested in the Defense Nuclear Waste Disposal account, which pays for disposal of high-level waste from the nuclear weapons program in the planned Yucca Mountain repository. The House Appropriations Committee recommended the full amount for both accounts for FY2009, while the Senate panel recommended $195.4 million from the Waste Disposal account and $193.0 million from the defense account.

Although nuclear utilities pay fees to the Nuclear Waste Fund to cover the disposal costs of civilian nuclear spent fuel, DOE cannot spend the money in the fund until it is appropriated by Congress. Through September 1, 2008, utility nuclear waste fees and interest totaled $28.136 billion, of which $7.094 billion had been disbursed to the waste disposal program, according to DOE's program summary report, leaving a balance of $21.071 billion in the Nuclear Waste Fund. In addition to the disbursements from the Nuclear Waste Fund, the waste disposal program received defense waste disposal appropriations totaling $2.969 billion through FY2008, according to DOE.[43]

DOE's latest update of its *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program* was released on August 5, 2008.[44] According to the new estimate, the Yucca Mountain program will cost $96.2 billion in 2007 dollars from the beginning of the program in 1983 to repository closure in 2133. DOE's previous estimate, issued in 2001, was $57.5 billion in 2000 dollars. Major factors in the increase are inflation and a higher estimate of spent fuel to be

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[42] Statement of Edward F. Sproat III, OCRWM Director, to the Energy and Water Development Subcommittee of the House Appropriations Committee, April 10, 2008.

[43] DOE, Office of Civilian Radioactive Waste Management, Office of Program Management, *Monthly Summary of Program Financial and Budget Information*, as of September 1, 2008, available at [http://www.ocrwm.doe.gov/about/budget/money.shtml]. The report notes that some figures may not add due to independent rounding.

[44] Available on the OCRWM website at [http://www.rw.doe.gov/about/budget/pdf/TSLCC_2007_8_05_08.pdf]

generated by existing reactors. Spent fuel from proposed new reactors is not included in the cost estimate.

Table 1. DOE Civilian Spent Fuel Management Funding
(in millions of current dollars)

Program	FY2007 Approp.	FY2008 Approp.	FY2009 Request	FY2009 House Comm.	FY2009 Senate Comm.
Yucca Mountain	298.1	267.1	372.8	— [a]	—
Transportation	35.3	18.3	20.0	—	—
Management and Integration	46.7	26.4	27.0	—	—
Program Direction	64.4	74.7	75.0	—	—
Total	**445.7**	**386.4**	**494.7**	**494.7**	**388.4**
Source of Funding					
Nuclear Waste Fund appropriations	99.2	187.3	247.4	274.3	195.4
Defense waste appropriations	346.5	199.2	247.4	274.4	193.0

Sources: DOE FY2009 Congressional Budget Request.

a. Subcategories not specified.

Low-Level Radioactive Waste

Current Policy. Selecting disposal sites for low-level radioactive waste, which generally consists of low concentrations of relatively short-lived radionuclides, is a state responsibility under the 1980 Low-Level Radioactive Waste Policy Act and 1985 amendments. Most states have joined congressionally approved interstate compacts to handle low-level waste disposal, while others are developing single-state disposal sites. Under the 1985 amendments, the nation's three (at that time) operating commercial low-level waste disposal facilities could start refusing to accept waste from outside their regional interstate compacts after the end of 1992. One of the three sites closed, and the remaining two are using their congressionally granted authority to prohibit waste from outside their regional compacts. Another site, in Utah, has since become available nationwide for most Class A low-level waste, but no site is currently open to nationwide disposal of all major types of low-level waste.

Despite the 1992 deadline, no new disposal sites have been opened under the Low-Level Waste Act. Legislation providing congressional consent to a disposal compact among Texas, Maine, and Vermont was signed by President Clinton September 20, 1998 (P.L. 105-236). However, on October 22, 1998, a proposed disposal site near Sierra Blanca, Texas, was rejected by the Texas Natural Resource Conservation Commission, and Maine has since withdrawn. Texas Governor Perry signed legislation June 20, 2003, authorizing the Texas Commission on Environment Quality to license adjoining disposal facilities for commercial and federally generated low-level waste. Pursuant to that statute, an application to build a disposal facility

for commercial and federal low-level waste in Andrews County, Texas, was filed August 2, 2004, by Waste Control Specialists LLC. The Texas Commission on Environmental Quality (TCEQ) issued a draft license for the facility August 11, 2008.[45]

The Midwestern Compact voted June 26, 1997, to halt development of a disposal facility in Ohio. Nebraska regulators rejected a proposed waste site for the Central Compact December 21, 1998, drawing a lawsuit from five utilities in the region. A U.S. district court judge ruled September 30, 2002, that Nebraska had exercised bad faith in disapproving the site and ordered the state to pay $151 million to the compact. A settlement was reached August 9, 2004, resulting in a payment of $145.8 million,[46] and the compact is seeking access to the planned Texas disposal facility. Most other regional disposal compacts and individual states that have not joined compacts are making little progress toward finding disposal sites.

The disposal facility at Barnwell, South Carolina, is currently accepting all Class A, B, and C low-level waste from the Atlantic Compact (formerly the Northeast Compact), in which South Carolina joined original members Connecticut and New Jersey on July 1, 2000. Under the compact, South Carolina can limit the use of the Barnwell facility to the three compact members, and a state law enacted in June 2000 phased out acceptance of non-compact waste through June 30, 2008. The Barnwell facility previously had stopped accepting waste from outside the Southeast Compact at the end of June 1994. The Southeast Compact Commission in May 1995 twice rejected a South Carolina proposal to open the Barnwell site to waste generators outside the Southeast and to bar access to North Carolina until that state opened a new regional disposal facility, as required by the compact. The rejection of those proposals led the South Carolina General Assembly to vote in 1995 to withdraw from the Southeast Compact and begin accepting waste at Barnwell from all states but North Carolina. North Carolina withdrew from the Southeast Compact July 26, 1999.

The only other existing disposal facility for all three major classes of low-level waste is at Hanford, Washington. Controlled by the Northwest Compact, the Hanford site will continue taking waste from the neighboring Rocky Mountain Compact under a contract. Since the South Carolina facility closed to out-of-region waste, the 36 states and the District of Columbia that are outside the Northwest, Rocky Mountain, and Atlantic Compacts have had no disposal site for Class B and C low-level waste. Waste generators in those states must store their Class B and C waste on site until new disposal sites are available.

Regulatory Requirements. Licensing of commercial low-level waste facilities is carried out under the Atomic Energy Act by NRC or by "agreement states" with regulatory programs approved by NRC. NRC regulations governing low-level waste licenses must conform to general environmental protection standards

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[45] Available on the TCEQ website at [http://www.tceq.state.tx.us/permitting/radmat/licensing/wcs_license_app.html#notice].

[46] USAToday.com, August 1, 2005, [http://www.usatoday.com/news/nation/2005-08-01-nukewaste_x.htm].

and radiation protection guidelines issued by EPA. Transportation of low-level waste is jointly regulated by NRC and the Department of Transportation.

Most states considering new or expanded low-level waste disposal facilities, including Texas and Utah, are agreement states. Most states, both agreement and non-agreement, have established substantially stricter technical requirements for low-level waste disposal than NRC's, such as banning shallow land burial and requiring concrete bunkers and other engineered barriers. NRC would issue the licenses in non-agreement states.

Concluding Discussion

Disposal of radioactive waste will be a key issue in the continuing nuclear power debate. Without a national disposal system, spent fuel from nuclear power plants must be stored on-site indefinitely. This situation may raise public concern near proposed reactor sites, particularly at sites without existing reactors where spent nuclear fuel is already stored. Several states have tied approval of new reactors to the availability of waste disposal capacity.[47]

Under current law, the federal government's waste disposal policy is focused on the planned Yucca Mountain repository. Despite presidential and congressional approval for the Yucca Mountain licensing process to go forward, DOE will face relentless opposition from the State of Nevada during NRC licensing proceedings. EPA's proposed new environmental standards for Yucca Mountain may face legal challenges as well, which could further slow the process.

Because of their waste-disposal contracts with DOE, owners of existing reactors are likely to continue seeking damages from the federal government if disposal delays continue. DOE's 2004 settlement with the nation's largest nuclear operator, Exelon, could require payments of up to $600 million from the federal judgment fund, and DOE estimates that payments could rise to $11 billion if Yucca Mountain does not open before 2020. The nuclear industry has predicted that future damages could reach tens of billions of dollars if the federal disposal program fails altogether.

The Administration's proposed nuclear waste legislation is intended to remove some of the obstacles to opening Yucca Mountain and to remove the lack of permanent waste disposal as an obstacle to licensing new nuclear power plants. The House and Senate Appropriations Committees in the 109th Congress urged that the federal government provide interim storage of spent nuclear fuel pending a permanent solution, but that option has proven highly controversial in the past.

The Administration's proposed Global Nuclear Energy Partnership would open the door for spent fuel reprocessing as a long-term option for handling nuclear waste. Reprocessing (or recycling) proponents have long contended that direct disposal of spent fuel — as currently planned — would waste a potentially vast energy resource

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[47] Lovell, David L., Wisconsin Legislative Council Staff, *State Statutes Limiting the Construction of Nuclear Power Plants*, October 5, 2006.

and that reprocessing could reduce the long-term hazard posed by nuclear waste. However, the United States has not pursued commercial reprocessing since the 1970s, because of concerns over nuclear weapons proliferation and costs. Heated reaction, both pro and con, to the Administration's latest initiative indicates that the controversy has not receded in the meantime.

Legislation

H.R. 2282 (Schmidt)

Nuclear Waste Storage Prohibition Act. Prohibits DOE from using GNEP funds to store nuclear waste at any site where reprocessing facilities are not operating or under construction. Introduced May 10, 2007; referred to Committee on Energy and Commerce.

H.R. 5632 (Gordon)

Prohibits importation of certain low-level radioactive waste into the United States. Introduced March 13, 2008; referred to committees on Energy and Commerce and Ways and Means.

H.R. 5943 (Burgess)

Nuclear Used Fuel Prize Act of 2008. Authorizes the Secretary of Energy to establish monetary prizes for technical advances in spent nuclear fuel management. Introduced May 1, 2008; referred to Committee on Science and Technology.

H.R. 6001 (Buyer)

Main Street U.S.A. Energy Security Act of 2008. Includes provisions to transfer the DOE nuclear waste disposal program to an independent authority and to encourage nuclear power growth. Introduced May 8, 2008; referred to multiple committees.

H.R. 6132 (Barton)

Authorizes the Nuclear Waste Fund to be used for nuclear spent fuel recycling. Introduced May 22, 2008; referred to committees on Energy and Commerce and Budget.

S. 37 (Domenici)

Nuclear Waste Access to Yucca Act. Permanently withdraws Yucca Mountain site from public use, authorizes nuclear waste interim storage facilities at Yucca Mountain, repeals the Yucca Mountain capacity limit, and makes other changes in the nuclear waste program. Introduced May 23, 2007; referred to Committee on Energy and Natural Resources.

S. 784 (Reid)/H.R. 4062 (Matheson)

Federal Accountability for Nuclear Waste Storage Act of 2007. Requires commercial nuclear power plants to transfer spent fuel from pools to dry storage casks and then convey title to the Secretary of Energy. Senate bill introduced March 6, 2007; referred to Committee on Environment and Public Works. House bill introduced November 1, 2007; referred to Committee on Energy and Commerce.

S. 2551 (Inhofe)

Nuclear Waste Policy Amendments Act of 2008. Repeals the repository capacity limit, provides for NRC's waste confidence finding, and establishes a phased licensing system for the repository. Introduced January 24, 2008; referred to Committee on Environment and Public Works.

S. 3215 (Domenici)

Strengthening Management of Advanced Recycling Technologies Act of 2008. Requires DOE to offer cooperative agreements for licensing spent nuclear fuel recycling facilities. Introduced June 26, 2008; referred to Committee on Energy and Natural Resources.

S. 3258 (Dorgan)

Energy and Water Development and Related Agencies Appropriations Act, 2009. Provides funding for nuclear energy programs. Reported as an original measure from the Appropriations Committee July 14, 2008 (S.Rept. 110-416).

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For Additional Reading

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