Order Code IB88090

Issue Brief for Congress
Received through the CRS Web

Nuclear Energy Policy

Updated January 30, 2003

Mark Holt and Carl E. Behrens
Resources, Science, and Industry Division

CONTENTS

Nuclear Energy Policy

SUMMARY

Nuclear energy policy issues facing Congress include questions about radioactive waste management, research and development priorities, power plant safety and regulation, terrorism, and the Price-Anderson Act nuclear liability system.

The Bush Administration has stressed the importance of nuclear power in the nation's energy policy, although it has requested relatively little additional R&D funding. The Administration's FY2003 budget request included $38.5 million for a Department of Energy (DOE) effort to encourage deployment of new commercial nuclear power plants by 2010. Because final action on those funding proposals was not taken in the 107th Congress, DOE nuclear programs are now operating under a short-term continuing resolution.

Several bills were introduced, but not passed, in the 107th Congress to encourage the growth of nuclear power. A number of nuclear provisions were included in comprehensive energy legislation (H.R. 4) passed by the House August 2, 2001, and by the Senate April 25, 2002. Conferees were unable to reach agreement on the measure.

The September 11, 2001, terrorist attacks on the United States raised questions about nuclear power plant security. Reactor security provisions were included in a Price-Anderson extension bill passed by the House November 27, 2001 (H.R. 2983), and in several other bills. An extra $36 million for nuclear power plant security was provided by the FY2002 supplemental appropriations bill, included in the FY2002 Defense Appropriations Bill passed by Congress December 20, 2001 (P.L. 107-117). Bills to strengthen nuclear power plant security have been introduced in the 108th Congress (S. 6, S. 131).

Disposal of highly radioactive waste has been one of the most controversial aspects of nuclear power. The Nuclear Waste Policy Act of 1982 (NWPA, P.L. 97-425), as amended in 1987, requires DOE to conduct detailed physical characterization of Yucca Mountain in Nevada as a permanent underground repository for high-level waste. President Bush recommended approval of the site February 15, 2002, and Nevada Governor Guinn on April 8, 2002, issued a "state veto" of the site, as allowed by NWPA. On May 8, 2002, the House passed a resolution to overturn the "state veto" and allow further activity at Yucca Mountain to proceed (H.J.Res. 87). The resolution was passed by the Senate on July 9 and signed by the President July 23, 2002 (P.L. 107-200).

Whether progress on nuclear waste disposal and other congressional action will revive the U.S. nuclear power industry's growth will depend primarily on economic considerations. Natural gas- and coal-fired power plants currently are favored over nuclear reactors for new generating capacity. However, some electric utilities are seeking approval of sites for possible new reactors.

MOST RECENT DEVELOPMENTS

President Bush's FY2003 budget request, submitted to Congress February 4, 2002, would provide $38.5 million for a Department of Energy (DOE) effort to encourage deployment of new commercial nuclear power plants by 2010. The overall budget request for nuclear energy programs was $249.8 million, similar to the FY2002 appropriation. A 40% increase was sought for the DOE nuclear waste disposal program, to $526.7 million. The Administration's nuclear funding proposals were generally approved by the House Appropriations Committee September 5 and by the Senate Appropriations Committee on July 24, except for a deep reduction in the nuclear waste request recommended by the Senate panel. Because final appropriations action was not taken in the 107th Congress, DOE nuclear programs are currently operating under a short-term continuing resolution. An omnibus continuing resolution for the remainder of FY2003 (H.J.Res. 2) is now being considered in a House-Senate conference.

A 15-year extension of the Price-Anderson Act nuclear liability system is included in H.J.Res. 2 as passed by the Senate January 23. Under Price-Anderson, commercial nuclear reactors must pay for any radiological damages to the public through a limited industry self-insurance system, and Department of Energy nuclear contractors are indemnified by the federal government. The Senate-passed provision would allow nuclear plants consisting of several small modules to be treated as a single reactor under the Price-Anderson system. The Price-Anderson extension language in the Senate version of H.J.Res. 2 is identical to provisions accepted in the 107th Congress by House-Senate conferees on an omnibus energy bill (H.R. 4) that was not completed before the session ended. For DOE contractors, Price-Anderson coverage was extended for two years by the FY2003 Defense Authorization Act (P.L. 107-314), signed December 2.

BACKGROUND AND ANALYSIS

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 uncertain long-term future. No nuclear plants have been ordered since 1978 and more than 100 reactors have been canceled, including all ordered after 1973. No units are currently under active construction; the Tennessee Valley Authority'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 have ranged from $2-$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 half that amount if many identical plants were built in a series, but such economies of scale have yet to be demonstrated.

Nevertheless, all is not bleak for the U.S. nuclear power industry, which currently comprises 103 licensed reactors at 65 plant sites in 31 states. (That number excludes the Tennessee Valley Authority's (TVA's) Browns Ferry 1, which has not operated since 1985; the TVA Board decided May 16, 2002, to spend about $1.8 billion to restart the reactor by 2007.) 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 55% of U.S. electricity generation. Nuclear plants generate more than half the electricity in six states. The 769 billion kilowatt-hours of nuclear electricity generated in the United States during 2001 was more than the nation's entire electrical output in 1963, when the first of today's 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 a record-high average of more than 88% of their total capacity in 2001, according to industry statistics.[1]

Ten commercial reactors have received 20-year license extensions from the Nuclear Regulatory Commission (NRC), giving them up to 60 years of operation. License extensions for 13 more reactors are currently under NRC review.[2]

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 been announced, 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.

Existing nuclear power plants appear to hold a strong position in the ongoing restructuring of the electricity industry. In most cases, nuclear utilities have received favorable regulatory treatment of past construction costs, and average nuclear operating costs are currently estimated to be lower than those of competing fossil fuel technologies.[3] Although eight U.S. nuclear reactors have permanently shut down since 1990, recent reactor sales could indicate greater industry interest in nuclear plants that previously had been considered marginal. Despite the shutdowns, total U.S. nuclear electrical output increased nearly 25% from 1990 to 2000, according to the Energy Information Administration. The increase resulted primarily from reduced downtime at the remaining plants, the startup of five new units, and reactor modifications to boost capacity.

---

[1] "U.S. Nuclear Record Sustained as 2001 Output nears 800-Million MWH," *Nucleonics Week*, February 14, 2002, p. 1.

[2] "Florida Reactors Get License Extension," *The Energy Daily*, June 10, 2002.

[3] "Production Costs Made Nuclear Cheapest Fuel in 1999, NEI Says," *Nucleonics Week*, January 11, 2001, p. 3.

A spike in fossil fuel prices and shortages of electricity during 2000-2001 helped encourage at least three nuclear operating companies to consider building new commercial nuclear reactors. Exelon helped form an international consortium that may build a demonstration Pebble Bed Modular Reactor (PBMR) in South Africa, a reactor cooled by helium that is intended to be highly resistant to accidents. However, Exelon announced in April 2002 that it would leave the consortium after a feasibility study is completed. Entergy, Dominion Resources, and Exelon have chosen sites in Mississippi, Virginia, and Illinois, respectively, for possible future nuclear units.[4] The Department of Energy (DOE) included an initiative in its FY2003 budget request to encourage construction of new commercial reactors by 2010.

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. But the large obstacles noted above must still be overcome before electric generating companies will risk ordering new nuclear units. (For more on the outlook for nuclear power, see CRS Report RL31064, *Nuclear Power: Prospects for New Commercial Reactors*.)

Nuclear Power Research and Development

The Bush Administration's National Energy Policy, issued in May 2001, calls for "the expansion of nuclear energy in the United States." The FY2003 nuclear energy request reflected that policy with a funding initiative to encourage construction of new commercial reactors by 2010 and additional funding for advanced reactor designs. However, total funding for nuclear energy supply programs would remain about the same as in FY2002.

The budget request would provide $46.5 million for nuclear energy technologies, which includes $38.5 million for DOE's "Nuclear Power 2010" initiative and $8.0 million for "Generation IV" advanced reactor technologies that could be ready for deployment after 2010. The House Appropriations Committee on September 5, 2002, recommended cutting the nuclear energy technologies request to $41.5 million so that $5 million could be shifted to the nuclear energy plant optimization program (NEPO, described below), which the Administration had proposed to terminate. The Senate Appropriations Committee voted July 24 to boost the nuclear energy technologies request to $48.5 million. Because final action on the appropriations was not taken in the 107th Congress, all DOE nuclear programs are currently operating under a short-term continuing resolution. An omnibus funding resolution for the remainder of FY2003 (H.J.Res. 2) passed by the Senate January 23, 2003, includes the same nuclear energy funding as recommended by the Senate panel last year.

According to the DOE budget justification, the Nuclear Power 2010 program, which would receive a $30.5 million increase over FY2002, will "identify the technical, institutional and regulatory barriers to the deployment of new nuclear power plants by 2010." The program seeks to deploy both a water-cooled reactor (similar to most existing

[4] Beattie, Jeff. "Entergy Names Mississippi Site for Possible New Reactor," *Energy Daily*, April 17, 2002. p. 4. Weil, Jenny. "Exelon Selects Clinton Site for Possible New Reactor," *Nucleonics Week*, May 2, 2002. p. 1.

commercial plants) and a gas-cooled reactor. The current phase of the initiative would include site approval, reactor design certification, license applications, detailed design work, and development of improved construction techniques. DOE announced it would seek proposals for joint DOE/industry teams in which DOE would pay up to half the cost of these activities.

DOE requested $8.0 million for FY2003 – double the FY2002 level – for Generation IV technologies. A variety of concepts are under consideration, according to the budget justification, including reactors fueled by plutonium recovered through reprocessing of spent nuclear fuel. The Administration's *National Energy Policy* report contends that plutonium recovery could reduce the long-term environmental impact of nuclear waste disposal and increase domestic energy supplies. However, opponents contend that the separation of plutonium from spent fuel poses unacceptable environmental risks and undermines U.S. policy on nuclear weapons proliferation.

DOE requested $18 million to study pyroprocessing technology and for electrometallurgical treatment of spent fuel from the Experimental Breeder Reactor II (EBR-II) in Idaho. No funding was requested for waste transmutation, which involves bombarding nuclear waste with neutrons from a fast reactor or particle accelerator to convert long-lived radioactive isotopes into radioisotopes that decay more quickly. Because those programs involve plutonium separation, they are generally opposed by nuclear nonproliferation groups.

DOE announced July 17, 2002, that work on advanced nuclear reactor and reprocessing technologies would be centered at the Idaho National Engineering and Environmental Laboratory (INEEL), which would be placed under the control of the DOE Office of Nuclear Energy, Science, and Technology. The Senate Appropriations Committee voted to provide $77.9 million for those activities, including the requested $18 million for EBR-II fuel treatment. According to the Senate report, "This program subsumes the Advanced Accelerator Applications program and its activities and will focus on the development of advanced fuel cycles, recycle or reprocessing of spent fuel, and transmutation technologies." The House panel approved only the requested $18 million.

A DOE program to support innovative nuclear energy research projects, the "nuclear energy research initiative" (NERI), would receive $25 million under the FY2003 request, a $7 million reduction from FY2002. The House Appropriations Committee recommended the full NERI request, while the Senate Appropriations Committee called for a $4 million increase. As noted above, the House panel recommended $5 million for NEPO, a research program to improve the economic competitiveness of existing nuclear power plants. The Senate Appropriations Committee also recommended $5 million for the program, $2 million below the FY2002 level.

The Energy Research, Development, Demonstration, and Commercial Application Act of 2003 (H.R. 238), introduced by Representative Boehlert on January 8, 2003, includes funding authorizations for DOE nuclear energy programs.

Nuclear Power Plant Safety and Regulation

Safety and Security

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 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 release of reactor cooling water.

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. In the wake of the September 11, 2001, terrorist attacks against the United States, concerns about nuclear power plant security have received heightened attention.

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. In more than 2,250 reactor-years of operation in the United States, the only incident at a commercial 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 following 30 years. A recent 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 note that some potential health effects "cannot be definitively excluded."[5]

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 unsafe. 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. These experts believe that most severe accidents would have small public

---

[5] Talbott, Evelyn O., *et al.* "Long Term Follow-Up of the Residents of the Three Mile Island Accident Area: 1979-1998." Environmental Health Perspectives. Published on-line October 30, 2002. [http://ehpnet1.niehs.nih.gov/docs/2003/5662/abstract.html]

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.

Security and Emergency Planning. Nuclear power plant security has been an ongoing issue, but concerns were considerably increased following the terrorist attacks on New York and Washington, D.C. At NRC's recommendation, nuclear power plants in the United States went to the highest level of security immediately after the attacks. The NRC Emergency Operations Center was activated, as well as regional NRC emergency centers, all of which maintained constant contact with the nation's nuclear power plants.

NRC ordered all commercial reactors on February 26, 2002, to "implement interim compensatory security measures for the generalized high-level threat environment." Some of the required security measures had been included in NRC's previous security recommendations. Although most of the detailed security requirements are secret, NRC said they generally included:

- increased patrols at nuclear power plants;
- augmented security forces and capabilities;
- establishment of additional security posts;
- installation of additional physical barriers;
- vehicle checks at greater distances from vital facilities;
- enhanced plant security coordination with law enforcement and military authorities; and
- more restrictive controls on personnel access to nuclear plant sites.

In light of the unprecedented attacks, NRC Chairman Richard A. Meserve, with the support of the other Commissioners, ordered a staff review of NRC's security regulations and procedures. NRC received $36 million in FY2002 supplemental appropriations to pay for analyzing the "design basis threats" that nuclear plants must be able to prevent, strengthen personnel screening procedures for nuclear facilities, and improve emergency preparedness programs and emergency communication capabilities. The funding was included in the FY2002 Defense Appropriations bill (P.L. 107-117), approved by Congress December 20, 2001. NRC is seeking an additional $29.3 million for FY2003 to continue its research effort on security threats. The House and Senate Appropriations Committees recommended approval of the full NRC budget request, but final action was not taken and NRC is currently operating under a continuing resolution. The full request is included in H.J.Res. 2 as passed by the Senate.

NRC regulations require nuclear power plants to be designed and operated to prevent unauthorized intrusion and to withstand external attacks. However, reactor containment structures are not specifically designed to withstand the types of deliberate air crashes that were carried out September 11, according to an NRC fact sheet. Groups critical of the nuclear industry contend that such a crash could cause a reactor meltdown, but some industry officials have expressed confidence that no radioactive release would occur. NRC is currently analyzing the potential effects of airliner attacks on nuclear power plants. To prevent internal threats, background checks are required for unescorted access and

computerized security doors monitor the movement of personnel throughout each reactor building. However, critics contend that existing personnel controls could be circumvented.

Nuclear plant security forces are tested periodically with mock attacks under NRC's Operational Safeguards Response Evaluation (OSRE) program. Nuclear power critics have pointed out that numerous security weaknesses have been uncovered by the OSRE exercises, although the significance of those problems has been the subject of debate. Based on interviews with 20 security guards at 13 nuclear plant sites, a report issued September 12, 2002, by the Project on Government Oversight (POGO) contended that many nuclear plants have too few guards, and that nuclear security forces often have inadequate training, equipment, and pay.

Since the September 11 terrorist attacks, a number of groups have intensified their criticism of NRC's nuclear plant security requirements as being inadequate against sophisticated assaults. The Nuclear Security Act of 2003 (S. 131), introduced January 9, 2003, by Senator Reid, would require the federal government to study a wide variety of security threats to nuclear facilities and determine which threats would come from enemies of the United States and therefore be the responsibility of the federal government and which threats should be guarded against by nuclear power plant owners. NRC would be required to review the security and emergency response plans at all nuclear power plants and other major nuclear facilities. An NRC employee is to be stationed at each nuclear facility as a "federal security coordinator." NRC-run "force on force" security exercises would be required at each nuclear facility every three years.

Stockpiling of potassium iodide (KI) tablets has also been an emergency planning issue. If taken quickly enough, the tablets can prevent radioactive iodine released during a nuclear incident from being absorbed by the thyroid gland. On December 20, 2001, NRC offered to supply potassium iodide tablets to states in which nuclear power plants are located or nearby. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (P.L. 107-188), signed June 12, 2002, required the Department of Health and Human Services to give KI tablets to state and local governments to stockpile at schools, hospitals, and other public facilities within 20 miles of nuclear power plants. That function was transferred to the new Department of Homeland Security by the Homeland Security Act of 2002 (P.L. 107-296), signed November 25, 2002.

(For more information, see CRS Report RS21131, *Nuclear Powerplants: Vulnerability to Terrorist Attack*, and CRS Terrorism Electronic Briefing Book fact sheet on *Nuclear Power Plant Emergency Response*, [http://www.congress.gov/brbk/html/ebter138.html].)

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 November 1995 report by the Organization for Economic Cooperation and Development (OECD), the primary observable health consequence of the accident has been a dramatic increase in childhood thyroid cancer. About 1,000 cases of childhood thyroid cancer were reported in certain regions surrounding the destroyed reactor — a rate that is as

much as a hundred times the pre-accident level, according to OECD. The death rate for accident cleanup workers also rose measurably, the organization reported. The OECD report estimated that about 50,000 square miles of land in Belarus, Ukraine, and Russia were substantially contaminated with radioactive cesium from Chernobyl.

The United States is providing direct assistance for upgrading the safety of remaining Soviet-designed reactors, a program being coordinated by DOE, NRC, the Agency for International Development (AID), and the Department of State. DOE is seeking $14.6 million in FY2003 for improving the operation and physical condition of Soviet-designed nuclear power plants, a decrease of $6.5 million from FY2002. The Senate Appropriations Committee agreed with the request, but the House Appropriations Committee cut it by $3 million, and final action was not taken in the 107th Congress. The General Accounting Office estimates that $1.93 billion was provided through November 1999 by the United States and other industrialized nations to improve the safety of Soviet-designed reactors. Of that amount, $753 was contributed by the European Union, $532 by the United States, $43 million by the International Atomic Energy Agency, and the remainder from 14 other countries.

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 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 (P.L. 102-486) 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 are met. NRC would hold preoperational hearings on the adequacy of plant construction only in specified circumstances. DOE's Nuclear Power 2010 initiative proposes to pay up to half the cost of combined construction and operating licenses for a water-cooled and a gas-cooled reactor.

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 begun reorganizing and overhauling many of its procedures. The Commission is moving toward "risk-informed regulation," in which safety enforcement is guided by the relative risks identified by detailed individual plant studies. NRC began implementing a new reactor oversight system April 2, 2000, that relies on a series of performance indicators to determine the level of scrutiny that each reactor should receive. However, the Union of Concerned Scientists has questioned the validity of the individual plant studies on which risk-informed regulation is based.

Decommissioning and Life Extension

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 all radioactive material from reactors after they are closed. Because no full-sized U.S. commercial reactor has yet been completely decommissioned, which can take several decades, the cost of the process can only be estimated. Decommissioning cost estimates cited by a 1996 DOE report, for one full-sized commercial reactor, ranged from about $150 million to $600 million in 1995 dollars. Disposal of large amounts of low-level waste, consisting of contaminated reactor components, concrete, and other materials, is expected to account for much of those costs.

Consolidation of the nuclear industry has raised questions about the tax treatment of decommissioning funds when a commercial reactor is sold. The House and Senate versions of H.R. 4 specified that dedicated nuclear decommissioning funds could be transferred to new reactor owners without incurring additional tax liabilities.

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 act was up for reauthorization on August 1, 2002, but even though an extension was not enacted for commercial nuclear power plants, existing reactors continue to operate under the current Price-Anderson liability system.

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 $200 million. Any damages exceeding that amount are to be assessed equally against all operating commercial reactors, up to $83.9 million per reactor. Those assessments – called "retrospective premiums" – would be paid at an annual rate of no more than $10 million per

reactor, to limit the potential financial burden on reactor owners following a major accident. Including three that are not operating, 106 commercial reactors are currently covered by the Price-Anderson retrospective premium requirement.

For each nuclear incident, therefore, the Price-Anderson liability system currently would provide up to $9.09 billion in public compensation. That total includes the $200 million in insurance coverage carried by the reactor that suffered the incident, plus the $83.9 million in retrospective premiums from each of the 106 currently covered reactors. On top of those payments, a 5% surcharge may also be imposed, raising the total per-reactor retrospective premium to $88.1 million and total compensation to $9.5 billion. Under Price-Anderson, the nuclear industry's liability for an incident is capped at that amount, which varies depending on the number of covered reactors, the amount of available insurance, and an inflation adjustment that is made every 5 years. Payment of any damages above that liability limit would require congressional approval under special procedures in the act.

The Price-Anderson Act also covers contractors who operate hazardous DOE nuclear facilities. The liability limit for DOE contractors is the same as for commercial reactors, except when the limit for commercial reactors drops because of a decline in the number of covered reactors. Since 1998, the number of covered commercial reactors has dropped from 110 to 106, so the commercial liability limit has dropped from $9.43 billion to $9.09 billion. Under the law, however, the limit for DOE contractors does not decline and so remains at $9.43 billion. Price-Anderson authorizes DOE to indemnify its contractors for the entire amount, 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.

In the 107th Congress, the House approved a 15-year extension of the Price-Anderson liability system November 27, 2001 (H.R. 2983). The total retrospective premium for each reactor would have been raised to $94 million and the limit on per-reactor annual payments raised to $15 million, with both to be adjusted for inflation every 5 years. For the purposes of those payment limits, a nuclear plant consisting of multiple small reactors (100-300 megawatts, up to a total of 950 megawatts) would have been considered a single reactor. Therefore, a power plant with six 120-megawatt pebble-bed modular reactors would have been liable for retrospective premiums of up to $94 million, rather than $564 million. The liability limit on DOE contractors would have been set at $10 billion per accident, also to be adjusted for inflation.

The Senate included provisions in H.R. 4 to extend Price-Anderson coverage for new commercial reactors for 10 years and indefinitely for DOE contractors. The liability limit for commercial reactors would have remained the same, with a five-year inflation adjustment, and the limit for DOE contractors would have been set at $10 billion with an inflation adjustment. Modular reactors of 100-300 megawatts built together in a plant of up to 1,300 megawatts would have been considered a single reactor under Price-Anderson.

The House-passed Price-Anderson bill would have authorized the federal government to sue DOE contractors to recover at least some of the compensation that the government had paid for any accident caused by intentional DOE contractor management misconduct. Such

cost recovery would have been limited to the amount of the contractor's profit under the contract involved, and no recovery would be allowed from nonprofit contractors.

Although DOE is generally authorized to impose civil penalties on its contractors for violations of nuclear safety regulations, Atomic Energy Act §234A specifically exempts seven non-profit DOE contractors and their subcontractors. Under the same section, DOE automatically remits any civil penalties imposed on non-profit educational institutions serving as DOE contractors. H.R. 2983 would have eliminated the civil penalty exemption for future contracts by the seven listed non-profit contractors and DOE's authority to automatically remit penalties imposed on all non-profit educational institutions serving as contractors. However, the bill would have limited the civil penalties against a non-profit contractor to the amount of discretionary fees (incentive fees above actual cost reimbursement) awarded by DOE under that contract. The Senate's Price-Anderson extension in H.R. 4 included similar provisions.

The House-Senate conference committee on H.R. 4 approved a compromise Price-Anderson subtitle September 12, 2002. The compromise version would have extended Price-Anderson indemnification authority for both NRC and DOE for 15 years, through August 1, 2017. The total retrospective premium per reactor would have been set at $94 million, divided into annual payments of no more than $15 million (with both limits to be adjusted for inflation every 5 years). The liability limit for DOE contractors would have been set at $10 billion, adjusted for inflation every 5 years. Modular reactors of 100-300 megawatts would have been treated as a single reactor under Price-Anderson, up to a limit of 1,300 megawatts. The civil penalty exemption for nonprofit contractors would have been replaced with a nonprofit penalty limit. However, the 107th Congress adjourned without completing action on the measure.

In the 108th Congress, a 15-year extension of Price-Anderson authority was included in the Senate-passed version of H.J.Res. 2, the omnibus appropriations bill (printed in the Congressional Record on January 28, 2003, page S1639). The Senate-passed language is identical to the Price-Anderson extension worked out by the conferees on H.R. 4. Representative Heather Wilson introduced a Price-Anderson extension bill (H.R. 330) January 8, 2003, that also includes all the provisions of the H.R. 4 Price-Anderson conference agreement. A 10-year extension of Price-Anderson coverage for new commercial reactors (S. 156) was introduced January 14, 2003, by Senator Voinovich.

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. However, opponents contend that Price-Anderson subsidizes the nuclear power industry by protecting it from some of the financial consequences of the most severe conceivable accidents.

Without an extension of the law, any commercial nuclear reactor licensed after August 1, 2002, could not be covered by the Price-Anderson system, although coverage would continue for existing reactors. Because no new U.S. reactors are currently planned, missing the deadline for extension would have little short-term effect on the nuclear power industry. However, any new DOE contracts signed during Price-Anderson expiration would have to use alternate indemnification authority. To prevent that problem, the National Defense

Authorization Act for FY2003 (P.L. 107-314), signed December 2, 2002, extends Price-Anderson coverage for DOE contractors through December 31, 2004.

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 tons of highly radioactive spent nuclear fuel and 50-200 cubic meters of low-level radioactive waste. Upon decommissioning, contaminated reactor components are also disposed of as low-level waste.

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, while states have the authority to develop disposal facilities for commercial low-level waste. 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.

The Nuclear Waste Policy Act of 1982 (NWPA, P.L. 97-425) as amended, names Nevada's Yucca Mountain as the sole candidate site for a national geologic repository. Following the recommendation of Energy Secretary Abraham, President Bush on February 15, 2002, recommended to Congress that DOE submit an application to NRC to construct the Yucca Mountain repository. As allowed by NWPA, Nevada Governor Guinn submitted a "notice of disapproval" (or "state veto") to Congress April 8, 2002. The state veto would have blocked repository construction at Yucca Mountain if a congressional resolution approving the site had not been enacted within 90 days of continuous session. The House passed a Yucca Mountain approval resolution (H.J.Res. 87) on May 8, 2002, by a 306-117 vote. The Senate approved the resolution by voice vote July 9 (following a 60-39 vote to consider S.J.Res. 34, the Senate version of the resolution), and the President signed it July 24 (P.L. 107-200).

The Bush Administration is seeking $524.7 million for the DOE civilian waste disposal program for FY2003, a 40% boost over FY2002. The increased budget is intended to pay for preparation of a Yucca Mountain repository construction permit application, which DOE expects to submit to NRC in FY2004. The additional funds are also needed for detailed repository design work, repository performance studies, and transportation planning, according to DOE. The House Appropriations subcommittee recommended the full request, but the Senate Appropriations Committee voted to cut the request by $188 million. Without a final FY2003 appropriation, the waste program is operating under a short-term continuing resolution. As passed by the Senate, H.J.Res. 2 would fund the program at the level approved last year by the Senate panel.

(For further details, see CRS Issue Brief IB92059, *Civilian Nuclear Waste Disposal*.)

Federal Funding for Nuclear Energy Programs

The following tables summarize current funding for DOE nuclear fission programs and uranium activities, and for the 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 FY2003 funding request to Congress February 4, 2002. The House Appropriations Committee marked up its FY2003 funding bill September 5, 2002 (H.R. 5431, H.Rept. 107-681). The Senate Appropriations Committee marked up its FY2003 Energy and Water Development appropriations bill July 24, 2002 (S. 2784, S.Rept. 107-220). Because final action was not taken, these programs are currently under a short-term continuing resolution. Funding in the Senate-passed H.J.Res. 2 is the same as the Senate committee level.

Table 1. Funding for the Nuclear Regulatory Commission

(budget authority* in millions of current dollars)

	FY2001 Approp.	FY2002 Approp.	FY2003 Request	FY2003 House comm.	FY2003 Senate comm.
Nuclear Regulatory Commission					
Reactor Safety	227.6	265.5	286.0	–**	--
Nuclear Materials Safety	53.1	63.4	64.2	--	--
Nuclear Waste Safety	64.1	71.6	71.9	--	--
International Nuclear Safety	5.1	5.3	5.4	--	--
Management and Support	149.7	166.2	171.0	--	--
Inspector General	5.8	6.2	6.8	6.8	6.8
(Nuclear Plant Security)		(36.0*)	(29.3)	--	--
TOTAL NRC BUDGET AUTHORITY	**505.5**	**559.1**	**585.0**	**585.0**	**585.0**
Offsetting fees	**453.2**	**479.4**	**498.9**	**526.5**	**526.5**
Net appropriation	**52.3**	**79.8**	**86.0**	**58.5**	**58.5**

* Additional $36 million for nuclear plant security provided by FY2002 supplemental appropriations included in FY2002 Defense Appropriations Bill (P.L. 107-117), approved by Congress December 20, 2001. The FY2002 supplemental security funding is not to be offset by fees. The security funding is included in the other NRC programs, so it should not be added to the NRC total as a separate funding category. FY2003 request subcategories do not add because they include an Administration proposal for full agency funding of federal retiree costs that was subsequently withdrawn.

** Subcategories not specified.

Table 2. DOE Funding for Nuclear Activities
(budget authority in millions of current dollars)

	FY2001 Approp.	FY2002 Approp.	FY2003 Request	FY2003 House comm.	FY2003 Senate comm.
Nuclear Energy (selected programs)					
Program Direction	22.0	23.0	23.4	23.4	23.4
University Reactor Assistance	12.0	17.5	17.5	17.5	19.5
Nuclear Energy Plant Optimization	5.0	7.0	0	5.0	5.0
Nuclear Energy Research Initiative	35.0	32.0	25.0	25.0	29.0
Nuclear Energy Technologies	7.5	12.0	46.5	41.5	48.5
Spent Fuel Processing	–	–	18.2	18.2	77.9
International Nuclear Safety*	20.5	21.1	14.6	11.6	14.6
Total, Nuclear Energy	259.9	250.5	249.8	213.7	324.1
Uranium Facilities Maintenance and Remediation	422.5	418.4	382.2	382.2	471.2
Nuclear Waste Activities					
Defense Environmental Management	6,122.2	6,489.2	6,593.8	6,893.4	6,690.3
Non-defense Environmental Manag.	288.8	236.4	166.0	213.3	176.0
Nuclear Waste Fund Activities**	390.4	375.0	524.7	524.7	336.0

* Funded under "Defense Nuclear Nonproliferation."
** Funded by a 1-mill-per-kilowatt-hour fee on nuclear power, plus appropriations for defense waste disposal.

LEGISLATION

H.R. 238 (Boehlert)

Energy Research, Development, Demonstration, and Commercial Application Act of 2003. Authorizes appropriations for nuclear energy research programs. Introduced January 8, 2003; referred to Committee on Science and Committee on Resources.

H.R. 330 (H. Wilson)

Price-Anderson Amendments Act of 2003. Extends Price-Anderson Act nuclear accident liability system for 15 years and increases liability limits. Introduced January 8, 2003; referred to Committee on Energy and Commerce.

S. 6 (Daschle)

Comprehensive Homeland Security Act of 2003. Includes provisions from S. 131 on nuclear facility security. Introduced January 7, 2003; referred to Committee on Judiciary.

S. 131 (Reid)

Nuclear Security Act of 2003. Requires the federal government to study a wide variety of security threats to nuclear facilities and determine which threats would come from enemies of the United States and therefore be the responsibility of the federal government and which threats should be guarded against by nuclear power plant owners. NRC would be

required to review the security and emergency response plans at all nuclear power plants and other major nuclear facilities. An NRC employee is to be stationed at each nuclear facility as a "federal security coordinator." Introduced January 9, 3003; referred to Committee on Environment and Public Works.