Corporate Context for
Energy Resources (ER) Programs

This section on Corporate Context that is included for the first time in the Department's budget is provided to facilitate the integration of the FY 2003 budget and performance measures. The Department's Strategic Plan published in September 2000 is no longer relevant since it does not reflect the priorities laid out in President Bush's Management Agenda, the 2001 National Energy Policy, OMB's R&D project investment criteria or the new policies that will be developed to address an ever evolving and challenging terrorism threat. The Department has initiated the development of a new Strategic Plan due for publication in September 2002, however, that process is just beginning. To maintain continuity of our approach that links program strategic performance goals and annual targets to higher level Departmental goals and Strategic Objectives, the Department has developed a revised set of Strategic Objectives in the structure of the September 2000 Strategic Plan.

Energy is the vital force powering business, manufacturing, and movement of goods and services throughout the country. The United States spends over one-half trillion dollars annually for energy, and our economic well-being depends on reliable, affordable supplies of clean energy.

The Energy Resources goal establishes the overarching purpose of the Department's energy programs. Focus of three of the Department's program offices is on energy technology R&D: Office of Fossil Energy (FE), Office of Nuclear Energy, Science and Technology (NE), and the Office of Energy Efficiency and Renewable Energy (EE). In addition to energy technology R&D the Department's Energy Information Administration (EIA) develops and publishes energy statistics and forecasts and the Department also delivers Federal hydroelectric power to consumers though the Power Marketing Administrations (PMAs).

Energy Resources (ER) Goal

Increase global energy security, maintain energy affordability and reduce adverse environmental impacts associated with energy production, distribution, and use by developing and promoting advanced energy technologies, policies and practices that efficiently increase domestic energy supply, diversity, productivity, and reliability.

Strategic Objectives

The Energy Resources business line goal is supported by the following strategic objectives. Offices requesting funding to achieve these objectives are identified with each objective:

ER1: Use public-private partnerships to promote energy efficiency and productivity technologies in order to enhance the energy choices and quality of life of Americans in 2020 relative to 2000

by: reducing the oil intensity of the U.S. economy by 25 percent (compared to 23 percent without EE programs); reducing energy intensity in the U.S. economy by 32 percent (compared to 28 percent without EE programs); and, reducing the need for additional electricity generating capacity by 10 percent (compared to the case without EE programs). (EE)

ER2: Use public private partnerships to bring cleaner, more reliable, and more affordable energy technologies to the marketplace, enhancing the energy choices and quality of life of Americans in 2020 relative to 2000 by: increasing the share of renewable energy to 10% (compared to 8 percent without EE programs); increasing the share of renewable-generated electricity to 12 percent (compared to 8 percent without EE programs); and, doubling the share of capacity additions accounted for by distributed power, which increases distributed generation to 11% of all electricity generation (compared to 8% without EE programs). (EE)

ER3: Reduce the burden of energy prices on low-income families by working with state and local agencies to weatherize at least 123,000 homes per year from 2003 through 2005. (EE)

ER4: Create public-private partnerships to provide technology to ensure continued electricity production from the extensive U.S. fossil fuel resource, including control technologies to permit reasonable-cost compliance with emerging regulations, and ultimately, by 2015, zero emission plants (including carbon) that are fuel-flexible, and capable of multi-product output and efficiencies over 60% with coal and 75% with natural gas. (FE)

ER5: By 2010, add over 1 million barrels a day of domestic oil production and almost 2 TCF per year of additional gas production as a result of technologies and practices from DOE supported research and development. (FE)

ER6: Maintain the Strategic Petroleum Reserve in a state of readiness to supply oil at sustained rate of 4.2 million barrels per day for 90 days within 15 days notice by the President. (FE)

ER7: Expand the capability of nuclear energy to contribute to the Nation's near and long-term energy needs by investing in our Nation's nuclear R&D infrastructure and promoting advanced research, such that by December 2004: the average capacity of existing U.S. nuclear power plants will increase from 90 to 92 percent; a new nuclear power plant construction project will be initiated in the United States; and a conceptual design will be developed for a nuclear energy system that addresses the technology issues hindering the worldwide expansion of nuclear power. (NE)

ER8: Provide national and international energy data, analysis, information and forecasts to meet the needs of the energy decision-makers and the public in order to promote sound policymaking, efficient energy markets and public understanding. (EIA)

ER9: Ensure Federal hydropower is marketed and delivered while passing the North American Electric Reliability Council's Control Compliance Ratings, meeting planned repayment targets, and achieving a recordable accident frequency rate at or below our safety performance standard. (PMA)

Budget Summary table

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Comparable Appropriation	FY 2003 Request
Office of Energy Efficiency and Renewable Energy (EE) Programs			
$ Energy Conservation excluding weatherization (272) ER1	$657,178	$685,470	$627,204
$ Renewable Energy Resources (271) ER2	370,453	386,406	407,720
$ Energy Conservation - Weatherization (272) ER3	152,664	230,000	277,100
Total EE	**1,180,295**	**1,301,876**	**1,312,024**
Office of Fossil Energy (FE) Programs			
$ Fossil Energy Research and Development (271), Clean Coal Technology (271), and Alternative Fuels (271) ER4 and ER5	545,982	627,626	534,155
$ Naval Petroleum and Oil Share Reserves (271), Elk Hill School Lands Fund (271), and Strategic Petroleum Reserve (274) ER6	187,312	233,525	281,823
Total FE	**733,294**	**861,151**	**811,509**
Nuclear Energy, Science and Technology (NE) Programs			
Office of			
$ Nuclear Energy Programs (271) ER7	277,105	293,928	250,659
Total NE	**277,105**	**293,928**	**250,659**
Environmental Information Administration (EIA)			
$ National Energy Information System (276) ER8	78,154	81,199	82,801
Total EIA	**78,154**	**81,199**	**82,801**
Power Marketing Administrations (PMA)			
$ Power Marketing Administrations (271) ER9	208,856	214,962	204,750
Total PMA	**208,856**	**214,962**	**204,750**
Total ER	**1,477,704**	**2,753,116**	**2,666,212**

Office of Nuclear Energy, Science and Technology

Executive Budget Summary

Mission

The Office of Nuclear Energy, Science and Technology (NE) is responsible for leading the Federal government's investment in nuclear science and technology. Our mission is to support innovative applications of nuclear technology that will benefit society. To develop these applications and reap their attendant benefits, Federal and private investments must not simply be made in response to the issues of the day, but to those that are most likely to emerge within the next 10 to 20 years. NE plays a key role in carrying out the President's *National Energy Policy* issued in May 2001. The Policy states:

> "Nuclear energy accounts for 20 percent of all U.S. electricity generation, and more than 40 percent of the electricity generated in ten states in the Northeast, the South, and the Midwest. Despite the closure of several less efficient plants during the 1990s, the 103 U.S. nuclear energy plants currently operating produce more electricity today than at any time in history. Since the 1980s, the performance of nuclear energy plant operations has substantially improved. While U.S. nuclear energy plants once generated electricity only around 70 percent of the time, the average plant today is generating electricity close to 90 percent. This improved performance has lowered the cost of nuclear generation, which is now competitive with other sources of electricity. There is potential for even greater generation from existing nuclear energy plants. Experts estimate that 2,000 MW could be added from existing nuclear power plants by increasing operating performance to 92 percent. In addition, about 12,000 MW of additional nuclear electricity generation could be derived from uprating U.S. nuclear power plants, a process that uses new technologies and methods to increase rated power levels without decreasing safety. However, modifications to uprate plants can be expensive and require extensive licensing review and approval by the Nuclear Regulatory Commission (NRC). Advanced reactor technology promises to improve nuclear safety. One example of an advanced reactor design is the gas-cooled, pebble-bed reactor, which has inherent safety features."

The Nation's use of and need for nuclear technologies will increase in the coming years. Nuclear energy is the only expandable, large-scale electricity source that avoids air emissions and meets the energy demands of a growing, modern economy. Nuclear energy produces electricity without emitting carbon dioxide or harmful pollutants such as sulfur oxides and nitrogen oxides. The opening to competition of energy markets in the United States and Europe and the growth of energy markets in Asia and developing countries have created major new business opportunities for the U.S. nuclear industry and employment opportunities for American workers.

Nuclear energy presents our most promising solutions to the world's long-term energy challenges. Harnessing nuclear energy to generate electricity to drive our twenty-first century economy, to produce

vast quantities of economical hydrogen for transportation use without emitting greenhouse gases, to produce heat and clean water to support growing industry and populations all over the world is a potential we ignore at the risk of a sustainable future. At the same time, nuclear energy presents issues that must be addressed--some through excellence in its use, but many others such as nuclear waste and economics--through advances in technology. Fully realizing nuclear energy's potential requires investment in long-term research to address the issues hindering its worldwide expansion. Much of the research at issue is far beyond the province of private industry; thus the role of government in establishing a long-term future for nuclear power is clear.

The near-term presents what is in many ways a more complex challenge. The strategy to provide for a long-term role for nuclear power stands on two essential pillars. First, currently operating nuclear power plants must be successful. This has been achieved. Due to the significant improvements ushered by industry in its efficient and safe operation of U.S. nuclear power plants over the last decade--and to important technologies developed through government-industry cooperation--this Nation's nuclear plants are generating more energy now than they have as a group at any time in history. They are among the most reliable and cost-effective electric generating assets on the grid and should be expected to remain so well into the century.

The second pillar has not yet been established; despite the increased prospects for nuclear power in this country, no new plants have been ordered for decades. There appear to be two key reasons for this: one is economics; with fossil fuels presenting an energy option that is inexpensive and easy to operate, the private sector has not yet established a business case to build a new nuclear power plant in the United States.

The other reason is uncertainty regarding how untested Nuclear Regulatory Commission processes will be implemented. New licensing procedures established to ease the identification of acceptable sites, provide for "one-step" licensing, and verify construction quality have never been used and industry is as yet hesitant to risk millions if not billions of dollars to experiment.

There is a limited role for the government in dealing with these near-term issues. To make a business case for building new plants, industry must continue to refine its designs and plans. Beyond this, there is some interest in technologies and designs not currently available to the U.S. market and the Department is planning activities to bring these technologies to the fore. To prove the untested processes, the Department plans to provide limited support for companies willing to demonstrate these regulatory structures.

In all its activities, the Department obtains advice on the direction of nuclear energy R&D programs from the independent Nuclear Energy Research Advisory Committee (NERAC). NERAC, a formal Federal advisory committee, provides expert advice on long-range plans, priorities, and strategies for the nuclear technology R&D and research infrastructure activities of the Office of Nuclear Energy, Science and Technology (NE). NERAC has several very active subcommittees examining various aspects of nuclear technology R&D. Reports issued by these subcommittees that address the future of nuclear energy include the *Long-Term Nuclear Technology Research and Development Plan, Nuclear Science and Technology Infrastructure Roadmap,* and *A Roadmap to Deploy New Nuclear Power Plants in the*

United States by 2010. NERAC is also providing expert advice to help guide development of the Generation IV Technology Roadmap. In addition, NERAC provides recommendations regarding government-industry cooperative research in support of the Nation's 103 operating nuclear power plants.

The *Long-Term Nuclear Technology Research and Development Plan*, developed by NERAC with significant input from the wider research community, recommends that R&D budget levels be increased to enable the Nation to realize further value from our currently operating nuclear plants; provide for economic technologies and approaches to build advanced nuclear power plants in the United States; complete a design for a Generation IV nuclear energy system; and support a range of nuclear energy related missions within the Department.

The *Nuclear Science and Technology Infrastructure Roadmap* evaluates the Department's ability to support the most likely R&D needs for the next 20 years. The roadmap is focused on reactors, hot cells and accelerators used to produce isotopes, irradiate materials, and to conduct experiments and examinations required to support our national missions in space exploration, national security, nuclear energy, medical isotopes, and general nuclear science. The roadmap matches the capabilities of each facility to one or more R&D requirements. The Roadmap concludes that although we are meeting most of our current needs with existing facilities, the Department must add significant new generation capacity if it is to meet expected infrastructure demands over the next decade.

A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010 provides a detailed assessment of the technical and institutional actions which must be taken by industry and government to enable the deployment of new, advanced nuclear power plants in the United States by 2010. The near-term deployment roadmap recommends the cost-shared demonstration of the federal regulatory processes for designing, siting, and operating new nuclear power plants.

Strategic Objective

ER7: Expand the capability of nuclear energy to contribute to the Nation's near and long-term energy needs by investing in our Nation's nuclear R&D infrastructure and promoting advanced research, such that by December 2004: the average capacity of existing U.S. nuclear power plants will increase from 90 to 92 percent; a new nuclear power plant construction project will be initiated in the United States; and a conceptual design will be developed for a nuclear energy system that addresses the technology issues hindering the worldwide expansion of nuclear power.

This strategic objective is supported by the Program Strategic Performance Goals that follow:

ER7-1: Effectively address the key issues--economics, proliferation, and waste management--affecting the future use of nuclear energy by conducting long-term, investigator-initiated, peer-reviewed research and development.

ER7-2: Resolve critical issues related to long-term plant aging, and develop advanced technologies to improve plant reliability, availability, and productivity to ensure that current plants can continue to operate up to and beyond their initial license period.

ER7-3: Successfully address the regulatory, technical, and institutional issues to enable one or more orders for new, commercial nuclear power plants in the United States by 2005 for deployment by 2010.

ER7-4: Develop, in close cooperation with the international community and industry, next-generation nuclear energy systems which represent significant improvements in all aspects of nuclear power technology.

ER7-5: Support advanced medical research in order to develop an isotope-based treatment to address all forms of cancer by the end of the decade.

ER7-6: Enable United States universities to continue to produce highly trained nuclear engineers and scientists to supply the Nation's energy, environmental, health care, and national security needs.

ER7-7: Develop and demonstrate an advanced, proliferation-resistant technology to reduce the quantity and toxicity of U.S. commercial spent nuclear fuel while simultaneously enabling the U.S. to vastly increase the efficient use of its nuclear fuel resources.

ER7-8: Protecting our Nation's nuclear R&D infrastructure by managing the Department's vital resources and capabilities, efficiently and effectively such that by December 2004: major research/critical facilities will continue to be operational and available for fulfillment of long-term missions as funded by industry and other Federal agencies while unneeded facilities are deactivated in a safe and cost-effective manner.

ER7-9: Deliver isotope products and services for commercial, medical, and research applications where there is no private sector capability or sufficient capacity does not exist to meet United States needs.

Strategy

In accomplishing its program mission, the Office of Nuclear Energy, Science and Technology will engage research institutions in industry, U.S. universities, national laboratories, international organizations, and other countries in cooperative and collaborative efforts. The major program elements that contribute to the mission are: University Reactor Fuel Assistance and Support, Nuclear Energy Research Initiative, Nuclear Energy Technologies, Fast Flux Test Facility, Radiological Facilities Management, Program Direction, and Spent Fuel Pyroprocessing and Transmutation. Program accomplishments that will enable NE to achieve its mission are identified in the detailed program budget submissions.

While the Department continues to support the objectives of the Nuclear Energy Plant Optimization program, no funds are being requested in FY 2003. Also, the Advanced Nuclear Medicine Initiative will no longer be pursued due to change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.

Funding Summary

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Original Appropriation	FY 2002 Adjustments	FY 2002 Comparable Appropriation	FY 2003 Request
Energy Supply					
University Reactor Fuel Assistance and Support	11,974	17,500	0	17,500	17,500
Nuclear Energy Plant Optimization	4,857	7,000	-500	6,500	0
Nuclear Energy Research Initiative	33,903	32,000	0	32,000	25,000
Nuclear Energy Technologies	7,483	12,000	0	12,000	46,500
Advanced Nuclear Medicine Initiative	2,500	2,500	0	2,500	0
Fast Flux Test Facility	38,439	38,439	-2,000	36,439	36,100
Radiological Facilities Management	88,284	87,767	-1,085	86,682	83,038
Program Direction	23,839	23,875	0	23,875	24,300
Spent Fuel Pyroprocessing & Transmutation	68,698	80,250	-3,000	77,250	18,221
Use of Prior Year	-520	0	-818	-818	0
Offset from Revenue	-2,352	0	0	0	0
Total, Energy Supply	277,105	301,331	-7,403	293,928	250,659
Total, NE	277,105	301,331	-7,403	293,928	250,659

Major Changes

The Department is consolidating the former Nuclear Facilities Management and Advanced Accelerator Applications programs into a new account titled Spent Fuel Pyroprocessing and Transmutation (SFP/T) program. This program requires the use of the unique facilities and expertise currently being conducted at the Department's laboratories, and U.S. universities. In FY 2002, the electrometallurgical treatment of sodium-bonded spent fuel is being pursued under the Nuclear Facilities Management program, and will continue in FY 2003 under the Spent Fuel Pyroprocessing and Transmutation program. In FY 2002 the Advanced Accelerator Applications (AAA) program, specifically, the development of advanced transmutation, advanced pyroprocessing technologies, and the transmutation science and technology education activities are being funded. In FY 2003, the budget proposes to terminate these AAA activities.

Another major change in FY 2003 includes the restructuring of NE's budget to include all of the infrastructure activities in a single program. Facilities and infrastructure activities previously funded in the Advanced Radioisotope Power Systems, Medical Isotope, ANL-W Operations, and the Test Reactor Area (TRA) Landlord programs have been incorporated into one account, the Radiological Facilities Management. This will more accurately reflect the activities being performed at NE-managed sites and facilities. The mission of this program is to maintain critical facilities in a safe, secure, environmentally compliant and cost-effective manner to support national priorities as funded by industry and other federal agencies. The Radiological Facilities Management program funds the Department's vital resources and capabilities at NE-managed facilities at Argonne National Laboratory-W (ANL-W), Idaho National Engineering and Environmental Laboratory (INEEL), Oak Ridge National Laboratory (ORNL), Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), Brookhaven National Laboratory (BNL), Pacific Northwest National Laboratory (PNNL), and the Mound, Ohio Plant. While these funds assure the readiness and operability of various NE-managed facilities, operations, production, research, and other additional activities are funded by DOE, industrial, research, and other Federal agency users.

In addition, starting in FY 2003**,** the Department plans to apply a more formal, peer-review structure to the process it applies to the production and distribution of research isotopes. This new process is called the Nuclear Energy Protocol for Research Isotopes (NEPRI). Under this protocol, the Department will apply an open, public process to determine (with comments from the Isotope Review Advisory Panel) and announce each year which research isotopes it will produce in a given year. Once a list of isotopes has been selected for production, customers must provide the Department advance cash payment to cover production costs. Each isotope will be priced such that its cost of production is paid by the customer for that isotope-no DOE funds will be expended on the development or production of medical, research, or industrial isotopes.

Major Issues

The Department's Office of Nuclear Energy, Science and Technology (NE) is responsible for the development of advanced nuclear power system technology, providing technology solutions to the spent fuel challenge, and maintaining a viable U.S. nuclear technology infrastructure. This is a highly

technical mission that requires staff with expertise in a broad range of highly specialized engineering (nuclear, materials, electrical, chemical, *etc.*) and scientific (physics, health physics, metallurgy, chemistry, *etc*.) disciplines. The *National Energy Policy* (NEP) embraces an expanded role for nuclear power. NE is one of the most programmatically diverse organizations in the Department and NE is faced with critical human capital challenges to pursue the technologies and programs recommended by the NEP. NE's recruiting strategy emphasizes the hiring of entry-level engineering and scientific staff to ensure continuation of an experienced, diverse technical workforce in the future. The average age of NE employees is 49, and there are many employees who will soon be eligible to retire. Over forty-five percent of the current organization is eligible to retire within just a few years. This situation presents a major challenge to the Federal nuclear energy research program.

In addition to its staff, the Department's nuclear research infrastructure is aging. The Department is the fortunate inheritor of one of the world's most comprehensive research infrastructures--most of which was constructed in the 1950s and 1960s. It is imperative that it is effectively maintained. NE has made it one it its most important priorities to make the investments and expend the management attention necessary to preserve our irreplaceable nuclear research infrastructure. Guided by invaluable input such as the NERAC *Nuclear Science and Technology Infrastructure Roadmap*, we will seek efficient ways to preserve our infrastructure and make appropriate investments to enhance it before passing it on to future generations.

William D. Magwood, IV
Director, Office of Nuclear Energy, Science and Technology

Date

University Reactor Fuel Assistance and Support

Program Mission

To retain the capability in the U.S. to conduct research, address pressing environmental challenges, and preserve the nuclear energy option, DOE must work with U.S. university nuclear engineering programs to maintain the education and training infrastructure necessary to develop the next generation of nuclear scientists and engineers. The University Reactor Fuel Assistance and Support program provides funding for U.S. university nuclear engineering programs and university research reactors, which play a critical role in providing this education and training. While the number of nuclear engineering programs and research reactors in the United States declined precipitously during the 1980s and 1990s, the Nation's need for nuclear engineers and nuclear trained personnel is now on the rise due to the excellent job market, the lack of large numbers of recent nuclear engineering graduates, and the increasing number of retirements in the nuclear field. Demand for nuclear engineers now exceeds supply.

This program supports the *National Energy Policy* objective to expand nuclear energy in the United States by preserving the education and training infrastructure at universities to develop the next generation of nuclear scientists and engineers. It also provides for the continued operation of the Nation's university research reactors which play a vital role in supporting nuclear education and training.

The independent Nuclear Energy Research Advisory Committee (NERAC) was established in October 1999 to provide expert advice and guidance on the Department's nuclear programs. Within NERAC, a *Blue Ribbon Panel* was convened and charged with considering the future of the U.S. nuclear education infrastructure, with particular focus on the future of the U.S. university research reactors and the relationship between universities and the national laboratories in the conduct of nuclear engineering research. In May 2000, the panel, with representatives from universities, national laboratories and government, presented its final report to NERAC. The Blue Ribbon Panel report, *The Future Direction of University Nuclear Engineering Programs*, recognized that the ability to advance nuclear innovation in the future is not only tied to research but to the health of the Nation's education and scientific research infrastructure. Without a continued supply of new graduates trained in the nuclear sciences, the Nation will not realize the full benefits associated with the many applications of nuclear technology.

In addition, the Blue Ribbon Panel recommended several initiatives to strengthen nuclear engineering education including increasing the number of doctoral and masters students receiving financial assistance; assisting universities in recruiting and training faculty through junior faculty research grants; expanding research in nuclear science and; better supporting our university research reactors through the existing upgrade program; and establishing a new competitive program for more costly equipment upgrades.

Several studies have been completed in an attempt to ascertain the current status and future outlook for nuclear engineering education in the U.S. and recommend initiatives to strengthen this vital sector of the university education curriculum. The Organization of Economic Cooperation and Development/Nuclear Energy Agency conducted a review of nuclear engineering education in its member countries and the Nuclear Energy Department Heads Organization surveyed U.S. industry and universities concerning

manpower requirements (www.engin.umich.edu/~nuclear/NEDHO/). The conclusion of these two studies was that the enrollment trends of the 1990's were not encouraging and more students need to be educated in nuclear engineering to provide the manpower required today and in the future. A third study by an expert panel appointed by NERAC recommended major increases in funding to maintain the nuclear engineering infrastructure in the United States (www.nuclear.gov). This three-person panel of experts from NERAC collected and assessed information on all university reactors including their research and training capabilities and operating costs. In April 2001, NERAC recommended that the Department provide support to keep essential reactor facilities in operation. This recommendation was supported by both Houses of Congress during the FY 2002 budget process. These studies form the basis for the FY 2003 budget request for University Reactor Fuel Assistance and Support.

Over the last several years our initiatives in support of students, faculty and facilities have yielded positive results. Undergraduate enrollments in nuclear engineering, declining for two decades, have stabilized and slowly increased at many schools due to the availability of more student scholarships, research funding, faculty support and greater funding support by the private sector resulting from our Matching Grant program. Minority participation and support has increased dramatically with our program pairing nuclear engineering schools with a minority institution enabling students from the minority university to gain degrees in both nuclear engineering and their chosen technical field.

Other areas have not fared as well. University research reactors and facilities are under constant pressure to shutdown if funding and usage problems are not addressed immediately. This development has far reaching and very damaging implications for research in the United States. For example, the Nuclear Regulatory Commission announced that it would be forced to seek access to overseas research facilities to continue vital nuclear related research if the University of Michigan reactor were to close. Also, Cornell University has decided to decommission its research reactor so that the site can be used for other purposes. The University of Michigan will initiate decommissioning of its reactor if they do not receive non-university funding to help offset the expense of maintaining the reactor. To address these and other problems, a new initiative entitled Innovations in Nuclear Infrastructure and Education will begin in FY 2002 to assist universities through the development of strategic partnerships with other universities, research centers, national laboratories, and industry.

Program Strategic Performance Goal

ER7-6 Enable United States universities to continue to produce highly trained nuclear engineers and scientists to supply the Nation's energy, environmental, health care, and national security needs.

Performance Indicator: Increased undergraduate and graduate enrollments in nuclear engineering.

Performance Standards
Blue = Substantial growth in nuclear engineering enrollments.
Green = Modest growth in nuclear engineering enrollments.
Yellow = Nuclear engineering enrollments remain stable.
Red = Slight decline in nuclear engineering enrollments.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
Support U.S. universities' nuclear energy research and education capabilities by: – Providing fresh fuel to all university reactors requiring this service; – Funding at least 23 universities with research reactors for reactor upgrades and improvements; – Partnering with private companies to fund 18 or more DOE/Industry Matching Grants Program for universities; – Continue to support Reactor Sharing enabling each of the 29 schools eligible for the program to improve the use of their reactors for teaching, training, and education within the surrounding community.*(ER2-8)* (MET GOAL)	Support U.S. universities' nuclear energy research and education capabilities by: – Providing fresh fuel to all university reactors requiring this service. – Funding approximately 23 universities with research reactors for reactor upgrades and improvements. – Partnering with private companies to fund 25 or more DOE/Industry Matching Grants for universities. – Providing funding for Reactor Sharing with the goal of enabling each of the 28 schools eligible for the program to improve the use of their reactors for teaching, training, and education. – Award 2 or more Innovations in Nuclear Infrastructure and Education awards.*(ER7-6)*	Support U.S. universities' nuclear energy research and education capabilities by: – Providing fresh fuel to all university reactors requiring this service. – Funding approximately 23 universities with research reactors for reactor upgrades and improvements. – Partnering with private companies to fund 25 or more DOE/Industry Matching Grants for universities. – Providing funding for Reactor Sharing with the goal of enabling each of the 28 schools eligible for the program to improve the use of their reactors for teaching, training, and education. – Continue Innovations in Nuclear Infrastructure and Education awards from FY 2002.*(ER7-6)*
Attract outstanding U.S. students to pursue nuclear engineering degrees by: – Providing 24 fellowships; – Increasing the number of Nuclear Engineering Education Research Grants to approximately 50 existing and new grants; – Providing scholarships to approximately 50 sophomore, junior and senior nuclear engineering and science scholarship recipients including the partnering of minority institutions with nuclear engineering schools to allow these students to achieve a degree in their chosen course of study and nuclear engineering.*(ER2-8)* (MET GOAL)	Attract outstanding U.S. students to pursue nuclear engineering degrees by: – Providing 24 graduate student fellowships with higher stipends. – Supporting 55 university Nuclear Engineering Education Research Grants to encourage creative and innovative thinking at U.S. universities. – Providing scholarships and summer on-the-job training to approximately 55 sophomore, junior and senior nuclear engineering and science scholarship recipients.*(ER7-6)*	Attract outstanding U.S. students to pursue nuclear engineering degrees by: – Providing 24 graduate student fellowships with higher stipends. – Supporting 55 university Nuclear Engineering Education Research Grants to encourage creative and innovative thinking at U.S. universities. – Providing scholarships and summer on-the-job training to approximately 55 sophomore, junior and senior nuclear engineering and science scholarship recipients.*(ER7-6)*

Significant Accomplishments and Program Shifts

- In FY 2003, funding remains level for the University Reactor Fuel Assistance and Support Program. The funding will provide support to the Nation's universities' nuclear and scientific programs to assure the future availability of trained nuclear engineers and scientists to meet the Nation's growing needs in the nuclear field.

Funding Profile

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Original Appropriation	FY 2002 Adjustments	FY 2002 Comparable Appropriation	FY 2003 Request
University Reactor Fuel Assistance and Support	11,974	17,500	0	17,500	17,500
Total, University Reactor Fuel Assistance and Support	11,974	17,500	0	17,500	17,500

Funding by Site

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Chicago Operations Office					
Argonne National Laboratory	170	270	270	0	0
Total, Chicago Operations Office	170	270	270	0	0
Idaho Operations Office					
Idaho Operations Office	8,673	14,100	14,100	0	0
Idaho National Engineering and Environmental Laboratory	2,786	2,800	2,800	0	0
Total, Idaho Operations Office	11,459	16,900	16,900	0	0
Savannah River Site	340	300	300	0	0
Oak Ridge National Laboratory	0	30	30	0	0
Washington Headquarters	5	0	0	0	0
All Other Sites	0	0	0	0	0
Total, University Reactor Fuel Assistance and Support	11,974	17,500	17,500	0	0

Site Descriptions

Argonne National Laboratory

Argonne National Laboratory (ANL) is one of the U.S. Department of Energy's scientific research laboratories and was the Nation's first national laboratory, chartered in 1946. ANL is located at two sites. The Illinois site, ANL-East, is the main laboratory and occupies 1500 acres, surrounded by a forest preserve about 25 miles southwest of the Chicago Loop. The Idaho site, ANL-West, is located within the boundary of the Idaho National Engineering and Environmental Laboratory (INEEL) in Southeastern Idaho, about 35 miles west of Idaho Falls.

In July 1999, the Department selected ANL and INEEL to serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories assist and work with the Department's Office of Nuclear Energy, Science and Technology to maintain and apply world class technical capabilities to assure that the Department is maximizing its investment in nuclear reactor technology research and development.

The International Student Exchange Program (ISEP) is conducted by ANL for the Office of Nuclear Energy, Science and Technology. This program provides for student exchanges between the United States and several other nations enabling nuclear engineering and science students the opportunity to work in another nation's national laboratories and increase their training opportunities. ANL also administers part of the university program summer internship program.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is an extensive research and engineering complex that has been at the center of some of the most advanced energy research in the world since 1949. In recent years, in addition to continued operation of complex nuclear and non-nuclear facilities, the INEEL has initiated technology development in applied environmental science and engineering.

In July 1999, the Department selected INEEL and ANL to serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories assist and work with the Department's Office of Nuclear Energy, Science and Technology to maintain and apply world class technical capabilities to assure that the Department is maximizing its investment in nuclear reactor technology research and development.

INEEL administers the University Reactor Fuel Assistance Program to provide fuel for university research reactors including fuel for conversions from high enriched uranium (HEU) to low enriched uranium (LEU), and to ship spent fuel from university reactors to DOE's Savannah River Site. INEEL also administers the peer-review of the Nuclear Engineering Education Research (NEER) program that provides competitive investigator-initiated, research grants to U.S. nuclear engineering schools; the university reactor upgrade program that provides funding for improvements and maintenance of the 28 university research reactors; and part of the university program summer internship program.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) is a U.S. Department of Energy scientific research laboratory located in Oak Ridge, Tennessee. ORNL administers part of the university programs summer internship program. ORNL also maintains the DOE computer code system, software, and documentation at the Radiation Safety Information Computational Center (RSICC) and serves as a repository for DOE computational research activities, including computer software that is developed by NERI and NEER research projects. The RSICC computer software is made available to nuclear engineering departments and NERI and NEER awardees.

All Other Sites

This description includes the activities funded at the various operations offices.

Included in the category is funding for the matching grants program that provides government/private sector matching funds for the nuclear engineering infrastructure at universities; reactor sharing that assists universities with reactors in sharing them with other universities, high schools, and others for training and experiments; nuclear engineering fellowships and scholarships for outstanding graduate and undergraduate students and minority/majority partnership scholarships, all of which are awarded through a peer-reviewed, competitive process. The peer review committees are composed of nuclear engineering professors representing a broad spectrum of nuclear engineering programs throughout the United States. These programs are administered by the South Carolina University Research and Education Foundation.

The Idaho Operations Office (ID) administers the NEER program that provides research grants to nuclear engineering schools and the university reactor upgrade program for reactor improvement and maintenance. The nuclear engineer training effort which supports nuclear engineering education recruitment activities in conjunction with a professional society is also administered by ID.

The Savannah River Operations Office administers the radiochemistry program for faculty support and student fellowships to help educate a new generation of radiochemists to address the technical challenges associated with radioactive wastes and contaminated sites.

University Reactor Fuel Assistance and Support

Mission Supporting Goals and Objectives

University nuclear engineering programs supply highly skilled workers to industry active in fields such as electricity generation, medical research and supply, environmental restoration, and national security, as well as to government agencies and national laboratories. To help ensure the continued viability of these programs, the Department provides assistance to university nuclear science and engineering and related programs. Assistance includes the DOE/Industry Matching Grants program, which leverages public sector funds with private contributions in a 50/50 cost share arrangement; the Nuclear Engineering Education Research program, which provides vital research funding to university nuclear technology programs; academic assistance to outstanding students and faculty through the Scholarships and Fellowships program with an added dimension supporting students at minority institutions in achieving nuclear engineering degrees at universities with a nuclear engineering department; and support of university research reactors.

University research reactors in the United States form a fundamental and key component of the national research and education infrastructure. Research conducted using these reactors is critical to many national priorities such as health care, materials science, and energy technology. Currently, there are 28 operating university research reactors at 26 campuses in 20 states. University reactors are the source of neutrons for research in such diverse areas as medical isotopes, human health, life sciences, environmental protection, advanced materials, lasers, energy conversion, and food irradiation. University research reactors directly support the development of highly qualified, technically knowledgeable personnel needed by national laboratories, private industry, the Federal government and academia, for basic and applied research critical to U.S. technological competitiveness. In addition, with the help of the Reactor Sharing program, many of the reactors serve as centers for education programs offered to other colleges and universities and high school students and teachers who visit the reactor for instructional programs and research.

The University Reactor Fuel Assistance and Support program funds the supply of fresh fuel to and return of spent fuel from university research reactors allowing universities to continue their important research and education activities. The Reactor Upgrade program provides funding for equipment instrumentation upgrades at the universities' research reactors, increasing their value as research tools, while the radiochemistry program supports students and faculty in the discipline of radiochemical science, which supports the nuclear energy infrastructure of the Nation. The Nuclear Engineering Education Support program prepares students for nuclear engineering and science careers and assists universities with special needs to improve their educational infrastructure including internships for students at DOE national laboratories. This program was initiated to address the knowledge gap of incoming college freshmen in the area of nuclear science and engineering.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
University Reactor Fuel Assistance and Support	11,974	17,500	17,500	0	0
Total, University Reactor Fuel Assistance and Support	11,974	17,500	17,500	0	0

Detailed Program Justification

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
University Reactor Fuel Assistance and Support	**11,974**	**17,500**	**17,500**
■ **University Nuclear Infrastructure (UNI)**	**4,049**	**8,000**	**8,000**

The UNI program provides new fuel for the universities; instrumentation, electronics, hardware, and software upgrades for the research reactors; and reactor sharing and research cooperation among educational institutions to facilitate the development of the Nation's next generation of nuclear scientists and engineers. A continued emphasis on research infrastructure support is needed to continue the successes made to date in the Nation's university nuclear engineering programs. The funding in FY 2003 will support the new Innovations in Nuclear Infrastructure and Education initiative to assist the universities in continuing the integration of academics and reactor research, enhancing the quality of the student education, and enabling the universities to better work directly with the Department's national laboratories and private industry in expanding the use of their facilities for research, education, and training of nuclear engineers and scientists through the establishment of regional research and training centers and strategic partnerships.

The UNI program will continue to supply fresh fuel to and ship spent fuel from university reactors requiring these services in FY 2003. In FY 2003, the program will provide fuel elements for the reactors at the Massachusetts Institute of Technology, Kansas State University, and the Universities of Missouri, Michigan, California, and Utah. In addition, the program will continue to provide grants permitting universities without research reactors to have access to university reactors for training, education, and research purposes. In FY 2001, 23 grants were made. In FY 2002 and FY 2003 the number of grants is expected to remain relatively constant.

The UNI program will also continue to assist in addressing the maintenance and upgrade of equipment required at university research reactors, providing for replacement of outdated equipment, maintenance of reactor systems, and upgrading of experimental capabilities at 22 university reactors in FY 2001, and at least 23 reactors in FY 2002 and FY 2003.

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003

- **DOE/Industry Matching Grants Program..... 800 1,200 1,200**

  In FY 2003, continue the DOE/Industry Matching Grants Program, which supports education, training, and innovative research at participating U.S. universities. Provide grants of up to $60,000, which are matched by industry to 25 universities in FY 2001, FY 2002 and FY 2003. The funding in FY 2002 and FY 2003 will enable the Department to more fully match the funding expected to be provided by the private sector for this program.

- **Fellowships/Scholarships to Nuclear Science and Engineering Programs at Universities..... 1,374 1,800 1,800**

  In FY 2003, provide fellowships and scholarships to students enrolled in nuclear science and engineering programs at U.S. universities. Fellowships will be provided to M.S. and PhD. students and scholarships will be provided to undergraduate students. The fellowship and scholarship program has had many more qualified applicants than could be funded, discouraging some students from continuing in the field of nuclear engineering. In FY 2002 and FY 2003 stipends for these fellowships will be increased to keep them competitive with non-nuclear engineering fellowships. A total of 20 fellowships and 50 scholarships were awarded in FY 2001 with 24 fellowships and 50 scholarships expected in FY 2002 and FY 2003.

  In FY 2000, the Department initiated support to students enrolled in minority serving institutions to pursue a nuclear engineering degree in cooperation with universities that grant those degrees. In FY 2001, the Department funded 3 minority/majority partnerships and expects to fund 5 partnerships in FY 2002 and FY 2003.

- **Nuclear Engineering Education Research Grants 5,000 5,600 5,600**

  The Nuclear Engineering Education Research Grants Program was reinstated in FY 1998 at the request of Congress to increase nuclear research opportunities for students and faculty. In FY 2001, existing and new grants totaled 50; a total of 55 are planned for FY 2002 and FY 2003. The additional funds provided in FY 2002 and requested in FY 2003 will fund an additional 5 projects. The increase will enable the percentage of exceptional proposals funded to rise to approximately 30 percent of those deserving funding, enabling support of additional students and faculty in nuclear engineering.

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
▪ **Nuclear Engineering Education Support/Opportunities.....**	**200**	**600**	**600**

Continue the Nuclear Engineering Education Support Program, a program that began in FY 2000 to support nuclear engineering education recruitment activities to ensure a highly informed group of students are available to enter university nuclear engineering and related scientific courses of study. The increased funding for Nuclear Engineering Education Support in FY 2002 and FY 2003 will allow a greater number of teacher workshops in nuclear science and engineering to be conducted at high schools and middle schools across the United States; the production and distribution of additional educational materials; and permit universities to address equipment, faculty, and material needs for their nuclear engineering curriculum that do not fall within the scope of other university program activities. The teacher workshops program is conducted in conjunction with the American Nuclear Society (ANS) which provides the training. ANS uses qualified volunteers from its membership to educate students keeping costs down. Since this program began in FY 2000, more than a hundred workshops have been held throughout the country. The additional workshops will reach thousands of teachers enabling them to better explain the nature and benefits of careers in nuclear science and engineering.

▪ **Radiochemistry Awards .....**	**300**	**300**	**300**

The three-year radiochemistry awards provide faculty support and student fellowships to help educate a new generation of radiochemists to address the technical challenges associated with radioactive wastes and contaminated sites. The funding for FY 2003 will allow the continuation of three new awards made in FY 2002 that support graduate and post-graduate students and new faculty positions.

▪ **Capital Equipment …….**	**251**	**0**	**0**

The Department shared in the cost of equipment upgrades for the clad thickness measurement and the water flow channel width measurement systems at the fuel fabrication contractor, BWX Technologies in Lynchburg, Virginia.

Total, University Reactor Fuel Assistance and Support.....	**11,974**	**17,500**	**17,500**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
University Reactor Fuel Assistance and Support	
■ The are no funding changes from FY 2002 to FY 2003 ..……..	-0-

Research and Development

Program Mission

The benefits of nuclear science and technology to our society are numerous and are increasingly important to the Nation's future. The mission of the Research and Development program is to continue to expand the benefits of nuclear science and technology by investing in innovative research, in the U.S. R&D infrastructure, and in our universities that train the scientists and engineers of the future.

Our Nation's investments in nuclear energy R&D are made in response to the benefits that are now routinely expected by the public and in anticipation of those new benefits that are likely to accrue. Currently, 20 percent of our Nation's electricity is made today with emission-free nuclear power plants. The *National Energy Policy* calls for the expansion of nuclear energy in the United States. In support of this goal, the Department's nuclear energy R&D programs address improving the performance of the Nation's current operating nuclear power plants, deploying new nuclear plants by 2010, and developing advanced reactor and fuel cycle concepts.

The Department obtains advice on the direction of nuclear energy R&D programs from the independent Nuclear Energy Research Advisory Committee (NERAC). NERAC, a formal Federal advisory committee, provides expert advice on long-range plans, priorities, and strategies for the nuclear technology R&D and research infrastructure activities of the Office of Nuclear Energy, Science and Technology (NE). NERAC has several very active subcommittees examining various aspects of nuclear technology R&D. Reports issued by these subcommittees that address the future of nuclear energy include the *Long-Term Nuclear Technology Research and Development Plan, Nuclear Science and Technology Infrastructure Roadmap,* and *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010.* NERAC is also providing expert advice to help guide development of the Generation IV Technology Roadmap. In addition, NERAC provides recommendations regarding government-industry cooperative research in support of the Nation's 103 operating nuclear power plants.

The *Long-Term Nuclear Technology Research and Development Plan*, developed by NERAC with significant input from the wider research community, recommends that R&D budget levels be increased to enable the Nation to realize further value from our currently operating nuclear plants; provide for economic technologies and approaches to build advanced nuclear power plants in the United States; complete a design for a Generation IV nuclear energy system; and support a range of nuclear energy related missions within the Department.

The *Nuclear Science and Technology Infrastructure Roadmap* evaluates the Department's ability to support the most likely R&D needs for the next 20 years. The roadmap is focused on reactors, hot cells and accelerators used to produce isotopes, irradiate materials, and to conduct experiments and examinations required to support our national missions in space exploration, national security, nuclear energy, medical isotopes, and general nuclear science. The roadmap matches the capabilities of each facility to one or more R&D requirements. The Roadmap concludes that although we are meeting most of our current needs with existing facilities, the Department must add significant new generation capacity if it is to meet expected infrastructure demands over the next decade.

A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010 provides a detailed assessment of the technical and institutional actions which must be taken by industry and government to enable the deployment of new, advanced nuclear power plants in the United States by 2010. The near-term deployment roadmap recommends the cost-shared demonstration of the federal regulatory processes for designing, siting, and operating new nuclear power plants.

Electricity demand in the United States is expected to grow sharply in the 21st century, requiring significant additions of new generation capacity. As much as 393,000 megawatts of new generating capacity may be required by 2020, which equates to the United States having to build between 1,300 and 1,900 new power plants. This equates to building and commissioning 60 to 90 power plants per year. To meet this need, the *National Energy Policy* recommends the expansion of nuclear energy in the United States, including the re-licensing of existing nuclear plants. The Nuclear Energy Plant Optimization (NEPO) program supports this objective by conducting research to address component aging and to improve plant efficiency and reliability. While the Department continues to support the objectives of the NEPO program, no funding is requested for FY 2003.

The Nuclear Power 2010 program is focused on resolving the technical, institutional and regulatory barriers to the deployment and operation of new nuclear power plants by 2010. In FY 2001, a Near-Term Deployment Working Group was established under the auspices of NERAC to engage members of the nuclear industry in a concerted effort to identify the technical, institutional and regulatory barriers and develop a roadmap to enable the deployment of new nuclear power plants by 2010. This working group recently issued *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010.* The recommendations of the near-term deployment roadmap form the basis for the activities of the Nuclear Power 2010 program. In FY 2001, the Department also initiated several studies and planning activities on specific reactor categories. These activities include a study of feasibility issues associated with the use of small reactors in remote areas; an assessment of the changes needed to existing Advanced Light Water Reactor (ALWR) designs to be considered viable in the U.S. marketplace; planning and implementation activities to commercialize the gas reactor technology under development for surplus weapons material disposition; and the cost-shared evaluation and identification of potential nuclear plant sites for demonstration of the new, untested Nuclear Regulatory Commission (NRC) Early Site Permit process.

Since its introduction in FY 1999, the Nuclear Energy Research Initiative (NERI) program has been the cornerstone for renewed interest in nuclear science and technology development in this country. In FY 2003, the Department will continue to conduct NERI research and development at universities, industrial companies, and national laboratories to address the principal obstacles to the expanded use of nuclear energy (*i.e.*, cost, safety, waste, and non-proliferation), advance the state of nuclear technology for a competitive marketplace, and help maintain a nuclear science and technology infrastructure to meet future challenges. While it is still early in the life of this program, NERI has already achieved considerable success. NERI has helped return the United States to a key leadership role in the international exploration of nuclear technology, prompting the interest and support of many other nations and leading to expanded research and development collaboration. The NERI program has helped re-energize research at U.S. laboratories, universities, and industry, and has begun to identify opportunities for enhanced future expansion of nuclear power. NERI is currently sponsoring R&D in areas including novel next generation, proliferation-resistant reactor designs, advanced nuclear fuel development, and

fundamental nuclear science. The Department initiated an international NERI (I-NERI) effort in FY 2001 with bilateral cost-shared research collaborations with other nations, I-NERI is focused on scientific research and advanced technology development to improve the cost and enhance the safety, proliferation resistance, and waste management of advanced nuclear energy systems.

Recognizing growing concerns worldwide about sustainable development, the Department started the Generation IV Nuclear Energy Systems Initiative. Generation IV advanced reactor and fuel cycle technologies are poised to play an important role in meeting electric and other non-electricity needs, such as hydrogen, clean water and process heat. Generation IV nuclear energy systems will meet these needs with advanced reactor and fuel cycle systems characterized by improved safety and reliability, economics, and sustainability.

The Generation IV Nuclear Energy Systems Initiative includes a strong international presence. In January 2000, the Department initiated the Generation IV International Forum (GIF) by convening a meeting of senior government officials from nine countries with long-term interest in the application of nuclear energy. In July 2001, Argentina, Brazil, Canada, France, Japan, Republic of Korea, Republic of South Africa, the United Kingdom and the United States signed a formal, government-sanctioned charter to identify and develop, Generation IV technologies, on a multilateral basis, to address the expansion of nuclear energy internationally. This group of countries has since been joined by Switzerland.

A Generation IV Technology Roadmap, planned for completion in early 2003, is under development to guide Generation IV R&D. The Roadmap will identify the six to eight most promising nuclear reactor and fuel cycle concepts. Following completion of the Roadmap, the Department will initiate the long-term research and development identified in the Roadmap in a cost-shared cooperation with other GIF member countries.

For each promising nuclear energy system concept identified in the Roadmap and surviving the subsequent viability down-selection, research and development will be conducted to increase fuel lifetime, establish or improve material compatibility, improve safety performance, reduce system cost, effectively incorporate passive safety features, enhance system reliability, and achieve a high degree of proliferation resistance.

Because of the importance of nuclear medicine to the advanced U.S. health care system, the application of isotopes in medical research has become an increasingly important focus of the Department's activities. In recent years, the Department has established a peer-reviewed research program, the Advanced Nuclear Medicine Initiative (ANMI), to advance nuclear medicine technology in the United States as well as supporting nuclear medicine education activities at the Nation's universities.

The ANMI was established in response to repeated recommendations made by nuclear medicine experts inside and outside the Federal government. This initiative supports U.S. broad-based research in nuclear medicine-based diagnosis and therapy (including use of alpha emitters). The ANMI partially fills an important national need not previously addressed by the National Institutes of Health and other programs. It builds upon the Department’s current programs and activities and takes advantage of the Department’s unique facilities and laboratory capabilities to apply advanced nuclear technologies to the challenge of curing cancer and other life-threatening illnesses. In addition, the ANMI supports the

development of science and technology programs at U.S. universities and colleges to address the critical shortage of trained experts in fields relevant to nuclear medicine such as radiochemistry and radiopharmacy. The ANMI uses a peer-review process in which members of the NERAC and other prominent experts evaluate the scientific merits of projects proposed by universities, hospitals, and the national laboratories for funding. The nine research and five educational financial assistance awards made in FY 2000 are three-year awards that will end in FY 2002. Based on the semiannual technical progress reports and site reviews, we are encouraged with the progress made to date. Although this has been a successful program, no funding is requested for the ANMI program in FY 2003 due to change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.

Program Strategic Performance Goal

ER7-1: **Nuclear Energy Research Initiative (NERI) –** Effectively address the key issues--economics, proliferation, and waste management--affecting the future use of nuclear energy by conducting long-term, investigator-initiated, peer-reviewed research and development.

Performance Indicator

Progress and advancement in NERI research evidenced by achievement of at least 75 percent of the stated NERI research project objectives and by the selection of concepts for continued development that have a high potential for commercialization.

Performance Standards

Blue: Performance was significantly above the planned annual targets for the PSPG
Green: Performance results meet all planned annual targets for the PSPG
Yellow: Performance was less than the planned annual targets, but not significantly less for the PSPG
Red: Performance was significantly less than the planned annual targets for the PSPG

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
Complete funding for the first 3-year phase of Nuclear Energy Research Initiative (NERI) research and development; select feasible and important reactor and fuel cycle concepts for continued development; and issue approximately 15 new awards.*(ER2-2)*(MET GOAL) Establish bilateral research programs with other countries to improve the cost, and enhance the safety, proliferation-resistance and waste management of future nuclear energy systems.*(ER2-2)*(MET GOAL)	Complete the first 3-year phase of NERI research and development. *(ER7-1)* Complete funding for the 10 NERI projects initiated in FY 2000; continue the 13 NERI projects initiated in FY 2001; and initiate approximately 23 new NERI projects and three NERI follow-on projects to advance NERI projects that were successfully completed and warrant further development.*(ER7-1)* Initiate I-NERI bilateral cost-shared research projects with 3 countries.*(ER7-1)*	Complete the ten NERI R&D projects initiated in FY 2000, complete funding for the 13 NERI projects initiated in FY 2001; provide funding for 16 of the 23 projects initiated in FY 2002; and continue the three NERI follow-on projects initiated in FY 2002. *(ER7-1)* Expand I-NERI program participation to 5 countries and organizations. *(ER7-1)*

Program Strategic Performance Goal

ER7-2: **Nuclear Energy Plant Optimization (NEPO)** – Resolve critical issues related to long-term plant aging, and develop advanced technologies to improve plant reliability, availability, and productivity to ensure that current plants can continue to operate up to and beyond their initial license period.

Performance Indicator

Progress toward addressing open issues related to plant aging and development of technologies to improve plant reliability, availability, and productivity.

Performance Standards

Blue: Performance was significantly above the planned annual targets for the PSPG
Green: Performance results meet all planned annual targets for the PSPG
Yellow: Performance was less than the planned annual targets, but not significantly less for the PSPG
Red: Performance was significantly less than the planned annual targets for the PSPG

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
[The Department completed 4 projects, continued 10 projects initiated in FY 2000, and initiated 8 new projects to conduct R&D activities associated with managing long-term effects of plant aging and improving electricity generation.]	Complete 5 projects initiated in prior years associated with managing long-term effects of plant aging and improving electricity generation. *(ER7-2)*	Complete 6 projects initiated in prior years using prior-year appropriations associated with managing long-term effects of plant aging and improving electricity generation. (ER7-2)

Program Strategic Performance Goal

ER7-3: **Nuclear Energy Technologies/Nuclear Power 2010** - Successfully address the regulatory, technical, and institutional issues to enable one or more orders for new, commercial nuclear power plants in the United States by 2005 for deployment by 2010.

Performance Indicator

Progress toward demonstration of untested regulatory and licensing processes for the siting and construction of nuclear power plants.

Performance Standards

Blue: Performance was significantly above the planned annual targets for the PSPG
Green: Performance results meet all planned annual targets for the PSPG
Yellow: Performance was less than the planned annual targets, but not significantly less for the PSPG
Red: Performance was significantly less than the planned annual targets for the PSPG

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
NA	Complete and issue the government/industry roadmap to build new nuclear plants in the United States by 2010.*(ER7-3)* Develop and complete cooperative agreements with U.S. electric utilities to jointly proceed with NRC Early Site Permit applications for specific DOE and/or commercial sites.*(ER7-3)* Develop and sign an agreement with U.S. industry and our international partners to begin a gas reactor fuel testing program that will enable licensing of gas-cooled reactors in the United States.*(ER7-3)*	Complete design and assembly of a fuel test rig and initiate fuel irradiations to support development of the technical and licensing basis to deploy an advanced gas-cooled reactor for new nuclear generation capacity by the end of the decade.*(ER7-3)* Complete cooperative agreement with U.S. electric utilities to jointly proceed with NRC construction/operating license application.*(ER7-3)*

Program Strategic Performance Goal

ER7-4: **Nuclear Energy Technologies/Generation IV Nuclear Energy Systems Initiative** - Develop, in close cooperation with the international community and industry, next-generation nuclear energy systems which represent significant improvements in all aspects of nuclear power technology.

Performance Indicator

Progress toward implementation of the Generation IV Technology Roadmap.

Performance Standards

Blue: Performance was significantly above the planned annual targets for the PSPG
Green: Performance results meet all planned annual targets for the PSPG
Yellow: Performance was less than the planned annual targets, but not significantly less for the PSPG
Red: Performance was significantly less than the planned annual targets for the PSPG

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
Formally establish the Generation IV International Forum to assist in identifying and conducting cooperative R&D. Initiate development of a Generation IV technology roadmap for the development of next generation nuclear energy systems.*(ER2-2)* (MET GOAL	Complete the draft Generation IV Technology Roadmap for development of next generation nuclear energy systems. The Roadmap is to be submitted to Congress by March 2003.*(ER7-4)*	Issue the Generation IV Technology Roadmap, detailing the R&D required to develop the most promising next generation nuclear energy system concepts.*(ER7-4)*

Program Strategic Performance Goal

ER7-5: **Advanced Nuclear Medicine Initiative -** Support advanced medical research in order to develop an isotope-based treatment to address all forms of cancer by the end of the decade.

Performance Standards

Blue: Performance was significantly above the planned annual targets for the PSPG
Green: Performance results meet all planned annual targets for the PSPG
Yellow: Performance was less than the planned annual targets, but not significantly less for the PSPG
Red: Performance was significantly less than the planned annual targets for the PSPG

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
Provide 5 grants under the Advanced Nuclear Medicine Initiative.*(ER2-6)* (MET GOAL)	Complete research and curriculum development funded by 14 three-year Advanced Nuclear Medicine Initiative grants to universities, hospitals and research institutions.*(ER7-5)*	

Significant Accomplishments and Program Shifts

Nuclear Energy Research Initiative

- In FY 2001, continued 43 projects initiated in FY 1999 and the 10 projects initiated in FY 2000. Awarded 13 new NERI R&D projects.

- In FY 2001, established International NERI (I-NERI) bilateral research agreements with France and Republic of Korea awarding 3 new R&D collaborative projects to improve the cost, and enhance the safety, non-proliferation and waste management of future nuclear energy systems.

- In FY 2002, complete 43 projects initiated in FY 1999. Continue the 10 NERI projects awarded in FY 2000, the 13 NERI projects awarded in FY 2001, and the 3 I-NERI research projects awarded in FY 2001. Initiate 23 new NERI projects, 3 NERI follow-on projects, and 10 new I-NERI projects.

- In FY 2003, complete the 10 NERI projects awarded in FY 2000. Continue the 13 NERI projects awarded in FY 2001. Continue 16 of the 23 NERI and 3 follow-on projects initiated in FY 2002. Continue the 13 I- NERI research projects awarded in FY 2001 and FY 2002.

Nuclear Energy Plant Optimization

- In FY 2001 and FY 2002, continue cooperative research and development activities consistent with the updated *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants.*

- In FY 2001, provided funding to complete 4 projects and initiate 8 new projects. In FY 2002, provide funding to complete 5 projects and initiate 2 new projects.

- In FY 2003, complete 11 projects initiated in prior years associated with managing the effects of plant aging and improving electricity generation with prior year funding.

Nuclear Energy Technologies

Nuclear Power 2010

- In FY 2001, completed the study on the feasibility of small reactors and issued a report to Congress; completed an assessment of ALWR improvements; and initiated planning and implementation of activities to commercialize the Gas Turbine-Modular Helium Reactor (GT-MHR) being developed for surplus weapons material disposition.

- In early FY 2002, complete the near-term deployment roadmap recommending actions to be taken by government and industry to successfully address regulatory and institutional issues and enable one or more orders for new commercial nuclear power plants in the United States by 2005 for deployment by 2010.

- In FY 2002, cost-shared regulatory demonstration projects will be initiated with industry to jointly proceed with NRC Early Site Permit applications for specific DOE and/or commercial sites. Advanced gas reactor fuel qualification activities will continue. Development and certification projects will be initiated for advanced light water and gas-cooled reactor concepts.

- In FY 2003, cost-shared regulatory demonstration projects will continue, initiating new projects for demonstration of the NRC combined Construction and Operating License process. Development and certification projects for advanced light water and gas-cooled reactor concepts will continue. Fuel irradiation at the Advanced Test Reactor will be initiated as part of the advanced gas-cooled reactor fuel qualification program.

Generation IV Nuclear Energy Systems

- In FY 2001, established the Generation IV technology goals and initiated development of the Generation IV Technology Roadmap.

- In FY 2001, established the Generation IV International Forum (GIF) with Argentina, Brazil, Canada, France, Japan, Republic of Korea, Republic of South Africa, the United Kingdom, and the United States. All GIF countries, as well as several international organizations, endorsed the Generation IV technology goals and provided cost-free experts who are participating in preparing the Roadmap.

- In early FY 2003, complete the Generation IV Technology Roadmap.

- In FY 2003, initiate the priority research and development identified in the Roadmap.

Advanced Nuclear Medicine Initiative

- In FY 2002 complete all ANMI grants initiated in FY 2000. The ANMI supports U.S. broad-based research in nuclear medicine-based diagnosis and therapy, including use of alpha emitters, and supports nuclear medicine education such as radiochemistry and radiopharmacy at universities and colleges thus achieving many of the goals recommended by the Institute of Medicine and other advisory bodies. Early indications show that the research under this initiative will yield a significant savings in healthcare costs and will increase the number of nuclear chemists and nuclear pharmacists. There are no funds requested in FY 2003 to support AMNI.

Funding Profile

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Original Appropriation	FY 2002 Adjustments	FY 2002 Comparable Appropriation	FY 2003 Request
Research and Development					
Nuclear Energy Plant Optimization	4,857	7,000	-500	6,500	0
Nuclear Energy Research Initiative	33,903	32,000	0	32,000	25,000
Nuclear Energy Technologies	7,483	12,000	0	12,000	46,500
Advanced Nuclear Medicine Initiative	2,500	2,500	0	2,500	0
Total, R&D	48,743	53,500	-500[a]	53,000	71,500

[a] FY 2002 General Reduction

Funding by Site

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Albuquerque Operations Office					
Los Alamos National Laboratory	485	490	0	-490	-100.0
Sandia National Laboratories	2,487	1,223	530	-693	-56.7
Total, Albuquerque Operations Office	2,972	1,713	530	-1,183	-69.1
Chicago Operations Office					
Chicago Operations Office	2,611	0	0	0	0.0
Ames Laboratory	200	211	217	+6	+2.8
Argonne National Laboratory	6,304	4,567	2,599	-1,968	-43.1
Brookhaven National Laboratory	628	608	100	-508	-83.6
Total, Chicago Operations Office	9,743	5,386	2,916	-2,470	-45.9
Idaho Operations Office					
Idaho Operations Office	2,894	0	0	0	0.0
Idaho National Engineering and Environmental Laboratory	2,828	2,170	4,127	+1,957	+90.2
Total, Idaho Operations Office	5,722	2,170	4,127	+1,957	+90.2
Oakland Operations Office					
Oakland Operations Office	550	0	0	0	0.0
Lawrence Livermore National Laboratory	1,089	1,060	598	-462	-43.6
Total, Oakland Operations Office	1,639	1,060	598	-462	-43.6
Oak Ridge Operations Office					
Oak Ridge National Laboratory	3,067	1,937	2,040	+103	+5.3
Oak Ridge Institute of Science and Education	515	800	0	-800	-100.0
Total, Oak Ridge Operations Office	3,582	2,737	2,040	-697	-25.5
Richland Operations Office					
Pacific Northwest National Laboratory	2,553	392	700	+308	+78.6
Total, Richland Operations Office	2,553	392	700	+308	+78.6
Washington Headquarters	3,003	4,382	0	-4,382	-100.0
All Other Sites	19,529	35,160	60,589	+25,429	+72.3
Total, Research and Development	48,743	53,000	71,500	+18,500	+34.9

Site Descriptions

Ames Laboratory

The Ames Laboratory is a single-purpose laboratory operated by Iowa State University in Iowa for the U.S. Department of Energy. Ames Laboratory conducts research in materials science, analytical chemistry, and nondestructive evaluation programs. In FY 2001, the Ames Laboratory supported the Nuclear Energy Research Initiative (NERI) program as the lead organization for a project conducting research for advanced reactor instrumentation.

Argonne National Laboratory

Argonne National Laboratory (ANL) is a U.S. Department of Energy scientific research laboratory and was the Nation's first national laboratory, chartered in 1946. ANL is located at two sites. The Illinois site, ANL-East, is the main laboratory and occupies 1500 acres, surrounded by a forest preserve about 25 miles southwest of the Chicago Loop. The Idaho site, ANL-West, is located within the boundary of the Idaho National Engineering and Environmental Laboratory (INEEL) in Southeastern Idaho, about 35 miles west of Idaho Falls.

In July 1999, the Department selected the ANL, along with the INEEL, to serve as the Nuclear Reactor Technology Lead Laboratories and serve as hosts for a variety of unique nuclear facilities. These Lead Laboratories assist and work with the Department's Office of Nuclear Energy, Science and Technology to maintain and apply world class technical capabilities to assure that the Department is maximizing its investment in nuclear reactor technology research and development.

In FY 2001, ANL supported the NERI program as the lead organization for six projects and collaborating in eight other projects in the areas of proliferation resistant reactor and fuel technology, advanced nuclear fuels, waste management and fundamental nuclear sciences. Eleven of these NERI projects have planned completions during FY 2002. ANL is the lead for 2 I-NERI projects with France and the lead and collaborator for two projects with Korea in reactor safety, advanced conventional methods, gas cooled reactor technology, and advanced fuels.

ANL is conducting 4 NEPO research tasks under NEPO in FY 2002. The research tasks include 1) assessing the effectiveness of non-destructive examination techniques for the detection and characterization of service-induced cracks in steam generator tubes, 2) developing software algorithms to accurately and consistently detect and characterize steam generator tubing degradation including tube burst pressure prediction from data provided from eddy current array probes, 3) determining the mechanical behavior of irradiated structure stainless steels under conditions of interest to light water reactors, and 4) providing on-going support of signal validation technologies and quantification of benefits of on-line monitoring. ANL is also assisting in recruiting students and faculty from minority institutions to take part in the NEPO program.

ANL and INEEL are coordinating the preparation of the Generation IV Technology Roadmap which will include an R&D plan that provides the sequencing and initial cost estimates of research tasks, and identified potential national and international advanced design nuclear energy system collaborations.

They perform necessary coordination activities among the working groups, with the Generation IV International Forum and with NERAC. In FY 2003, the Department will initiate viability research and development on six-to-eight most promising candidate Generation IV advanced nuclear energy system concepts. ANL will conduct, for one of more promising concepts, parametric studies to establish designs that optimize key performance parameters and develop plans to guide subsequent experimentation and testing.

Brookhaven National Laboratory

The Brookhaven National Laboratory (BNL) is a multiprogram laboratory located in Upton, New York. BNL research activities under the Nuclear Energy Research Initiative (NERI) are directed toward proliferation resistant fuel technology and new reactor design with improved safety performance. In FY 2001, BNL was the lead organization on two NERI projects and is collaborating with a university on one other R&D project. Two of the NERI projects will be completed during FY 2002. BNL is a collaborating laboratory on one French I-NERI project involving advanced gas-cooled reactor research. BNL also provides technical support to the Generation IV Technology Roadmap. BNL is performing a NEPO task to provide guidance for definition, design, implementation, operation, and maintenance of hybrid control rooms.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is an extensive research and engineering complex that has been the center of nuclear energy research since 1949. In recent years, INEEL has initiated technology development in applied environmental science and engineering.

In July 1999, the Department selected INEEL, along with ANL, to serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories assist and work with the Department's Office of Nuclear Energy, Science and Technology to maintain and apply world class technical capabilities to assure that the Department is maximizing its investment in nuclear reactor technology research and development.

In FY 2001, INEEL participated in the NERI program as the lead organization on four projects and collaborating on two other awards; INEEL research is in areas of low output reactor technology and advanced proliferation resistant fuel technology. Five of the NERI projects that INEEL is participating in have planned completion dates during FY 2002. INEEL is the lead on a French I-NERI project awarded in FY 2001 on advanced gas reactor fuel research and two Korean I-NERI projects awarded in FY 2002 involving reactor safety and advanced computational analysis.

INEEL and ANL are coordinating the preparation of the Generation IV Technology Roadmap which will include an R&D plan that provides the sequencing and initial cost estimates of research tasks, and identifies potential national and international advanced design nuclear energy system collaboration. They perform necessary coordination activities among the working groups, with the Generation IV International Forum and with NERAC. INEEL is also supporting the test planning and specifications, test fixture development and irradiation ability for the Department's advanced gas reactor fuel qualifications program. In FY 2003, the Department will initiate viability research and development on

six-to-eight most promising candidate Generation IV advanced nuclear energy system concepts. INEEL will conduct, for one of more promising concepts, parametric studies to establish designs that optimize key performance parameters and develop plans to guide subsequent experimentation and testing. INEEL will also begin irradiation of advanced gas-cooled reactor fuel in the Advanced Test Reactor.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) is a U.S. Department of Energy scientific research laboratory located in California. In FY 2001, LLNL was the lead organization in three projects and is collaborating with university, laboratory, and industry partners in two other projects, conducting research on proliferation resistant reactors, fuel technology, and isomers in support of the Nuclear Energy Research Initiative (NERI). Two of these NERI projects have scheduled completions during FY 2002. LLNL also provides technical support to the Generation IV Technology Roadmap. LLNL in collaboration with ANL, is performing studies as part of the NEPO Program to understand the mechanical behavior of irradiated structure stainless steels.

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. In FY 2001, LANL was the lead organization for one NERI project and the collaborating organization on two other projects. Two of these NERI projects are scheduled to be completed during FY 2002. LANL also provides technical support to the Generation IV Technology Roadmap.

Oak Ridge Institute for Science and Education

The Oak Ridge Institute for Science and Education (ORISE) is a Department of Energy science and education facility located in Oak Ridge, Tennessee. ORISE has developed unique capabilities and extensive experience in administering independent peer-review activities. ORISE supports the peer-review activities of the Nuclear Energy Research Initiative (NERI).

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) is a U.S. Department of Energy scientific research laboratory located in Oak Ridge, Tennessee. In FY 2001, ORNL participated in the NERI program as the lead research organization on six projects and as a collaborator on three projects. These projects involve advanced reactor and control concepts, reactor materials research and advanced fuel components. Five of the NERI projects have planned completion dates during FY 2002. ORNL is the lead collaborator on two French I-NERI projects awarded in FY 2001 involving gas cooled reactor and advanced materials research, and the lead on one Korean I-NERI project awarded in FY 2002 involving sensor and control research and development.

In FY 2002, ORNL is performing research on one NEPO task to assess the vulnerability of nuclear power plants to various transmission grid problems. ORNL is supporting the planning and implementation of fuel irradiation tests and examinations as part of the Department's advanced gas

reactor fuel qualification program. ORNL provides technical support to the Generation IV Technology Roadmap activity.

ORNL also maintains the DOE computer code systems, software, and documentation at the Radiation Safety Information Computational Center (RSICC) and serves as a repository for DOE computational research activities, including computer software that is developed by NERI and NEER research projects. The RSICC computer software is made available to nuclear engineering departments and NERI and NEER awardees.

Pacific Northwest National Laboratory

The Pacific Northwest National Laboratory (PNNL) is a multiprogram laboratory located at the Department's Hanford site in Richland, Washington. In FY 2001, PNNL conducted research and development on the Nuclear Energy Research Initiative (NERI) as the lead organization on 4 projects and as a collaborator on one project. These projects involve advanced reactor and fuel technology and fundamental nuclear science. Four of the five NERI projects are scheduled for completion in FY 2002.

PNNL is continuing research in FY 2002 on the NEPO program to support revision of Appendix L of the ASME Code through analysis of the probability of detecting fatigue cracks. They are also developing an integrated plan for obtaining key structures and components from operating or decommissioned nuclear power plants to test components that are aged under actual plant conditions.

PNNL provides technical assistance and peer-review assistance in support of the bilateral research and development conducted under the I-NERI program.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. In FY 2001, SNL was the lead organization for five NERI projects and the collaborating organization on four other projects involving proliferation resistant reactor design, improved reactor performance and nuclear waste management. Eight of these NERI projects are scheduled to be completed during FY 2002. SNL is also the lead for an I-NERI project with Korea on advanced methods for equipment condition monitoring. SNL is conducting research on two tasks under NEPO in FY 2002. One task is to develop empirical data to characterize aging degradation of polymers used in electrical cables in order to develop cable aging models. For the second task, SNL is investigating nuclear magnetic resonance relaxation modulus profiling and destiny measurements for cable polymer aging assessment, and preparing a cable aging database. SNL provides technical support to the Generation IV Technology Roadmap activity.

All Other Sites

This section describes the activities funded at the various operations offices as well as activities in the "all other sites" category.

For the NERI and I-NERI programs, this category includes university and industry funding for all years as well as funding that will ultimately be provided to national laboratories as a result of the solicitations and awards in FY 2002 and FY 2003.

This category includes FY 2002 NEPO program funding for those NEPO research projects for which decisions on the performing organizations have not yet been made. In FY 2002, the Oakland Operations Office will be contracting with Electric Power Research Institute for NEPO research and development activities.

The Department is preparing a Generation IV Technology Roadmap which will include an R&D plan that provides the sequencing and initial cost estimates of research tasks, and identifies potential national and international advanced design nuclear energy system collaboration. In FY2003, the Department will initiate viability research and development on six-to-eight most promising candidate Generation IV advanced nuclear energy system concepts. Several sites will participate in performing parametric studies for one of more promising concepts to establish designs that optimize key performance parameters and develop plans to guide subsequent experimentation and testing.

In addition, in FY 2001 and FY 2002 this category includes the ANMI grants.

Nuclear Energy Plant Optimization

Mission Supporting Goals and Objectives

The Nuclear Energy Plant Optimization (NEPO) program was developed as part of a comprehensive approach to assure that the United States has the technological capability to assure adequate supplies of baseload electricity while minimizing harmful impacts on the environment. The President's Committee of Advisors on Science and Technology (PCAST) Panel on Federal Energy Research and Development identified the critical role of nuclear power in its November 1997 report. The Panel's report recommended that the Department work with its laboratories and industry to develop a cost-shared program to address the technical issues that may prevent the continued operation of existing nuclear power plants.

The NEPO program supports the *National Energy Policy* objectives regarding the use of nuclear energy in the United States by conducting research to ensure that current nuclear plants can continue to deliver reliable, safe, and affordable electricity up to and beyond their initial 40-year license period. The NEPO program supports the Secretary of Energy's priorities to ensure U.S. energy security by protecting critical infrastructure that supports the production and delivery of energy in America and focusing on programs that help America increase its supply of energy by increased domestic production.

The Department established the NEPO program in FY 2000 as a cost-shared program with industry. The R&D projects initiated in FY 2000 and FY 2001, and those to be initiated in FY 2002 address plant aging and development and application of new technologies to improve plant reliability, availability, and productivity while maintaining a high level of safety. The Department and the electric utility industry's Electric Power Research Institute (EPRI) developed the *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* to help the Federal Government and private sector jointly identify, prioritize, and execute R&D. The plan, first issued in March 1998 and later updated in October 2000, is based upon input from utilities, DOE national laboratories, NRC, and other key stakeholders. Research funded under the NEPO program is based upon this joint strategic plan. Approximately sixty percent of the total funding for R&D conducted under the NEPO program is provided by industry.

The Nuclear Energy Research Advisory Committee (NERAC) Subcommittee on Operating Nuclear Power Plants Research and Development provides the Department independent, expert advice on the execution of the NEPO program. A Coordinating Committee, with representatives from NRC, industry, national laboratories, and universities, working directly with the NERAC operating plant subcommittee, provides the Department with recommendations on prioritization of the R&D projects. NEPO R&D projects are awarded on a competitive basis, unless there is a unique capability that justifies the work being performed at a specific location or by a specific contractor. Non-competitive awards are made only when the R&D requires a unique facility which already exists and it is not prudent to incur the cost of building a duplicate facility elsewhere, or the selected recipient has a unique knowledge of and experience with the specific data associated with the R&D being conducted and a significant delay will occur if the R&D is conducted elsewhere. NEPO projects are performed at U.S. national laboratories or

by commercial contractors. While the national laboratories do not compete against industry for project awards, strong priority is placed on open competition of tasks, both at the national laboratories and at commercial contractors.

The NEPO program has made significant progress toward addressing many of the material aging and generation optimization issues which have been identified as the key long-term issues facing current operating plants. Recent results from the NEPO program include: a determination of the optimum amount of the zinc which should be added to a typical pressurized water reactor to reduce the possibility of cracks developing in some of the significant components of the reactor; the development of new electrical cable monitoring techniques for improved prediction of cable lifetimes; the development of techniques to qualify smart transmitters to replace existing analog transmitters which are less accurate and difficult to maintain; the development of an industry consensus approach for implementing digital upgrades to existing nuclear power plant safety systems; and the determination of the optimum fuel burnup and operating cycle length for both pressurized and boiling water reactors. Further highlights of the NEPO program are contained in the *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants HIGHTLIGHTS,* dated June 14, 2001 (see http://nepo.ne.doe.gov).

In responding to FY 2002 Congressional direction to provide $400,000 for U.S. uranium conversion-related studies, the Department utilized $400,000 of NEPO funds.

While the Department continues to support the objectives of the NEPO program, no funding is requested for FY 2003.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Nuclear Energy Plant Optimization	4,857	5,927	0	-5,927	-100.0
U.S. Conversion Industry Viability Assistance	0	400	0	-400	-100.0
Small Business Innovative Research/Small Technology Transfer Program	0	173	0	-173	-100.0
Total, Nuclear Energy Plant Optimization	4,857	6,500	0	-6,500	-100.0

Detailed Program Justification

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
Nuclear Energy Plant Optimization	**4,857**	**5,927**	**0**

Projects initiated in FY 2000 and FY 2001, and those to be initiated in FY 2002 address long-term reliability of steam generators and electrical cables, behavior of irradiated structural materials, long-term fatigue, regulatory qualification of digital instrumentation and control upgrades, smart diagnostic transmitters, optimum fuel burn-up and cycle length, pressurized water reactor water chemistry, and assessment of aging effects on critical components and structures. In FY 2001, funding was provided to continue R&D activities on ten projects initiated in FY 2000 associated with managing long-term effects of plant aging and improving the reliability, availability and productivity of existing nuclear power plants; eight new projects were initiated. In FY 2002, funding is being provided to continue R&D activities on nine projects initiated in prior years; two new projects are being initiated. In FY 2003, R&D activities on approximately eleven projects initiated in prior years will be completed utilizing prior year funds. No funds are requested for FY 2003.

U.S. Conversion Industry Viability Assistance	**0**	**400**	**0**

In FY 2002, Congress appropriated funding to be used to address technical, economic, environmental and regulatory aspects of maintaining a viable and competitive U.S. nuclear fuel conversion supplier. No funds are requested for FY 2003.

Small Business Innovative Research and Small Business Technology Transfer Programs	**0**	**173**	**0**
Total, Nuclear Energy Plant Optimization	**4,857**	**6,500**	**0**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
Nuclear Energy Plant Optimization	
■ The reduction of $5,927,000 reflects no funds being requested in FY 2003.	-5,927
U.S. Conversion Industry Viability Assistance	
■ The reduction of $400,000 reflects no funds being requested in FY 2003.....	-400
Small Business Innovative Research and Small Business Technology Transfer Programs	
■ The decrease of $173,000 in SBIR/STTR reflects the decrease in funding for research and development.....	-173
Total Funding Change, Nuclear Energy Plant Optimization.....	**-6,500**

Nuclear Energy Research Initiative

Mission Supporting Goals and Objectives

The Nuclear Energy Research Initiative (NERI) supports the *National Energy Policy* by conducting research to advance the state of nuclear science and technology in the United States by addressing the key technical issues impacting the expanded use of nuclear energy. Through important research programs such as NERI, the Nation's nuclear research infrastructure at the national laboratories, universities and industry is maintained. NERI research in reactor concepts, advanced nuclear fuels, and waste management will contribute to meeting future energy needs and environmental goals.

The President's Committee of Advisors on Science and Technology (PCAST) determined that for the United States to maintain a viable, long-term option to use nuclear energy to meet the important energy and environmental challenges facing the future of the Nation, key issues affecting the future viability of nuclear energy must be addressed. These issues, including the economics of using fission to generate electricity, concerns regarding safety and proliferation resistance, and the continuing challenges associated with nuclear waste, the PCAST stated, can be solved by technology research. To respond to these issues, the Department established the NERI program. This program funds innovative scientific and engineering research in such areas as next generation nuclear power systems, proliferation resistant nuclear energy technologies, and new technologies to deal with nuclear wastes.

Nuclear energy currently provides one-fifth of U.S. electricity generation and can contribute a significant portion of U.S. electrical energy production for many years to come. In this new millennium, the Nation faces new issues associated with energy supply and environmental policy. The potential role of nuclear power to address these new challenges, such as global climate change, will depend upon the ability of the Federal government, universities, national laboratories, industry, and others to pool their talents and creatively address the key challenges affecting the future of nuclear energy.

The United States has always been a world leader in both the policy and technical aspects of nuclear energy. The United States has more nuclear power plants in operation today than any other nation and most of the world's operating nuclear power plants are based on the pioneering efforts of the U.S. light water reactor technology development. Given the projected growth in global energy demand as developing nations industrialize; our vital strategic interests in addressing global climate change, nuclear non-proliferation, nuclear safety, and economic competitiveness; and our need to satisfy growing domestic needs for energy in an environmentally responsible manner, the United States must maintain its scientific and technological leadership in nuclear energy. This leadership provides the United States a key "seat at the table" at on-going international discussions regarding the future implementation of nuclear technologies, nuclear non-proliferation, nuclear safety, and many other issues important to U.S. policy objectives.

Recognizing the importance of a focused program of international cooperation, the PCAST issued a June 1999 PCAST report on *The Federal Role in International Cooperation on Energy Innovation*, (http://www.ostp.gov/html/P2E.pdf) which highlights the need for an international component of the NERI program to promote "bilateral and multilateral research focused on advanced technologies for improving the cost, safety, waste management, and proliferation resistance of nuclear fission energy

systems." The report further states that: "The costs of exploring new technological approaches that might deal effectively with the multiple challenges posed by conventional nuclear power are too great for the United States or any other single country to bear, so that a pooling of international resources is needed... Research efforts underway in Russia, Germany, Japan, South Africa, and South Korea on a variety of advanced reactor types and proliferation-resistant fuel cycles are potentially suitable foci for U.S. participation...".

The Department and its independent Nuclear Energy Research Advisory Committee (NERAC) have endorsed PCAST's recommendations and established, with the support and advice of the Congress, both a base NERI program and an International Nuclear Energy Research Initiative (I-NERI) component. The I-NERI activity is enhancing the Department's ability to leverage the nuclear technology research funding available in other countries while also providing the United States greater credibility and influence in international activities associated with the application of nuclear technologies.

The NERI program is directed toward accomplishing the following objectives:

- Develop advanced concepts and scientific breakthroughs in nuclear fission and reactor technology to address and overcome the principal technical and scientific obstacles to the expanded use of nuclear energy in the United States;

- Advance the state of nuclear technology to maintain a competitive position in overseas markets and a future domestic market;

- Promote and maintain a U.S. nuclear science and engineering infrastructure to meet future technical challenges;

- Collaborate with international agencies and research organizations to promote nuclear technology research and development through bilateral and multilateral cost-shared agreements.

In June 2000, NERAC issued a long-range R&D plan developed in conjunction with the nuclear community, *Long Term Nuclear Technology Research and Development Plan*, (http://nuclear.gov/nerac/LTRDP-ne.html) which identifies the research and technology development necessary over the next 10 to 20 years to help assure nuclear energy remains a viable electricity generation option. In addition, NERAC established a task force to identify technical opportunities to increase the proliferation resistance of nuclear power systems, and to recommend to DOE appropriate areas of research. The resulting report, *Technical Opportunities to Increase the Proliferation Resistance of Global Civilian Nuclear Power Systems (TOPS)*, (http://nuclear.gov/nerac/tops.pdf) approved by NERAC in January 2001, provides R&D recommendations to improve the intrinsic and extrinsic barriers to the proliferation of nuclear materials. These reports are used by the Office of Nuclear Energy, Science and Technology to help guide the research conducted under NERI.

The most important planning document affecting the NERI program in FY 2002 and beyond is the *National Energy Policy*. This comprehensive plan specifies a vital role for nuclear power in supporting the nation's near and long-term energy requirements. The *Policy* highlights the need for international

cooperation in the exploration of advanced reactor and fuel cycle technologies and guides the Department in determining which long-term technologies it must pursue. In addition to its nuclear power-specific recommendations, the *National Energy Policy* also provides important guidance regarding other areas of energy, such as the need to explore advanced sources of energy for transportation. Currently, the Department's Office of Energy Efficiency and Renewable Energy is leading a vital exploration of fuel cell technology and hydrogen for transportation—the one area of our energy infrastructure that remains highly depended upon imports of foreign oil. Because the Department believes that hydrogen may become an essential element of the Nation's energy future, the NERI program is initiating a major focus on the application of advanced nuclear energy systems for the production of hydrogen. No other energy technology available has the potential of creating the large quantities of hydrogen that would be needed to sustain the vast U.S. transportation system without generating the air pollutants we would seek to avoid by using hydrogen. It is possible that one day, all elements of U.S. transportation—automobiles, rail, aircraft—will rely upon hydrogen. Only nuclear technologies can generate hydrogen in large quantities without emitting air pollution. NERI will explore, in cooperation with relevant Energy Efficiency and Renewable Energy programs, how best to apply advanced nuclear technology to this important task.

NERI features a competitive, investigator-initiated, peer-reviewed selection process to fund innovative nuclear energy-related research. The NERI program solicits proposals from the U.S. scientific and engineering community for research at universities, national laboratories, and industry. NERI encourages collaborative research and development activities among these different research organizations; as well as the cost-free participation of foreign research organizations. The Department believes that by funding creative research ideas at the Nation's science and technology institutions and companies, the United States will find new solutions to the issues associated with safety, economics, proliferation, and nuclear waste. NERI program funding is also used to fund program support activities such as the independent, objective merit-peer review process used to evaluate the proposals submitted.

The NERI research projects are selected based on the excellence of the research proposals and include technologies such as next-generation nuclear power systems; proliferation nuclear fuel cycle technologies, new technologies for management of nuclear waste, and fundamental areas of nuclear science that directly impact the long-term success of nuclear energy.

The international component of NERI, the I-NERI program, also benefits from a peer-review to select projects. The I-NERI program allows for research opportunities with foreign collaborators through a specified cost share arrangement with each participating country. The peer review selection process for the I-NERI program includes both U.S. reviewers as well as international expert reviewers from the participating country. Specific research topics are identified and selected in conjunction with the international partnering countries and focus on new, next-generation nuclear energy system and fuel cycle technology concepts. Bilateral I-NERI agreements were established in 2001 with France's *Commissariat a l'Energie Atomique (CEA)* and the Republic of Korea's Ministry of Science and Technology (MOST). Discussions are ongoing with Japan, South Africa and the Nuclear Energy Agency, and bilateral agreements are expected to be in place in FY 2002.
In FY 1999 and FY 2000, the Department received 432 NERI research proposals representing about $430 million in research in response to the NERI solicitations. A total of 46 proposals were selected for award in FY 1999 and 10 proposals were selected for award in FY 2000 based on the recommendations

of the peer-review process. The 56 NERI projects represent the individual and collaborative research efforts of 52 separate domestic research organizations including 24 universities, 8 national laboratories, 19 industrial organizations, and a U.S. Government R&D organization. The 56 NERI projects also included significant international collaboration with participation by 20 foreign research organizations including 6 foreign universities, 8 industrial companies, and 6 government or R&D organizations. This international participation is funded by the foreign government or corporation. The international collaboration in NERI research provides additional value to the program by leveraging U.S. funding with foreign research funds and providing U.S. researchers with access to additional scientific and technical expertise and research facilities not available in the United States.

In FY 2001, the Department received 143 NERI research proposals in response to the NERI solicitations, and on the basis of the objective merit-peer review evaluation process, 13 proposals were selected for award. These 13 NERI projects represent the individual and collective research efforts of 24 separate domestic research organizations including 8 universities, 8 DOE laboratories, and 8 industrial organizations. The 13 NERI projects include significant international collaboration with participation by 6 foreign organizations including two foreign universities, one industrial company, and 3 government organizations. In addition, 3 collaborative I-NERI R&D projects were awarded under the collaborative agreement with France.

In FY 2002, approximately 23 new NERI projects will be initiated. Three NERI follow-on projects will be initiated to advance promising NERI projects that have been successfully completed and warrant further development. The 23 NERI projects that were initiated in FY 2000 and FY 2001 will be continued. In the I-NERI program, the 3 I-NERI projects initiated with France in FY 2001 will be continued. Seven I-NERI collaborative projects were awarded in early FY 2002, one under the agreement with France and 6 under the agreement with the Republic of Korea. Additional awards of 3-5 collaborative R&D projects are expected to be made following successful establishment of bilateral agreements with Japan, the Republic of South Africa, and the Nuclear Energy Agency.

In FY 2003, the Department will not pursue any new NERI or I-NERI projects, but will focus its attention to ongoing projects. The NERI program will complete the funding of the 13 NERI projects initiated in FY 2001. Funding will be continued on 16 of the 23 NERI projects and three follow-on projects initiated in FY 2002. Funding will be provided for the third year of the bilateral I-NERI projects initiated in FY 2001 and the second year of the I-NERI projects initiated in FY 2002.

In implementing the NERI program, the Office of Nuclear Energy, Science and Technology consults with the Office of Science to ensure that the NERI program approach to peer review is consistent with the good practices established by that office. In addition, the Office of Nuclear Energy, Science and Technology coordinates with all relevant DOE program offices to assure that the best use is made of the Department's financial, intellectual, and physical resources. The Department’s independent Nuclear Energy Research Advisory Committee (NERAC) also provides ongoing oversight and advice on the planning and implementation of the NERI program.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Nuclear Energy Research Initiative	33,903	31,152	24,337	-6,815	-21.9
SBIR/STTR	0	848	663	-185	-21.8
Total, Nuclear Energy Research Initiative	33,903	32,000	25,000	-7,000	-21.9

Detailed Program Justification

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
Nuclear Energy Research Initiative.....	**33,903**	**32,000**	**25,000**

- **Nuclear Energy Research Initiative..... 27,089 23,364 16,062**

The NERI program was initiated in FY 1999 to stimulate innovative research to address the difficult issues that currently constrain nuclear energy as an expandable and economic future electric energy option in the United States. DOE proposed the NERI program to encourage innovation and foster new ideas from our nation's universities, national laboratories, and industry to address these key issues, including proliferation, nuclear waste, enhanced reactor safety, and nuclear plant economics.

The NERI projects include research and development on next-generation nuclear energy systems; proliferation resistant nuclear fuel cycle technologies, new technologies for management of nuclear waste, and fundamental areas of nuclear science that directly impact the long-term success of nuclear energy. The advances in these areas will be incorporated in potential future advanced reactor designs and nuclear fuel systems.

In FY 2001, funding for 43 FY 1999 NERI research and development projects was completed; funding was provided to continue the 10 projects initiated in FY 2000; and 13 new projects were awarded.

In FY 2002, 43 NERI research and development initiated in FY 1999 are expected to be completed. The program will complete the funding of 10 projects initiated in FY 2000 and provide the second year of funding for the 13 projects initiated in FY 2001. Funding will also be provided to initiate approximately 23 new NERI projects. In addition, 3 NERI follow-on projects will be initiated to advance promising NERI projects that have been successfully completed and warrant further development.

In FY 2003, the research activities on 10 NERI projects initiated in FY 2000 will be completed. The program will complete the funding of the 13 NERI projects initiated in FY 2001 and provide funding for 16 of the 23 NERI projects and 3 follow-on projects initiated in FY 2002 (performance measure). The decrease of $7,302,000 is due to no new projects being initiated in FY 2003.

In FY 2002 and FY 2003, NERI will focus prominently on research required to support implementation of the *National Energy Policy* and exploring the large-scale generation of hydrogen.

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
▪ **International Nuclear Energy Research Initiative (I-NERI)**	**6,814**	**7,788**	**8,275**

In FY 2001, I-NERI was initiated to promote international collaborative research focused on development of advanced technologies, such as next-generation nuclear energy systems, which represent improvements in nuclear technology in terms of economic performance, proliferation resistance, waste management and enhanced safety. The collaborative international research projects awarded in FY 2001 are being cost-shared with other countries under bilateral agreements. In FY 2001, the Department completed I-NERI agreements with France and the Republic of Korea.

Discussions initiated in FY 2001 with Japan, the Republic of South Africa, and the Nuclear Energy Agency are expected to lead to bilateral agreements being executed in FY 2002.

In FY 2001, 3 collaborative I-NERI research projects with France were initiated.

In early FY 2002, 6 collaborative I-NERI research projects were initiated under the bilateral agreement with the Republic of Korea, and one collaborative I-NERI project was initiated under the bilateral agreement with France. An additional 3-5 I-NERI research projects will be awarded following the successful establishment of the bilateral agreements with Japan, the Republic of South Africa, and the Nuclear Energy Agency. Funding for the 3 I-NERI research projects initiated with France in FY 2001 will be continued.

In FY 2003, bilateral research projects initiated in FY 2001 and FY 2002 will be continued. No new I-NERI projects will be initiated. The increase of $487,000 reflects the change in second and third year funding for the international cost-shared research projects initiated in FY 2001 and FY 2002.

▪ **Small Business Innovative Research and Small Business Technology Transfer Programs**	**0**	**848**	**663**
Total, Nuclear Energy Research Initiative	**33,903**	**32,000**	**25,000**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
Nuclear Energy Research Initiative	
▪ The decrease of $7,302,000 reflects no new projects being initiated in FY 2003.	-7,302
International Nuclear Energy Research Initiative	
▪ The increase of $487,000 reflects the change in second and third year funding for the international cost-shared research projects initiated in FY 2001 and FY 2002..	+487
Small Business Innovative Research and Small Business Technology Transfer Programs	
▪ Corresponding decrease in SBIR/STTR.....	-185
Total Funding Change, Nuclear Energy Research Initiative.....	**-7,000**

Nuclear Energy Technologies

Mission Supporting Goals and Objectives

Electricity demand in the United States is expected to grow sharply in the 21st century requiring new generation capacity. Forecasts indicate that the United States will need about 393,000 megawatts of new generating capacity by 2020—even if ambitious assumptions are made regarding implementation of energy efficiency practices and technologies. If U.S. electricity demand continues to grow at the high rate as it has recently, even more generating capacity will be needed. This growth, which powers the U.S. economy, would require the United States to build between 1,300 and 1,900 new power plants over the next two decades. This averages to building and commissioning 60 to 90 new power plants per year. To help meet this need for new baseload electricity generation, the *National Energy Policy* has recommended expansion of nuclear energy in the United States as a major component of our Nation's energy picture.

Fully 20 percent of our Nation's current electricity production capacity is produced by nuclear power plants. In order to expand the use of nuclear power to meet current and future growth in electricity demand in the United States as recommended in the *National Energy Policy*, the technical, regulatory, and institutional barriers which currently exist must be successfully addressed by government and industry. The Department recognizes that there are near-term and long-term elements to this challenge. The Nuclear Energy Technologies program is structured to address the challenges ahead, cooperating with industry to implement near-term goals and the international community to explore long-term technologies.

To enable the deployment and operation of new, advanced nuclear power plants in the United States in the relatively near-term--by the end of the decade--it is essential to demonstrate the new, untested Federal regulatory and licensing processes for the siting, construction, and operation of new plant designs. In addition, independent expert analysis commissioned by the Department and carried out by the Nuclear Energy Research Advisory Committee (NERAC) has shown that the research and development on near-term advanced reactor concepts that offer enhancements to safety and economics is needed to enable these new technologies to come to market.

For the longer term, the Department believes that Generation IV nuclear energy systems can play a vital role in fulfilling the Nations long-term energy needs. Generation IV systems represent a new generation of nuclear energy and fuel cycle technologies that can be made available after the end of the decade but no later than 2030, and offer significant advances in the areas of sustainability, safety, reliability, and economics. Growing concerns for the environment favor energy sources that can satisfy the need for electricity and other energy-intensive products on a sustainable basis with minimal environmental impact. Advances in sustainability entail improvements in fuel utilization, waste management, and proliferation resistance. Advances in safety and reliability--with a goal of entirely eliminating the need for offsite emergency response--will improve public confidence while providing improved investment protection for plant owners. Advances in economics will ensure competitive life cycle cost and acceptable financial risk. Next-generation nuclear energy systems can serve a vital role in the Nation's long-term, diversified energy supply.

Nuclear Power 2010 - The Department believes it is critical to deploy new baseload nuclear generating capacity within the decade to support the *National Energy Policy* objectives of energy supply diversity and energy security. A major obstacle to the deployment of new nuclear plants is the uncertainties associated with the Federal regulatory processes and the financial and schedule risks resulting from these uncertainties. The Nuclear Power 2010 program is a joint government/industry cost-shared activity to develop advanced reactor technologies and demonstrate new regulatory processes leading to initiation of private sector construction of new nuclear power plants in the United States in 2005. Nuclear Power 2010 is an integrated program that aggressively pursues regulatory approvals and design completion in a phased approach, leading to construction and startup of new nuclear plants in the United States by 2010.

A Near-Term Deployment Working Group, operating under the auspices of the Department's Nuclear Energy Research Advisory Committee, an independent advisory body, and composed of representatives from the nuclear industry, national laboratories, and U.S. universities, initiated a concerted effort in FY 2001 to identify the technical, institutional and regulatory barriers to the deployment of new nuclear power plants by 2010. The working group recently issued *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010* which recommends actions to be taken by industry and the Department to support deployment of new advanced nuclear power plants in the United States by 2010 (see www.nuclear.gov). The recommendations of the near-term deployment roadmap, which have broad industry support, provide the basis for the activities of the Nuclear Power 2010 program.

Candidate reactor technologies identified by industry for near term deployment include both advanced water-cooled and gas-cooled reactor designs. Near term deployment efforts will be pursued on a dual-track basis, providing maximum potential for success of both water-cooled and gas-cooled reactor designs. Two reactor technology tracks will be pursued as water-cooled and gas-cooled reactors offer very different and complementary power generation characteristics (*i.e.,* large base load and small incremental electricity supplies) and each has attracted support from different U.S. power generation companies in different regions of the country.

A phased plan of action is proposed to achieve near term deployment. The phased approach will also permit ongoing measurement of progress and validation or adjustment of the work, as needed to achieve the program objective. The project phases to achieve new plant operation by 2010 include: Phase 1 – Regulatory Approvals; and Phase 2 – Design Completion. These phased actions will accomplish, in a coordinated manner, the essential regulatory and technical work, both generic and design-specific, to make possible new nuclear plants in this decade.

The Department will issue a solicitation to industry seeking proposals from joint venture project teams comprised of reactor vendors and power generation companies to participate in the Nuclear Power 2010 program. The solicitation will seek innovative business arrangements, such as consortia among designers, constructors, nuclear steam supply systems and major equipment supplies, and plant owner/operators, with strong and common incentives to successfully build and operate new plants in the United States.

Phase 1 is a parallel effort to demonstrate the Early Site Permit (ESP) and combined Construction/Operating License (COL) regulatory processes to eliminate licensing uncertainties (and associated financial risks) and obtain Design Certification of one advanced light water reactor and one advanced gas-cooled reactor. Phase 1 is a broad set of actions, both generic and plant-specific, related to application of the Nuclear Regulatory Commission (NRC) regulatory processes: preparation and submittal of ESP applications to demonstrate the siting process and to secure multiple ESPs; preparation and submittal of applications for rector design certification (DC) to demonstrate an efficient DC process and to secure approval for the two reactor designs; and preparation and submittal of COL applications for the two reactor technologies.

Phase 2 activities will complete the detailed engineering and design work for one advanced light water reactor and one advanced gas-cooled reactor in time to allow start of plant construction by 2005 to support operation by 2010. Phase 2 includes the detailed testing, engineering, and planning necessary to permit start of construction by the private sector. Phase 2 is also a dual track effort, involving government/industry collaboration in support of one water-cooled reactor design and one gas-cooled reactor design. For each reactor technology, the work would include: detailed design including first-of-a-kind engineering; nuclear, component and plant system testing; plant materials testing, if needed; fuel development and testing, if needed; balance of plant/power conversion system testing, if needed; and construction technology advancement (modular techniques) to shorten time to market.

Generation IV Nuclear Energy Systems Initiative – Generation IV is a new generation of nuclear reactor and fuel cycle systems that can be made available to the market after the end of the decade, but before 2030, and that offer significant advances toward challenging sustainability, safety and reliability, and economics goals. The sustainability goals for Generation IV systems focus on fuel utilization, waste management, and proliferation resistance. The safety and reliability goals focus on safe and reliable operation, investment protection, and essentially eliminating the need for emergency response. The economics goals focus on competitive life cycle and energy production costs and financial risk. The goals for Generation IV Nuclear Energy Systems were developed and endorsed by the Nuclear Energy Research Advisory Committee and the Generation IV International Forum to serve as the basis for development of a technology roadmap to guide subsequent research and development. The Generation IV Technology Roadmap was initiated in October 2000 and the final draft Roadmap will be available in September 2002. The Roadmap, which will be issued in early 2003, will outline the benefits, the technical and institutional barriers, and the research needs for the most promising nuclear energy system concepts.

The Generation IV Technology Roadmap is being prepared under the auspices of the Nuclear Energy Research Advisory Committee and the Generation IV International Forum (GIF). The GIF, a formal, chartered organization of Governments with representatives from Argentina, Brazil, Canada, France, Japan, Switzerland, Republic of South Korea, Republic of South Africa, United Kingdom, and the United States, is providing cost-free technical experts to assist the Department in the development of the Generation IV Technology Roadmap. The GIF is working to develop advanced nuclear technologies that address the factors impacting the expansion of nuclear energy internationally: economic competitiveness of building and safely operating nuclear energy systems; remaining concerns regarding nuclear safety and proliferation; and the challenge of minimizing and managing nuclear wastes. Once the Roadmap is complete, it will serve as the organizing basis of national, bilateral, and multilateral

research and development activities by GIF member countries for the development of Generation IV systems. Research and development will be conducted to increase fuel lifetime, establish or improve material compatibility, improve safety performance, reduce system cost, effectively incorporate passive safety features, enhance system reliability, and achieve a high degree of proliferation resistance. These R&D tasks will be pursued in cost-shared collaboration with other GIF member countries.

The Generation IV Technology Roadmap will identify the six-to-eight most promising nuclear energy system concepts including the front and back end of the fuel cycle, power conversion systems, waste management, and other nuclear infrastructure elements. Candidate systems include water-cooled, gas-cooled, and liquid-metal-cooled concepts, as well as one or more non-classical concepts such as reactor concepts with a liquid or gaseous core or concepts featuring novel energy conversion technologies. Generation IV nuclear energy systems also include energy conversion systems that produce non-electricity products such as hydrogen, desalinated water, and process heat.

The fundamental design objectives for Generation IV water-cooled reactors are aimed at simplifying the design to reduce cost and increase safety, optimizing fuel utilization, and reducing waste generation. Key research objectives are expected to include design simplification, modularization, and increased plant capacity factors as methods to reduce construction and operational costs. Fuel cycle optimization will be addressed through evaluation of high-burn-up fuels, long operating cycles, potential use of thorium, recycle of plutonium and/or uranium-233, and system deployment in conjunction with transmutation fuel cycles. The system options may include integral-type pressurized water reactors designed with a high degree of passive safety or advanced boiling water reactors with inherent safety.

Advanced gas-cooled reactors are also potential options for Generation IV nuclear energy systems. By achieving high fuel utilization and minimizing difficulties associated with in-service-inspection, gas-cooled concepts have the potential to improve economic competitiveness. From the long-term sustainability perspective, fast spectrum gas-cooled reactors have the ability to use fuel more effectively and reduce the quantity of high-level nuclear wastes through recycling of the longest-lasting fission products. The fundamental research objectives for Generation IV gas-cooled reactors are aimed at increasing efficiency by operating at high temperatures, reducing cost, and increasing safety, optimizing fuel utilization, and reducing waste generation. Key research objectives are expected to include experimental demonstration of advanced fuels, material and component capabilities including irradiation performance of recycled fuel; thermal-hydraulic tests relevant to static and dynamic operation; and passive safety confirmation tests. The system options may include high temperature reactors with hardened neutron spectra and gas-cooled fast reactors.

Liquid-metal-cooled reactors could also meet the technical objectives for Generations IV nuclear energy systems because of their inherent passive safety, their potential to optimize fuel utilization, and, through application of fuel recycle, to minimize long-term toxicity of the waste streams. The fundamental research objectives for Generation IV liquid-metal-cooled reactors are to reduce system cost, effectively incorporate passive safety features, enhance system reliability, achieve a high degree of proliferation resistance, and facilitate achievement of ultra-long lifetime cores and a high degree of operational autonomy. Key research objectives are expected to include developing advanced fuels capable of high burn-up and amenable to proliferation-resistant recycle technologies, and developing simplification and modular fabrication and installation technologies. The system options may include large monolithic or

modular sodium-cooled systems or small, transportable heavy liquid metal-lead or lead-bismuth eutectic-reactors.

Non-classical nuclear energy system concepts are also possible options for Generations IV nuclear energy systems because of their potential to meet the Generation IV technology goals. This category of advanced reactors includes concepts such as molten salt cores and gaseous cores. However, the non-classical systems have broader research and development needs because of their design immaturity.

The goal of the Generation IV Nuclear Energy Systems Initiative is to address the fundamental research and development issues necessary to establish the viability of the advanced system concepts. By successfully addressing the fundamental R&D issues, the concepts are highly likely to attract future private-sector sponsorship and ultimate commercialization. The design, licensing, construction, and operation of Generation IV Nuclear Energy Systems will be the responsibility of the nuclear suppliers and owner-operators.

The objectives of the Generation IV Nuclear Energy Systems Initiative are to:

- identify nuclear energy system concepts and associated fuel cycles that offer the greatest potential for meeting Generation IV technology goals;
- set forth a long-term research, development and demonstration plan for those concepts and fuel cycles;
- conduct viability research and development on the most promising concepts; and
- conduct a technology development and demonstration program leading to commercial deployment of the selected concepts.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Nuclear Energy Technologies	7,483	12,000	46,500	+34,500	+288.0
Total, Nuclear Energy Technologies	7,483	12,000	46,500	+34,500	+288.0

Detailed Program Justification

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
Nuclear Energy Technologies	**7,483**	**12,000**	**46,500**
■ **Nuclear Power 2010**	**3,000**	**8,000**	**38,500**

In FY 2001, the Department initiated an evaluation of the technical and institutional issues to be addressed to support near-term deployment of new nuclear power plants in the United States. Also in FY 2001, the Department initiated activities with the Nuclear Regulatory Commission (NRC) to develop an appropriate gas reactor regulatory and licensing framework. In addition, the Department initiated planning and implementation activities to commercialize the advanced gas reactor being developed for surplus weapons material disposition. These activities include commercial fuel development and testing, preparation of a plant cost evaluation, and an assessment of waste disposal acceptability.

In FY 2002, the Nuclear Energy Research Advisory Committee (NERAC) issued the results of their evaluation of the technical and institutional issues to be addressed to support near-term deployment of new nuclear power plants, *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010*. This report identifies the regulatory and institutional gaps that must be overcome and the recommended actions to be taken by industry and government to enable one or more orders for new commercial nuclear power plants in the United States by 2005 with operation by 2010. The report's key recommendations call for the demonstration of the regulatory licensing processes of 10 CFR Part 52 for Early Site Permit (ESP), Design Certification (DC), and combined Construction-Operating License (COL). The recommendations also call for the completion of the detailed design and engineering for at least one advanced light water and one advanced gas-cooled reactor design. Successful completion of these activities will address the essential regulatory and technical barriers and make possible new orders by 2005 and the construction of new nuclear plants in the United States within this decade.

In FY 2002, the Department will initiate a cost-shared study with industry to evaluate and identify potential sites (commercial and federal) for new nuclear power plants, and establish industry/government cooperative agreements to demonstrate the NRC Early Site Permit licensing processes (10 CFR Part 52) for the siting of nuclear power plants.

(dollars in thousands)

FY 2001	FY 2002	FY 2003

In FY 2002, the Department will also initiate cost-shared development and certification projects for enhanced advanced light water reactors and advanced gas-cooled reactors. The Department will solicit the industry, seeking joint venture project teams composed of reactor vendors and power generation companies to participate in the Nuclear Power 2010 program. The purpose of these joint venture teams is to develop innovative business arrangements, such as consortia among designers, constructors, reactor equipment suppliers, and plant owner/operators with strong and common incentives to successfully build and operate new plants in the United States. These activities will be cost-shared with industry contributing at least 50 percent of the costs. For the engineering and design activities, the Department will recover its investments through royalty payments on future reactor sales.

In FY 2002, the Department will continue the advanced gas-cooled reactor fuel qualification activities initiated in FY 2001. A cooperative agreement will be established with U.S. industry and international partners for an irradiation and qualification program for advanced gas-cooled reactor fuel. The gas-cooled reactor fuel irradiation, test and qualification program will be finalized, and the design and fabrication of the irradiation test fixtures will be completed.

In FY 2002, the Department will continue its cooperation with the Nuclear Regulatory Commission (NRC) on the development of a gas reactor regulatory and licensing framework. The Department and the NRC will complete the initial evaluation of the gas-cooled reactor technologies with the vendors and identify the technical issues and research required for licensing.

In FY 2003, the Department will continue the cost-shared Early Site Permit demonstration projects initiated with industry in FY 2002. In FY 2003, the Department will also continue the cost-shared design certification activities for one advanced light water reactor and one advanced gas-cooled reactor. These activities include the necessary engineering and design to receive regulatory approval of the reactor designs and prepare the designs for commercial deployment.

In FY 2003, performance will be measured by the Department initiating cost-shared demonstration projects for two combined Construction and Operating License applications

In FY 2003, the Department will also continue the advanced gas-cooled reactor fuel qualification activities initiated in FY 2001. The Department, in cooperation with the Nuclear Regulatory Commission and industry, will begin irradiating gas-cooled reactor fuel in the Advanced Test Reactor (ATR) at the Idaho National Engineering and Environmental Laboratory.

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
■ **Generation IV Nuclear Energy Systems Initiative.....**	**4,483**	**4,000**	**8,000**

In FY 2001, the Generation IV nuclear energy system technology goals were developed and endorsed by the international community to serve as the basis for the development of the Generation IV Technology Roadmap and to guide subsequent long-term R&D. The Generation IV International Forum (GIF) was formally established, and cost-free technical experts from member countries are actively participating in the development of the Roadmap.

In FY 2002, the *draft* Generation IV Technology Roadmap will be completed. The Roadmap will establish the long-term research and development plan for nuclear energy system concepts and associated fuel cycles that offer the greatest potential for meeting the goals of the Generation IV Nuclear Energy Systems Initiative.

In FY 2003, the Department will issue the Generation IV Technology Roadmap.

In FY 2003, the Department will initiate viability research and development on the six-to-eight most promising advanced nuclear energy system concepts. Initial phases of the R&D plan developed as part of the Roadmap will be implemented for those cross-cutting technologies common to the six-to-eight most promising energy system concepts. DOE's R&D activities will be highly leveraged with international cooperation facilitated by the Generation IV International Forum. The GIF has already set a date for an important meeting in Fall 2002 during which GIF member countries will develop teams of countries to address various aspects of the Generation IV Technology Roadmap.

Total, Nuclear Energy Technologies	**7,483**	**12,000**	**46,500**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002($000)
Nuclear Power 2010	
▪ Cost-shared projects will be continued to demonstrate the untested NRC Early Site Permit licensing process, and new projects will be initiated to demonstrate the combined Construction/Operating licensing process. Cost-shared projects will be initiated for NRC design certification/approval and detailed engineering and design work for advanced light water and advanced gas-cooled reactor technologies. Research will be expanded for the irradiation, testing and qualification of the advanced gas reactor fuel.….	+30,500
Generation IV Nuclear Energy Systems Initiative	
▪ The Generation IV Technology Roadmap will be completed in 2003 and the R&D plan developed as part of the Roadmap will be initiated for those cross-cutting technologies common to the six-to-eight most promising energy system concepts.....	+4,000
Total Funding Change, Nuclear Energy Technologies	**+34,500**

Advanced Nuclear Medicine Initiative

Mission Supporting Goals and Objectives

The U.S. Department of Energy supports research by exploring the use of isotopes to advance medical technology through the ANMI.

Because of the importance of nuclear medicine to the advanced U.S. health care system, the application of isotopes in medical research has become an increasingly important focus of the Department's activities. In recent years, the Department has established a peer-reviewed research program, the Advanced Nuclear Medicine Initiative (ANMI), to advance nuclear medicine technology in the United States as well as to support nuclear medicine education activities at the Nation's universities.

The ANMI was established in response to repeated suggestions made by nuclear medicine experts inside and outside the Federal government. This initiative supports U.S. broad-based research in nuclear medicine-based diagnosis and therapy (including use of alpha emitters). It builds upon the Department's current programs and activities and takes advantage of its unique facilities and laboratory capabilities to apply advanced nuclear technologies to the challenge of curing cancer and other life-threatening illnesses. In addition, the ANMI supports the development of science and technology programs at U.S. universities and colleges to address the critical need to train experts in fields relevant to nuclear medicine such as radiochemistry and radiopharmacy. The ANMI uses a peer-review process in which members of the Nuclear Energy Research Advisory Committee (NERAC) and other prominent experts judge the scientific merits of projects proposed by universities, hospitals, and the national laboratories for funding. The nine research and five educational financial assistance awards made in FY 2000 are three-year awards that will come to a conclusion in FY 2002. No funding is requested in FY 2003 due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Advanced Nuclear Medicine Initiative	2,500	2,500	0	-2,500	-100.0
Total, Advanced Nuclear Medicine Initiative	2,500	2,500	0	-2,500	-100.0

Detailed Program Justification

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
Advanced Nuclear Medicine Initiative	**2,500**	**2,500**	**0**

The ANMI sponsors nuclear medical science using a peer review selection process. The Department's support is provided in two forms: direct research financial assistance and making isotopes available for research at prices that researchers can afford. The ANMI contains two major components:

- Encourage the training of individuals in nuclear medicine methods by establishing university scholarships and fellowships for nuclear medicine specialists and by sponsoring summer internships at appropriate institutions.

- Continue a focused program in the U.S. to support research applications, in particular alpha-emitting isotopes, to fight a spectrum of malignant diseases including most common cancers and infectious diseases such as meningitis.

Total, Advanced Nuclear Medicine Initiative	**2,500**	**2,500**	**0**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
No funding is requested in FY 2003	-2,500
Total Funding Change, Advanced Nuclear Medicine Initiative	**-2,500**

Infrastructure

Program Mission

The Infrastructure programs provide for the management of the Department's vital resources and capabilities at sites and facilities assigned to the Office of Nuclear Energy, Science and Technology (NE). These resources ensure that the Department's unique facilities are available to meet the vital missions of the Federal government and that these assets are maintained in a safe, secure, environmentally-compliant and cost-effective manner, ensuring the protection of site workers, the public, and the environment. The Infrastructure programs include the Fast Flux Test Facility (FFTF) and the Radiological Facilities Management with activities conducted at the following sites: Argonne National Laboratory-West (ANL-W), the Fast Flux Test Facility (FFTF), the nuclear research infrastructure at the Test Reactor Area (TRA) at Idaho National Engineering and Environmental Laboratory (INEEL), and certain facilities within the Oak Ridge National Laboratory (ORNL), Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), Brookhaven National Laboratory (BNL), Pacific Northwest National Laboratory (PNNL) and the Mound, Ohio Plant.

Beginning in FY 2003, the facilities and infrastructure activities previously funded in the Advanced Radioisotope Power Systems program, Medical Isotope Program, ANL-W Operations, and the Test Reactor Area (TRA) Landlord programs have been incorporated into one account, the Radiological Facilities Management program. This change will more accurately reflect the activities being performed at NE managed sites and facilities. The Radiological Facilities Management program includes maintaining DOE NE facilities in a user-ready status to support vital U.S. Government missions; continuing stewardship of special nuclear materials and other important materials, and managing and dispositioning DOE legacy materials (including those activities under the Nuclear Facilities Management program) to deal with materials at ANL-West. Finally, the FFTF program provides for the safe and environmentally-compliant deactivation of that facility, implementing a Secretarial decision made in December 2001.

Program Strategic Performance Goal

ER7-8: Protecting our Nation's nuclear R&D infrastructure by managing the Department's vital resources and capabilities, efficiently and effectively such that by December 2004: major research/critical facilities will continue to be operational and available for fulfillment of long-term missions as funded by industry and other Federal agencies while unneeded facilities are deactivated in a safe and cost-effective manner.

Performance Indicators:
Readiness of systems and facilities to meet user requirements while maintaining full compliance with environmental and safety requirements.

Performance Standards

Blue = Performance was significantly above the planned annual targets for the PSPG.
Green = Performance results meet all planned annual targets for the PSPG.
Yellow = Performance was less than the planned annual targets, but not significantly less for the PSPG.
Red = Performance was significantly less than the planned annual targets for the PSPG.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
FFTF: Complete the National Environmental Policy Act review of the environmental impacts of enhancing the Department's nuclear research facility infrastructure and issue a Record of Decision.*(EQ3-2)* (MET GOAL)	**FFTF**: Complete upgrades on the FFTF Sodium Removal System.*(ER7-8)*	**FFTF**: Meet all milestones in the Hanford Federal Facility Agreement and Consent Order.*(ER7-8)*
Radiological Facilities Management: Complete installation of the full scale Pu-238 scrap recovery line to process Pu-238 scrap that will be required to provide radioisotope power systems for planned NASA and national security missions.*(ER2-7)* (MET GOAL*)* Competitively select system integration contractor to develop a flight qualified Stirling Radioisotope Power System for future space exploration missions.*(ER2-7)* (MET GOAL) Complete initial assessment of special purpose fission technologies that is focused on concepts and technologies for space applications.*(ER2-7*) (MET GOAL) Complete 75 percent of the facility construction and equipment installation for the new 100 MeV Isotope Production Facility, which is needed to continue production of short-lived radioisotopes essential for U.S. medical research. *(ER2-6* (MET GOAL)	**Radiological Facilities Management**: Bring the full-scale scrap recovery line to full operation and begin processing Pu-238 scrap for reuse in ongoing and future missions requiring use of radioisotope power systems.*(ER7-8)* Demonstrate the operational capability of radioisotope power systems infrastructure by fabricating quality products at each of the major facilities (i.e., at last 8 iridium clad vent sets at ORNL, at least 8 encapsulated Pu-238 fuel pellets at LANL, and at least 1 heat source module at Mound).*(ER7-8)* Complete 80 percent of the construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived radioisotopes essential for U.S. medical research. *(ER7-8)* Meet the milestones for legacy waste cleanup at TRA in the Voluntary Consent Order between the State of Idaho and DOE and efficiently manage resources to limit growth in backlog of maintenance to no more than 10 percent.*(ER7-8)*	**Radiological Facilities Management**: Demonstrate the operational capability of radioisotope power systems infrastructure by fabricating quality products at each of the major facilities (i.e., at last 8 iridium clad vent sets at ORNL, at least 8 encapsulated Pu-238 fuel pellets at LANL, and at least 1 heat source module at Mound), and by processing at least 2 kilograms of scrap Pu-238 through the new full scale Pu-238 scrap recovery line at LANL.*(ER7-8)* Complete construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived radioisotopes essential for U.S. medical research.*(ER7-8)*

Significant Accomplishments and Program Shifts

Fast Flux Test Facility

- In May 1999, a Secretarial decision was made to prepare a Program Scoping Plan to clearly define the potential uses of the FFTF, the roles and responsibilities of potential user communities, and opportunities for private-public partnerships. The objective of the program scoping plan was to establish whether a compelling rationale exists for DOE to further consider the potential restart of FFTF.

- In August 1999, following the completion of the Program Scoping Plan and a review by the Department's Nuclear Energy Research Advisory Committee, a Secretarial decision was made to initiate a NEPA review of the environmental impacts associated with the restart and operation of FFTF as a nuclear research and medical isotope production user facility.

- In September 1999, initiated preparation of the *Programmatic Environmental Impact Statement (PEIS) for Accomplishing Expanded Civilian Nuclear Research and Development and Isotope Production Missions in the United States, including the role of Fast Flux Test Facility*, as well as the FFTF long-range research and development plan, the FFTF waste management and minimization plan, and analyses of costs and nonproliferation impacts associated with nuclear infrastructure alternatives being evaluated in the PEIS.

- In January 2001, issued a Record of Decision based on the Nuclear Infrastructure PEIS and related reports; this decision stated that the FFTF would be permanently deactivated.

- In FY 2001, funding for safeguard and security activities was transferred from NE to EM, the Lead Program Secretarial Office for the Hanford Site.

- On December 19, 2001, after an exhaustive, eight-month review of possible missions and future commercial uses for the FFTF, the Department announced a final decision to proceed with permanent deactivation of the facility.

Radiological Facilities Management

- In FY 1999, Argonne National Laboratory and Idaho National Engineering and Environmental Laboratory were designated as the Nuclear Reactor Technology Lead Laboratories for DOE-NE.

- In FY 2001, funding for safeguards and security activities was transferred from NE to the Lead Program Secretarial Office for the ANL-West site.

- In FY 2001, the previous Termination Costs program was split into two programs: ANL-West Operations and Nuclear Facilities Management, in order to more accurately reflect the activities being performed at ANL-West

- In FY 2001, the installation of the full-scale processing line at LANL (which will allow scrap Pu-238 to be recycled and reused for ongoing and future missions) was completed. In FY 2002, the line will become operational and will begin to process Pu-238 scrap for reuse in ongoing and future missions.

- In FY 2001, initiated the procurement for the development of a Stirling Radioisotope Generator and, in FY 2002 initiate the development of a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG). Both efforts will be conducted using funding provided by NASA.

- In FY 1999, construction started on replacement of the isotope production facility. The Isotope Production Facility (IPF) at the Los Alamos Neutron Science Center (LANCE) will produce medical and research short-lived accelerator isotopes. This construction project will be completed in FY 2003 as scheduled.

- Starting in FY 2002**,** the Department plans to apply a more formal, peer-review structure to the process it applies to the production and distribution of research isotopes. This new process is called the Nuclear Energy Protocol for Research Isotopes (NEPRI). Under this protocol, the peer-reviewed process will be applied to determine which isotopes will be produced by the Department in a given year. Once a list of isotopes has been selected for production, customers must provide the Department advance cash payment to cover production costs starting in FY 2003. Each isotope will be priced such that its cost of production is paid by the customer for that isotope. No radiological facilities management appropriated funds will be expended on the development or production of these isotopes. The Department will apply an open, public process to determine (with comments from the Isotope Review Advisory Panel) and announce each year which research isotopes it will produce.

- Beginning in FY 2003, the facilities and infrastructure activities previously funded in the Advanced Radioisotope Power Systems program, Medical Isotope Program, ANL-W Operations, and the Test Reactor Area (TRA) Landlord programs have been incorporated into one account, the Radiological Facilities Management program. This will more accurately reflect the activities being performed at NE managed sites and facilities.

Funding Profile

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Original Appropriation	FY 2002 Adjustments	FY 2002 Comparable Appropriation	FY 2003 Request
Fast Flux Test Facility (FFTF)	38,439	38,439	-2,000	36,439	36,100
Radiological Facilities Management	88,284	87,767	-1,085	86,682	83,038
Total, Infrastructure	126,723	126,206	-3,085[a]	123,121	119,138

[a] FY 2002 General Reduction ($2.0 million applied to FFTF: $500 applied to ANL-West for Advance Radioisotope Power Systems.

Funding by Site

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	1,912	10	0	-10	-100.0
Los Alamos National Laboratory	15,482	15,422	15,268	-154	-1.0
Sandia National Laboratory	2,650	1,900	1,800	-100	-5.3
Total, Albuquerque Operations Office	20,044	17,332	17,068	-264	-1.5
Chicago Operations Office					
Argonne National Laboratory	31,937	32,857	31,115	-1,742	-5.3
Brookhaven National Laboratory	2,100	1,800	1,850	+50	+2.8
Chicago Operations Office	472	0	0	0	0.0
Babcock and Wilcox	0	0	500	+500	+100.0
Total Chicago Operations Office	34,509	34,657	33,465	-1,192	-3.4
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory	9,288	10,883	11,155	+272	+2.5
Total, Idaho Operations Office	9,288	10,883	11,155	+272	+2.5
Oak Ridge Operations Office					
Oak Ridge National Laboratory	13,010	11,100	10,500	-600	-5.4
Total, Oak Ridge Operations Office	13,010	11,100	10,500	-600	-5.4
Oakland Operations Office					
Oakland Operations Office	1,600	1,050	0	-1,050	-100.0
Total, Oakland Operations Office	1,600	1,050	0	-1,050	-100.0
Ohio Operations Office					
Mound	10,496	10,550	10,450	-100	-0.9
Total, Ohio Operations Office	10,496	10,550	10,450	-100	-0.9
Richland Operations Office					
Fluor Daniel Hanford	35,566	36,439	36,100	-339	-0.9
Richland Operations Office	0	10	0	-10	-100.0
Total, Richland Operations Office	35,566	36,449	36,100	-349	-1.0
Savannah River Operations					
Savannah River Site	715	0	0	0	0.0
Total, Savannah River Operations	715	0	0	0	0.0
Washington Headquarters	1,495	1,100	400	-700	-63.6
All Other Sites	0	0	0	0	0.0
Total, Infrastructure	126,723	123,121	119,138	-3,983	-3.2

Site Descriptions

Argonne National Laboratory

Argonne National Laboratory (ANL) is one of the U.S. Department of Energy's largest research centers, and was the nation's first national laboratory, chartered in 1946. ANL is located at two sites. The Illinois site, ANL-East, is the main laboratory and occupies 1500 acres, surrounded by a forest preserve about 25 miles southwest of the Chicago Loop. The Idaho site, ANL-West, is located within the boundary of the Idaho National Engineering and Environmental Laboratory (INEEL) in Southeastern Idaho, about 35 miles west of Idaho Falls.

The capabilities on ANL are essential to meeting objectives defined in the *National Energy Policy* as well as meeting national security goals. Typically, basic research is conducted at ANL-East, with large-scale testing and development conducted at ANL-West. For example, experiments, modeling, and analysis at ANL-East resulted in the development of the electrometallurgical technology that was demonstrated at ANL-West through the treatment of a limited quantity of sodium-bonded spent nuclear fuel. The capabilities of ANL-West also include nuclear fuel development, post-irradiation examinations, waste and nuclear material characterization, and development of dry, interim storage for spent fuel and other highly radioactive materials.

Activities under the ANL-W Operations effort involve a number of significant facilities at ANL-West, including the Hot Fuel Examination Facility (HFEF), Fuel Conditioning Facility (FCF), Fuel Manufacturing Facility (FMF), Analytical Laboratory (AL), Electron Microscopy Laboratory (EML), and Radioactive Scrap and Waste Facility (RSWF). These facilities are supported by several other nuclear, radiological and industrial support and office facilities.

The HFEF is a versatile, modern hot cell facility that is operated to characterize and package spent fuel and radioactive waste, including high-level waste, which could ultimately be placed in a geologic repository. The FCF demonstrated the treatment of sodium-bonded spent nuclear fuel from the Experimental Breeder Reactor-II using electrometallurgical treatment technology and was used to treat some of the EBR-II spent fuel inventory.

The FMF is currently being used to develop and test fuel for research reactors, and to verify suitability of waste forms that would result from electrometallurgical treatment. The AL and the EML provide analytical capabilities in support of electrometallurgical treatment technology and the development of waste forms for the resulting high level waste that will be suitable for long-term geologic disposal. The RSWF provides a fully permitted interim dry underground temporary storage capability for a variety of experimental spent fuels and radioactive scrap. Other facilities at ANL-West, such as the Zero Power Physics Reactor, the TREAT and the Sodium Process Facility (SPF), while not currently operating, provide a number of reactor physics, core design, nuclear materials, and waste treatment testing capabilities. The SPF was used to convert radioactive sodium into a chemically stable, low-level waste

form. The sodium that was converted included legacy sodium from the Enrico Fermi Atomic Power Plant (Fermi-I) in Michigan, which was stored at ANL-West and the primary and secondary sodium coolant from the EBR-II.

The EBR-II is a liquid metal cooled fast reactor at ANL-West that operated successfully conducting research and producing electrical power for 30 years. It has been defueled and is scheduled to be deactivated in March 2002. ANL and the INEEL serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories assist and work with the Department's Office of Nuclear Energy, Science and Technology to maintain and apply world class technical capabilities to assure that the Department is maximizing its investment in nuclear reactor technology research and development. This effort will focus principally on research and development activities that addresses long-term nuclear reactor technology issues such as reducing the cost of nuclear-generated electricity, finding better ways to deal with spent fuel and proliferation issues, improving the performance of existing plants, and achieving even higher levels of safety than has been achieved thus far.

Brookhaven National Laboratory

Brookhaven National Laboratory (BNL) is an U.S. Department of Energy (the Department) scientific research laboratory located on Long Island, New York. The Brookhaven Linear Isotope Producer (BLIP) at BNL uses a linear accelerator that injects 200 million-electron-volt protons into the 33 giga-electron-volt Alternating Gradient Synchrotron. The BLIP facility operates about 20 weeks per year and produces radioisotopes such as strontium-82, germanium-68, copper-67, and others that are used in medical diagnostic applications. BNL is also active in the development of new isotope processes and delivery systems. A conceptual design report to acquire and install a new 70MeV cyclotron facility at BNL was completed in April 2000. The facility would be used as a resource for research and development of isotope and related medical and scientific applications. This facility would provide reliable production of accelerator isotopes year round without interruption from other programs. In addition, it will serve as a much-needed national resource for the education and training of future radiochemists and radio pharmaceutical scientists.

Hanford Site

The FFTF, located at the Department's Hanford Site, near Richland, Washington, is a U.S. Government-owned 400 megawatt-thermal sodium-cooled, fast-neutron flux reactor originally intended for irradiation testing of nuclear reactor fuels and materials for the U.S. liquid metal reactor (LMR) program. The FFTF is the largest and most modern facility of its kind in the world.

The design, operation, and maintenance of FFTF was conducted in accordance with the standards established by the Office of Reactor Development and Technology (RDT) and the American National Standards Institute (ANSI), and the codes established by the American Society of Mechanical Engineers (ASME). An independent safety review of the design and construction of FFTF was conducted by the U.S. Nuclear Regulatory Commission (NRC) at the request of the Energy Research and Development Administration. The objective of the safety review was "to provide an in-depth technical review of the design of the FFTF comparable to that of a licensed plant." The NRC safety review was directed at

"evaluating the adequacy of the design to ensure safe operation of the plant" and resulted in the issuance of a Safety Evaluation Report in August 1978.

The FFTF is an array of buildings and equipment arranged around a reactor containment building. The reactor vessel is located in a shielded cell in the center of the containment. Heat is removed from the reactor vessel by liquid sodium circulated through three primary loops (including primary pumps, piping and intermediate heat exchangers) also located in cells in containment. Secondary sodium coolant loops transport the reactor heat from the intermediate heat exchangers to the air-cooled tubes of the dump heat exchangers.

The FFTF includes facilities for receiving, conditioning, storing, installing and removing from the core all routinely replaced core components, and storing irradiated fuel. Post-irradiation examination and packaging capabilities are also available. Utilities and services at FFTF include onsite emergency generation of electrical power, heating and ventilation, radiation monitoring, fire protection, auxiliary cooling systems for cell atmospheres and some components. The FFTF is being maintained in a safe condition with the reactor completely defueled while the shutdown activities are conducted, such that the facility remains in compliance with federal and state safety and environmental regulations. The main heat transport system is being operated at approximately 400°F, with the sodium kept in a molten state to support eventual draining and storage. Essential systems, staffing, and support services will continue to be maintained at levels to support FFTF system closure and deactivation, as well as fuel transfer to dry storage and sodium draining. Surveillance and maintenance activities are being performed to ensure that there is: (1) no degradation of plant systems needed for deactivation; (2) retention of the authorization basis and configuration control; (3) maintenance of key staffing, qualifications, and training; and (4) compliance with Federal and state safety and environmental requirements. However, overall surveillance and maintenance requirements (and cost) are less than those prescribed for the standby condition, since there is no longer any need to maintain a restart potential for FFTF systems and equipment.

The FFTF was operated from April 1982 to April 1992 in support of various Department programs such as material testing for fusion, space reactor, and international fast reactor programs. The facility played a key role in Liquid Metal Reactor (LMR) development and testing activities as it provided a test bed for demonstrating and evaluating the performance of fuel assembly and core designs in a prototypic LMR environment. The FFTF is widely considered the Department's best nuclear facility in terms of conduct of operations.

The FFTF has been in a hot-standby condition since December 1993. In November 1995, the Department decided to limit deactivation work at FFTF to those activities which would not prohibit the facility from being returned to service in order to study the facility's capability for tritium and medical isotope production. In January 1997, the Department decided to continue to maintain the facility in standby to further evaluate the tritium and medical isotope production capabilities of the facility and to determine what role, if any, the facility could play in the Department's tritium production strategy.

In December 1998, the Department announced the decision to remove the FFTF from consideration as a tritium supply source but to further investigate the facility's potential role in the Department's national nuclear technology infrastructure. In May 1999, after careful consideration of the recommendations

from the Nuclear Energy Research Advisory Committee (NERAC) and other analyses, the Department concluded that the facility could possibly serve a unique and valuable science and research role. As such, the Department developed a program plan that clearly defines the potential application of the facility and the roles and responsibilities of potential user communities.

In July 1999, following a review of the program scoping plan, NERAC voted 19 to 2, in favor of a resolution recommending the Department proceed toward a Record of Decision on FFTF. NERAC further recommended that a non-proliferation policy review, cost evaluation, and mission assessment be conducted to inform the Record of Decision. NERAC also recommended that, in moving to the Record of Decision, NE prepare a long-range plan for its research and development activities and that FFTF be included in this plan.

Based on the results from the program scoping plan and the NERAC recommendations, the Department announced on August 18, 1999, that it would initiate a NEPA review of the environmental impacts associated with the restart and operation of FFTF as a nuclear research and medical isotope production facility. The results from the NEPA review led to a Record of Decision in January 2001, which resulted in the establishment of a FFTF Shutdown Project.

On December 19, 2001, after an exhaustive, eight-month review of possible missions and future commercial uses for the FFTF, the Department announced a final decision to proceed with permanent deactivation of the facility.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is an extensive research and engineering complex that has focused on some of the most advanced energy research in the world since 1949. In recent years, in addition to continued operation of complex nuclear and non-nuclear facilities, the INEEL has initiated technology development in applied environmental science and engineering. The Idaho Test Reactor Area (TRA) is located within the INEEL. Since the early 1950s, test reactors, laboratories, hot cells and supporting facilities have been built at TRA. The principal facility operating at TRA is the Advanced Test Reactor (ATR). The ATR is one of the world's largest and most advanced test reactors. It provides both vital irradiation testing for reactor fuels and core components, primarily for the U.S. Navy Nuclear Propulsion Program, and isotopes critically needed by medicine and industry. The 250-megawatt ATR has nine major locations where independent loops can be used for experimental or irradiation work, and numerous drop-in locations for experiments and isotope production throughout the core region. The ATR is unique in being able to adjust the local power and neutron flux within the core. This provides unusual flexibility in meeting test sponsor and isotope production needs. The three most important isotopes normally produced in the at ATR are: iridium-192, used in industrial radiography and radiation oncology for tumor therapy; cobalt-60, used in food sterilization and cancer treatment; and nickel-63 used in direct conversion power sources.
Other facilities currently operating on the site are: the ATR Critical Facility reactor, which supports ATR operations; the TRA Hot Cells; the Office of Science Safety and Tritium Applied Research (STAR) Facility which does fusion fuel research and has been designated by the Secretary of Energy as a National User Facility; and the INEEL Applied Engineering and Development Laboratory. ATR

operations and a wide variety of scientific research projects are planned to continue at TRA until well into the twenty-first century. The following facilities at TRA are shutdown in a surveillance and maintenance status awaiting decontamination and decommissioning: the Materials Test Reactor (MTR), the MTR Canal, the Engineering Test Reactor, the Coupled Fast Reactivity Measurement Facility, and the Advanced Reactivity Measurement Facility. TRA is operated for the Department by Bechtel BWTX Idaho, LLC. Responsibility for TRA Facilities resides with the Office of Nuclear Energy, Science and Technology. The TRA Facilities account provides for maintaining and upgrading TRA common use facilities and the utility infrastructure to ensure that programmatic, reliability and ES&H requirements are met.

The INEEL and the ANL serve as the Nuclear Reactor Technology Lead Laboratories. They are essential to meeting the goals of the *National Energy Policy*. These Lead Laboratories assist and work with the Department's Office of Nuclear Energy, Science and Technology to maintain and apply world class technical capabilities to assure that the Department is maximizing its investment in nuclear reactor technology research and development. This effort will focus principally on research and development activities that addresses long-term nuclear reactor technology issues such as reducing the cost of nuclear-generated electricity, finding better ways to deal with spent fuel and proliferation issues, improving the performance of existing plants, and achieving even higher levels of safety than has been achieved thus far.

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. A portion of the Plutonium Facility-4 at the Technical Area-55 at LANL is dedicated to Pu-238 processing. This capability is the only existing Pu-238 processing and encapsulation capability within the DOE complex and is used to process and encapsulate Pu-238 used in radioisotope power sources for the National Aeronautics and Space Administration (NASA) space exploration missions and national security applications. The LANL capabilities were expanded to include establishing a Pu-238 scrap recovery capability to recycle Pu-238 scrap for use in future missions. In FY 2002, LANL technical expertise is also used in analyzing the reactor core aspects of fission power concepts that may be required to satisfy future higher power space applications. However, this activity will be phased out in FY 2003.

Once in operation after completion of construction in FY 2003, the new 100 MeV Isotope Production Facility (IPF) at LANL will use the proton beam of the Los Alamos Neutron Science Center (LANSCE) Linear Accelerator. The IPF may operate up to 8 months per year in conjunction with other programs. This will be an increase in operating time of 20 weeks from FY 1999. The unique characteristics of the LANSCE accelerator include a high-energy, high-current beam that allows production of higher quality radioisotopes, as well as exotic radioisotopes that cannot be produced in other facilities. Three major

products produced at the site are germanium-68, a calibration source for Positron Emission Tomography (PET) scanners; strontium-82, the parent of rubidium-82, used in cardiac PET imaging; and sodium-22, a positron-emitter used in neurologic research.

Mound, Ohio Plant

The Mound Plant is located in southwest Ohio adjacent to the city of Miamisburg. Previously, the main mission of the Mound, Ohio Plant was to manufacture components for nuclear weapons for Defense Programs. As part of the Department's Non-nuclear Consolidation Plan, the Department decided to consolidate Defense Program activities to other sites and transferred the Mound, Ohio Plant site to the Office of Environmental Management for cleanup and transition of the facilities and properties to commercial operations. Only the facilities used to assemble and test radioisotope power systems used for NASA space exploration missions and national security applications will remain in long-term use by DOE Programs.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) is a U.S. Department of Energy scientific research laboratory located in Oak Ridge, Tennessee. ORNL has developed the unique capabilities for fabricating carbon insulator and iridium heat sources components for radioisotope power sources used for NASA space exploration missions. These sophisticated heat source components are necessary for the safe operation of these power systems during normal operation and during launch, reentry or other deployment accidents.

In FY 2001 and FY 2002, ORNL has also been the site for doing the target assembly and the processing of irradiated targets associated with the potential establishment of a domestic Pu-238 production capability. Some of the targets were irradiated at the High Flux Isotope Reactor (HFIR) located at ORNL. However, most of the targets were shipped to the Advanced Test Reactor in Idaho for irradiation. ORNL will continue in FY 2003, to conduct preconceptual design efforts related to target fabrication and processing requirements that would be needed for Pu-238 production and on assessing the issues associated with transfer of Np-237 from Savannah River to ORNL. Technical reactor expertise was also used at ORNL in FY 2002 to independently evaluate and assess potential space fission power and propulsion concepts and technologies proposed to meet the higher power requirements that may be needed to satisfy future space missions.

In addition, the High Flux Isotope Reactor (HFIR) at ORNL provides one of the world's highest steady-state neutron fluxes. The reactor is normally scheduled to operate about 43 weeks per year to support primary missions other than isotope production. Isotope products made at this facility include: tungsten-188, rhenium-186, californium-252, and iridium-192. One target position, with hydraulic capability to simultaneously load and unload up to eight targets is available and is heavily used for medical radioisotope production. Additional peripheral target positions became available in the second half of FY 1999. The program depends heavily on HFIR for isotope production. The program also

maintains the Hot Cell Facility, Building 3047, at ORNL to process and package the radioisotopes produced at the HFIR. In addition, one of the cells in Building 3047 is being modified to accommodate processing alpha isotopes to meet future demand.

Currently, the electromagnetic calutrons at ORNL have been placed in a cold-standby mode with minimum maintenance. The calutrons will be shut down and transferred to the Department's Environmental Management Program for disposition. Within the calutron building, ORNL operates two laboratories used for processing and forming enriched stable isotopes: the material laboratory performs a wide variety of metallurgical, ceramic, and high vacuum processing techniques; the chemical laboratory performs scraping, leaching, dissolving, oxidizing processes to remove unwanted materials and place the isotope into a "chemically stable" form. These laboratories and the stable isotope inventories will be transferred to site area X-10 at Oak Ridge.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. SNL has unique analytical and testing capability used to evaluate radioisotope power system response during hypothetical launch accidents. These capabilities are used on an as required basis to support preparation of Safety Analysis Reports. In FY 2002, Sandia technical expertise was also used in defining overall system concepts involving space fission energy systems that may be required to satisfy higher power space applications. However, this activity will be phased out in FY 2003. SNL's Annular Core Research Reactor (ACRR) is a 2-megawatt, pool-type research reactor that is used to produce isotopes for medical applications. The ACRR is a highly flexible facility applied to the mission requirements of the Department in both isotope and national security applications.

Savannah River Site

The Savannah River Site is located in the Central Savannah River Area of South Carolina. The Office of Nuclear Energy, Science and Technology has been maintaining the Plutonium Fuel Form Facility in an environmentally safe shutdown condition. This facility is being transferred in FY 2002 to the Office of Environmental Management for decontamination and decommissioning.

Capital Operating Expenses & Construction Summary
Capital Operating Expenses

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Capital Equipment	340	1,147	1,785	638	55.6
General Plant Projects	1,800	1,316	866	-450	-34.2
Total, Capital Operating Expenses	2,140	2,463	2,651	188	7.6

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp.	FY 2001 Approp.	FY 2002 Approp.	FY 2003 Request.	Unapprop. Balance
95-E-201, TRA Fire and Life Safety Improvements, INEEL	18,323	12,840	457	500	500	4,026
99-E-200, TRA Electrical Utility Upgrade, INEEL	7,709	766	877	950	1,840	3,276
99-E-201, Isotope Production Facility, LANL-	19,999	12,770	3,014	2,494	1,721	0
Total, Construction	46,031	26,376	4,348	3,944	4,061	7,302

Fast Flux Test Facility

Mission Supporting Goals and Objectives

As part of the Department's strategic environmental quality mission, this program supports the permanent deactivation of the Fast Flux Test Facility (FFTF). In accomplishing this goal, the reactor and supporting buildings, systems, and equipment will be placed in a radiologically and industrially stable and safe condition, in compliance with applicable Federal and State environmental, health, and safety regulations and requirements. The final condition of the FFTF will be suitable for eventual decontamination and decommissioning (D&D).

The specific objectives to enable this goal are included in the FFTF Project Management Plan which delineates those activities, schedules, and costs that will place the FFTF in an industrially and radiologically safe condition, while minimizing surveillance and maintenance costs. In executing this plan, the Department will place FFTF nuclear fuel in dry storage; drain and store sodium from the reactor, secondary piping systems and fuel storage pools for dispositioning; and place all FFTF systems and equipment, in an industrially safe condition.

Experience gained from the deactivation of the Experimental Breeder Reactor-II (EBR-II), located on the Argonne National Laboratory-West site in Idaho will be applied to the deactivation planning for the FFTF. The EBR-II, shutdown in 1994, has been drained of all sodium coolant, and all of this coolant, both primary and secondary, has been processed into a stable state suitable for disposition. Argonne National Laboratory engineers continue to work closely with FFTF deactivation planners to ensure that lessons learned are imparted to the extent practicable to the FFTF project. This experience is anticipated to result in efficiencies, and, in some cases, such as sodium processing, direct application of state of the art technology developed specifically for sodium reactor deactivation purposes.

FY 2003 funding will be directed toward continued progress in FFTF deactivation, in anticipation of a funding profile starting in FY 2004 that would cost-effectively complete the deactivation project by the end of FY 2009.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Fast Flux Test Facility (FFTF)	35,807	36,439	36,100	-339	-0.9
Nuclear Infrastructure Programmatic Environmental Impact Statement (PEIS)/Special Studies	2,632	0	0	0	0.0
Total, Fast Flux Test Facility (FFTF)	38,439	36,439	36,100	-339	-0.9

Detailed Program Justification

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
Fast Flux Test Facility	**35,807**	**36,439**	**36,100**

Execute an FFTF Project Management Plan to permanently deactivate FFTF. In FY 2003, the FFTF will be maintained in a safe, environmentally compliant condition. Deactivation of the FFTF will continue in FY 2003 with validation of the fuel handling control systems, reestablishment of hot cell operating capabilities, upgrade of the sodium drain controls, and restoration of the Sodium Storage Facility.

- **Safety and Environmental Compliance, and Project Management and Planning** — **32,582 34,589 33,370**

  Conduct surveillance and maintenance activities to maintain the facility in compliance with applicable Federal and State health, safety and environmental regulations, and to ensure availability of systems required for deactivation activities. Key plant systems must remain operational to support draining 260,000 gallons of sodium coolant to the Sodium Storage Facility. Additionally, irradiated and unirradiated plutonium-uranium oxide fuel stored at the facility must be monitored and maintained until fully transferred to dry storage. Develop and implement planning and resource documents, and project management controls to efficiently implement deactivation decision and readiness review process, applying experience gained from the deactivation of the Experimental Breeder Reactor-II (EBR-II), located on the Argonne National Laboratory-West site in Idaho. In FY 2002, issue a revised *FFTF Project Management Plan* and resource-loaded project schedule. In FY 2003, achieve a reduction in surveillance and maintenance costs in accordance with the revised *FFTF Project Management Plan* and resource-loaded project schedule. The decrease of $1,219,000 in FY 2003 reflects completion of key planning documents, and a decrease in surveillance and maintenance on systems and equipment for which a restart potential no longer is required.

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
▪ **Reactor Vessel Drain Pump**	**344**	**0**	**0**
Procure custom-designed and fabricated pump for drain of reactor vessel. In FY 2001, preliminary drawings were completed. Decrease of $344,000 in FY 2002 reflects current plan to complete procurement in FY 2004.			
▪ **Training and Qualification Support**	**0**	**0**	**310**
Provide training and qualification support for fuel off-load, sodium drain, and system deactivation and lay-up activities. The increase of $310,000 reflects initiation of this support to prepare for FY 2004 activities.			
▪ **Fuel-Handling and Washing**	**2,761**	**1,850**	**1,980**
Modify and maintain the sodium removal (washing) system, fuel-handling control systems, the solid waste transfer cask, and closed-loop ex-vessel machine to support preparation and transfer of fuel from its current storage to dry interim cask storage. In FY 2002, complete upgrades to fuel handling control systems and continue validation of fuel handling control system software. In FY 2003, reestablish hot cell operating capabilities, complete validation of fuel handling control system software, and achieve a fuel handling system state of sufficient readiness which would permit initiation of fuel handling operations in FY 2004 (after completion of the solid waste transfer cask upgrades). The increase of $130,000 in FY 2003 reflects additional activities to complete validation of control system software, reestablish hot cell operating capabilities, and increase fuel handling system readiness to support the initiation of fuel transfer operations by FY 2004.			
▪ **Sodium Draining and Storage**	**120**	**0**	**440**
Modify and maintain the sodium draining system and the Sodium Storage Facility. Prepare documentation and conduct testing and reviews/assessments as required to employ these systems in support of sodium draining operations. Conduct sodium draining activities in accordance with the FFTF Project Management Plan. Complete upgrades to the sodium drain controls and restoration of the Sodium Storage Facility in FY 2003. Increase of $440,000 is due to initiation of activities to complete upgrades to the sodium drain controls and restore the Sodium Storage Facility in FY 2003.			
Environmental Reviews and Special Studies	**2,632**	**0**	**0**
Prepare a Programmatic Environmental Impact Statement (PEIS) for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the role of the Fast Flux Test Facility (FFTF). Support reviews, studies and public outreach necessary to reach a determination regarding the future of the FFTF.			
Total, Fast Flux Test Facility	**38,439**	**36,439**	**36,100**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
Fast Flux Test Facility	
Safety and Environmental Compliance, and Project Management and Planning	
▪ The decrease of $1,219,000 in FY 2003 reflects completion of key planning documents, and a decrease in surveillance and maintenance on systems and equipment for which a restart potential no longer is required.	-1,219
Training, and Qualification	
▪ The increase of $310,000 reflects initiation of training and qualification support to prepare for fuel off-load, sodium drain, and system deactivation and lay-up activities in FY 2004.....	+310
Fuel-Handling and Washing Systems	
▪ The increase of $130,000 in FY 2003 reflects additional activities to complete validation of control system software, reestablish hot cell operating capabilities, and increase fuel handling system readiness to support initiation of fuel transfer operations by FY 2004	+130
Sodium Draining and Storage Systems	
▪ The increase of $440,000 is due to initiation of activities to complete upgrades to the sodium drain controls and restore the Sodium Storage Facility in FY 2003	+440
Total Funding Change, Fast Flux Text Facility	**-339**

Radiological Facilities Management

Mission Supporting Goals and Objectives

The mission of the Office of Nuclear Energy, Science and Technology's (NE's) Radiological Facilities Management program is to maintain critical user facilities in a safe, secure, environmentally-compliant and cost-effective manner to support national priorities. The Radiological Facilities Management program funds the management of the Department's vital resources and capabilities at NE-managed facilities at Argonne National Laboratory-W (ANL-W), Idaho National Engineering and Environmental Laboratory (INEEL), Oak Ridge National Laboratory (ORNL), Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), Brookhaven National Laboratory (BNL), Pacific Northwest National Laboratory (PNNL), and the Mound, Ohio Plant. While these funds assure the readiness and operability of various NE-managed facilities, operations, production, research, and other additional activities are funded by DOE, industrial, research, and other Federal agency users.

At ANL-West, the Radiological Facilities Management program supports meeting *National Energy Policy* goals by maintaining and operating important facilities required for advanced nuclear energy technology research and development. Key activities conducted under this program include maintaining essential facilities; safely and securely managing all special nuclear materials; and deactivating unneeded facilities.

At INEEL, this program maintains the essential Test Reactor Area facilities required to achieve the objectives of the *National Energy Policy* and national security goals of the U.S. Since the early 1950s, test reactors, laboratories, hot cells and supporting facilities have been built and operated at this site. The only reactor currently operating at this site is the Advanced Test Reactor (ATR), which is the responsibility of and operated by the Office of Nuclear Energy, Science and Technology. The principal user of the ATR is the Office of the Deputy Administrator for Naval Reactors within the Department's National Nuclear Security Administration. The ATR is vital to achieving the Department's Strategic Plan's National Nuclear Security Objective NS5 - providing the U.S. Navy with safe, militarily effective nuclear propulsion plants and ensuring their continued safe and reliable operation. ATR currently conducts virtually all irradiation testing of Navy reactor fuels. In addition, other facilities operating on the site include: the ATR Critical Facility, which is used to verify core loading with new experiments; the Nuclear Materials Inspection and Storage Facility, which receives, inspects and stores new ATR fuel until needed; the TRA Hot Cells where vital isotopes for medicine and industry that are produced in the ATR, and some experiments that have been irradiated in the ATR, are processed and shipped; the INEEL Applied Engineering and Development Laboratory; Office of Science's Safety and Tritium Applied Research (STAR) Facility for fusion fuel research; and a major industrial machine shop facility that supports not only TRA facilities but also performs support work for all of INEEL. Vital nuclear reactor testing, isotope production, fusion energy research, and numerous other scientific research projects are planned to continue at the Test Reactor Area until well into the 21st century.

At ORNL, the Radiological Facilities Management program maintains the unique infrastructure for iridium fabrication in a safe, secure, environmentally-compliant and cost-effective manner. These facilities provide the capability to support radioisotope power systems for upcoming space and national security applications. The Department is maintaining the option to produce Pu-238 domestically to enable the Department to continue its support for key national security activities. The Department completed an evaluation of potential sites where this capability could be established and issued a Record of Decision in January 2001, that would provide for the reestablishment of a domestic Pu-238 production capability at facilities at ORNL and INEEL. In addition, this program maintains Building 3047 Hot Cells, Building 9204-3 Chemical and Materials Laboratories, and Building 9204-3 for stable isotope processing.

At LANL, this program maintains the Pu-238 Processing Facilities in the Plutonium Facility-4 at Technical Area-55 at LANL, including a Pu-238 scrap recovery line to recycle scrap Pu-238, in an operational and safe and environmentally compliant mode. In addition, the TA-48 Hot Cell, Building RC-1 is maintained in a safe and environmentally compliant condition and state of readiness for the production, packaging and shipment of radioisotopes. In FY 2003, construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived isotopes for medical research will be completed and operational activities will be implemented.

In addition, the Radiological Facilities Management program maintains the heat source and power system assembly and testing facilities at the Mound, Ohio Plant for radioisotope power systems; the Annular Core Research Reactor (ACRR) and associated hot cells at SNL; and the Brookhaven Linear Isotope Producer (BLIP) building 931 and Hot Cell building 801. In addition, a conceptual design report has been developed for a dedicated isotope production 70 MeV cyclotron at BNL and the Department proposes to proceed with pre-Title I engineering and design activities.

The FY 2003 budget requests funding to manage the Department's vital resources and capabilities at ANL-W , INEEL, ORNL, LANL, SNL, BNL, PNNL, and Mound to ensure that DOE missions can be met in a safe, environmentally-compliant and cost effective manner. Also, the FY 2003 budget provides for the management and disposition of the Department's legacy materials at ANL-W associated with DOE's past nuclear energy activities.

Funding Schedule

dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Radiological Facilities Management					
Idaho National Engineering & Environmental Laboratory	8,733	10,733	11,155	+422	+3.9
Argonne National Laboratory-West	31,207	32,857	31,615	-1,242	-3.8
Mound Site	10,045	10,050	10,450	+400	+4.0
Los Alamos National Laboratory	14,882	14,922	15,268	+346	+2.3
Oak Ridge National Laboratory	12,385	11,050	10,500	-550	-5.0
Sandia National Laboratory	2,200	1,700	1,800	+100	+5.9
Brookhaven National Laboratory	2,000	1,800	1,850	+50	+2.8
Savannah River Site	715	0	0	0	0
Other Activities	6,117	3,570	400	-3,170	-88.8
Total, Radiological Facilities Management	88,284	86,682	83,038	-3,644	-4.2

Detailed Program Justification

	FY 2001	FY 2002	FY 2003
Idaho National Engineering and Environmental Laboratory (INEEL)	**8,733**	**10,733**	**11,155**

- **Test Reactor Area (TRA) Facilities** **5,459 6,320 7,664**

  Conduct surveillance, preventive maintenance, and repair activities on site common use TRA facilities and utilities. A backlog of about $3,600,000 in maintenance and repair has evolved. Continue environmental compliance measures for current waste streams and cleanup of legacy waste in accordance with DOE, Federal and State of Idaho regulations, and specific agreements with the State of Idaho. Such environmental activities include: TRA Waste Tank Remediation; characterization and disposition of legacy wastes; and decontamination of site facilities as required. Provide engineering, planning, development, design, project validation and construction management for the Fire & Life Safety LICP, the Electrical Utility Upgrade LICP, and GPPs. Maintain the TRA Hot Cells (TRAHC) to support ATR operations as required. The increase of $1,344,000 will be used to accomplish anticipated emerging maintenance and repair in FY 2003 and reduce the maintenance backlog by about 20 percent. These activities are essential for maintaining the reliability and longevity of the support systems critical in keeping the program facilities, including the ATR, operational.

	FY 2001	FY 2002	FY 2003
■ **Advanced Test Reactor Research and Development Upgrade Initiative**	0	2,000	0

In FY 2002, a special clean room to be called the Test Train Assembly Area (TTAA) will be established adjacent to the TRAHC to allow users of the ATR to assemble their tests and experiments for insertion into the reactor. Funding will provide all necessary special tools and equipment. In addition, upgrades to the TRAHC will be made to support the TTAA operations and provide for post irradiation processing of user experiments. No funds are requested in FY 2003.

■ **Capital Equipment**	340	97	285

Procure equipment to support TRA Facilities requirements. In FY 2003 funding will be used to purchase new raw water feed pumps and health physics equipment, including large fixed personnel contamination monitors and hand-held radiation monitoring instruments.

■ **General Plant Projects (GPP)**	1,600	866	866

In FY 2003, complete the construction of a new potable water well and water system to meet new state and Federal drinking water standards on-site. This project was to have been completed in FY 2002; however, this project was deferred to FY 2003 to allow for an emerging urgent project to replace 30 inch diameter buried radioactive waste piping that had been found to be seriously deteriorated.

■ **TRA Fire and Life Safety Improvements**	457	500	500

In FY 2003, continue the TRA Fire & Life Safety LICP which corrects numerous significant violations of fire safety codes and regulations across the site.

■ **TRA Electrical Utility Upgrade**	877	950	1,840

Continue the TRA Electrical Utility Upgrade LICP which replaces most of the obsolete site high voltage electrical distribution system which is inadequate for current tenant needs and becoming unreliable due to age and dwindling availability of spare parts. Any significant failures in this system now could not be quickly remedied and would have major impact on site operations, most importantly operations of the ATR. Types of components needing replacement or modification include switchgear, transformers, electrical panels, underground ductbanks, power cables, control wiring, and instrumentation and control equipment. The increase of $890,000 will allow for acceleration of the construction phase consistent with planned project completion in FY 2005 instead of FY 2008. An independent review of the project requested by Congress found the project fully justified and recommended accelerated funding due to the deteriorated condition of systems.

Total, INEEL	8,733	10,733	11,155

	FY 2001	FY 2002	FY 2003
Argonne National Laboratory-W (ANL-W).....	**31,207**	**32,857**	**31,615**

- **Nuclear Facility Support 18,625 19,193 18,888**
  Continue engineering, technical, operator and technician support for maintaining the nuclear facilities[a] at ANL-W in compliance with DOE Orders, and applicable environmental and industrial safety requirements. Includes maintenance and calibration of radiation protection, detection and control systems; maintenance of heating, ventilation and air conditioning, filtration, emergency power, breathing air, instrument air and materials handling systems; calibration of facility instrumentation and control equipment; radiation monitoring; safety oversight; safety analysis; material control and accountability; waste management; procedures; and training. The FY 2003 decrease of $305,000 reflects reductions in maintenance, calibration, engineering, monitoring, oversight, procedures, and training to minimum safe levels.

- **Radiological Facility Support 2,439 2,624 2,540**
  Continue engineering and operations support similar to that provided above for nuclear facilities, but for maintaining the radiological facilities[b] at ANL-W. The FY 2003 decrease of $84,000 reflects reductions similar to those listed above for nuclear facilities except for radiological facilities.

- **Balance-of-Plant Support 3,722 3,871 2,685**
  Continue maintenance of non-nuclear and non-radiological facilities; utilities; roads; fences; grounds; electrical distribution, sanitary and wastewater systems; and steam production and distribution, fire detection and protection, and life safety communications systems to ensure safe operations, environmental compliance, and protection of Government investment. The FY 2003 decrease of $1,186,000 is due to reductions in oversight and environmental monitoring to minimum safe levels, and deferring the purchase of facility and infrastructure spare/repair parts, periodic and corrective maintenance, engineering, and non-essential procedure revisions and training to a future year.

- **Site Materials and Services 6,421 6,719 7,002**
  Support site materials and services provided by either ANL-W or the INEEL site services contractor. These items include electricity and power management, fuel oil, telecommunications, dosimetry, solid waste management, fire department, emergency management, transportation, and occupational medicine. The FY 2003 increase of $283,000 is due principally to the increased cost of electricity, power management and transportation.

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[a] A nuclear facility is a facility that contains the radiological active materials inventory specified in DOE Standard 1027.

[b] A radiological facility is a facility that contains radioactive materials that do not have the inventory of a nuclear facility.

	FY 2001	FY 2002	FY 2003
■ **General Plant Project (GPP) Funding.....**	**0**	**450**	**0**

Replace/upgrade systems to correct identified regulatory (e.g., DOE, OSHA, NFPA) deficiencies and to improve system performance in the areas of fire detection and suppression, life safety communication systems, control systems, electrical distribution, and plant utilities to ensure safe operations, environmental compliance, and protection of Government investment. The FY 2003 decrease of $450,000 reflects a one-year deferral of GPP activities.

■ **Disposition of Legacy Materials Activities.....**	**0**	**0**	**500**

Continue the repackaging and removal of DOE legacy spent fuel from a commercial facility. This activity is an integrated task to characterize, repackage, and remove DOE legacy spent nuclear fuel and associated waste materials from a commercial facility at a non-government site and includes storage of these materials at this facility. These DOE legacy materials consist of fuel rod remnants and drums of transuranic contaminated high level waste from earlier DOE funded research programs that are currently stored at a commercial facility. Before this DOE legacy material can be shipped from this commercial facility to disposition sites, these materials must be characterized and repackaged; shipping cask components designed, fabricated, tested; licensing amendments prepared and approved; and appropriate safety analysis reviewed and updated. Funding in FY 2003 covers material storage costs at the commercial facility and other minimal tasks associated with this activity. This activity was funded in the Nuclear Facilities Management program in FY 2001 for $1,200,000 and FY 2002 for $388,000.

Total, ANL-W.....	**31,207**	**32,857**	**31,615**
Mound, Ohio Plant.....	**10,045**	**10,050**	**10,450**
■ **Radioisotope Power System Assembly and Testing Facilities .....**	**6,200**	**6,400**	**6,800**

Continue to maintain and operate facilities at the Mound, Ohio Plant that enable the Department to conduct heat source and power system assembly and testing of radioisotope power systems. In FY 2001, maintained the facilities in an operational mode and proceeded with the consolidation of radioisotope power system assembly and testing activities in a stand-alone NE "island," separate from the rest of the site. In FY 2002, complete these consolidation efforts while maintaining the facilities in an operational mode and initiate upgrades in safeguards and security capabilities. In FY 2003, continue to maintain the facilities in an operational mode, including maintenance of shipping casks and trailers used by the Department to transport these systems to user sites and complete the upgrades in safeguards and security capabilities. Performance will be measured by exercising the facility to fabricate at least one General Purpose Heat Source module. The increase of $400,000 is related to upgrades in safeguards and security capabilities.

	FY 2001	FY 2002	FY 2003
■ **Safety Analysis and Testing Infrastructure**	3,645	3,300	3,300

The Department sustains an analytical and testing infrastructure required to enable the Department to assure the safety of radioisotope power systems assembled and tested at the Mound, Ohio Plant. This capability includes the operation and updating of sophisticated analytical codes that can analyze the behavior of materials and systems under potential accident environments and the conduct of specialized tests and equipment that can characterize the environments that materials and systems could be subjected to during potential extreme accident or operational scenarios. In FY 2001, the program placed greatest emphasis on testing and characterization of potential propellant fire tests. In FY 2002, the focus will be on exercising the codes to assure their current operational capability by analyzing the potential environments and consequences that could occur in potential future applications. In FY 2003, the focus on assuring the operational capability of the codes will continue by applying the codes to specific potential future applications and by documenting the results of propellant fire tests conducted in prior years.

■ **General Plant Projects**	200	0	0

In FY 2001, complete construction of an administrative building.

■ **Capital Equipment**	0	350	350

In FY 2002 and FY 2003, replace calorimeter and other equipment at Mound required to maintain the facility in an operational mode.

Total, Mound, Ohio Plant	10,045	10,050	10,450
Los Alamos National Laboratory (LANL)	14,882	14,922	15,268
■ **Pu-238 Encapsulation and Scrap Recovery Facilities**	8,456	9,495	10,000

Maintain and operate dedicated Pu-238 processing, encapsulation and scrap recovery facilities within the Plutonium Facility (PF-4) at Technical Area 55 at LANL. In FY 2001, the emphasis was on activities related to the upgrading and replacement of aging gloveboxes and equipment in the processing and encapsulation facilities and on installing the full scale scrap recovery line equipment and gloveboxes. In FY 2002, the replacement and upgrading of equipment and gloveboxes will continue and the full scale scrap recovery line will be brought to full operational status. In FY 2003, replacement and upgrading of gloveboxes and equipment will continue and the operational status of the processing and encapsulation facilities will be demonstrated by exercising the equipment to fabricate at least 8 encapsulated Pu-238 fuel pellets. The scrap recovery line will also be in full operation. Performance will be measured by fabricating at least 8 encapsulated Pu-238 fuel pellets and by processing at least 2 kilograms of Pu-238 through the scrap recovery facilities. The FY 2003 funding increase of $505,000 reflects the increased annual costs associated with full year-round operation of the Pu-238 scrap recovery line.

	FY 2001	FY 2002	FY 2003
■ **Capital Equipment for the Pu-238 Facilities**	1,379	700	1,000

Procure new gloveboxes at LANL and install new equipment and gloveboxes for the Pu-238 scrap recovery line. In FY 2001, complete capital equipment procurement and glovebox installation for new scrap recovery and waste recovery lines at LANL. FY 2002 and FY 2003 procure additional glove boxes at LANL and purchase equipment to consolidate the Pu-238 chemical and isotopic analyses within the TA-55 complex at LANL. The FY 2003 funding increase of $300,000 will be used to accelerate the replacement of worn out glove boxes and associated equipment at LANL.

■ **TA-48 Hot Cell, Building RC-1**	2,033	1,733	1,697

Maintain facility in a safe and environmentally compliant condition and state of readiness for the production, packaging and shipment of radioisotopes and other services needed in medical diagnostic and therapeutic applications and other scientific research used by Federal and non-Federal entities. Activities include maintenance, radiological monitoring and facility inspections. The $36,000 decrease is due to a one year deferral of some hot cell hardware purchases.

■ **Isotope Production Facility**	3,014	2,494	1,721

In FY 2003 complete the construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived isotopes for medical research isotopes.

■ **Isotope Production Facility –Other Project Costs**	0	500	850

Prepare procedures and documentation to verify system and startup testing; perform Readiness Review based on the facility categorization as a low-hazard non-nuclear radiological facility and to implement operation of the 100 MeV Isotope Production Facility. The additional $350,000 will provide for completing all required procedures and documentation needed to start IPF operations.

Total LANL	14,882	14,922	15,268
Oak Ridge National Laboratory (ORNL)	12,385	11,050	10,500
■ **Iridium Fabrication Facilities for Radioisotope Power Systems**	3,685	3,900	3,900

Maintain unique infrastructure and capability at ORNL to fabricate iridium cladding and carbon insulators used to encapsulate and contain the Pu-238 pellets used in radioisotope power systems. These sophisticated heat source components are necessary for the safe operation of the radioisotope power systems. The Department maintains its capabilities in this area through small-scale production campaigns of these components. In FY 2001, fabricated the first components using a new, improved iridium fabrication process. In FY 2002 and FY 2003, continue to assure the operational capability of this facility. Performance will be measured by fabricating at least 8 iridium clad vent sets.

	FY 2001	FY 2002	FY 2003
■ **Capital Equipment for Iridium Fabrication Facilities ...**	**100**	**0**	**150**

The FY 2003 funding increase of $150,000 will be used to replace aging equipment at the Iridium Fabrication facility at ORNL.

■ **Domestic Pu-238 Production Capability .....**	**1,600**	**1,100**	**950**

The Department is maintaining the option to produce Pu-238 domestically to enable the Department to continue its support for key national security activities. The Department completed an evaluation of potential sites where this capability could be established and issued a Record of Decision in January 2001, that would provide for the reestablishment of a domestic Pu-238 production capability at facilities at ORNL and INEEL. The FY 2003 efforts will focus on pre-conceptual design activities associated with the processing facilities at ORNL and on resolving transportation issues on moving Np-237 from the Savannah River Site to ORNL. The decrease of $150,000 is due to reduced test activities at the ATR.

■ **Building 3047 Hot Cells .....**	**2,500**	**2,500**	**2,500**

Maintain facility in a safe and environmentally compliant condition and state of readiness for the production, packaging and shipment of radioisotopes and other services needed in medical diagnostic and therapeutic applications and other scientific research used by Federal and non-Federal entities. Activities include maintenance, radiological monitoring and facility inspections.

■ **Building 9204-3 – Chemical and Material Laboratories**	**2,400**	**2,400**	**2,400**

Maintain facility in a safe and environmentally compliant condition and state of readiness for the processing, packaging and shipment of stable isotopes and other services needed in medical diagnostic and therapeutic applications and other scientific research used by Federal and non-Federal entities. Activities include maintenance, radiological monitoring and facility inspections.

■ **Building 9204-3 – Calutron Shutdown.....**	**900**	**850**	**600**

The calutrons at the Y-12 complex in Oak Ridge will be transferred to the Office of Environmental Management for final environmental cleanup; and all stable isotope activities will be transferred out of Y-12 to X-10. The stabilization activities for the transfer to EM will be continued in FY 2002 including removal of magnet cooling oil, removal of PCB transformer oil as well as capacitors and radiological surveying of all unattached contaminated items to be removed from the facility. In FY 2003, radiological surveying and characterization will be continued and unattached contaminated items will begin to be removed from the facility. The decrease of $250,000 is due to a slightly slower schedule to allow for historical preservation analysis.

	FY 2001	FY 2002	FY 2003
■ **Stable Isotope Enrichment Unit**	**300**	**0**	**0**

The purchase of a stable isotope enrichment unit would provide low-volume, enriched stable isotopes at affordable prices will be postponed. This was to be part of the new joint project with Tennessee State University (TSU), UT/Battelle and DOE. that will provide U.S. researchers with a reliable supply of stable (i.e., non-radioactive) isotopes. UT/Battelle will work closely with Tennessee State to develop a joint educational agenda for students at the university and other institutions in the region.

■ **Alpha Emitting Isotopes**	**900**	**300**	**0**

Over the last several year the DOE has been processing material to obtain thorium-229, the parent isotope of actinium-225. Alpha-emitting radioisotopes are being demonstrated to be successful for cancer therapy. Specifically, bismuth-213 (a daughter radioisotope of actinium-225 has been shown to be effective in treating acute myeloid leukemia (AML) in a series of Phase I clinical trials at Memorial Sloan Kettering Cancer Center in New York. Beginning in FY 2003, any future processing of thorium-229 will be financed by the private sector, thereby enabling the decrease of $300,000.

Total ORNL	**12,385**	**11,050**	**10,500**
Sandia National Laboratory	**2,200**	**1,700**	**1,800**
■ **TA-5 ACRR & Hot Cells**	**2,200**	**1,700**	**1,800**

Support operations of the Annular Core Research Reactor (ACRR) in a safe, environmentally compliant condition and state of readiness and maintain the associated hot cells in a non-nuclear stand by status. Activities include maintenance, radiological monitoring and facility inspections. The increase of $100,000 is needed to maintain the hot cells in non-nuclear standby status.

Brookhaven National Laboratory	**2,000**	**1,800**	**1,850**
■ **Brookhaven Linear Isotope Producer (BLIP) building 931 and Hot Cell building 801**	**1,850**	**1,800**	**1,650**

Maintain facility in a safe and environmentally compliant condition and state of readiness for the production of radioisotopes and other services needed in medical diagnostic and therapeutic applications and other scientific research used by Federal and non-federal entities. Activities include maintenance, radiological monitoring and facility inspections. The decrease of $150,000 is enabled by lower cost in FY 2003 for the purchase of equipment.

	FY 2001	FY 2002	FY 2003
■ **70 MeV Cyclotron**	**150**	**0**	**200**

Brookhaven National Laboratory has completed a conceptual design report for the installation of a new 70 MeV cyclotron, with multiple beam lines and total beam current of 2000 microamperes. The proposed cyclotron would provide additional accelerator target-hours to meet future U.S. medical isotope production requirements. It would also serve as a training facility for the next generation of nuclear/radiochemists. The FY 2003 increase is needed to initiate engineering and design and development (pre Title I) activities for the 70 MeV cyclotron. In conjunction with the LANL Isotope Production Facility, this dedicated cyclotron will provide for continued year-round production of vital research isotopes. The total estimated cost for this project is $35.8M.

Total, BNL	**2,000**	**1,800**	**1,850**
Savannah River Site	**715**	**0**	**0**
■ **Maintain PuFF Facility**	**715**	**0**	**0**

In FY 2001, maintain the Plutonium Fuel form (PuFF) facility in a safe shutdown mode. In FY 2002 PuFF was transferred to EM and funds are no longer required in this program.

Other Activities	**6,117**	**3,570**	**400**
■ **Associated Nuclear Support**	**400**	**400**	**400**

This funding provides for requirements applicable to isotope producing sites. Such items include annual NRC certification for isotope shipping casks, independent financial audits of the revolving fund, and other related expenses.

■ **Isotope Product and Process Improvement**	**50**	**0**	**0**

In FY 2001, the Medical Isotope Program conducted research to make new or existing isotope products more efficient, more cost effective, and enable the program to respond to the evolving needs of research customers. Any requests for future new product development will be sponsored by other Federal agencies or the private sector.

■ **Generic Technology Base for Radioisotope Power Systems**	**1,667**	**170**	**0**

In FY 2001 and FY 2002, the Department conducted a limited technology base program in power system and heat source enhancements. The decrease of $170,000 is due to this activity being phased out in FY 2003.

	FY 2001	FY 2002	FY 2003
■ **Special Purpose Fission Technology**	**2,000**	**1,000**	**0**

Efforts in FY 2001 and 2002 were focused on assessing potential space reactor technologies and defining concepts for a small Mars surface power system and an in-space power system for nuclear electric propulsion applications. These systems would support potential future space exploration missions involving aggressive robotic research on planetary bodies and ultimately human exploration. This assessment has been successfully completed; future activities will be expanded and funded by NASA. The decrease of $1,000,000 reflects the transfer of funding to NASA.

■ **Special Applications**	**2,000**	**2,000**	**0**

Efforts in FY 2001 and 2002 were focused on development and safety activities related to national security applications. In FY 2003, funding for this activity has been transferred to the Department of Defense (DOD), therefore, no funding is requested. The decrease of $2,000,000 reflects the transfer of funding to DOD.

Total, Other Activities	**6,117**	**3,570**	**400**
Total, Radiological Facilities Management	**88,284**	**86,682**	**83,038**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
INEEL	
■ Test Reactor Area Facilities: The increase of $1,344,000 will be used to accomplish anticipated emerging maintenance and repair in FY 2003 and reduce the maintenance backlog by about 20 percent	+1,344
■ Advanced Test Reactor Research and Development Upgrade Initiative: This activity will be completed in FY 2002, therefore no funds are requested in FY 2003	-2,000
■ Capital Equipment: The increase of $188,000 will be used to purchase new raw water feed pumps and health physics equipment, including large fixed personnel contamination monitors and hand-held radiation monitoring instruments.	+188
■ TRA Electrical Utility Upgrade: The increase of $890,000 will allow for acceleration of the construction phase consistent with planned project completion in FY 2005 instead of FY 2008	+890
Total, INEEL	+422

	FY 2003 vs. FY 2002 ($000)
ANL-W	
■ Nuclear Facility Support: The FY 2003 decrease of $305,000 reflects reductions in maintenance, calibration, engineering, monitoring, oversight, procedures, and training to minimum levels	-305
■ Radiological Facility Support: The FY 2003 decrease of $84,000 reflects reductions in maintenance, calibration, engineering, monitoring, oversight, procedures, and training to minimum levels	-84
■ Balance-of-Plant Support: The FY 2003 decrease of $1,186,000 is due to reductions of oversight and environmental monitoring to minimum level	-1,186
■ Site Materials and Services: The FY 2003 increase of $283,000 is due principally to the increased cost of electricity, power management, and transportation	+283
■ General Plant Projects: The FY 2003 decrease of $450,000 reflects a one-year deferral of GPP activities	-450
■ Disposition of Legacy Materials Activities: The FY 2003 increase of $500,000 covers material storage costs at the commercial facility and other minimal tasks associated with this activity. This activity was funded in the Nuclear Facilities Management program in FY 2001 and FY 2002	+500
Total ANL	-1,242
Mound, Ohio Plant	
■ Radioisotope Power System Assembly and Testing Facility: The FY 2003 funding increase of $400,000 is related to the upgrades in safeguards and security capabilities	+400
Total Mound	+400
LANL	
■ Pu-238 Encapsulation and Scrap Recovery Facilities: The FY 2003 funding increase of $505,000 reflects the increased annual costs associated with full year-round operation of the Pu-238 scrap recovery line	+505
■ Capital Equipment for Encapsulation and Scrap Recovery Facilities: The FY 2003 funding increase of $300,000 will be used to accelerate the replacement of worn out glove boxes and associated equipment at LANL	+300
■ TA-48 Hot Cell, Building RC-1: The $36,000 decrease is due the delay of purchase of hardware equipment	-36

	FY 2003 vs. FY 2002 ($000)
■ Construction: The decrease in $773,000 is due to the Los Alamos Isotope Production Facility (IPF) being completed in FY 2003	-773
■ IPF – Other Project Costs: The increase of $350,000 will provide for completing all required procedures and documentation needed to start IPF operations	+350
Total LANL	+346

ORNL

■ Capital Equipment for Iridium Fabrication Facilities: The FY 2003 funding increase of $150,000 will be used to replace aging equipment at the Iridium Fabrication facility at ORNL	+150
■ Domestic Pu-238 Production Capability: The decrease of $150,000 is due to reduced test activities at the ATR	-150
■ Building 9204-3 – Calutron Shutdown: The decrease of $250,000 is due to a slightly slower schedule to allow for historical preservation analysis.	-250
■ Alpha Emitting Isotopes: Beginning in FY 2003, any future processing of thorium-229 will be financed by the private sector, thereby enabling the decrease of $300,000.	-300
Total ORNL	-550

SNL

■ TA-5 ACRR & Hot Cells: The increase of $100,000 is needed to maintain the hot cell in non-nuclear stand by status	+100
Total SNL	+100

BNL

■ Hot Cells at BNL: The decrease of $150,000 is due to delaying the purchase of equipment and minor upgrades	-150
■ 70 MeV cyclotron: In FY 2003, the increase of $200,000 is to initiate engineering and design and development (pre Title I) activities for the 70 MeV cyclotron	200
Total BNL	+50

	FY 2003 vs. FY 2002 ($000)
Other Activities	
■ Generic Technology Base for Radioisotope Power Systems: The decrease of $170,000 is due to activity being phased out in FY 2003	-170
■ Special Purpose Fission Technology: The decrease of $1,000,000 reflects the transfer of funding to NASA	-1,000
■ Special Applications: The decrease of $2,000,000 reflects the transfer of funding to DOD	-2,000
Total Other Activities	-3,170
Total Funding Change	**-3,644**

Isotope Production and Distribution Program Fund

Program Mission

The mission of the Office of Nuclear Energy, Science and Technology's (NE), Office of Isotopes for Medicine and Science is to maintain the infrastructure required to support the national need for a reliable supply of isotope products, services, and related technology used in medicine, industry, and research. This assures that critical isotope production infrastructure is operated in a safe, secure, environmentally-compliant and cost-effective manner, thus ensuring that the facilities are available to users who need DOE-produced isotopes. A combination of an appropriation and revenues from isotope sales are deposited in the Isotope Production and Distribution Fund, which is a revolving fund. All isotope production costs are financed by revenues from sales of isotopes products and services. The Fund's revenue and expenses are audited annually consistent with Government Auditing Standards and other relevant acts, such as the Chief Financial Officers Act of 1990 and the Government Performance and Results Act of 1993. Included in the Annual Financial Statements and Program Overview are the performance measures results.

The Department has supplied isotopes and related services to the public for more than 50 years. As the range of available isotopes and recognized uses has grown, isotope applications have become vital to continued progress in medical research and practice, new industrial processes, diagnosis, and therapies, which are an indispensable and growing component of the U.S. health care system. The use of medical isotopes reduces health care costs and improves the quality of patient care.

As the range of available isotopes and the recognized uses for them have increased, new or improved isotope products have become essential for progress in medical research and practice, new industrial processes, and scientific investigation. A substantial national and international infrastructure has been built around the use of isotopes. It is estimated that one in every three people treated at a hospital makes use of a radioisotope in their laboratory tests, diagnoses, or therapy. Each day, over 40,000 patients benefit from medical imaging technologies and more than 100 million laboratory tests each year. It is estimated that there are over 13 million nuclear medicine procedures were performed in more than 4,000 nuclear medicine facilities in the United States. The use of nuclear medicine also reduces health care cost and improves the quality and effectiveness of patient care. For example, the use of isotope-based myocardial perfusion imaging in emergency department chest pain centers has been shown to reduce the time a patient remains hospitalized (12 hours *vs*. 1.9 days) and to reduce charges ($1,832 per patient) compared to conventional evaluation. Therefore, an adequate supply of medical and research isotopes is essential to the Nation's health care system, and to basic research and industrial applications that contribute to national economic competitiveness.

The Department will continue to make new capital investments to replace, or enhance processing equipment and infrastructure in order to improve production and processing of isotopes to meet current and anticipated future increases in demand. Beginning in FY 2003, the facilities and infrastructure activities previously funded in the Medical Isotope Program have been consolidated into one account, the Radiological Facilities Management program. This will more accurately reflect the activities being performed at NE managed sites and facilities. The Radiological Facilities Management program includes maintaining DOE NE facilities in a user-ready status to support vital DOE missions.

Starting in FY 2002 with full implementation in FY 2003**,** the Department plans to apply a more formal, peer-review structure to the process it applies to the production and distribution of research isotopes. This new process is called the Nuclear Energy Protocol for Research Isotopes (NEPRI). Under this protocol, the peer-reviewed process will be applied to determine which isotopes will be produced by the Department in a given year. The Department will apply an open, public process to determine (with comments from the independent Isotope Review Advisory Panel) and announce each year which research isotopes it will produce. Once a list of isotopes has been selected for production, customers must provide the Department advance cash payment to cover production costs. Each isotope will be priced such that its cost of production is paid by the customer for that isotope. No government funds will be expended on the development or production of these isotopes.

Program Strategic Performance Goal

ER7-9: Deliver isotope products and services for commercial, medical, and research applications where there is no private sector capability or sufficient capacity does not exist to meet United States needs.

Performance Indicator

Quality of isotope products and services produced and number of shipments made.

Performance Standards

Blue = Meet customer specifications 98 percent or more and on-time deliveries 96 percent or more.
Green = Meet customer specifications no less than 97 percent and on-time deliveries no less than 95 percent.
Yellow = Meet customer specifications no less than 93 percent and on-time deliveries no less than 91 percent.
Red = Meet customer specifications 92 percent or less and on-time deliveries 90 percent or less.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
Supply quality stable and radioactive isotopes for industrial, research, and medical applications that continue to meet customer specifications no less than 97 percent of the time and maintain 95 percent on-time deliveries. *(ER2-6)*(NEARLY MET GOAL)	Supply quality stable and radioactive isotopes for industrial, research, and medical applications that continue to meet customer specifications no less than 97 percent of the time and maintain 95 percent on-time deliveries.*(ER7-9)*	Supply quality stable and radioactive isotopes for industrial, research, and medical applications that continue to meet customer specifications no less than 97 percent of the time and maintain 95 percent on-time deliveries.*(ER7-9)*

Significant Accomplishments and Program Shifts

- Continue to serve over 250 customers, mostly researchers, each year by producing and distributing essential isotopes to meet national demand when no domestic or private sector capability exists, where unique Government production facilities are needed such as nuclear reactors or large accelerators, or where non-Federal production capacity is insufficient to meet U.S. needs.

- Starting in FY 2002 with full implementation in FY 2003**,** initiate the Nuclear Energy Protocol for Research Isotopes (NEPRI); a new, more formal protocol that will guide the selection of research isotopes for development, production and distribution functions. Under this protocol, all isotopes, including commercial and research isotopes, will be priced to recover the full cost of production. DOE will determine each year, with comments from the NERAC Standing Isotope Subcommittee, which research isotopes it will produce.
- To aid in a reliable isotope supply, cooperative isotope supply agreements have been established with facilities in Russia, South Africa, Belgium, and Canada. Discussions are currently underway with the MURR at the University of Missouri, other facilities in Russia, and the HANARO reactor in South Korea to further enhance supply.
- Privatization of selected Isotope activities will result in a decrease in both expenses and resources. The Medical Isotope Program continues to seek opportunities for the private sector to assume commercially attractive activities. In FY 2001, the Department entered into a non-exclusive agreement with the University of California-Davis to produce iodine-125 at the McClellan Nuclear Radiation Center. I-125, a commercial medical isotope, is used for the treatment of prostrate cancer. Until this agreement, there was no domestic producer.

Funding Profile

No funds are requested for the Isotope Production and Distribution Fund. Isotopes are currently processed by three facilities LANL, BNL and ORNL. Each of the sites' production expenses associated with processing and distributing isotopes will be offset by revenue generated from sales. See the Radiological Facilities Management section for justification of appropriations request. Sales in FY 2001 were $7.8 million and the projected sales FY 2002 and FY 2003 are estimated to be $8 million, respectively.

99-E-201, Isotope Production Facility, TA-53, Design and Construction, Los Alamos National Laboratory, Los Alamos, New Mexico

(Changes from FY 2002 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

Funding of $1.721M for the Isotope Production Facility (IPF) is requested to achieve the completion of this project in FY 2003. This request reflects the $520K reprogramming request approved in FY 2001. It also reflects the results of independent reviews of the project by the Princeton Group Office conducted in February 2001 and September 2001, and commitments by the new Los Alamos Neutron Science Center (LANSCE) management team and the Office of Defense Program to the completion of the project. Project work scheduled during the LANCE outage from January 2001 to May 2001 was completed successfully, thus positioning the project for successful completion in FY 2003. This fiscal year budget request is sufficient to complete the project.

1. Construction Schedule History

	Fiscal Quarter					
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete	Total Estimate Cost	Total Project Cost
FY 1999 Budget Request (Preliminary)	1Q 1998	4Q 1998	1Q 1998	2Q 2000	12,065	12,843
FY 2000 Budget Request	1Q 1999	1Q 2000	1Q 1999	3Q 2001	14,000	15,520
FY 2001 Budget Request	1Q 1999	1Q 2000	1Q 1999	3Q 2001	14,000	15,520
FY 2002 Budget Request	1Q 1999	1Q 2000	1Q 2000	4Q 2003	20,751	23,140
FY 2001 Reprogramming (previous)	1Q 1999	1Q 2000	1Q 2000	4Q 2003	20,057	22,446
FY 2003 Budget Request (Current)	1Q 1999	1Q 2000	1Q 2000	3Q 2003	19,999	23,494

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design			
1999	2,805	2,805	2,634
2000	1,028	1,028	1,199
Construction			
1999	3,195	1,080	232
2000	5,742	6,276	5,252
2001	3,014[a]	4,302[a]	5,787[a]
2002	2,494	2,463	2,924
2003	1,721	2,045	1,971

3. Project Description, Justification and Scope

This project proposes to build a new target irradiation facility for the production of radioisotopes at the Los Alamos Neutron Science Center (LANSCE) accelerator. The project, which started in FY 1999, will include installation of a beam switching device at the point where the beam is diverted, construction of a short beam line to the targeting area, and construction of a target handling facility with a beam stop. This facility will utilize a 100 MeV proton beam obtained by diverting a portion of the main LANSCE beam before it enters the final portion of the accelerator and directing it to a new targeting area dedicated to isotope production. In most cases production of radioisotopes is both more efficient and more selective with low beam energies (100 MeV) than with the full high beam energy (800 MeV) available at LANSCE. Therefore, once the new facility is in operation, the program will continue to produce most of the same isotopes, but with greater efficiency.

The proposed target irradiation facility will replace the existing isotope production capability located at the end of the LANSCE beam, which is housed at TA-53 in building MPF-3 at the east end of Area A of LANSCE. However, Area A, where the existing Isotope Production Facility is located, will be rendered inoperable by the proposed reconfiguration of the LANSCE accelerator complex thereby preventing Los Alamos from producing these isotopes. As noted in the program mission statement, the use of nuclear medicine reduces health care cost and improves the quality and effectiveness of patient care. Currently, more than 12 million nuclear medicine procedures are performed each year in the United States, and it is estimated that one in every three hospitalized patients has a nuclear medicine procedure performed in the management of his or her illness.

[a] Includes approved reprogramming request of $520K

The Medical Isotope Program has been one of the more successful and visible ongoing activities at Los Alamos. It has used the unique capabilities of the Laboratory's facilities and staff to respond to a well-recognized national need for radioisotope production and development. IPF will produce short-lived isotopes needed to support medical diagnostic and therapeutic research because of its capability to insert and withdraw targets while the main LANSCE beam is in operation. Today, there are many customers in industry, research institutions, the medical community, academia, and other agencies who purchase the over 30 radioisotopes produced in the isotope production facility at LANSCE. The current Laboratory plan to redirect the focus of the LANSCE accelerator complex toward neutron science has placed the use of the existing isotope production facility in jeopardy. This change in focus from nuclear physics to neutron science can be viewed as an opportunity for the medical isotope program to construct a dedicated radioisotope production facility which can operate on a non-interfering basis with any of the proposed LANSCE configurations, while at the same time operating at a lower beam intensity than the present Isotope Production Facility. This new facility would advance the Department of Energy's objective to be a reliable domestic source of research radioisotopes crucial for the future of industry, education and medicine.

The facility is located on the north side of the LANSCE linear accelerator (Linac) building near the west end of the accelerator complex. A beam line will be built from the transition region between the Drift Tube Linac and the Side Coupled Cavity Linac extending to the northeast to a targeting facility located to the north of Sector A. The new beam line will be approximately 100 feet in length with the beam line center approximately 30 feet below grade. The target handling hot cell will be located within a new building located above the end of the beam line. This building will be approximately 3000 square feet in area, and will house all the necessary equipment and control systems for carrying out target irradiations. The building will include a high bay area with overhead cranes.

This project includes design, excavation, and construction of the beam line tunnel, design and construction of the beam line and its control systems, design and construction of the building to house the targeting facility, and design and construction of the target handling and control systems.

The IPF facility design contract was completed in September 1999 and the facility construction contract awarded in January 2000, with contractor mobilization in April 2000. An accelerator outage is necessary for the installation of new beam line equipment and to allow the excavation of the soil that serves as a radiation shield during normal operations and the construction of a concrete radiation shield wall. In late December 1999, LANSCE management delayed the scheduled accelerator outage from March 2000, to October 2000 to provide extended accelerator beam time to the Office of Science and Defense Program users. This delay forced a rescheduling of all IPF critical path work activities. The Cerro Grande Fire in May 2000, forced another change to the accelerator outage, pushing the new outage date to late December 2000. All major beam line components required for the IPF project have been delivered and staged in a mock-up area to facilitate rapid installation during the accelerator outage.

From a historical perspective, the Office of Nuclear Energy, Science and Technology validated the IPF project on cost, schedule and scope in August 1997. This validation was based on funding of $8M in FY 1999, $4M in FY 2000, and with detailed design commencing in FY 1998. The design effort in FY 1998 was to have been funded via a no-funds reprogramming or similar financial instrument. Consistent with this validation, the FY 1999 budget request was based on the assumption that detailed design work would begin in the 1Q 1998. Subsequent to the FY 1999 budget request, The Office of Isotopes for Medicine and Science was not authorized to fund these detailed design activities, thereby delaying the actual start of the detailed design until the 1Q 1999.

In an effort to offset the project duration increase caused by funds received in FY 1999, the FY 2000 budget request was raised an additional $1.935M to cover an increase in contractor resources along with associated management oversight costs ($675K increase). Escalation due to delayed activities accounted for an increase of approximately $100K. Additionally, based on a project review by the Los Alamos Neutron Science Center (LANSCE) Review committee and by an independent contract organization sponsored by the Albuquerque Operations Office, it was concluded that the planned contingency was too low given the experiences of similar retrofit projects recently completed at LANSCE. The contingency for the project was raised from 15% to 24% ($1.16M increase).

In March 2000, the project cost and schedule baselines were revised to reflect the actual costs to date, to incorporate fabrication and construction estimates based on awarded contracts, and to accommodate the impact of the delayed accelerator outage. The resulting TEC was increased by 18% (from $14,000K to $16,500K) to cover the estimated cost impact and to provide adequate contingency ($995K or about 9% of the construction budget) based on the identified risks during the remaining construction period. Subsequent to the March 2000, re-base-lining, the Cerro Grande Fire shutdown LANL and resulted in further delaying the accelerator outage to late December 2000. In response to this delay, in conjunction with the FY 2000 funding reductions, increased construction costs for the target handling hot cell and beam line equipment, the project management performed a detailed, bottom-up estimates for the costs and schedule work remaining to complete the project, including incorporation of actual costs. The revised baseline reflects the rescheduling of a large number of activities into FY 2002 and FY 2003. In response to the revised project costs, an independent review was conducted by the Princeton Group Office on February 7-8, 2001, that examined the estimated cost overruns, causes of the problem, and associated corrective actions. This review concluded that: 1) the risk on the remaining technical issues is very low and well understood; 2) that the cost drivers are due to the increased special facility equipment design and construction costs and low initial estimates for instrumentation and controls; and, 3) the schedule changes are due to delayed accelerator outages, and adjustments to accommodate funding profiles. In spite of the relatively large cost and schedule increases, the independent review concluded that the aggressive management actions implemented by the project team greatly minimized the impact of these drivers. The Office of Isotopes for Medicine and Science has received a written commitment from Defense Programs, (headquarters organization with overall programmatic operations for LANSCE) that the IPF will receive first priority of staff resources during the FY2002 outage and that future accelerator outages will be scheduled to support timely project completion. In September 2001, the Princeton Group Office performed a follow-up review and concluded that the new baseline reflects all known conditions and risks and incorporated or adequately resolved all of the recommendations from

the February 2001 review. The new baseline was reviewed by the Office of Engineering and Construction Management and approved by the Deputy Secretary on January 2, 2002. This project data sheet incorporates revised estimates.

Completion of this project is fundamental to the Office of Isotopes for Medicine and Science mission of providing accelerator based isotopes on a reliable year round basis to support medical diagnostic and therapeutic research.

4. Details of Cost Estimate[a]

	(dollars in thousands) Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design (Design, Drawings, and Specifications)	2,414	2,414
Design Management costs (2.7% of TEC)	535	535
Project Management costs (4.4% of TEC)	884	884
Total, Design and Management Costs (19.1% of TEC)	3,833	3,833
Construction Phase		
Improvements to Land	521	486
Buildings	5,368	5,286
Special Equipment	5,730	5,254
Utilities	156	102
Inspection, design and project liaison, testing, and acceptance	1,402	1,417
Construction Management (2.6% of TEC)	515	487
Project Management (8.2% of TEC)	1,633	2,338
Total, Construction Costs	15,325	15,370
Contingencies		
Design	0	0
Construction	841	854
Total, Contingencies (4.2% of TEC)	841	854
Total, Line Item costs (TEC)	19,999	20,057

[a] The previous estimate ties to the FY2001 Reprogramming budget submission.

5. Method of Performance

Procurement will be accomplished under fixed-price contracts awarded on the basis of competitive bidding. The M&O contractor and contracted Architect-Engineers will perform construction inspection.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 1999	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost							
Facility Cost							
Design	0	2,634	1,199	0	0	0	3,833
Construction	0	232	5,252	5,787	2,924	1,971	16,166
Total, Line Item TEC	0	2,866	6,451	5,787	2,924	1,971	19,999
Other Project Costs							
Conceptual design costs	643	0	0	0	0	0	643
Other ES&H costs	0	100	4	238	285	184	811
Other project-related costs	682	200	0	0	241	918	2,041
Total Other Project Costs	1,325	300	4	238	526	1,102	3,495
Total, Project Cost (TPC)	1,325	3,166	6,455	6,025	3,450	3,073	23,494

7. Related Annual Funding Requirements

(FY 2004 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs	155	285
Annual facility maintenance/repair costs	260	111
Utility costs	60	39
Total related annual funding	475[a]	435
Total operation cost (operating from FY 2004 through FY 2023)	9,500	8,700

[a] This estimate does not include the incremental costs for beam delivery by LANSCE to IPF

99-E-200, Electrical Utility Upgrade, Idaho National Engineering and Environmental Laboratory, Idaho

(Changes from FY 2002 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

The planned funding profile in the Financial Schedule in Section 2 has been updated to accelerate the construction phase. The project was originally planned to be complete in FY 2002. Due to the aged and deteriorated condition of the electrical equipment, accelerating construction is by adjusting priorities on other projects. This will help to ensure reliability and adequacy of critical high voltage power systems but still maintain the overall project completion date.

Because of the extended project funding profile, the design for the project has been divided into two parts. Design of the first part has been completed and is ready for construction. Design of the second part ($114K) has been deferred to FY 2002 to assure that the latest equipment is incorporated into the design of the final parts of the project. This is reflected in Section 6.

Section 1 indicates that physical construction started in 2Q 2002, and Section 6 indicates construction was planned to start in FY 2001. There was no actual physical construction in FY 2001, since FY 2001 construction money was used to buy electrical system components.

1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
FY 1999 Budget Request *(Preliminary Estimate)*	2Q 1999	3Q 2000	3Q 2000	3Q 2002	6,700	7,320
FY 2000 Budget Request	2Q 1999	3Q 2000	4Q 2000	1Q 2004	6,700	7,560
FY 2001 Budget Request	2Q 1999	3Q 2001	4Q 2001	4Q 2004	6,995	7,937
FY 2002 Budget Request	2Q 1999	3Q 2001	2Q 2002	4Q 2005	7,709	8,856
FY 2003 Budget Request *(Current Baseline Estimate)*	2Q 1999	4Q 2002	2Q 2002	4Q 2005	7,709	8,856

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design/Construction			
1999	341	341	315
2000	425[a]	425	350
2001	877[b]	877	877
2002	950	950	950
2003	1,840	1,840	1,840
2004	1,840	1,840	1,941
2005	1,436	1,436	1,436

3. Project Description, Justification and Scope

The Test Reactor Area (TRA) was established in the early 1950's with the development of the Materials Test Reactor. Two other major test reactors as well as other facilities followed. The electrical distribution system supplying power to these programs was installed in accordance with the applicable codes and standards of the day but has not been upgraded to remain compliant with current safety and construction codes. The equipment is deteriorated and obsolete, and now is becoming unreliable. Repair parts are difficult to acquire or completely unavailable.

Over the past 40 years, numerous modifications to the configuration of the system have been accomplished. These modifications, while providing immediate solutions to specific problems, did not always address optimum overall system operation. These changing requirements have resulted in two main transformers being operated above manufacturer's recommended sustained loading. Even though this is safe, it will shorten transformer life. Plans and drawings of the system have not kept up with all the modifications and are unreliable, which poses a clear safety hazard to personnel operating and maintaining the system.

This project addresses: (1) the need to bring the system into compliance with current codes and standards, (2) the inadequate configuration that has developed over time, and (3) the need to replace obsolete, deteriorated system equipment that can no longer be maintained. Failure to correct these deficiencies will result in unreliable systems and significant personnel safety hazards.

[a] Excludes $908K reprogrammed to other DOE activities in FY 2000.

[b] Includes $48K reduction for FY 2001 rescission.

An external, independent review of this project conducted in June 1999, in response to a Congressional mandate for such reviews, strongly endorsed the need for this project, found the project well planned, and recommended that the Department accelerate funding.

The TRA Electrical Utility Upgrade Project provides for the design, procurement, and construction activities to correct the above described general system deficiencies in the 13.8kV and 5kV class equipment at the TRA. The work scope of this project provides:

1. Increased reliability by replacement of 30 to 40 year old switchgear, transformers and panels. The old equipment is subject to failure, spare parts unavailability, and unreliable operation increasing the risk of interruptions to down stream equipment.
2. An upgrade of the standby power system. The standby power system is used to supply emergency power to the breakers during power failures so that breaker operation can be maintained. The standby power system is 45 years old and subject to frequent failure and unavailability of spare parts.
3. Consolidation and reconfiguration of the electrical distribution system to make the system more efficient and provide for future possible expansion. This will reduce the amount of switchgear required and provide for standardization, both of which will result in (1) an overall savings to the government by significantly reducing maintenance and training costs in future years and (2) will significantly lower safety risk for operators and maintenance personnel.
4. Reconfiguration to remove parts of the electrical distribution system currently housed in otherwise shutdown facilities. This will allow for demolition of these unneeded facilities by the Office of Environmental Management which will result in a significant overall savings to the government by eliminating maintenance costs.
5. A significant reduction in fire hazards. An obsolete, deteriorated switchgear will be replaced with modern equipment designed to current fire safety code requirements.

The project scope includes, but is not limited to, replacement of selected switchgear and facility transformers, modifications to electrical services and panels, construction of underground ductbanks, replacement of power cables and control wiring, and modifications to instrumentation and control equipment.

4. Details of Cost Estimate

	(dollars in thousands)	
	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design Costs (Design Drawings and Specifications)	662	662
Design Management Costs (0.3% of TEC)	20	20
Project Management Costs (1.3% of TEC)	97	97
Total, Design and Management Costs (10.1% of TEC)	779	779
Construction Phase		
Utilities	3,996	3,996
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	315	315
Construction management (9.4% of TEC)	721	721
Project management (8.8% of TEC)	679	679
Total, Construction Costs	5,711	5,711
Contingencies (15.8% of TEC)	1,219	1,219
Total, Line Item costs (TEC)	7,709	7,709

5. Method of Performance

The Department of Energy Idaho Operations Office (DOE-ID) will be responsible for project validation, implementation of the project (including selection of principal contractors) and approval of specified procurement actions. DOE-ID project management oversight will be performed by the Construction Management Group in the Office of Program Execution. Safety, environmental, and other project support will be furnished to the project on an as-needed basis by the DOE-ID matrix organization.

The design, project management, and construction management will be performed under a negotiated contract with the operating contractor. Construction and procurement will be accomplished by fixed price contracts awarded on the basis of competitive bidding. Inspection may be performed by another agent. Check-out of systems and maintenance of the completed project will be performed by the operating contractor.

The INEEL operating contractor Project Manager will be responsible for the entire project.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2001	FY 2002	FY 2003	Outyears	Total
Project Cost						
Facility Cost						
Design	665	0	114	0	0	779
Construction	0	877	836	1,840	3,377	6,930
Total, Line item TEC	665	877	950	1,840	3,377	7,709
Other project costs						
Conceptual design costs	138	0	0	0	0	138
NEPA documentation costs	4	0	0	0	0	4
Other project-related costs	194	15	300	385	111	1,005
Total other project costs	336	15	300	385	111	1,147
Total, Project Cost (TPC)	1,001	892	1,250	2,225	3,488	8,856

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

	Current Estimate	Previous Estimate
Total related annual funding	*	*

***Narrative Explanation of Related Annual Funding Requirements**

This project replaces existing equipment and cabling built to outdated standards and currently at the end of useful life. The replacement system will be built using current standards for design and materials and will correct numerous inefficiencies with the existing system. Routine maintenance and repairs for all TRA common use facilities and utilities, including this system, are funded through the annual TRA Facilities Maintenance and Repair budget. Annual maintenance and operating costs for the design life expectancy of the new system are expected to be significantly less than the current costs of operating the existing system for reasons noted in Section 3. above.

95-E-201, Fire and Life Safety Improvements, Idaho National Engineering and Environmental Laboratory, Idaho

(Changes from FY 2002 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

An increase in the project funding profile is required due to several factors.

The original project end date was FY 1999. Because other projects have been a higher priority since FY 1995 when this project started, project TEC and TPC must be increased to accomplish remaining work. This extra funding is needed to compensate for: (1) the unplanned additional management costs caused by continuing deferrals of planned work, (2) yearly escalation factors for all the additional years beyond the original planned completion date, (3) a new Fire Hazard Analysis in FY 2000 for TRA that increased requirements in some areas to achieve compliance with code, and (4) unexpected additional costs incurred during the construction phase. These factors have exhausted the original project contingency funding.

Most of the unexpected additional costs during the construction phase have been incurred during FY 2000 and FY 2001 as a result of two factors that could not have been anticipated during the original planning phase. First, during the refurbishment of the aged and deteriorated raw water storage tanks (supply for fire water), polychlorinated biphenyl (PCB) material on the inside of the tanks was encountered which had not been anticipated since these areas were inaccessible during the project planning phase. This resulted in significant construction delays and additional costs to dispose of the material. Second, the seismic requirements for the construction of the redundant fire water supply tank and pump house (approximately 50% of the entire construction costs for the project) had to be upgraded based on new standards invoked after the construction phase had begun. This also resulted in significant construction delays and additional costs. These two issues alone have raised construction costs by $1,821K above planned and added design costs.

A thorough reassessment of the project indicates that an increase of at least $2,877K in TEC and $3,981K in TPC is required to complete the project.

1. Construction Schedule History

	Fiscal Quarter				Total Estimated Cost ($000)	Total Project Cost ($000)
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete		
FY 1995 Budget Request *(Preliminary Estimate)*	2Q 1995	4Q 1997	2Q 1997	4Q 1999	15,500	17,030
FY 1996 Budget Request	2Q 1995	4Q 1997	2Q 1997	4Q 1999	15,472	17,002
FY 1997 Budget Request	2Q 1995	1Q 1997	3Q 1995	4Q 1999	15,446	17,011
FY 1998 Budget Request	2Q 1995	1Q 1997	3Q1995	4Q 2000	15,446	17,011
FY 1999 Budget Request	2Q 1995	1Q 1997	3Q1995	4Q 2000	15,446	17,011
FY 2000 Budget Request	2Q 1995	1Q 2000	3Q 1995	4Q 2001	15,446	17,322
FY 2001 Budget Request	2Q 1995	2Q 2001	3Q 1995	4Q 2005	15,446	17,366
FY 2002 Budget Request	2Q 1995	2Q 2001	3Q 1995	4Q 2005	15,446	18,364
FY 2003 Budget Request (Current Baseline Estimate)	2Q 1995	3Q 2008	3Q 1995	2Q 2011	18,323	22,345

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design/Construction			
1995	1,696	1,696	1,180
1996	1,900	1,900	1,140
1997	1,000	1,000	1,819
1998	4,425	4,425	954
1999	2,345	2,345	3,471
2000	1,474	1,474	2,958
2001	457[a]	457	1,581
2002	500	500	448
2003	500	500	368
2004	500	500	567
2005	500	500	519
2006	500	500	519
2007	500	500	533
2008	500	500	559
2009	500	500	561
2010	500	500	577
2011	526	526	569

[a]Includes $43K reduction for FY 2001 rescission.

3. Project Description, Justification and Scope

Project Description

Numerous fire code deficiencies were documented in eight formal assessments conducted within all buildings and facilities of the TRA complex between 1989 and 1993. One hundred and forty-seven buildings and structures were individually reviewed for compliance with DOE Orders 5480.7, 5480.4, DOE-ID appendix 12044, DOE-ID 0550, National Fire Protection Association (NFPA) Codes, and industry good practices for improved risk.

From this effort, 684 recommendations were developed for fire protection improvements to ensure compliance with current regulations and national codes. Improvements have been ranked in priority order to ensure that extending completion to FY 2011 will have minimum impact on fire and life safety.

This project provides the following:

- Upgrade deficient fire barriers to meet code and reduce Maximum Possible Fire Loss (MPFL) or smoke damage impacts to personnel and property.

- Modifications to or installation of new automatic fire suppression systems to meet code requirements for operations personnel life safety and to reduce Maximum Credible Fire Loss (MCFL) potentials to acceptable improved risk levels as required by DOE Order 5480.7.

- Modifications to existing building heating and ventilating systems to: control fire and smoke spread; enhance smoke detection; upgrade or replace interior doors to provide smoke and fire barriers; provide protection of structural support members; and seal penetrations in fire barriers (existing walls and floors) to provide effective control of property damage and increase life safety protection.

- Modifications to the fire detection and alarm system to meet codes and to make the TRA system compatible with the Idaho National Engineering and Environmental Laboratory (INEEL) site wide fire alarm system.

- Addition of fully redundant water supply, consisting of new Underwriters Laboratories (UL)-listed and Factory Mutual (FM)-approved fire pumps and a tank capable of delivering 100 percent of the highest demand for volume, pressure, and duration, to meet requirements of DOE Order 5480.7.

- Additions or modifications to existing fire water distribution piping, hydrants and valves.

- This project has a direct positive impact on the safety of TRA by assuring a reliable and adequate fire water supply to critical site safety systems including the Advanced Test Reactor (ATR) nuclear safety systems.

- A DOE Fire Safety Appraisal, which was conducted in 1989, identified the current capacity of the raw water storage tanks as deficient. The appraisal states that sufficient water must be on hand to supply the ATR Emergency Core Cooling System and a major plant fire simultaneously. This project will correct this deficiency.

- The Fire & Life Safety deficiencies identified have been divided into 11 work packages (phases) based on site areas and type of work activity to allow for accomplishment under a managed work plan. The packages (phases) have been developed for optimal subcontracting actions and to utilize the available qualified site crafts to accomplish the planned work in an efficient manner. The work is ongoing.

Justification

Justification/requirement to perform this project is based on the following studies, reports and evaluations.

- October 9, 1989, Study for Bringing Fire Protection Up to Code and Within Compliance Site-Wide - EWP-27-89.

- Power Reactor Programs - Risk Management Resource Manual developed by Power Reactor Programs Safety and Environmental Compliance - November 15, 1989.

- The Advanced Test Reactor as it relates to Compliance with USNCR 10CFR50 Appendix R Fire Protection Requirements performed in 1989 by Protection Consultants.

- Life Safety Code Review of Test Reactor Area Buildings 603, 657, 604, 606, 616, 622, 621, 625, 632, 635, 654, 637, 647, 649, 652, 653, 653A, 662, 657, 661, 661 Addition, 662, and 668 performed by Protection Consultants August 1989.

- Architectural Engineering Conceptual Design Report for TRA portion of the INEEL Fire and Life Safety Improvements Project issued April 12, 1990.

- Fire Protection Line Item Deficiencies From the Base Line Safety Audit by T. V. Kraft, November 25, 1991.

- Architectural Engineering Conceptual Design report for Test Reactor Area Fire and Life Safety Improvements Project issued February 25, 1992.

- April 15, 1993, report from D. M. Sherick to DOE-IDs R. V. Furstenau that highlighted certain FY 1995 F&LS Improvement Project activities that are of the highest priority since they address significant deficiencies that are currently in clear violation of a specific DOE order or national fire safety code.

- The FY 1995 TRA Fire Protection Line Item Upgrade is part of and coordinated with the overall fire protection upgrade for the entire INEEL. A FY 1992 Site Wide Fire Protection Upgrade also involves facilities at TRA. Therefore, care has been taken to ensure that each upgrade is consistent in approach with the other, that all pertinent areas of the TRA Base Line Safety Audit are covered by the combined scope of both line items, that there are not redundant or overlapping areas of scope, and that the priorities are set accurately to address the risks posed.

Regulatory Drivers

Compliance with applicable sections of the Code of Federal Regulations, DOE and DOE-ID requirements, the NFPA and NEC.

NEPA Documentation - Finalization of Air Permit Completed in FY 1998. (As tasks are worked, continue review to ensure that all NEPA requirements are identified and met.)

Raw Water Storage Tank System to meet ATR seismic requirements, and simultaneously supply emergency cooling water with sufficient water for a major plant fire.

Scope

The project scope includes, upgrade deficient fire barriers, modify or install new automatic fire suppression systems, modify existing building heating and ventilating systems, modify fire detection and alarm systems, adding a fully redundant water supply, and adding or modifying existing fire water distribution piping, hydrants and valves.

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design Costs (Design Drawings and Specifications)	1,581	1,341
Design Management Costs (0.3% of TEC)	51	41
Project Management Costs (0.5% of TEC)	86	83
Total, Design and Management Costs (9.4% of TEC)	1,718	1,465
Construction Phase		
Improvements to Land	152	152
Buildings	6,548	6,122
Utilities	3,343	2,357
Standard Equipment	636	636
Inspection, design and project liaison, testing, checkout, and acceptance	1,657	783
Construction Management (11.3% of TEC)	2,065	1,514
Project management (9.3% of TEC)	1,704	1,366
Total, Construction Costs	16,105	12,930
Contingencies (2.7% of TEC)	500	1,051
Total, Line Item costs (TEC)	18,323	15,446

5. Method of Performance

The Department of Energy Idaho Operations Office (DOE-ID) is responsible for project validation and oversight of the project, including selection of principal contractors (i.e., INEEL Operating Contractor) and approval of specified procurement actions. DOE-ID project management oversight is performed by the Construction Management Group in the Office of Program Execution. Safety, environmental and other project support is furnished to the project on an as-needed basis by the DOE-ID matrix organization.

The design, project management, and construction management is performed under a negotiated contract with the operating contractor. Construction and procurement will be accomplished by fixed price contracts awarded on the basis of a competitive, Best Value bidding process. Inspection may be performed by another agent. Check-out of systems and maintenance of the completed project is performed by the operating contractor.

The INEEL Operating Contractor's (OC) Project Manager is responsible for the entire project including design, all construction activities at the TRA/INEEL site, construction subcontracting, direction of the activities of construction subcontractors, and performance and management of construction activities as required to complete the project in a timely, safe, and cost-effective manner.

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2001	FY 2002	FY 2003	Outyears	Total
Project Cost						
Facility Cost						
Design	1,412	53	0	240	0	1,705
Construction	10,110	1,528	448	128	4,404	16,618
Total, Line Item TEC	11,522	1,581	448	368	4,404	18,323
Other Project Costs						
Conceptual design costs	350	0	0	0	0	350
NEPA documentation costs	61	2	0	0	0	63
Other project-related costs	1,388	521	215	200	1,285	3,609
Total Other Project Costs	1,799	523	215	200	1,285	4,022
Total, Project Cost (TPC)	13,321	2,104	663	568	5,689	22,345

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

	Current Estimate	Previous Estimate
Annual Facility operating costs	31	31
Annual Programmatic operating expenses directly related to the facility	0	0
Total related annual funding	31	31
Total operating costs *(operating from FY 2003 through FY 2033)*	930	930

Narrative Explanation of Related Annual Funding Requirements

The additional TRA Facilities annual operating costs from the Fire & Life Safety Improvements project are primarily to maintain the new redundant fire water supply consisting of two new diesel driven fire water pumps and a new, additional one million gallon fire water tank. Total operating costs are estimated based on a nominal 30 year design life for the new redundant fire water system.

Spent Fuel Pyroprocessing and Transmutation

Program Mission

The mission of the Department's Spent Fuel Pyroprocessing and Transmutation (SFP/T) program is to conduct innovative research and development on advanced fuel cycle technologies as recommended by the President's *National Energy Policy*. The technologies pursued by this program could provide new solutions to many of the environmental issues facing nuclear energy associated with spent nuclear fuel. With the unique, focused expertise at the Department's Los Alamos National Laboratory in advanced fuels; expertise in nuclear systems at Argonne National Laboratory-West; and expertise in materials and gas-cooled systems technology at Oak Ridge National Laboratory, the Department has the expertise available to realize very ambitious technology goals in this area of study.

The Department's current program to explore the establishment of a high-level nuclear waste repository at Yucca Mountain, Nevada is essential to provide a disposition path for both governmental high-level wastes (largely the result of decades of defense-related activities) and for the accumulated inventories of commercial spent fuel resulting from the Nation's nuclear power plants. This material, while very small in quantity compared to the wastes produced by other industrial and energy-producing activities, requires careful handling and disposition. The Department's Civilian Radioactive Waste program has established a path-forward for the existing materials that will enable the continued operation of current nuclear power plants and safely contain long-lived radioactive species from the environment.

If nuclear energy is to expand in the long-term, however, the Nation will need to face two issues. First, the current program is designed to create a high-level waste repository of capacity sufficient to contain only the Nation's current inventory of spent nuclear fuel—therefore, a second repository might be required in the longer-term future. Second, at the current rate of use, known sources of uranium for nuclear fuel will be exhausted before the end of the century. Accelerated use of nuclear power, as anticipated by the *National Energy Policy*, could see uranium resources becoming uneconomically precious by the middle of the century.

To address these issues, the Department has embarked, with its international partners, on a long-term research program to develop advanced nuclear fuel cycle technologies which can:

- Reduce the quantities of high-level wastes requiring deep geologic disposal by about 90 percent;
- Reduce the period of time waste materials must be isolated from the environment from 10,000 years to only about 300 years; and
- Enable the amount of energy to be obtained from uranium resources to be increased by nearly a factor of ten, making nuclear energy a resource option that will be available for several hundred years.

Investigating these technologies requires the use of the unique facilities and expertise currently being conducted at the Department's laboratories, and U.S. universities. In FY 2002, the electrometallurgical treatment of sodium-bonded spent fuel is being pursued under the Nuclear Facilities Management program, and will continue in FY 2003 under the Spent Fuel Pyroprocessing and Transmutation program. In FY 2002 the Advanced Accelerator Applications (AAA) program, specifically, the development of advanced transmutation, advanced pyroprocessing technologies, and the transmutation science and technology education activities are being funded. In FY 2003, the budget proposes to terminate these AAA activities.

Minimizing the quantity and toxicity of nuclear wastes resulting from recycling of spent fuel is a central mission of this research program. Spent nuclear fuel contains highly radioactive isotopes that will remain highly toxic for many thousands of years. Significant amounts of radioactive wastes from past U.S. recycling efforts remain in storage at Hanford and other DOE sites, awaiting treatment and disposal. It is the focus of this program to avoid the mistakes of the past by dealing with all the radioactive materials resulting from recycling of the toxic isotopes in spent nuclear fuel. Pyroprocessing technologies may be used to create an optimized nuclear fuel cycle that is both highly proliferation-resistant and have minimal impact on the environment.

As an integrated element of this research effort, the Department will continue its work at Argonne National Laboratory-West (ANL-W) to treat remaining EBR-II spent nuclear fuel at a rate consistent with the conduct of a parallel research program to investigate advanced recycling technology. Eventually, improvements in electrometallurgical technology and ANL-W's processing capability-which will result from the pyroprocessing research program-will be used to optimize waste treatment operations. In any event, the Department will meet all its commitments to the State of Idaho. The Department will complete an *ANL-W Nuclear Technology Operations Plan* during FY 2002 that will balance the needs of new research activities with the need to meet environmental commitments; particularly those made to the State of Idaho to treat and remove DOE spent fuel for eventual disposal.

In FY 2002, this program investigated advanced technologies anticipated by the *National Energy Policy* by conducting scientific and engineering research, development, and demonstration of: (1) advanced, environmentally sound, pyroprocessing technologies; (2) transmutation of spent nuclear fuel in both reactors and accelerator driven systems; and (3) coupled accelerator/sub-critical reactor systems.

In FY 2002, achievement of the Spent Fuel Pyroprocessing and Transmutation (SFP/T) program mission will be accomplished through four major activities:

- *Spent Fuel Pyroprocessing Research and Development*
  In order to make early progress in investigating pyroprocessing technology, this research and development will utilize existing facilities and expertise currently in place at Argonne National Laboratory-West (ANL-W) (*i.e.*, Fuel Conditioning Facility [FCF] and the Hot Fuel Examination Facility [HFEF]). Specific areas of study will include: recovery of actinides from irradiated fuel and remote fabrication of fuel assemblies containing recycled actinides; material throughput sufficient to establish feasibility of the process for large-scale application; reduction of oxide fuel to metal for recycling by pyroprocessing; demonstration of the use of pyroprocessed fuel in reactors; and qualification of the metal and ceramic waste forms. The Department would include continuation of joint collaborative activities with countries such as France in spent fuel recycling and transmutation

systems research, design, development, and demonstration. Considerable expertise has been developed overseas on these technologies, and the interest in significant cooperation and collaboration with the United States in this area is very high. The Department has held many detailed discussions with its international partners regarding the best way to achieve our mutual technology goals.

- *Transmutation Systems Development*

  Reactor-Based Transmutation Systems: The use of reactors which produce neutrons economically--to transmute nuclear waste will be a key area of study for this program. Specific activities would include the following:

  - Research, development and design of cost effective reactor systems for waste transmutation using current and advanced technologies. This aspect of the program will focus on design studies of reactors that utilize fuels which are compatible with pyroprocessing separation systems. Designs to be considered include fast reactors, light water and gas-cooled reactors.

  - Research and development of advanced reactor fuels, including non-fertile and fertile power reactor fuels will be conducted to integrate new fuels into thermal and fast reactor systems.

  Accelerator-Based Transmutation Systems: Significant analysis has been conducted on the potential of accelerator-based systems to optimize the waste management benefits of spent fuel recycling (i.e., in reactor-based transmutation systems) by dealing effectively and flexibly with a wide range of long-lived nuclear species, including highly toxic materials such as radioactive iodine. Specific areas of study and or experiment will include:

  - Conceptual design activities on: (1) a sub-critical multiplier system, including a spallation target, and the coupling of an accelerator to the system, and (2) target-materials-test station for spallation target experiments and materials studies.

  - Transmutation fuels development, specifically, development and testing of non-fertile fuels.

  - Testing of advanced "Spoke Resonator" technology in the Low Energy Demonstration Accelerator (LEDA), including the development of a three year plan to upgrade LEDA from 6.7 MeV to 60 MeV. LEDA's unique capabilities have great relevance to the program's long-term objectives. The dwindling infrastructure remaining in the U.S. not only makes the future of the LEDA a subject of considerable interest but also necessitates a vigorous international cooperation program to gain access to test facilities in countries such as Japan, Switzerland, and potentially Russia.

- *Transmutation Science Education*

  This portion of the program would include continuing the successful Advanced Accelerator Applications Fellowship Program to support the development of new scientists and engineers and foster a new area of nuclear science and engineering associated with the technologies needed to deal with commercial spent nuclear fuel. Using prior year funds, the SFP/T program will continue at least

10 AAA fellowships in FY 2003 to pursue Master and Ph.D. degrees in nuclear science and technology. No new fellowships will be awarded in FY 2003.

- *EBR-II Spent Fuel Treatment*

  This activity includes the operations of the Argonne-West facilities in accordance with the Record of Decision for treatment and management of stored sodium-bonded fuels. Treatment of the EBR-II sodium-bonded spent fuel will continue at a rate of 500 kilograms of heavy metal per year.

Program Strategic Performance Goal

ER7-7: Develop and demonstrate an advanced, proliferation-resistant technology to reduce the quantity and toxicity of U.S. commercial spent nuclear fuel while simultaneously enabling the U.S. to vastly increase the efficient use of its nuclear fuel resources.

Performance Indicator: Program Milestones

- Meet treatment and disposition commitments to the State of Idaho for EBR-II sodium-bonded spent nuclear fuel.

- Successful demonstration of significant actinide recovery from the processing of prototypic spent fuel with the resulting uranium sufficiently cleaned up so that mandatory disposal for the uranium in a repository is not required.

- Award at least 10 Advanced Accelerator Application fellowship awards in FY 2002.

- In FY 2002, successfully couple and test the newly developed "Spoke Resonator" in the Low Energy Demonstration Accelerator (LEDA) and the development of a three year plan to upgrade LEDA from 6.7 MeV to 60 MeV.

- In FY 2002, successful testing of advanced non-fertile fuel developed in the Advanced Test Reactor.

Performance Standards
Blue = Performance was significantly above the planned annual targets for the PSPG.
Green = Performance results meet all planned annual targets for the PSPG.
Yellow = Performance was less than the planned annual targets, but not significantly less for the PSPG.
Red = Performance was significantly less than the planned annual targets for the PSPG.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Targets	FY 2003 Targets
Complete the conversion and disposition of 100 percent of the Fermi reactor sodium coolant in storage at Argonne National Laboratory-West.*(EQ3-2)* (EXCEEDED GOAL)	Following completion of primary sodium drain, complete deactivation of Experimental Breeder Reactor II (EBR-II) and all directly related surplus facilities by March 2002.*(ER7-7)*	Treat a minimum of 0.5 metric tons of heavy metal of EBR-II spent nuclear fuel.*(ER7-7)*
Complete draining the Experimental Breeder Reactor II (EBR-II) primary system and process 100 percent of all EBR-II sodium in compliance with the INEEL Site Treatment Plan.*(EQ3-2)* (MET GOAL)	Treat a minimum of 0.5 MTHM (metric tons of heavy metals) of EBR-II spent nuclear fuel.*(ER7-7)*	Initiate laboratory scale oxide reduction pyroprocessing *(ER7-7)*
Treat a minimum of 0.5 MTHM (metric tons of heavy metals) of EBR-II spent nuclear fuel.*(EQ3-2)* (EXCEEDED GOAL)	Demonstrate the separation of highly radioactive isotopes from civilian spent nuclear fuel from uranium with the uranium cleaned up to 99.999 percent pure (Class C waste), using the newly developed UREX process.*(ER7-7)*	
Establish new international agreement on advanced accelerator applications programs with at least one country that significantly leverages financial and technical resources to the mutual benefit of both countries particularly in areas such as safety, fuels and materials development, and facility operations.*(ER2-2)* (MET GOAL)	Successfully manufacture advanced transmutation non-fertile fuels and testing containers for irradiation testing in the Advanced Test Reactor.*(ER7-7)*	
Establish a new Advanced Accelerator Applications university fellowship program and fund 10 new graduate students in engineering and science.*(ER2-8)* (MET GOAL)	Complete reactor based transmutation studies, and down selection of technologies to two of the nine multi-tier transmutation case studies developed in FY 2001.*(ER7-7)*	
	Add 10 new students to the Advanced Accelerator Application university fellowship program, and foster the graduation of the 10 students awarded fellowships in FY 2001.*(ER7-7)*	
	Complete the construction and bench testing of two super-efficient "Spoke Resonators" for use in future advanced proton accelerators for transmutation.*(ER7-7)*	
	Transfer the Russian Lead-bismuth Spallation Target (currently in Russia) to the University of Las Vegas at Nevada for experimental studies in the planned Lead Bismuth Laboratory.*(ER7-7)*	

Significant Accomplishments and Program Shifts

- In FY 2001, the processing of all stored Fermi and EBR-II sodium at ANL-W was completed and progress continued toward the complete deactivation and closure of EBR-II.

- In FY 2001, FY 2002, and FY 2003, consistent with the ROD, treat at least 0.5 MTHM (metric tons of heavy metals) per year of EBR-II spent nuclear fuel.

- In FY 2001, the Advanced Accelerator Applications program was formally established within the Office of Nuclear Energy, Science and Technology consistent with congressional direction and funding for FY 2001.

- In FY 2001, developed, at the request of Congress, a ten-year AAA program plan for transmutation research and development.

- In FY 2001, established a science and engineering based research program for transmutation technologies; initiated systems studies to establish and evaluate technology options.

- In FY 2001, the AAA University fellowship program was established. Ten fellowships were awarded for the pursuit of master's degrees in areas of interest to the AAA program.

- By March 2002, complete deactivation of EBR-II, thereby completing all required actions included in the 1994 congressional decision to terminate the Integral Fast Reactor program and deactivate EBR-II.

- In FY 2002, demonstrate the separation of highly radioactive isotopes from civilian spent nuclear fuel from uranium with the uranium cleaned up to 99.999 per cent pure (Class C waste), using the newly developed UREX process.

- In FY 2002, successfully manufacture advanced transmutation non-fertile fuels and testing containers for irradiation testing in the Advanced Test Reactor.

- In FY 2002, complete reactor based transmutation studies, and down select technologies to two of the nine multi-tier transmutation case studies developed in FY 2001.

- In FY 2002, add 10 new students to the Advanced Accelerator Application university fellowship program, and foster the graduation of the 10 students awarded fellowships in FY 2001.

- In FY 2002, complete the construction and bench testing of two highly efficient "Spoke Resonators" for use in future advanced proton accelerators for transmutation.

- In FY 2002, transfer the Russian Lead-bismuth Spallation Target (currently in Russia) to the University of Las Vegas at Nevada for experiment studies in the planned Lead Bismuth Laboratory.

- In FY 2002 through FY 2003, experienced personnel, facilities and equipment that were being used for electrometallurgical treatment technology are redirected to the research and development activities required to support the SFP/T program. Therefore, the Department has requested no new funds for the Nuclear Facilities Management program for FY 2003. In FY 2003, the Department has consolidated the Nuclear Facilities Management program with the Advanced Accelerator Applications (AAA) program and formed one focused research and development program titled "Spent Fuel Pyroprocessing and Transmutation."

Funding Profile

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Original Appropriation	FY 2002 Adjustments	FY 2002 Comparable Appropriation	FY 2003 Request
Spent Fuel Pyroprocessing and Transmutation	68,698	80,250	-3,000	77,250	18,221
Use of Prior Year Balances	0	0	-818	-818	0
Total, Spent Fuel Pyroprocessing and Transmutation	68,698[a]	80,250[b]	-3,818[c]	76,432	18,221

[a] FY 2001 includes $34.773M appropriated under Nuclear Facilities Management and $33.925M under Advanced Accelerator Application (AAA) program. The $33.9M provided in FY 2001 to NE for Advanced Accelerator Applications (AAA) activities, does not include funds for the Accelerator Production of Tritium (APT) activities which was funded by DP in FY 2000 ($88M) and FY 2001 ($34M.)

[b] FY 2002, includes $30.25M appropriated under Nuclear Facilities Management and $50M appropriated under AAA program.

[c] FY 2002 General Reduction of $3.0M applied to Nuclear Facilities Management and $0.8 to AAA for use of prior year balances reduction.

Funding by Site

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	6,293	2,750	0	-2,750	-100.0
University of Nevada, Las Vegas	3,000	4,500	0	-4,500	-100.0
Los Alamos National Laboratory	13,861	15,550	0	-15,550	-100.0
Sandia National Laboratories	50	0	0	0	0.0
Total, Albuquerque Operations Office	23,204	22,800	0	-22,800	-100.0
Chicago Operations Office					
Chicago Operations Office	0	0	0	0	0.0
Babcock and Wilcox	1,200	388	0	-388	-100.0
Argonne National Laboratory	41,794	41,062	18,221	-22,841	-55.6
Brookhaven National Laboratory	320	500	0	-500	-100.0
Total, Chicago Operations Office	43,314	41,950	18,221	-23,729	-56.6
Idaho Operations Office					
Idaho Operations Office	0	1,500	0	-1,500	-100.0
Idaho National Engineering and Environmental Laboratory	0	600	0	-600	-100.0
Total, Idaho Operations Office	0	2,100	0	-2,100	-100.0
Oakland Operations Office					
Oakland Operations Office	0	0	0	0	0.0
Lawrence Livermore National Laboratory	302	200	0	-200	-100.0
Total, Oakland Operations Office	302	200	0	-200	-100.0
Oak Ridge Operations Office					
Oak Ridge National Laboratory	500	3,250	0	-3,250	-100.0
Oak Ridge Institute of Science and Education	0	0	0	0	0.0
Total, Oak Ridge Operations Office	500	3,250	0	-3,250	-100.0
Richland Operations Office					
Fluor Daniel Hanford	0	0	0	0	0.0
Pacific Northwest National Laboratory	220	300	0	-300	-100.0
Total, Richland Operations Office	220	300	0	-300	-100.0
Savannah River Site	1,037	1,500	0	-1,500	-100.0
Washington Headquarters	121	4,332	0	-4,332	-100.0
All Other Sites	0	0	0	0	0.0
Total, Spent Fuel Pyroprocessing and Transmutation	68,698[a]	76,432[b]	18,221	-58,211	-76.2

[a] FY 2001 includes $34.773M appropriated under Nuclear Facilities Management and $33.925M under Advanced Accelerator Application (AAA) program. The $33.9M provided in FY 2001 to NE for Advanced Accelerator Applications (AAA) activities, does not include funds for the Accelerator Production of Tritium (APT) activities which was funded by DP in FY 2000 ($88M) and FY 2001 ($34M).

[b] Includes funding appropriated under Nuclear Facilities Management and AAA programs minus the FY 2002 general reduction and use of prior year balances reduction.

Site Descriptions

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a multi-disciplinary research facility located on approximately 28,000 acres near the town of Los Alamos in northern New Mexico. LANL is engaged in a variety of programs for DOE and other government agencies. The primary mission for LANL is research and technical activities supporting the Nation's defense. LANL also supports DOE missions related to arms control, non-proliferation, nuclear material disposition, energy research, science and technology, and environmental management. Research and development in the basic sciences, mathematics, and computing have a broad range of applications, including: national security, non-nuclear defense, nuclear and non-nuclear energy, atmospheric and space research, geoscience, bioscience, biotechnology, and the environment. As the Department's lead center for transmutation science and technology, LANL supports the conceptual design for the target material test station; and testing of the advanced accelerator components in the Low Energy Demonstration Accelerator (LEDA). LANL also supports the activities under the transmutation science education program related to nuclear science and engineering research at U.S. universities. LANL also works with ANL to support work at the Megawatt Pilot Experiment (MEGAPIE).

Sandia National Laboratories

Sandia National Laboratory (SNL) is a research development facility located on approximately 18,000 acres on the Kirtland Air Force Base reservation near Albuquerque, New Mexico and has smaller facilities in Livermore, California and Tonopah, Nevada. The mission of SNL is to meet national needs in the nuclear weapons and related defense systems, energy security, and environmental integrity. SNL is focused on the assessment of the proliferation aspects of waste transmutation, with specific focus on the front end pyroprocessing of light water reactor oxide fuel to metal fuel and coordination on related efforts with U.S. universities. SNL conducts seminars to assist in assessing the proliferation resistance of pyroprocessing technologies.

Argonne National Laboratory

Argonne National Laboratory (ANL) is one of the U.S. Department of Energy's largest research centers, and was the nation's first national laboratory, chartered in 1946. ANL is located at two sites. The Illinois site, ANL-East, is the main laboratory and occupies 1,500 acres, surrounded by a forest preserve about 25 miles southwest of the Chicago Loop. The Idaho site, ANL-West, is located within the boundary of the Idaho National Engineering and Environmental Laboratory (INEEL) in Southeastern Idaho, about 35 miles west of Idaho Falls.

Because of ANL's extensive experience with the development of fuel and separation technologies, the Laboratory has important responsibilities in the Spent Fuel Pyroprocessing and Transmutation program. ANL will conduct pyroprocessing research of EBR-II fuel and waste form research. ANL will also work

with LANL to participate in support of the MEGAPIE experiments. Typically, basic research is conducted at ANL-East, with large-scale testing and development conducted at ANL-West. For example, experiments, modeling, and analysis at ANL-East resulted in the development of the electrometallurgical technology that was demonstrated at ANL-West through the treatment of a limited quantity of sodium-bonded spent nuclear fuel. The capabilities of ANL-West also include nuclear fuel development, post-irradiation examinations, waste and nuclear material characterization, and development of dry, interim storage for spent fuel and other highly radioactive materials.

Activities under the Nuclear Facilities Management program involve a number of significant facilities at ANL-West, including the Hot Fuel Examination Facility (HFEF), Fuel Conditioning Facility (FCF), Fuel Manufacturing Facility (FMF), Experimental Breeder Reactor-II (EBR-II), Sodium Process Facility (SPF), Analytical Laboratory (AL), Electron Microscopy Laboratory (EML), and Radioactive Scrap and Waste Facility (RSWF). These facilities are supported by several other nuclear, radiological and industrial support and office facilities.

Brookhaven National Laboratory

The Brookhaven National Laboratory (BNL) is a multi-program laboratory located on approximately 5,200 acres in Upton, New York. The Department of Energy's Brookhaven National Laboratory conducts research in the physical, biomedical, and environmental sciences, as well as in energy technologies. Brookhaven also builds and operates major facilities available to university, industrial, and government scientists. BNL provides expertise in the design of spallation targets and also related work in the design of the subcritical multiplier.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is a multi-program laboratory that encompasses 571,000 acres (893 square miles) approximately 23 miles west of the city of Idaho Falls, Idaho. The Test Reactor Area is located in the south central portion of INEEL and includes the following facilities: the currently operating Advanced Test Reactor, the currently operating Advanced Test Reactor Critical Facility, four defueled reactors, storage of spent fuel, hot cells, and a repository for unirradiated fuel known as the Nuclear Materials Inspection and Storage (NMIS) facility. The major mission of the TRA is to conduct scientific and engineering experiments for the Department of Energy and to support various other nuclear and non-nuclear programs. The major facility at TRA, the Advanced Test Reactor, has been used by the Department of Energy's Naval Reactors Program since it began operation in 1967. Irradiation tests of transmutation fuel are planned for the Advanced Test Reactor in FY 2002.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) is a multi-disciplinary research and development laboratory focused on national defense, which has two noncontiguous geographic locations in northern California. LLNL is approximately one square mile and is located 40 miles east of San Francisco. LLNL conducts research in advanced defense technologies, energy, environment, biosciences, and basic science. LLNL provides expertise related to waste form characterization acceptable for disposition in a repository.

Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) is a multi-program laboratory located on the Oak Ridge Reservation which is approximately 35,000 acres near Knoxville, Tennessee. The Department of Energy's Oak Ridge National Laboratory conducts research in basic and applied research science. ORNL provides materials expertise to develop the spallation target and specific reactor components, and conducts research and development on transmutation fuels for "gas-cooled reactors.

Pacific Northwest National Laboratory

Pacific Northwest National Laboratory is a multi-program laboratory is approximately 640 acres located on the Department's Hanford site in Washington. The Department of Energy's Pacific Northwest National Laboratory conducts research in the environmental sciences and technology arena to support the Department's energy mission. PNNL provides independent oversight in the areas of subcritical multiplier design, target materials test station design, and reactor-based and accelerator-based transmutation systems.

All Other Sites

The University of Nevada, Las Vegas (UNLV) involves graduate students in AAA research activities leading to masters or doctoral degrees. The goal of the AAA university participation program at UNLV is that UNLV will establish interdisciplinary engineering degrees in subjects directly involving AAA research programs.

Oakland Operations Office provides contract oversight of the Lawrence Livermore National Laboratory activities in support of the SFP/T program. Idaho Operations provides contract oversight of the Idaho National Engineering and Environmental Laboratory activities in support of the SFP/T program. Savannah River Site provides fuel and separations technology support to the SFP/T program.

Spent Fuel Pyroprocessing and Transmutation

Mission Supporting Goals and Objectives

A very high priority of the Department is the need to conduct advanced research and development to investigate technologies that may be of great importance in assuring that the United States has reliable and economic access to energy supplies. The *National Energy Policy* presents a comprehensive plan to explore a range of energy technologies needed to assure a balanced, long-term portfolio that can meet our future needs. One such technology that serves as the focus of one of the Policy's key recommendations is the advanced nuclear fuel recycling technology known as "pyroprocessing." This technology holds the promise of recovering over 98% of the energy value in nuclear fuel that is lost in the "once-through" fuel cycle, while dramatically minimizing nuclear waste, and reducing the radio-toxicity of the material. This technology also provides for a high degree of proliferation-resistance, and the elimination of large quantities of plutonium and other fissile material contained in spent nuclear fuel.

Minimizing the quantity and toxicity of nuclear wastes resulting from recycling of spent fuel is the central mission of this research program. Spent nuclear fuel contains highly radioactive isotopes that will remain highly toxic for many thousands of years. Significant amounts of radioactive waste exists in civilian spent nuclear fuel, and from past U.S. recycling efforts remain in tanks at Hanford and other sites, awaiting treatment and disposal. It is the focus of this program to avoid the mistakes of the past by dealing with all the radioactive materials resulting from spent nuclear fuel and recycling of the toxic isotopes in spent nuclear fuel. Pyroprocessing technologies may be used to create an optimized nuclear fuel cycle that is both highly proliferation-resistant and have minimal impact on the environment.

In FY 2002, this program investigated advanced technologies anticipated by the *National Energy Policy* by conducting scientific and engineering research, development, and demonstration of: (1) advanced, environmentally sound, pyroprocessing technologies; (2) transmutation of spent nuclear fuel in both reactors and accelerator driven systems; (3) design of a coupled accelerator/sub-critical reactor systems; and (4) the development of advanced transmutation fuel (including non-fertile). The mission of this program is consistent with the *National Energy Policy* (NEP), approved by the President in May of 2001, which recommends reconsideration of a next generation fuel cycle technologies, specifically:

"....United States should reexamine its policies to allow for research, development and deployment of fuel conditioning methods (such as pyroprocessing) that reduce waste streams and enhance proliferation resistance. In doing so, the United States will continue to discourage the accumulation of separated plutonium, worldwide."

"The United States should also consider technologies, in collaboration with international partners with highly developed fuel cycles and a record of close cooperation, to develop reprocessing and fuel treatment technologies that are cleaner, more efficient, less waste intensive, and more proliferation resistant."

In FY 2002, this program is designed to investigate these technologies and enable the Department to make informed decisions as to their potential future application in the United States. In FY 2002, achievement of the Spent Fuel Pyroprocessing and Transmutation (SFP/T) program mission will be accomplished through the following activities:

Spent Fuel Pyroprocessing Research and Development

In order to make early progress in investigating pyroprocessing technology, this research and development will utilize existing facilities and expertise currently in place at Argonne National Laboratory - West (ANL-W) (*i.e.*, Fuel Conditioning Facility [FCF] and the Hot Fuel Examination Facility [HFEF]). Pyroprocessing technology will separate actinide (potential fuel) from the uranium in spent fuel from which new fuel and transmutation targets can be transmuted in reactors and accelerator based systems. Specific areas of study will include:

- Recovery of actinides from irradiated fuel and remote fabrication of fuel assemblies containing recycled actinides;

- Material throughput sufficient to establish feasibility of the process for large-scale application.

Transmutation Systems Development

*Reactor-Based Transmutation System*s
The use of reactors to simultaneously generate energy and transmute nuclear waste will be a prime area of study for this program. Specific activities will include:

- Research, development and design of cost effective reactor systems for waste transmutation using both current and advanced technologies. This aspect of the program will focus on design studies of reactors that utilize fuels which are compatible with pyrochemical separation systems. Designs to be considered include fast reactors, light water and gas-cooled reactors.

- Research and development of advanced reactor fuels, including non-fertile and fertile power reactor fuels will be conducted to integrate new fuels into thermal and fast reactor systems (including core physics studies, systems integration, and development and testing of fuel and materials).

- Irradiation in the Advanced Test Reactor in Idaho of advanced transmutation fuels.

Accelerator-Based Transmutation Systems
Significant research and analysis has been conducted on the potential of accelerator-based systems (accelerator driven sub-critical reactors) to optimize the waste management benefits of spent fuel recycling by dealing effectively and flexibly with a wide range of long-lived nuclear species, including highly toxic materials such as radioactive iodine. Specific areas of study will include:

- Conceptual design activities on: (1) a sub-critical multiplier system, including a spallation target, and the coupling of an accelerator to the system, (2) target-materials-test station for spallation target experiments and materials studies.

- Transmutation fuels development, specifically, development and testing of non-fertile fuels.

- The Department will continue to emphasize joint collaborative activities in spent fuel recycling research, design, development, and demonstration. Considerable expertise has been developed

overseas on these technologies, and the potential for significant cooperation and collaboration is very high. The Department has already held discussions with several potential international partners with expertise in areas of interest to the program and for which focused cooperative programs would allow the U.S. and partnering countries to achieve their technology goals. Countries conducting efforts synergistic with the SFP/T program include:

- **France:** technical expertise in aqueous separations, fuels, and test facilities;
- **Italy and Spain:** nuclear designs and technologies;
- **Switzerland:** development and testing of neutron spallation targets using lead-bismuth;
- **Russia:** lead-bismuth technology, fabrication and testing of neutron targets, expertise in fuels and separations and advanced reactor development;
- **Japan:** nuclear fuels, separation technologies, and design of basic and applied research facilities; and
- **South Korea:** expertise in reactor and nuclear system design.

Transmutation Science Education

This portion of the program will continue the successful Advanced Accelerator Applications Fellowship Program to support the development of new scientists and engineers and foster a new area of nuclear science and engineering associated with the technologies needed to deal with commercial spent nuclear fuel. In addition, the program will continue the complementary university research program based at the University of Nevada-Las Vegas to fully integrate universities into the larger SFP/T R&D effort.

EBR-II Spent Fuel Treatment

This activity includes the operations of the Argonne-West facilities in accordance with the Record of Decision for treatment and management of stored sodium-bonded fuels. Treatment of the EBR-II sodium-bonded spent fuel will continue at a rate of 500 kilograms of heavy metal per year.

In FY 2003, achievement of the Spent Fuel Pyroprocessing and Transmutation (SFP/T) program mission will be accomplished through the following activities:

Spent Fuel Pyroprocessing Research and Development

In order to make early progress in investigating pyroprocessing technology, this research and development will utilize existing facilities and expertise currently in place at Argonne National Laboratory - West (ANL-W) (*i.e.*, Fuel Conditioning Facility [FCF] and the Hot Fuel Examination Facility [HFEF]). Pyroprocessing technology will separate actinide (potential fuel) from the uranium in spent fuel from which new fuel and transmutation targets can be transmuted in reactors and accelerator based systems. Specific areas of study will include:

- Reduction of oxide fuel to metal for recycling by pyroprocessing;
- Demonstration of the use of pyroprocessed fuel in reactors (a “fast” reactor such as the French PHENIX reactor) to establish the practicality of an advanced closed fuel cycle;
- Qualification of the metal and ceramic waste forms resulting from pyroprocessing for final disposal.

Transmutation Science Education

Using prior year funds, the SFP/T program will continue at least 10 AAA fellowships in FY 2003 to pursue Master and Ph.D. degrees related to nuclear science and technology. No new fellowships will be awarded in FY 2003.

EBR-II Spent Fuel Treatment

As part of the refocus to pyroprocessing, the EBR-II spent nuclear fuel will be processed in FY 2003, at a rate consistent with the conduct of a parallel research program to investigate advanced pyroprocessing technology for oxide fuels, and process technologies with higher throughput.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Spent Fuel Pyroprocessing and Transmutation					
EBR-II Shutdown	8,781[a]	4,200[a]	0	-4,200	-100
Spent Fuel Treatment	14,964[a]	15,450[a]	15,450	0	0
Disposition Legacy Materials Activities	1,200[a]	388[a]	0	-388	-100
Spent Fuel Pyroprocessing R&D	10,228[b]	7,212[a]	2,771	-4,441	-61.6
Transmutation Systems Development	30,025[c]	43,450[c]	0	-43,450	-100
Transmutation Science Education	3,500[c]	6,550[c]	0	-6,550	-100
Use of Prior Year Balances	0	-818	0	818	100
Total, Spent Fuel Pyroprocessing and Transmutation	68,698[c]	76,432[d]	18,221	-58,211	-76.2

[a] Funded under Nuclear Facilities Management in FY 2001 and FY 2002.

[b] In FY 2001 $0.4M funded under Advanced Accelerator Application (AAA) and $9.8M funded under Nuclear Facilities Management.

[c] FY 2001 includes $34.773M appropriated under Nuclear Facilities Management and $33.925M under AAA program. The $33.9M provided in FY 2001 to NE for Advanced Accelerator Applications (AAA) activities, does not include funds for the Accelerator Production of Tritium (APT) activities which was funded by DP in FY 2000 ($88M) and FY 2001 ($34M.)

[d] FY 2002 includes $30.25M appropriated under Nuclear Facilities Management and $50M appropriation under AAA minus the FY 2002 general reduction and use of prior year balances reduction.

Detailed Program Justification

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
Spent Fuel Pyroprocessing and Transmutation	**68,698**	**76,432**	**18,221**
▪ **EBR-II Shutdown**	**8,781**[a]	**4,200**[a]	**0**

Includes processing and disposition of EBR-II secondary and primary sodium and Fermi sodium. These activities were completed in FY 2001. Also includes, engineering and technical effort for the deactivation of the EBR-II and directly related facilities. Performance will be measured by deactivating EBR-II and all directly related surplus facilities in FY 2002. No funds are requested for this activity as deactivation will be completed in FY 2002.

▪ **Spent Fuel Treatment**	**14,964**[a]	**15,450**[a]	**15,450**

Operate Argonne facilities in accordance with Record of Decision (ROD) for treatment and management of stored sodium-bonded fuels. In FY 2001, funding supported completing deferred facility and process equipment maintenance and improvements and performance was measured by treating spent fuel at a minimal rate (0.5 MTHM per year). In FY 2002 and FY 2003, performance will also be measured by maintaining the spent fuel treatment rate at only 0.5 MTHM per year.

▪ **Disposition of Legacy Materials Activities**	**1,200**[a]	**388**[a]	**0**

Continue the repackaging and removal of DOE legacy spent fuel from a commercial facility. This activity is an integrated task to characterize, repackage, and remove DOE legacy spent nuclear fuel and associated waste materials from a commercial facility at a non-government site and includes storage of these materials at this facility. These DOE legacy materials consist of fuel rod remnants and drums of transuranic contaminated high level waste from earlier DOE funded research programs that are currently stored at a commercial facility. Before this DOE legacy material can be shipped from this commercial facility to disposition sites, these materials must be characterized and repackaged; shipping cask components designed, fabricated, tested; licensing amendments prepared and approved; and appropriate safety analysis reviewed and updated. The funds for the disposition of legacy materials activities have been transferred to the Radiological Facilities Management Program in FY 2003.

[a] Funded under Nuclear Facilities Management in FY 2001 and FY 2002.

(dollars in thousands)

	FY 2001	FY 2002	FY 2003
▪ **Spent Fuel Pyroprocessing Research and Development..**	**10,228**[a]	**7,212**[a]	**2,771**

Technical support for sodium-bonded spent nuclear fuel treatment includes research and development of treatment process refinements to ensure proper treatment of damaged EBR-II fuel rods, a development and test effort on waste stream treatment process equipment of a scale suitable for inventory treatment, long-term waste characterization tests to support qualification activities and to gain Nuclear Regulatory Commission approval for emplacement of metal and ceramic waste forms in a geologic repository, and improvements to existing process equipment. Existing equipment at ANL-W that will be required to support the demonstration of actinide recovery technologies must be qualified for remote operations, installed, tested, and used with the Fuel Conditioning Facility (FCF) electrorefiner. In addition, operation of FCF and the Hot Fuel Examination Facility will continue, but be refocused to allow for pyroprocessing research and development. This activity also supports the development of zeolite columns and other equipment refinements to reduce waste volume and improve process efficiency. Performance in FY 2003 will be measured by initiating laboratory scale oxide reduction pyroprocessing. The FY 2003 decrease of $4,441,000 reflects a reduction in R&D activities due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.

▪ **Transmutation Systems Development .....**	**30,025**[b]	**43,450**[b]	**0**

These funds support the development of fuel and material that can be used for both reactor-based and accelerator-based transmutation systems. Resources applied in FY 2002 to study materials and separations process development, including international cooperation, is ended in FY 2003. FY 2002 performance will be measured by demonstrating the separation of highly radioactive isotopes from civilian spent nuclear fuel from uranium with the uranium cleaned up to 99.999 per cent pure (Class C waste), using the newly developed UREX process. Performance will also be measured by successfully manufacturing in FY 2002 advanced transmutation non-fertile fuels and testing containers for irradiation testing in the Advanced Test Reactor in FY 2003. Another measure of performance in FY 2002 is completing reactor based transmutation studies, and down selection of technologies to two of the nine multi-tier transmutation case studies developed in FY 2001. Completing the construction and bench testing of two super-efficient "Spoke Resonators" for use in future advanced proton accelerators for transmutation in FY 2002 as well as transferring the Russian Lead-bismuth Spallation Target (currently in Russia) to the University of Las Vegas at Nevada for experiment studies in the planned Lead Bismuth Laboratory are additional performance measures for FY 2002. The decrease of $43,450,000 reflects a reduction in these activities due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.

[a] In FY 2001 $0.4M was funded under AAA. In FY 2001 $9.8M and in FY 2002 $7.2M was funded under Nuclear Facilities Management .

[b] Funded under AAA in FY 2001 and FY 2002

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
▪ **Transmutation Science Education**	**3,500**[a]	**6,550**[a]	**0**

These funds support the development of new scientists and engineers and foster a new area of nuclear science and engineering associated with transmutation. This will permit continuing the Advanced Accelerator Application University related support program. Performance in FY 2001 and FY 2002 is measured by supporting 10 new fellowships to pursue Master and Ph.D. degrees in nuclear science and engineering. In addition, the program will continue the complementary university research program based at the University of Nevada-Las Vegas to fully integrate other universities into the larger SFP/T research and development effort. The Idaho Accelerator Center is supported in FY 2002 to improve accelerator-driven transmutation science. In FY 2003, transmutation science education and university support programs are suspended to allow the funding of higher priority programs. The decrease of $6,550,000 reflects a reduction in these activities due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.

▪ **Use of Prior Year Balances**	**0**	**-818**	**0**
Total, Spent Fuel Pyroprocessing and Transmutation	**68,698**	**76,432**	**18,221**

[a] Funded under AAA in FY 2001 and FY 2002.

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY2002 ($000)
Spent Fuel Pyroprocessing and Transmutation	
EBR-II Shutdown	
▪ The decrease of $4,200,000 reflects completion of EBR-II deactivation activities in FY 2002	-4,200
Disposition of Legacy Materials Activities	
▪ The decrease of $388,000 reflects the transfer of these activities to the Radiological Facilities Management program in FY 2003	-388
Spent Fuel Pyroprocessing Research and Development	
▪ The decrease of $4,441,000 reflects a reduction in R&D activities due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants	-4,441
Transmutation Systems Development	
▪ The decrease of $43,450,000 reflects a reduction in these activities due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.	-43,450
Transmutation Science Education	
▪ The decrease of $6,550,000 reflects a reduction in these activities due to a change in focus to emphasize other research and development activities such as near-term deployment of new nuclear plants.	-6,550
Use of Prior Year Balances	818
Total, Spent Fuel Pyroprocessing and Transmutation	-58,211

Program Direction

Mission Supporting Goals and Objectives

The Office of Nuclear Energy, Science and Technology (NE) Program Direction account funds expenses associated with the technical direction and administrative support of NE programs. The Department's Office of Nuclear Energy, Science and Technology (NE) is responsible for the development of advanced nuclear power system technology, providing technology solutions to the spent fuel challenge, and maintaining a viable U.S. nuclear technology infrastructure. This is a highly technical mission that requires staff with expertise in a broad range of highly specialized engineering (nuclear, materials, electrical, chemical, *etc.*) and scientific (physics, health physics, metallurgy, chemistry, *etc*.) disciplines. The *National Energy Policy* (NEP) embraces an expanded role for nuclear power. NE is one of the most programmatically diverse organizations in the Department and NE is faced with critical human capital challenges to pursue the technologies and programs recommended by the NEP.

Use of Program Direction funds is composed of four basic elements:

"Salaries and Benefits" funds salary and benefits for Headquarters and Operations Office personnel providing technical direction to nuclear energy activities and programs, as well as oversight of the High Flux Isotope Reactor at the Oak Ridge National Laboratory, the Advanced Test Reactor at Idaho National Engineering and Environmental Laboratory and activities funded by other Federal agencies. The Department's objective to maintain a highly skilled workforce, requires NE to provide the technical expertise needed to assure the safe operation of the Department's various reactor facilities, to manage effectively new research and development programs, such as the Nuclear Power 2010, Generation IV, and Spent Fuel Pyroprocessing and Transmutation, most of which are still in early stages of development.

"Travel" includes funding for transportation of Headquarters and Operations office employees associated with NE programs, their *per diem* allowances while in authorized travel status, and other expenses incidental to travel.

"Support Services" includes funding for technical and management support services provided to NE Headquarters and Operations office employees. NE is far less dependent upon support service contractors than most other similar organizations. NE requires its senior technical managers to be Federal employees with significant experience necessary to accomplish program objectives. NE does not rely on expert contractors from the national laboratories to manage NE programs in place of Federal staff. NE only receives very limited support from M&O contractors assigned to the metropolitan D.C. area. To reduce support services costs, NE has retrained and redeployed staff to reduce dependence on contractors while meeting growing needs in programs such as the Nuclear Power 2010, Generation IV, and Spent Fuel Pyroprocessing and Transmutation.

"Other Related Expenses" includes funding for administrative expenses, such as: training, computer hardware and software acquisitions, telecommunications, and publication and subscription services. In addition, the Department's Office of Management Budget, and Evaluation (ME) operates a Working Capital Fund to provide funding for mandatory administrative costs, such as, rent and telephone services. Payments into this fund reflect usage of Fund services which are priced and charged to users in accordance with policies established by the Working Capital Fund Board. The Other Related Expenses category also includes support for the activities of the Nuclear Energy Research Advisory Committee.

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Program Direction					
Salaries and Benefits	15,951	17,507	18,132	+625	+3.6
Travel	802	736	736	0	0
Support Services	4,106	2,776	2,776	0	0
Other Related Services	2,980	2,856	2,656	-200	-7.0
Total Program Direction	23,839[a]	23,875	24,300	+425	+1.8
Total Excluding Full Funding for Federal Retirements, Program Direction	23,042	23,000	23,439	+439	+1.9

[a] The FY 2001 and FY 2002 column of the FY 2003 Congressional Request includes funding in the amount of $797K and $875K, respectively, for the Government's share of increased costs associated with pension and annuitant health care benefits. These funds are comparable to FY 2003 funding of $861K. (The data is presented on a comparable basis as if the legislation had been enacted and implemented in FY 2001.)

Funding Schedule

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Chicago					
Salaries and Benefits	1,476	1,180	1,219	+39	+3.3
Travel	85	88	65	-23	-26.1
Support Services	29	36	36	-0	0.0
Other Related Expenses	101	85	53	-32	-37.6
Total, Chicago	1,691	1,389	1,373	-16	-1.2
Full Time Equivalents	12	9	9	0	0.0
Idaho					
Salaries and Benefits	1,113	1,186	1,225	+39	+3.3
Travel	30	30	28	-2	-6.7
Support Services	0	0	0	0	0.0
Other Related Expenses	123	127	102	-25	-19.7
Total, Idaho	1,266	1,343	1,355	+12	+.9
Full Time Equivalents	11	11	11	0	0.0
Oak Ridge					
Salaries and Benefits	864	798	824	+26	+3.3
Travel	44	13	21	+8	+61.5
Support Services	70	40	40	0	0.0
Other Related Expenses	55	10	10	0	0.0
Total, Oak Ridge	1,033	861	895	+34	+3.9
Full Time Equivalents	8	8	8	0	0.0
Oakland					
Salaries and Benefits	119	224	232	+8	+3.6
Travel	18	10	10	0	0.0
Support Services	0	0	0	0	0.0
Other Related Expenses	23	24	23	-1	-4.2
Total, Oakland	160	258	265	+7	+2.7
Full Time Equivalents	1	2	2	0	0.0
Richland					
Salaries and Benefits	574	649	671	+22	+3.4
Travel	16	20	16	-4	-20.0
Support Services	0	0	0	0	0.0
Other Related Expenses	0	0	0	0	0.0
Total, Richland	590	669	687	+18	+2.7
Full Time Equivalents	5	6	6	0	0.0

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Headquarters					
Salaries and Benefits	11,805	13,470	13,961	+491	+3.6
Travel	609	575	596	+21	+3.7
Support Services	4,007	2,700	2,700	0	0
Other Related Expenses	2,678	2,610	2,468	-142	-5.4
Total, Headquarters	19,099	19,355	19,725	+370	+1.9
Full Time Equivalents	99	110	107	-3	-2.7
Total Nuclear Energy					
Salaries and Benefits	15,951	17,507	18,132	+625	+3.6
Travel	802	736	736	0	0.0
Support Services	4,106	2,776	2,776	0	0.0
Other Related Expenses	2,980	2,856	2,656	-200	-7.0
Total, Program Direction	23,839	23,875	24,300	+425	+1.8
Full-Time Equivalents	136	146	143	-3	-2.1

Detailed Program Justification

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
Salaries and Benefits	**15,951**	**17,507**	**18,132**

Over the past several years, NE Headquarters has streamlined from a multi-layered organization to a single-layered organization; downsized significantly; retrained and redeployed staff to reduce dependence on contractors; and continuously redirected and realigned staff to accomplish program goals efficiently and effectively. For the future, however, additional staff will be needed to assure the safe operation of the Department's various reactor facilities and to implement the *National Energy Policy* and provide adequate Federal oversight of essential programs. NE recruiting emphasizes the hiring of entry-level engineering and scientific staff to ensure continuation of an experienced and diverse technical workforce with the skills mix projected to be needed in the future. Over forty-five percent of the current NE staff will be eligible to retire within just a few years, and it is essential that program direction resources are available to compete for needed skills. NE field employees include: Chicago Operations Office (9), Idaho Operations Office (11), Oakland Operations Office (2), Oak Ridge Operations Office (8), and the Richland Operations Office (6).

Travel	**802**	**736**	**736**

In accordance with the Departmental initiative to minimize travel costs, a series of actions have been taken with regard to Headquarters travel. Guidelines were issued to eliminate unnecessary or low value travel, multiple travelers to the same location/meeting are being limited. Conference attendance is being severely limited. Use of video-conferencing is used extensively and is encouraged whenever possible. NE field employees travel costs are similarly included in the Departmental travel costs reduction initiative.

FY 2003 funding reflects continued support of the Department-wide initiative to reduce administrative overhead and increase efficiencies.

Support Services	**4,106**	**2,776**	**2,776**

In accordance with the Departmental initiative to reduce the level of support services contracting, NE has reduced Headquarters support services contracting from $10.6 million in support services contracts in FY 1995 to approximately $2.8 million FY 2002 and FY 2003. NE has undertaken a special effort to minimize support services and reduced funding by 32% from our FY 2001 level. FY 2003 funding reflects continued support of the Department-wide initiative to reduce administrative overhead and increase efficiencies.

	(dollars in thousands)		
	FY 2001	FY 2002	FY 2003
Other Related Expenses	**2,980**	**2,856**	**2,656**

The single largest expenditure ($1.584 million in FY 2003) in the other related expenses category is earmarked for the Headquarters Working Capital Fund (WCF). The Department's Office of Management, Budget, and Evaluation (ME) established a Working Capital Fund to provide funding for mandatory administrative costs, such as, office space and telephone services. Payments to this fund reflect usage of Fund services which are priced and charged to users in accordance with policies established by the Working Capital Fund Board. The Other Related Expense category also includes support for the Nuclear Energy Research Advisory Committee. Finally, this category includes expenses for computer hardware and software support, training, periodicals and subscriptions, etc. FY 2003 funding reflects a reduction in expenses from FY 2002 in support of the Department-wide initiative to reduce administrative overhead and increase efficiencies.

Total, Program Direction	**23,839**	**23,875**	**24,300**

Explanation of Funding Changes from FY 2002 to FY 2003

	FY 2003 vs. FY 2002 ($000)
Salaries and Benefits	
▪ Increase includes 2.6% escalation in accordance with established OMB Budget request guidelines ($450K), approximately 1% for promotions and within-grade salary increases ($175K)	+625
Other Related Expenses	
▪ The decrease at Headquarters (-$142K) and the Field Offices (-$58K) supports the Department-wide initiative to reduce administrative overhead and increase efficiencies.	-200
Total, Program Direction	+425

Support Services

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Technical Support Services	2,883	1,856	1,856	0	0
Management Support Services	1,223	920	920	0	0
Total, Support Services	4,106	2,776	2,776	0	0

Other Related Expenses

(dollars in thousands)

	FY 2001	FY 2002	FY 2003	$ Change	% Change
Working Capital Fund	1,518	1,657	1,584	-73	-4.4
Nuclear Energy Research Advisory Committee	500	400	380	-20	-5.0
ADP/TeleVideo Hardware and Software	325	335	303	-32	-9.6
Subscriptions/Publications	20	20	19	-1	-5.0
Training	50	50	43	-7	-14.0
Other Miscellaneous	567	394	327	-67	-17.0
Total, Other Related Expenses	2,980	2,856	2,656	-200	-7.0