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Nuclear Energy Policy

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Nuclear Energy Policy

Summary

Nuclear energy policy issues facing Congress include the implementation of federal incentives for new commercial reactors, radioactive waste management policy, research and development priorities, power plant safety and regulation, and security against terrorist attacks.

The Bush Administration has called for an expansion of nuclear power. For Department of Energy (DOE) nuclear energy research and development and infrastructure, the Administration is requesting $801.7 million for FY2008, a nearly 30% increase from the FY2007 appropriation. The request would boost funding for the Advanced Fuel Cycle Initiative (AFCI) from $167.5 million in FY2007 to $395.0 million in FY2008 as the primary component of the Administration's Global Nuclear Energy Partnership (GNEP). The House Appropriations Committee recommended cutting AFCI to $120.0 million while providing a total funding level of $835.2 million (H.R. 2641, H.Rept. 110-185). The Senate Appropriations Committee recommended $242.0 million for AFCI and $795.5 million for nuclear energy overall (S. 1751, S.Rept. 110-127).

Significant incentives for new commercial reactors are included in the Energy Policy Act of 2005 (P.L. 109-58), signed by the President on August 8, 2005. These include production tax credits, loan guarantees, insurance against regulatory delays, and extension of the Price-Anderson Act nuclear liability system. Together with higher fossil fuel prices and the possibility of greenhouse gas controls, the federal incentives for nuclear power have helped spur renewed interest by utilities and other potential reactor developers. Plans for about 30 reactor license applications have been announced, although no commitments have been made to build the plants. No reactor has been ordered in the United States since 1978, and all orders since 1973 were subsequently canceled.

The September 11, 2001, terrorist attacks on the United States raised concern about nuclear power plant security. The Energy Policy Act of 2005 includes several reactor security provisions, including requirements to revise the security threats that nuclear plant guard forces must be able to defeat, regular force-on-force security exercises at nuclear power plants, and the fingerprinting of nuclear facility workers.

Disposal of highly radioactive waste has been one of the most controversial aspects of nuclear power. The Nuclear Waste Policy Act of 1982 (P.L. 97-425), as amended in 1987, requires DOE to conduct a detailed physical characterization of Yucca Mountain in Nevada as a permanent underground repository for high-level waste. DOE plans to submit a license application for the Yucca Mountain repository to the Nuclear Regulatory Commission (NRC) by June 30, 2008. The opening of the repository is now scheduled for 2017.

This report will be updated as events warrant.

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Most Recent Developments

The Bush Administration's FY2008 budget request, released February 5, includes $801.7 million for Department of Energy (DOE) nuclear energy research and development and infrastructure, nearly 30% above the FY2007 appropriation. The request would boost funding for the Advanced Fuel Cycle Initiative (AFCI) from $167.5 million in FY2007 to $395.0 million in FY2008 as the primary component of the Administration's Global Nuclear Energy Partnership (GNEP). The House Appropriations Committee recommended cutting AFCI to $120.0 million while providing a total funding level of $835.2 million for nuclear energy (H.R. 2641, H.Rept. 110-185). The Senate Appropriations Committee recommended $242.0 million for AFCI and $795.5 million for nuclear energy overall (S. 1751, S.Rept. 110-127).

The Administration requested $494.5 million for the civilian nuclear waste program in FY2008, $50 million above the FY2007 level. The House Appropriations Committee approved the full request, while the Senate panel voted to hold the program's funding to about the FY2007 level. The program is developing a national nuclear waste repository at Yucca Mountain, Nevada. DOE announced on July 19, 2006, that it would submit a Yucca Mountain license application to the Nuclear Regulatory Commission (NRC) by June 30, 2008. If Congress passes proposed changes in the repository licensing process, according to DOE, nuclear waste shipments to Yucca Mountain could begin by 2017.

NRC issued the first nuclear reactor Early Site Permit (ESP) March 15 to Exelon Generating Company for a potential new reactor at the company's Clinton, IL, nuclear plant. NRC authorized a second ESP on March 27, for the Grand Gulf site in Mississippi. The holders of those ESPs will not have to revisit site-related issues if they seek licenses for new reactors at the Clinton and Grand Gulf sites during the next 20 years.

The Treasury Department on May 1, 2006, published interim guidance for a nuclear power tax credit provided by the Energy Policy Act of 2005 (P.L. 109-58), which provides a strong incentive for the construction of new nuclear power plants. The tax credit is available for up to 6,000 megawatts of new nuclear capacity for the first eight years of operation, up to $125 million annually per 1,000 megawatts. Under the Treasury Department guidance, the 6,000 megawatts of eligible capacity will be allocated proportionally among reactors that file license applications by the end of 2008 or, after that date, until enough applications are filed to use the capacity.

Because the nuclear industry has often blamed past nuclear reactor construction cost overruns on licensing delays, the energy act authorizes the Secretary of Energy to pay for up to $500 million in costs resulting from NRC delays for each of the first two new reactors and up to $250 million for the next four. DOE published a final rule for this "standby support" program on August 11, 2006.

Overview of Nuclear Power in the United States

The U.S. nuclear power industry, while currently generating about 20% of the nation's electricity, faces an unclear long-term future. No nuclear plants have been ordered in the United States since 1978, and more than 100 reactors have been canceled, including all ordered after 1973. No new units are currently under active construction; the Tennessee Valley Authority's (TVA's) Watts Bar 1 reactor, ordered in 1970 and licensed to operate in 1996, was the most recent U.S. nuclear unit to be completed. The nuclear power industry's troubles include high nuclear power plant construction costs, public concern about nuclear safety and waste disposal, and regulatory compliance costs.

High construction costs are perhaps the most serious obstacle to nuclear power expansion. Construction costs for reactors completed since the mid-1980s ranged from $2 to $6 billion, averaging more than $3,000 per kilowatt of electric generating capacity (in 1997 dollars). The nuclear industry predicts that new plant designs could be built for less than that amount if many identical plants were built in a series, but such economies of scale have yet to be demonstrated.

Nevertheless, the outlook recently has been improving for the U.S. nuclear power industry, which currently comprises 104 licensed reactors at 65 plant sites in 31 states. (That number includes TVA's Browns Ferry 1, which restarted May 22, 2007, after a 22-year shutdown and $1.8 billion refurbishment.) Electricity production from U.S. nuclear power plants is greater than that from oil, natural gas, and hydropower, and behind only coal, which accounts for more than half of U.S. electricity generation. Nuclear plants generate more than half the electricity in six states. The near-record 823 billion kilowatt-hours of nuclear electricity generated in the United States during 2006[1] was more than the nation's entire electrical output in the early 1960s, when the first large-scale commercial reactors were being ordered.

Average operating costs of U.S. nuclear plants dropped substantially during the past decade, and costly downtime has been steadily reduced. Licensed commercial reactors generated electricity at an average of 89.8% of their total capacity in 2006, according to industry statistics.[2]

Forty-eight commercial reactors have received 20-year license extensions from the Nuclear Regulatory Commission (NRC), giving them up to 60 years of operation.

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[1] "World Nuclear Generation Sets Record in 2006," *Nucleonics Week*, February 15, 2007, p. 1.

[2] Ibid.

License extensions for eight more reactors are currently under review, and many others are anticipated, according to NRC.[3]

Industry consolidation could also help existing nuclear power plants, as larger nuclear operators purchase plants from utilities that run only one or two reactors. Several such sales have occurred, including the March 2001 sale of the Millstone plant in Connecticut to Dominion Energy for a record $1.28 billion. The merger of two of the nation's largest nuclear utilities, PECO Energy and Unicom, completed in October 2000, consolidated the operation of 17 reactors under a single corporate entity, Exelon Corporation, headquartered in Chicago.

Existing nuclear power plants appear to hold a strong position in electricity wholesale markets. In most cases, nuclear utilities have received favorable regulatory treatment of past construction costs, and average nuclear operating costs are currently estimated to be competitive with those of fossil fuel technologies.[4] Although eight U.S. nuclear reactors were permanently shut down during the 1990s, none has been closed since 1998. Despite the shutdowns, annual U.S. nuclear electrical output increased by more than one-third from 1990 to 2006, according to the Energy Information Administration and industry statistics. The increase resulted primarily from reduced downtime at the remaining plants, the startup of five new units, and reactor modifications to boost capacity.

The strong performance of existing reactors and the relatively high cost of natural gas — the favored fuel for new power plants for most of the past 15 years — have prompted renewed electric industry consideration of the feasibility of building new reactors. Electric utilities and other firms have announced plans to apply for combined construction permits and operating licenses (COLs) for 30 reactors (see **Table 1**). However, no commitments have been made to build them if the COLs are issued. The Department of Energy (DOE) is assisting with some of the COL applications and site-selection efforts as part of a program to encourage new commercial reactor orders by 2010.

Strong incentives for building new nuclear power plants were included in the Energy Policy Act of 2005 (EPACT05, P.L. 109-58), signed by the President on August 8, 2005. Particularly significant is a 1.8-cents/kilowatt-hour tax credit for up to 6,000 megawatts of new nuclear capacity for the first eight years of operation, up to $125 million annually per 1,000 megawatts.

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[3] [http://www.nrc.gov/reactors/operating/licensing/renewal/applications.html]

[4] Energy Information Administration, *Nuclear Power: 12 percent of America's Generating Capacity, 20 percent of the Electricity*, July 17, 2003, at [http://www.eia.doe.gov/cneaf/nuclear/page/analysis/nuclearpower.html].

Table 1. Announced Nuclear Plant License Applications

Announced Applicant	Site	Planned Application	Reactor Type	Units
Ameren	Callaway (MO)	2008	Areva EPR	1
Amarillo Power	Not specified	2007	Mitsubishi US-EPR	2
Constellation Energy (Unistar)	Calvert Cliffs (MD)	4Q 2007	Areva EPR	1
	Nine Mile Point (NY)	1st half 2008	Areva EPR	1
	Not specified	4Q 2008	Areva EPR	1
Dominion	North Anna (VA)	Nov. 2007	GE ESBWR	1
DTE Energy	Fermi (MI)	4Q 2008	Not specified	1
Duke Energy	Cherokee (SC)	2007-2008	Westinghouse AP1000	2
Entergy	River Bend (LA)	May 2008	GE ESBWR	1
Exelon	Matagorda or Victoria Counties (TX)	Nov. 2008	Westinghouse AP1000 or GE ESBWR	2
FPL	Not specified	2009	Not specified	1
NRG Energy	South Texas Project	2007	GE ABWR	2
NuStart	Grand Gulf (MS)	Nov. 2007	GE ESBWR	1
	Bellefonte (AL)	Oct. 2007	Westinghouse AP1000	2
PPL	Susquehanna (PA)	Not specified	Not specified	1
Progress Energy	Harris (NC)	Oct. 2007	Westinghouse AP1000	2
	Levy County (FL)	July 2008	Westinghouse AP1000	2
SCE&G	Summer (SC)	3Q 2007	Westinghouse AP1000	2
Southern	Vogtle (GA)	Mar. 2008	Westinghouse AP1000	2
TXU	Comanche Peak (TX)	4Q 2008	Mitsubishi US-APWR	2
Total Units				**30**

Sources: NRC, *Nucleonics Week*, *Nuclear News*, Nuclear Energy Institute, company news releases.

The Treasury Department published interim guidance for the nuclear tax credit on May 1, 2006.[5] Under the guidance, the 6,000 megawatts of eligible capacity will be allocated among reactors that file license applications by the end of 2008 or, after that date, until enough applications are filed to use the capacity. If license applications for more than 6,000 megawatts of nuclear capacity are submitted by 2008, then the tax credit will be allocated proportionally among the proposed reactors.

The Energy Information Administration (EIA) projects that the nuclear energy tax credit will stimulate construction of 9 gigawatts of nuclear generating capacity by 2020. That construction effort will reduce costs for future reactors and lead to 3.5 more gigawatts of capacity by 2030, according to EIA. However, those projections are highly sensitive to assumptions about growth in electricity demand, the price of competing fuels, and reactor construction costs. For example, if reactor construction costs do not decline, only the amount of new nuclear capacity eligible for the tax credit — 6 gigawatts — would be constructed, according to EIA.[6]

Because the nuclear industry has often blamed licensing delays for past nuclear reactor construction cost overruns, EPACT05 authorizes the Secretary of Energy to pay for up to $500 million in costs resulting from NRC delays for each of the first two new reactors and up to $250 million for the next four. DOE published a final rule for the "standby support" program August 11, 2006.[7]

EPACT05 also authorized federal loan guarantees for up to 80% of construction costs for advanced energy projects that reduce greenhouse gas emissions, including new nuclear power plants. The EPACT loan guarantees are widely considered crucial by the nuclear industry to obtain financing for new reactors. DOE issued guidelines for the initial round of loan guarantees on August 8, 2006. However, the initial round is limited to $2 billion and does not include nuclear power plants. The FY2007 continuing resolution (P.L. 110-5) provided initial administrative funding for the program and authorized up to $4 billion in loan guarantees (twice the Administration request), but it also prohibited DOE from awarding loan guarantees until final rules were in place. DOE issued proposed rules for the program May 16, 2007 (72 FR 27471).

DOE's proposed loan guarantee rules have been sharply criticized by the nuclear industry for limiting the guarantees to 90% of a project's debt. The industry contends that EPACT05 would allow all of a project's debt to be covered, as long as debt did not exceed 80% of total construction costs. In its explanation of the proposed rules, DOE expressed concern that guaranteeing 100% of a project's debt could reduce

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[5] Department of the Treasury, Internal Revenue Service, *Internal Revenue Bulletin*, No. 2006-18, "Credit for Production From Advanced Nuclear Facilities," Notice 2006-40, May 1, 2006, p. 855.

[6] Energy Information Administration, *Annual Energy Outlook 2007*, DOE/EIA-0383(2007), February 2007, p. 84.

[7] Department of Energy, "Standby Support for Certain Nuclear Plant Delays," *Federal Register*, August 11, 2006, p. 46306.

lenders' incentive to perform adequate due diligence and therefore increase default risks.

The House Appropriations Committee recommended $7 billion in loan guarantees for FY2008, which, including the $4 billion ultimately provided for FY2007, would give DOE a cumulative authorization of $11 billion — $2 billion above the Administration's requested cumulative level of $9 billion (H.R. 2641, H.Rept. 110-185). The FY2008 DOE budget justification said that the precise allocation of the loan guarantees among nuclear, coal, renewable energy, and other eligible technologies "would depend on the merits and benefits of particular project proposals and their compliance with statutory and regulatory requirements." However, the House panel allocated $2 billion for coal, $4 billion for biofuels, and $1 billion for electric transmission and renewable power systems, specifically omitting the Administration's mention of nuclear power. But because the $4 billion authorized in FY2007 is not allocated among the various technologies, the effect of the proposed FY2008 allocation is uncertain. The Senate Appropriations Committee's version of the bill does not cap the loan guarantee level or specify eligible technologies (S. 1751, S.Rept. 110-127).

Global warming that may be caused by fossil fuels — the "greenhouse effect" — is cited by nuclear power supporters as an important reason to develop a new generation of reactors. This "green" nuclear power argument has received growing attention in think tanks and academia. As stated by MIT in its major study *The Future of Nuclear Power*: "Our position is that the prospect of global climate change from greenhouse gas emissions and the adverse consequences that flow from these emissions is the principal justification for government support of the nuclear energy option."[8] However, most environmental groups contend that nuclear power's potential greenhouse gas benefits are outweighed by the technology's safety risks and the hazards of radioactive waste.

(For more on federal incentives and the economics of nuclear power, see CRS Report RL33442, *Nuclear Power: Outlook for New U.S. Reactors*, by Larry Parker and Mark Holt.)

Nuclear Power Research and Development

For nuclear energy research and development — including advanced reactors, fuel cycle technology, nuclear hydrogen production, and infrastructure support — DOE requested $801.7 million for FY2008, nearly 30% above the FY2007 funding level. The request would boost funding for the Advanced Fuel Cycle Initiative (AFCI) from $167.5 million in FY2007 to $395.0 million in FY2008. The higher AFCI funding would allow DOE to continue developing a demonstration plant for separating plutonium and uranium in spent nuclear fuel, as part of the Administration's Global Nuclear Energy Partnership (GNEP). The nuclear energy program is run by DOE's Office of Nuclear Energy, Science, and Technology.

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[8] Interdisciplinary MIT Study, *The Future of Nuclear Power*, Massachusetts Institute of Technology, 2003, p. 79.

The House Appropriations Committee recommended cutting AFCI to $120.0 million and shifting the mixed-oxide (MOX) fuel program to the nuclear energy program from the nuclear nonproliferation program. The Committee also recommended shifting funding from GNEP's proposed plutonium-burning fast reactors to the high temperature gas-cooled Next Generation Nuclear Plant program. Overall, the Committee recommended a funding level of $835.2 million for nuclear energy, including $74.9 million from the Other Defense Activities account (H.R. 2641, H.Rept. 110-185).

The Senate Appropriations Committee recommended $795.5 million for nuclear energy, including $75.9 million from Other Defense Activities. AFCI would receive $242.0 million, double the House level but $153 million below the Administration request. The Senate panel opposed the House plan to shift the MOX fuel program to the nuclear energy R&D program (S. 1751, S.Rept. 110-127).

According to DOE's FY2008 budget justification, the nuclear energy R&D program is intended "to secure nuclear energy as a viable, long-term commercial energy option, providing diversity in the energy supply." However, opponents have criticized DOE's nuclear research program as providing wasteful subsidies to an industry that they believe should be phased out as unacceptably hazardous and economically uncompetitive.

Under the Administration's GNEP initiative, plutonium partially separated from the highly radioactive spent fuel from nuclear reactors would be recycled into new fuel to expand the future supply of nuclear fuel and potentially reduce the amount of radioactive waste to be disposed of in a permanent repository. The United States and other advanced nuclear nations would lease new fuel to other nations that agreed to forgo uranium enrichment, spent fuel recycling (also called reprocessing), and other fuel cycle facilities that could be used to produce nuclear weapons materials. The leased fuel would then be returned to supplier nations for reprocessing. Solidified high-level reprocessing waste would be sent back to the nation that had used the leased fuel, along with supplies of fresh nuclear fuel, according to the GNEP concept; see [http://www.gnep.energy.gov].

Although GNEP is largely conceptual at this point, DOE issued a Spent Nuclear Fuel Recycling Program Plan in May 2006 that provides a general schedule for a GNEP Technology Demonstration Program (TDP),[9] which would develop the necessary technologies to achieve GNEP's goals. According to the Program Plan, the first phase of the TDP, running through FY2006, consisted of "program definition and development" and acceleration of AFCI. Phase 2, running through FY2008, is to focus on the design of technology demonstration facilities, which then are to begin operating during Phase 3, from FY2008 to FY2020.

Nuclear critics oppose GNEP's emphasis on spent fuel reprocessing, which they see as a weapons proliferation risk, even if weapons-useable plutonium is not completely separated from other spent fuel elements, as envisioned by the Administration. "As the research of DOE scientists makes clear, the reprocessing

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[9] DOE, *Spent Nuclear Fuel Recycling Plan*, Report to Congress, May 2006.

technologies under consideration would still produce a material that is not radioactive enough to deter theft, and that could be used to make nuclear weapons," according to the Union of Concerned Scientists.[10]

The House Appropriations Committee sharply criticized GNEP, calling the Administration's proposal "rushed, poorly-defined, expansive, and expensive." The Committee recommended focusing on further research before committing the much higher funding required for commercial-scale facilities. The Senate Appropriations Committee was more supportive of GNEP, but nevertheless directed that funds be used only for R&D at existing facilities and conceptual design work.

Nuclear Power 2010. President Bush's specific mention of "clean, safe nuclear power" in his 2007 State of the Union address reiterated the Administration's interest in encouraging construction of new commercial reactors — for which there have been no U.S. orders since 1978. DOE's efforts to restart the nuclear construction pipeline have been focused on the Nuclear Power 2010 Program, which will pay up to half of the nuclear industry's costs of seeking regulatory approval for new reactor sites, applying for new reactor licenses, and preparing detailed plant designs. The Nuclear Power 2010 Program, which includes the Standby Support Program authorized by EPACT05 to pay for regulatory delays, is intended to encourage near-term orders for advanced versions of existing commercial nuclear plants.

The Nuclear Power 2010 Program is helping three utilities seek NRC Early Site Permits (ESPs) for potential new reactors in Illinois, Mississippi, and Virginia. NRC issued the first of these on March 15, 2007, to Exelon Generating Company for a potential new reactor at the company's Clinton, Illinois, nuclear plant. The ESP means that Exelon would not have to revisit site-related issues if it sought a license for a new reactor at the Clinton site during the next 20 years. Under Nuclear Power 2010, DOE paid half the $15 million cost of the Clinton ESP. NRC authorized an ESP for the Mississippi site on March 27, 2007.

In addition, two industry consortia are receiving DOE assistance over the next several years to design and license new nuclear power plants. DOE awarded the first funding to the consortia in 2004. DOE requested $114.0 million for Nuclear Power 2010 for FY2008, more than 40% above the FY2007 funding level of $80.3 million. The House Appropriations Committee recommended flat funding for the program, contending that funds should not be provided for reactor design work. However, the Senate Appropriations Committee called for a $21.0 million increase from the budget request, for a total of $135.0 million.

The nuclear license applications under the Nuclear Power 2010 program are intended to test the "one-step" licensing process established by the Energy Policy Act of 1992 (P.L. 102-486). Under the process, NRC may grant a combined construction permit and operating license (COL) that allows a completed plant to begin operation

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[10] Union of Concerned Scientists, *U.S. Nuclear Fuel Reprocessing Initiative*, [http://www.ucsusa.org/global_security/nuclear_terrorism/US_Nuclear_Fuel_Reprocessing_Initiative.html].

if all construction criteria have been met. Even if the licenses are granted by NRC, the industry consortia funded by DOE have not committed to building new reactors. The following two consortia receive COL assistance under the Nuclear Power 2010 program:

- A consortium led by Dominion Resources that is preparing a COL for an advanced General Electric reactor. The proposed reactor would be located at Dominion's existing North Anna plant in Virginia, where the company is also seeking an NRC early-site permit with DOE assistance.

- A consortium called NuStart Energy Development, including Exelon and several other major nuclear utilities, which announced on September 22, 2005, that it would seek a COL for a Westinghouse design at the site of TVA's uncompleted Bellefonte nuclear plant in Alabama and for a General Electric design at the Grand Gulf plant in Mississippi. The Nuclear Power 2010 Program is providing funding for review and approval of a COL application for the Bellefonte site.

The advanced Westinghouse reactor selected by NuStart, the AP-1000, may first be built in China. Under a contract signed December 16, 2006, four of the Westinghouse reactors are to be constructed at two sites, with the first two units to begin operating by 2013.[11] The contract could help pay for detailed engineering and demonstrate the commercial viability of the new design, which received final design certification from NRC effective February 27, 2006.[12] A preliminary commitment to provide almost $5 billion in financial support for the China reactor sale was approved on February 18, 2005, by the Export-Import Bank of the United States. Critics contend that the Ex-Im financing could provide unwarranted subsidies to the nuclear power industry and unwisely transfer U.S. nuclear technology to China.

Generation IV. Advanced commercial reactor technologies that are not yet close to deployment are the focus of DOE's Generation IV Nuclear Energy Systems Initiative, for which $36.1 million was requested for FY2008 — about the same as the FY2007 funding level. The House Appropriations Committee recommended nearly tripling the request to $115.1 million, with $70 million devoted to the Next Generation Nuclear Plant (NGNP). Under DOE's current plans, NGNP will use Very High Temperature Reactor (VHTR) technology, which features helium as a coolant and coated-particle fuel that can withstand temperatures up to 1,600 degrees celsius. The Senate panel recommended $55.0 million, with $45.0 million to be spent for the VHTR.

NGNP also would receive most of the Administration's FY2008 request, $30 million. The Energy Policy Act of 2005 authorizes $1.25 billion through FY2015 for NGNP development and construction (Title VI, Subtitle C). The authorization

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[11] "Westinghouse Wins China Contract; Chinese Look at Next Expansion," *Nucleonics Week*, December 21, 2006, p. 1.

[12] 71 *Federal Register* 4464, January 27, 2006.

requires that NGNP be based on research conducted by the Generation IV program and be capable of producing electricity, hydrogen, or both. Phase I research on the NGNP is to continue until 2011, when a decision will be made on moving to the Phase II design and construction stage, according to the FY2008 DOE budget justification.

In conjunction with the GNEP Technology Demonstration Program, the Generation IV Program will also focus on developing a sodium-cooled fast reactor (SFR). Existing U.S. commercial nuclear reactors use water to slow down, or "moderate," the neutrons released by the fission process (splitting of nuclei). The relatively slow (thermal) neutrons are highly efficient in causing fission in certain isotopes of heavy elements, such as uranium 235 and plutonium 239.[13] Therefore, fewer of those isotopes are needed in nuclear fuel to sustain a nuclear chain reaction (in which neutrons released by fissioned nuclei then induce fission in other nuclei, and so forth). The downside is that thermal neutrons cannot efficiently induce fission in more than a few specific isotopes.

In contrast, "fast" neutrons, which have not been moderated, are less effective in inducing fission than thermal neutrons but can induce fission in a much wider range of isotopes, including all major plutonium isotopes. Therefore, nuclear fuel for a fast reactor must have a higher proportion of fissionable isotopes than a thermal reactor to sustain a chain reaction, but a larger number of different isotopes can constitute that fissionable proportion.

A fast reactor's ability to fission most heavy radioactive isotopes, called "transuranics" (TRU), makes it theoretically possible to repeatedly separate those materials from spent fuel and feed them back into the reactor until they are entirely fissioned. In a thermal reactor, the buildup of non-fissile isotopes sharply limits the number of such separation cycles before the recycled fuel can no longer sustain a nuclear chain reaction.

"Given the benefits of continuous recycling, at this time GNEP-TDP is focused on the development of fast reactor technologies, recognizing that fast reactor operating experience is much more limited than thermal reactor operating experience, and that fast burn reactor fuels, or transmutation fuels, are not fully developed," according to the DOE Program Plan.[14]

The House Appropriations Committee directed DOE to make the gas-cooled NGNP a higher priority than fast reactors for GNEP and begin a competitive solicitation for a commercial demonstration plant at the Idaho National Laboratory. The Senate panel also emphasized gas-cooled reactors in the Generation IV program.

The Generation IV program is also monitoring international research on lead-cooled fast reactors, gas-cooled fast reactors, and supercritical water-cooled reactors, according to the FY2008 budget justification. The Senate Appropriations Committee

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[13] Isotopes are atoms of the same chemical element but with different numbers of neutrons in their nuclei.

[14] *Spent Nuclear Fuel Recycling Program Plan*, p. 8.

provided $25 million for such reactor technologies, including sodium-cooled, in the Advanced Fuel Cycle Initiative (below).

Advanced Fuel Cycle Initiative. The Advanced Fuel Cycle Initiative is the primary component of the GNEP program. AFCI's $395 million budget request for FY2008 is more than double the FY2007 funding level of $167.5 million, which in turn is more than double the FY2006 appropriation. The House Appropriations Committee voted to cut AFCI to $120.0 million. "The Department should focus its limited AFCI resources in FY2008 on research activities at the Idaho National Laboratory, the Oak Ridge National Laboratory, and the Argonne National Laboratory, with support from university and private sector researchers as appropriate," the Committee report said. The Senate Appropriations Committee recommended double the House level, providing funds to upgrade existing R&D facilities.

According to the DOE budget justification, AFCI will develop and demonstrate nuclear fuel cycles that could reduce the long-term hazard of spent nuclear fuel and recover additional energy. Such technologies would involve separation of plutonium, uranium, and other long-lived radioactive materials from spent fuel for reuse in a nuclear reactor or for transmutation in a particle accelerator. Much of the program's research will focus on a separations technology called UREX+, in which uranium and other elements are chemically removed from dissolved spent fuel, leaving a mixture of plutonium and other highly radioactive elements. Proponents believe the process is proliferation-resistant, because further purification would be required to make the plutonium useable for weapons and because its high radioactivity would make it difficult to divert or work with. However, the Senate panel called for DOE to "examine a broader array of technologies than UREX+," as well as different types of reactor fuel.

FY2008 funding will also be used for conceptual design work on an Advanced Fuel Cycle Facility (AFCF) to provide engineering-scale demonstration of AFCI technologies, according to the budget justification. At the same time, industry design teams are to complete conceptual designs for nuclear fuel recycling demonstration facilities to be used for GNEP. However, both appropriations panels rejected funding for development of AFCF in FY2008.

Removing uranium from spent fuel would eliminate most of the volume of spent nuclear fuel that would otherwise require disposal in a deep geologic repository, which DOE is developing at Yucca Mountain, Nevada. The UREX+ process also would reduce the heat generated by nuclear waste — the major limit on the repository's capacity — by removing cesium and strontium for separate storage and decay over several hundred years. Plutonium and other long-lived elements would be fissioned in accelerators or fast reactors (such as the type under development by the Generation IV program) to reduce the long-term hazard of nuclear waste. Even if technically feasible, however, the economic viability of such waste processing has yet to be determined, and it still faces significant opposition on nuclear nonproliferation grounds.

Nuclear Hydrogen Initiative. In support of President Bush's program to develop hydrogen-fueled vehicles, DOE is requesting $22.6 million in FY2008 for the Nuclear Hydrogen Initiative, about 10% above the FY2007 funding level but below the FY2006 appropriation. The House Committee recommended flat funding for the program, and the Senate panel approved the full request. According to DOE's FY2008 budget justification, the program will continue laboratory-scale experiments to allow selection by 2011 of a hydrogen-production technology for pilot-scale demonstration by 2013.

Nuclear Power Plant Safety and Regulation

Safety

Controversy over safety has dogged nuclear power throughout its development, particularly following the March 1979 Three Mile Island accident in Pennsylvania and the April 1986 Chernobyl disaster in the former Soviet Union. In the United States, safety-related shortcomings have been identified in the construction quality of some plants, plant operation and maintenance, equipment reliability, emergency planning, and other areas. In a relatively recent example, it was discovered in March 2002 that leaking boric acid had eaten a large cavity in the top of the reactor vessel in Ohio's Davis-Besse nuclear plant. The corrosion left only the vessel's quarter-inch-thick stainless steel inner liner to prevent a potentially catastrophic loss of reactor cooling water. Davis-Besse remained closed for repairs and other safety improvements until NRC allowed the reactor to restart in March 2004.

NRC's oversight of the nuclear industry is an ongoing issue; nuclear utilities often complain that they are subject to overly rigorous and inflexible regulation, but nuclear critics charge that NRC frequently relaxes safety standards when compliance may prove difficult or costly to the industry.

Domestic Reactor Safety. In terms of public health consequences, the safety record of the U.S. nuclear power industry in comparison with other major commercial energy technologies has been excellent. During approximately 2,700 reactor-years of operation in the United States,[15] the only incident at a commercial nuclear power plant that might lead to any deaths or injuries to the public has been the Three Mile Island accident, in which more than half the reactor core melted. Public exposure to radioactive materials released during that accident is expected to cause fewer than five deaths (and perhaps none) from cancer over the subsequent 30 years. A study of 32,000 people living within 5 miles of the reactor when the accident occurred found no significant increase in cancer rates through 1998, although the authors noted that some potential health effects "cannot be definitively excluded."[16]

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[15] *Nuclear Engineering International*, "Country averages as at end March 2006," August 2006, p. 38.

[16] Evelyn O. Talbott et al., "Long Term Follow-Up of the Residents of the Three Mile Island Accident Area: 1979-1998," Environmental Health Perspectives, published online October 30, 2002, at [http://ehp.niehs.nih.gov/docs/2003/5662/abstract.html].

The relatively small amounts of radioactivity released by nuclear plants during normal operation are not generally believed to pose significant hazards, although some groups contend that routine emissions are unacceptably risky. There is substantial scientific uncertainty about the level of risk posed by low levels of radiation exposure; as with many carcinogens and other hazardous substances, health effects can be clearly measured only at relatively high exposure levels. In the case of radiation, the assumed risk of low-level exposure has been extrapolated mostly from health effects documented among persons exposed to high levels of radiation, particularly Japanese survivors of nuclear bombing in World War II.

The consensus among most safety experts is that a severe nuclear power plant accident in the United States is likely to occur less frequently than once every 10,000 reactor-years of operation. (For the current U.S. fleet of about 100 reactors, that rate would yield an average of one severe accident every 100 years.) These experts believe that most severe accidents would have small public health impacts, and that accidents causing as many as 100 deaths would be much rarer than once every 10,000 reactor-years. On the other hand, some experts challenge the complex calculations that go into predicting such accident frequencies, contending that accidents with serious public health consequences may be more frequent.

Reactor Safety in the Former Soviet Bloc. The Chernobyl accident was by far the worst nuclear power plant accident to have occurred anywhere in the world. At least 31 persons died quickly from acute radiation exposure or other injuries, and thousands of additional cancer deaths among the tens of millions of people exposed to radiation from the accident may occur during the next several decades.

According to a 2006 report by the Chernobyl Forum organized by the International Atomic Energy Agency, the primary observable health consequence of the accident was a dramatic increase in childhood thyroid cancer. The Chernobyl Forum estimated that about 4,000 cases of thyroid cancer have occurred in children who after the accident drank milk contaminated with high levels of radioactive iodine, which concentrates in the thyroid. Although the Chernobyl Forum found only 15 deaths from those thyroid cancers, it estimated that about 4,000 other cancer deaths may have occurred among the 600,000 people with the highest radiation exposures, plus an estimated 1% increase in cancer deaths among persons with less exposure. The report estimated that about 77,000 square miles were significantly contaminated by radioactive cesium.[17] Greenpeace issued a report in 2006 estimating that 200,000 deaths in Belarus, Russia, and Ukraine resulted from the Chernobyl accident between 1990 and 2004.[18]

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[17] The Chernobyl Forum: 2003-2005, *Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts,* International Atomic Energy Agency, April 2006.

[18] Greenpeace. *The Chernobyl Catastrophe: Consequences on Human Health,* April 2006, p. 10.

Licensing and Regulation

For many years, a top priority of the nuclear industry was to modify the process for licensing new nuclear plants. No electric utility would consider ordering a nuclear power plant, according to the industry, unless licensing became quicker and more predictable, and designs were less subject to mid-construction safety-related changes required by NRC. The Energy Policy Act of 1992 (P.L. 102-486) largely implemented the industry's licensing goals, but no plants have been ordered.

Nuclear plant licensing under the Atomic Energy Act of 1954 (P.L. 83-703; U.S.C. 2011-2282) had historically been a two-stage process. NRC first issued a construction permit to build a plant and then, after construction was finished, an operating permit to run it. Each stage of the licensing process involved complicated proceedings. Environmental impact statements also are required under the National Environmental Policy Act.

Over the vehement objections of nuclear opponents, the Energy Policy Act of 1992 provides a clear statutory basis for one-step nuclear licenses, which would combine the construction permits and operating licenses and allow completed plants to operate without delay if construction criteria were met. NRC would hold preoperational hearings on the adequacy of plant construction only in specified circumstances. DOE's Nuclear Power 2010 initiative (discussed above) is paying up to half the cost of combined construction and operating licenses for two advanced reactors. Also as discussed above, Section 638 of the Energy Policy Act of 2005 authorizes federal payments to the owner of a completed reactor whose operation is delayed by regulatory action.

A fundamental concern in the nuclear regulatory debate is the performance of NRC in issuing and enforcing nuclear safety regulations. The nuclear industry and its supporters have regularly complained that unnecessarily stringent and inflexibly enforced nuclear safety regulations have burdened nuclear utilities and their customers with excessive costs. But many environmentalists, nuclear opponents, and other groups charge NRC with being too close to the nuclear industry, a situation that they say has resulted in lax oversight of nuclear power plants and routine exemptions from safety requirements.

Primary responsibility for nuclear safety compliance lies with nuclear plant owners, who are required to find any problems with their plants and report them to NRC. Compliance is also monitored directly by NRC, which maintains at least two resident inspectors at each nuclear power plant. The resident inspectors routinely examine plant systems, observe the performance of reactor personnel, and prepare regular inspection reports. For serious safety violations, NRC often dispatches special inspection teams to plant sites.

In response to congressional criticism, NRC has reorganized and overhauled many of its procedures. The Commission has moved toward "risk-informed regulation," in which safety enforcement is guided by the relative risks identified by detailed individual plant studies. NRC's risk-informed reactor oversight system, inaugurated April 2, 2000, relies on a series of performance indicators to determine the level of scrutiny that each reactor should receive.[19]

Reactor Security

Nuclear power plants have long been recognized as potential targets of terrorist attacks, and critics have long questioned the adequacy of the measures required of nuclear plant operators to defend against such attacks. All commercial nuclear power plants licensed by NRC have a series of physical barriers against access to vital reactor areas and are required to maintain a trained security force to protect them. Following the terrorist attacks of September 11, 2001, NRC began a "top-to-bottom" review of its security requirements.

A key element in protecting nuclear plants is the requirement that simulated terrorist attacks, monitored by NRC, be carried out to test the ability of the plant operator to defend against them. The severity of attacks to be prepared for are specified in the form of a "design basis threat" (DBT). After more than a year's review, on April 29, 2003, NRC changed the DBT to "represent the largest reasonable threat against which a regulated private guard force should be expected to defend under existing law." The details of the revised DBT were not released to the public.

The Energy Policy Act of 2005 required NRC to further revise the DBT based on an assessment of terrorist threats, the potential for multiple coordinated attacks, possible suicide attacks, and other criteria. NRC approved the DBT revision based on those requirements on January 29, 2007. The revised DBT does not require nuclear power plants to protect themselves against deliberate aircraft attacks. NRC contended that nuclear facilities were already required to mitigate the effects of large fires and explosions, no matter what the cause, and that active protection against airborne threats was being addressed by U.S. military and other agencies.[20]

EPACT05 also requires NRC to conduct force-on-force security exercises at nuclear power plants every three years (which was NRC's previous policy), authorizes firearms use by nuclear security personnel (preempting some state restrictions), establishes federal security coordinators, and requires fingerprinting of nuclear facility workers.

(For background on security issues, see CRS Report RS21131, *Nuclear Power Plants: Vulnerability to Terrorist Attack*, by Mark Holt and Anthony Andrews.)

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[19] For more information about the NRC reactor oversight process, see [http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/index.html]

[20] NRC Office of Public Affairs, *NRC Approves Final Rule Amending Security Requirements*, News Release No. 07-012, January 29, 2007.

Decommissioning

When nuclear power plants end their useful lives, they must be safely removed from service, a process called *decommissioning*. NRC requires nuclear utilities to make regular contributions to special trust funds to ensure that money is available to remove radioactive material and contamination from reactor sites after they are closed. The first full-sized U.S. commercial reactors to be decommissioned were the Trojan plant in Oregon, whose decommissioning received NRC approval on May 23, 2005, and the Maine Yankee, for which NRC approved most of the site cleanup on October 3, 2005. The Trojan decommissioning cost $429 million, according to reactor owner Portland General Electric, and the Maine Yankee decommissioning cost about $500 million.[21] Those costs are within the range estimated by a 1996 DOE report of about $150 million to $600 million in 1995 dollars.

The tax treatment of decommissioning funds has been a continuing issue. The Energy Policy Act of 2005 provides favorable tax treatment to nuclear decommissioning funds, subject to certain restrictions.

Nuclear Accident Liability

Liability for damages to the general public from nuclear incidents is addressed by the Price-Anderson Act (primarily Section 170 of the Atomic Energy Act of 1954, 42 U.S.C. 2210). The Energy Policy Act of 2005 extended Price-Anderson coverage for new reactors and new DOE nuclear contracts through the end of 2025.

Under Price-Anderson, the owners of commercial reactors must assume all liability for nuclear damages awarded to the public by the court system, and they must waive most of their legal defenses following a severe radioactive release ("extraordinary nuclear occurrence"). To pay any such damages, each licensed reactor must carry financial protection in the amount of the maximum liability insurance available, currently $300 million. Any damages exceeding that amount are to be assessed equally against all covered commercial reactors, up to $95.8 million per reactor. Those assessments — called "retrospective premiums" — would be paid at an annual rate of no more than $15 million per reactor, to limit the potential financial burden on reactor owners following a major accident. According to NRC, 104 commercial reactors are currently covered by the Price-Anderson retrospective premium requirement.

For each nuclear incident, the Price-Anderson liability system currently would provide up to $10.8 billion in public compensation. That total includes the $300 million in insurance coverage carried by the reactor that suffered the incident, plus the $95.8 million in retrospective premiums from each of the 104 currently covered reactors, totaling $10.3 billion. On top of those payments, a 5% surcharge may also be imposed, raising the total per-reactor retrospective premium to $100.6 million and the total available compensation to about $10.8 billion. Under Price-Anderson, the nuclear industry's liability for an incident is capped at that amount, which varies

[21] Sharp, David, "NRC Signs Off On Maine Yankee's Decommissioning," *Associated Press*, October 3, 2005.

depending on the number of covered reactors, the amount of available insurance, and an inflation adjustment that is made every five years. Payment of any damages above that liability limit would require congressional approval under special procedures in the act.

The Energy Policy Act of 2005 raised the limit on per-reactor annual payments to $15 million from the previous $10 million, and required the annual limit to be adjusted for inflation every five years. As under previous law, the total retrospective premium limit of $95.8 million is to be adjusted every five years as well. For the purposes of those payment limits, a nuclear plant consisting of multiple small reactors (100-300 megawatts, up to a total of 1,300 megawatts) would be considered a single reactor. Therefore, a power plant with six 120-megawatt pebble-bed modular reactors would be liable for retrospective premiums of up to $95.8 million, rather than $574.8 million (excluding the 5% surcharge).

The Price-Anderson Act also covers contractors who operate hazardous DOE nuclear facilities. The Energy Policy Act of 2005 set the liability limit on DOE contractors at $10 billion per accident, to be adjusted for inflation every five years. The liability limit for DOE contractors previously had been the same as for commercial reactors, excluding the 5% surcharge, except when the limit for commercial reactors dropped because of a decline in the number of covered reactors. Price-Anderson authorizes DOE to indemnify its contractors for the entire amount of their liability, so that damage payments for nuclear incidents at DOE facilities would ultimately come from the Treasury. However, the law also allows DOE to fine its contractors for safety violations, and contractor employees and directors can face criminal penalties for “knowingly and willfully” violating nuclear safety rules.

The Energy Policy Act of 2005 limits the civil penalties against a nonprofit contractor to the amount of management fees paid under that contract. Previously, Atomic Energy Act §234A specifically exempted seven nonprofit DOE contractors and their subcontractors from civil penalties and authorized DOE to automatically remit any civil penalties imposed on nonprofit educational institutions serving as DOE contractors. The Energy Policy Act eliminated the civil penalty exemption for future contracts by the seven listed nonprofit contractors and DOE’s authority to automatically remit penalties on nonprofit educational institutions.

The Price-Anderson Act’s limits on liability were crucial in establishing the commercial nuclear power industry in the 1950s. Supporters of the Price-Anderson system contend that it has worked well since that time in ensuring that nuclear accident victims would have a secure source of compensation, at little cost to the taxpayer. Extension of the act was widely considered a prerequisite for new nuclear reactor construction in the United States. Opponents contend that Price-Anderson inappropriately subsidizes the nuclear power industry by reducing its insurance costs and protecting it from some of the financial consequences of the most severe conceivable accidents.

Nuclear Waste Management

One of the most controversial aspects of nuclear power is the disposal of radioactive waste, which can remain hazardous for thousands of years. Each nuclear reactor produces an annual average of about 20 metric tons of highly radioactive spent nuclear fuel, for a nationwide total of about 2,000 metric tons per year. Each reactor also annually generates about 50-200 cubic meters of low-level radioactive waste, plus contaminated reactor components that are also disposed of as low-level waste, especially after a reactor is decommissioned.

The federal government is responsible for permanent disposal of commercial spent fuel (paid for with a fee on nuclear power) and federally generated radioactive waste, whereas states have the authority to develop disposal facilities for commercial low-level waste. Under the Nuclear Waste Policy Act (42 U.S.C. 10101, et seq.), spent fuel and other highly radioactive waste is to be isolated in a deep underground repository, consisting of a large network of tunnels carved from rock that has remained geologically undisturbed for hundreds of thousands of years. Yucca Mountain in Nevada is the only candidate site for the national repository. The act required DOE to begin taking waste from nuclear plant sites by 1998 — a deadline that under DOE's latest schedule will be missed by nearly 20 years.

After numerous delays, DOE announced July 19, 2006, that it would submit a Yucca Mountain license application to NRC by June 30, 2008. If Congress passes proposed changes in the repository licensing process, according to DOE, nuclear waste shipments to Yucca Mountain could begin by 2017. The waste program is run by DOE's Office of Civilian Radioactive Waste Management (OCRWM).

DOE requested $494.5 million for the nuclear waste program in FY2008, nearly the same as the FY2006 level and $50 million above FY2007 funding. According to DOE, the FY2008 funding request would allow OCRWM to submit the Yucca Mountain license application in FY2008 as currently planned, conduct security and safety planning, develop a preliminary transportation plan, and improve site infrastructure and operations.[22] The House Appropriations Committee approved the full request, while the Senate panel voted to hold the program's funding to about the FY2007 level.

Funding for the program is provided under two appropriations accounts. The Administration requested $202.5 million from the Nuclear Waste Fund, which holds fees paid by nuclear utilities. An additional $292.0 million is being requested under 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 delays in the Yucca Mountain program follow a July 9, 2004, ruling by the U.S. Court of Appeals for the District of Columbia Circuit that overturned a key aspect of the Environmental Protection Agency's (EPA's) regulations for the planned

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[22] DOE, *FY 2008 Congressional Budget*, DOE/CF-017, Vol. 4, p. 490.

repository.[23] The three-judge panel ruled that EPA's 10,000-year compliance period was too short, but it rejected several other challenges to the rules. EPA proposed a new standard on August 9, 2005, that would allow higher radiation exposure from the repository after 10,000 years.

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 announced February 17, 2006, that the technical work conducted by the geologists was sound but that some work would be redone or further corroborated before submission of a repository license application.

Further delays in the nuclear waste program could prove costly to the federal government under a settlement announced on August 10, 2004, between the Department of Justice and Exelon Corporation, which had filed a breach-of-contract suit over DOE's failure to begin accepting spent fuel by 1998 as required by NWPA. Under the settlement, Exelon is to be reimbursed from the federal Judgment Fund for its spent fuel storage costs caused by the waste program delays. Exelon estimates that it will receive up to $600 million if waste acceptance does not begin until 2015. Several other utilities have also negotiated settlements. The Tennessee Valley Authority on January 31, 2006, won a $34.9 million judgment from the U.S. Court of Federal Claims for waste storage costs incurred through September 2004, and three New England reactor owners were granted awards totaling $143 million in September 2006.[24] Numerous other utility claims are pending.[25] (For further details, see CRS Report RL33461, *Civilian Nuclear Waste Disposal*, by Mark Holt.)

Federal Funding for Nuclear Energy Programs

The following tables summarize current funding for DOE nuclear fission programs and NRC. The sources for the funding figures are Administration budget requests and committee reports on the Energy and Water Development Appropriations Acts, which fund all the nuclear programs. President Bush submitted his FY2008 funding request on February 5, 2007. FY2007 funding for the programs is provided by a continuing resolution enacted February 15, 2007 (H.J.Res. 20, P.L. 110-5). Funding for individual sub-accounts for FY2007 is described in an Operating Plan submitted by DOE on March 16, 2007. The House Appropriations Committee approved the FY2008 Energy and Water Appropriations Bill on June 6, 2007 (H.R. 2641, H.Rept. 110-185). The Senate Appropriations Committee approved its version of the measure on June 28, 2007 (S. 1751, S.Rept. 110-127).

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

[24] U.S. Court of Federal Claims, *Yankee Atomic Electric Company v. the United States*, No. 98-126C, unsealed October 4, 2006.

[25] Hiruo, Elaine, and Tom Harrison, "TVA, Negotiated Settlements Add to Taxpayers' Yucca Mt. Bill," *NuclearFuel*, March 13, 2006, p. 11.

Table 2. Funding for the Nuclear Regulatory Commission
(budget authority in millions of current dollars)

	FY2007 Approp.	FY2008 Request	FY2008 House Comm.	FY2008 Senate Comm.
Nuclear Regulatory Commission				
— Reactor Safety	— [a]	709.0	— [a]	— [a]
— Nuclear Materials and Waste	—	199.4	—	—
— Inspector General	8.3	8.2	8.1	8.7
Total NRC budget authority	824.9	916.6	933.7	919.3
— Offsetting fees	666.7	765.1	765.1	765.6
Net appropriation	**158.2**	**151.5**	**168.6**	**153.7**

a. Subcategories not specified.

Table 3. DOE Funding for Nuclear Activities
(budget authority in millions of current dollars)

	FY2007 Approp.	FY2008 Request	FY2008 House Comm.	FY2008 Senate Comm.
Nuclear Energy (selected programs)				
University Reactor Assistance	16.5	0	0	15.0
Nuclear Power 2010	80.3	114.0	80.3	135.0
Generation IV Nuclear Systems	35.6	36.1	115.1	55.0
Nuclear Hydrogen Initiative	19.3	22.6	19.3	22.6
Advanced Fuel Cycle Initiative	167.5	395.0	120.0	243.0
Nuclear R&D Infrastructure	236.4	157.7	261.2	249.7
Program Direction	62.6	76.2	71.4	76.2
Total, Nuclear Energy	618.2	801.7	835.2	795.5
Civilian Nuclear Waste Disposal[a]	444.5	494.5	494.5	446.1

a. Funded by a 1-mill-per-kilowatt-hour fee on nuclear power, plus appropriations for defense waste disposal and homeland security.

Legislation

H.R. 994 (John Hall)/S. 649 (Clinton)

Requires NRC to conduct an independent safety assessment of the Indian Point nuclear power plant in New York. House bill introduced February 12, 2007; referred to Committee on Energy and Commerce. Senate bill introduced February 15, 2007; referred to Committee on Environment and Public Works.

H.R. 1133 (Berkley)

Freedom through Renewable Energy Expansion (FREE) Act. Repeals provisions of the Energy Policy Act of 2005 (P.L. 109-58) regarding the next generation nuclear plant project. Introduced February 16, 2007; referred to multiple committees.

H.R. 2162 (Lowey)

Nuclear Power Licensing Reform Act of 2007. Requires that nuclear power plants before receiving an initial or renewed license be found not to pose an unreasonable threat because of safety or security vulnerabilities and have adequate evacuation plans approved by the relevant federal agencies and states within 50 miles of the facility. Introduced May 3, 2007; referred to Committee on Energy and Commerce.

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. 2641 (Visclosky)/S. 1751 (Dorgan)

Energy and Water Development Appropriations for FY2008. Includes funding for DOE nuclear waste program and GNEP. Reported as an original measure by the House Committee on Appropriations June 11, 2007 (H.Rept 110-185) following committee markup June 6, 2007. Floor consideration began June 19, 2007. Senate bill reported as an original measure by Senate Committee on Appropriations July 9, 2007 (S. Rept. 110-127) following committee markup June 28, 2007.

H.R. 2814 (Marchant)

Authorizes the Secretary of Energy to provide loan guarantees for 100% of the cost of construction of new domestic nuclear power production facilities. Introduced June 21, 2007; referred to Committees on Energy and Commerce and Science and Technology.

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. 280 (Lieberman)

Climate Stewardship and Innovation Act of 2007. Includes provisions establishing research program on nuclear fuel cycles and a demonstration program to reduce nuclear power plant licensing costs. Introduced January 12, 2007; referred to Committee on Environment and Public Works.

S. 784 (Reid)

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. Introduced March 6, 2007. Referred to Committee on Environment and Public Works.

S. 1008 (Sanders)

Requires the Nuclear Regulatory Commission to develop and implement procedures for independent safety assessments of nuclear power plants. Introduced March 28, 2007; referred to Committee on Environment and Public Works.