Office of Nuclear Energy, Science and Technology

Executive Summary

Mission

As we become more conscious of the significant energy and environmental challenges facing the United States and the world in this new century, the benefits of nuclear fission as a key energy source for both the near- and long-term future are increasingly apparent. Over the last thirty years, nuclear power has risen to become the second most important source of electric energy in the United States and at the same time, the most economic. The Department of Energy and its predecessor organizations played a large role in this success story. While investing only about $3 billion in today's dollars since the late 1950s and early 1960s—far less than what has been spent on many other energy technologies in just the last decade—the Federal government transferred the technical and scientific expertise created to defend the Nation in the Cold War to the private sector in the form of light water reactor technology.

This technology now represents the dominant method of generating energy from nuclear fission in both the United States and the world. A key mission of the Department's nuclear energy research and development program is to help enhance that basic technology and, through some of the most advanced civilian technology research conducted today, chart the way toward the next leap in technology. With these efforts, and those of industry and our overseas partners, nuclear energy will fulfill its promise as a safe, advanced, inexpensive and environmentally benign approach to providing reliable energy to all the world's people.

Departmental Goal

Goal 1 - ENERGY SUPPLIES: Through public-private partnerships, DOE's policy and research will provide the technology capable of developing abundant, reliable, affordable, and environmentally-sound energy supplies.

This Departmental goal is supported by the Program Strategic Performance Goals that follow:

> **ER7-1: Deploy new nuclear generation to meet energy and climate goals** by enabling an industry decision to deploy at least one new advanced nuclear power plant in the U.S. by 2010 to support the President's goal of reducing greenhouse gas intensity by 18 percent by 2012; completing design of an economic, commercial-scale hydrogen production system using nuclear energy by 2015; and developing a next-generation nuclear system for deployment after 2010 but before 2030 that provides significant improvements in proliferation and terrorism resistance, sustainability, safety and reliability, and economics.
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> **ER7-2: Maximize energy from nuclear fuel** by enabling a decision by 2010 to forgo the technical need for a second repository while still supporting expanded nuclear power in the U.S. and develop the technology to reduce commercial high-level waste by a factor of four by 2015; and commercializing technology to reduce long-term radiotoxicity and heat load of spent fuel by 2030.

ER7-3: **Protect existing nuclear generation** to support the National Energy Policy objectives to maintain and expand the Nation's electricity generation infrastructure by sponsoring innovative, investigator-initiated R&D to enhance the performance of light-water reactor technology to increase generating output from existing plants by at least an additional 500 megawatts by 2020.

ER7-4: **Maintain and enhance national nuclear capabilities** by producing highly-trained nuclear scientists and engineers to meet the Nation's energy, environmental, health care, and national security needs; preserving critical user facilities and nuclear materials in a safe, secure, environmentally-compliant, and cost-effective manner to support national priorities; replenishing Federal technical and management staff with emphasis on obtaining high-caliber junior professionals with diverse backgrounds; and delivering 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 such that by December 2004, deliveries continue to be made to customers as needed.

Goals and Objectives

Deploying New Nuclear Generation to Meet Climate Goals

Despite the increased prospects for nuclear power in this country, no new plants have been ordered for decades. There appears to be two key reasons for this: one is economics--with fossil fuels presenting an energy option that is relatively quick and inexpensive to build, and the financial risk associated with nuclear projects, which would be based on new technologies and reliant upon untested regulatory processes.

A key example of these risks is the uncertainty of how the Nuclear Regulatory Commission (NRC) will implement its new "one-step" licensing procedure. This process was established to ease the identification of acceptable sites, provide for a combined license for both the construction and operation of new nuclear plants, and provide a clear means to verify the quality of the construction of nuclear power plants. While this new approach represents a major improvement in the way nuclear plants would be licensed, this process has never been put to the test and many questions about its implementation remain. As a result, industry is hesitant to risk billions of dollars until these processes have been shown to work effectively in practice.

There is a limited role for the government in addressing 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 forefront. The Department plans to provide limited but critical support for companies willing to demonstrate this new regulatory structure. NE program activities will enable the Nation to meet the President's objective of reducing U.S. greenhouse gas intensity by 18 percent over the next 10 years through the deployment of new nuclear generating capacity.

The **Nuclear Energy Technologies** program is working to identify, assess, and develop cost-efficient technologies that further enhance nuclear safety, minimize the generation of nuclear waste, and further reduce the risk of proliferation. In FY 2004, the **Nuclear Power 2010 program**, a Secretarial initiative, will aggressively pursue demonstration of key regulatory approval processes, foster the completion of cost-effective, advanced nuclear plant designs and develop gas-cooled reactor technologies in order to pave the way for the deployment of new, advanced nuclear plants in the United States by 2010.

For the longer-term future, the Department believes that new, next-generation technologies should be considered. This is a key role of the Department of Energy—developing and enabling the deployment of revolutionary energy technologies that—while long-term and high risk in nature—can provide tremendous benefits to the American people.

As a prime example, the Department believes that the future energy picture of the United States can and should include a large role for hydrogen. Hydrogen will make it possible for this Nation to realize a primary objective of the National Energy Policy—to enhance the energy independence and security of the United States while making significant improvements in environmental quality. Hydrogen could someday be used to power our entire transportation system, reducing our reliance on imported oil, and dramatically reducing the harmful emissions associated with the combustion of fossil fuels. The technologies to support the use of hydrogen, such as in the Department's FreedomCAR initiative, are making important inroads. However, technologists have long wrestled with how to produce the very large quantities of reliable, economic hydrogen that would be needed to replace petroleum-based fuels in our economy.

The Department is working with industry and overseas governments to establish what may prove to be an important answer: nuclear energy-produced hydrogen. Applying advanced thermochemical processes, it may be possible to apply a new generation of nuclear energy plants to produce very large amounts of hydrogen without emitting carbon dioxide or other gases. With its new **Nuclear Hydrogen Initiative**, the Department will develop new technologies to generate hydrogen on a commercial scale in an economic and environmentally benign manner. The Department's Offices of Nuclear Energy, Fossil Energy, and Energy Efficiency and Renewable Energy are working in coordination to provide the technological underpinnings of the Administration's *Hydrogen Fuel* initiative. In the case of nuclear energy, the Department will conduct research and development into advanced thermochemical technologies which may, when used in tandem with next-generation nuclear energy systems, enable the United States to generate hydrogen at a scale and cost (current fossil-fuel-based methods emit greenhouse gases and are roughly four time more costly than the market will support) that would support a future, hydrogen-based economy.

Developing the next-generation nuclear systems to make hydrogen possible will be a key aspect of the **Generation IV Nuclear Energy Systems Initiative** (which is part of the **Nuclear Energy Technologies** program). Through this effort, the United States will lead multi-national research and development projects to usher forth next-generation nuclear reactors and fuel cycles based on the results of the internationally endorsed *Generation IV Technology Roadmap.* This international approach allows for the development of technologies that are widely acceptable; enables the Department to access the best expertise in the world to develop complex new technologies; and allows us to leverage our scarce nuclear R&D resources.

Maximizing Energy from Nuclear Fuel

Commercial nuclear power plants currently use only 2-3 percent of the total energy value of their fuel supply. By **Maximizing Energy from Nuclear Fuel**, the plants and supporting fuel cycle facilities will be designed to use as much of the energy in the fuel as possible. This will be done by developing fuels that can remain in the reactor for longer periods of time and by developing reconditioning technologies that enable used nuclear fuels to be recycled back into the reactors as fresh fuel.

The **Advanced Fuel Cycle Initiative** (AFCI) program will develop technologies which can reduce the volume and long-term toxicity of high level waste from spent nuclear fuel, reduce the long-term proliferation threat posed by civilian inventories of plutonium in spent fuel, and provide for proliferation-resistant technologies to recover the energy content in spent nuclear fuel. Currently, the spent nuclear fuel at nuclear plant sites contains the energy equivalent of 6 billion barrels of oil or about two full years of U.S. oil imports.

The AFCI includes two essential elements that will be conducted in parallel as part of an integrated research effort. The first element would be an intermediate-term technology program element—AFCI Series One—which emphasizes advanced technical enhancements to the current commercial nuclear power infrastructure. This area of work will include creating the proliferation-resistant processes and fuels to enable the destruction of significant quantities of commercially generated plutonium in light water reactors or high temperature gas-cooled reactors in operation during the middle of the next decade. Doing so will support the Nation's first repository and reduce and possibly eliminate the technical need for additional repositories

AFCI Series Two consists of a phased approach to developing the technologies needed to address the long-term issues associated with spent nuclear fuel management. Specifically, this effort will develop fuel cycle technologies that could sharply reduce the long-term radiotoxicity and heat load of high-level waste sent to a geologic repository, and support development of potential Generation IV fuel cycles.

These two program elements are part and parcel of the integrated AFCI effort. Each builds on research and development conducted under the other element and both will be necessary to enable the United States to develop a long-term approach to the nuclear fuel cycle that meets its energy, environment, and nonproliferation policy imperatives.

Protecting Existing Nuclear Generation

The current United States fleet of 103 commercial nuclear power plants accounts for 20 percent of the Nation's electricity production and is one of the least expensive options for power production available on the national grid. As such, **Protecting Existing Nuclear Generation** is a critical objective in supporting the *National Energy Policy* objectives to maintain and expand the Nation's electricity generation infrastructure.
The **Nuclear Energy Research Initiative (NERI)** program funds innovative investigator-initiated, peer-reviewed R&D at U.S. universities, national laboratories, and industry to improve the performance of U.S. light water reactor technology and develop concepts to solve issues inhibiting the long-term growth of nuclear power.

Maintaining and Enhancing Our National Nuclear Capabilities

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. The Department is also responsible for providing critical support to our Nation's university nuclear engineering programs and associated research reactor infrastructure. It is imperative that we **maintain and enhance our National nuclear capabilities** by managing these vital resources and capabilities, efficiently and effectively to ensure that major research/critical facilities will continue to be operational and available for fulfillment of long-term missions. Guided by invaluable input from the Nuclear Energy Research Advisory Committee (NERAC), we seek efficient ways to preserve our national nuclear assets and make appropriate investments to enhance them before passing them on to future generations.

The **University Reactor Fuel Assistance and Support** program supports the operation and upgrade of university research and training reactors, provides graduate fellowships and undergraduate scholarships to outstanding students, uses innovative programs to bring nuclear technology education to small, minority-serving institutions, and provides nuclear engineering research grants to university faculty. The program helps to maintain domestic capabilities to conduct research and the critical infrastructure necessary to attract, educate, and train the next generation of scientists and engineers with expertise in nuclear energy technologies. The Department also partners with industry in a 50/50 cost share program to assist the universities in maintaining their research capabilities. DOE also provides the supply of fresh fuel to and transport of spent fuel from university research reactors and supports reactor equipment upgrades at universities.

The **Radiological Facilities Management** maintains irreplaceable DOE nuclear technology facilities in a safe, secure, environmentally compliant and cost-effective manner to support national priorities. It maintains the Department's vital resources and capabilities at NE-managed facilities at Argonne National Laboratory-West, Oak Ridge National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, and Brookhaven National Laboratory.

On July 15, 2002, Secretary of Energy Spencer Abraham announced a major mission realignment for the Idaho National Engineering and Environmental Laboratory (INEEL), establishing the laboratory as the Nation's leading center for nuclear energy research and development. The INEEL will become the "command center" for the Office of Nuclear Energy, Science and Technology's (NE) nuclear energy research and development enterprise, including the lead role in the development of the Department's next-generation nuclear reactor and fuel cycle systems and space nuclear power and propulsion systems.

The INEEL will transition its R&D focus from environmental cleanup to nuclear energy technologies while maintaining its multiprogram national laboratory status to best serve ongoing and future national needs. The INEEL will draw upon its strengths in applied engineering, technical integration, production-scale operations, project execution and prototyping as it seeks active R&D partnerships with other DOE national laboratories, universities, and the private sector to develop and deploy next-generation nuclear technologies.

The **Idaho Facilities Management** program maintains the INEEL and ANL-W facilities at Idaho in a safe, environmentally compliant and safe condition to support nuclear energy R&D programs, as announced by the Secretary in July 2002. Finally, the **Idaho Sitewide Safeguards and Security** program supports activities that are required to protect DOE assets at INEEL and ANL-W from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts, which may

cause unacceptable adverse impacts on national security, program continuity, the health and safety of employees, the public, or the environment.

The **Program Direction** account funds expenses associated with the technical direction and administrative support of NE programs. NE is responsible for leading the Federal government's investment in nuclear science and technology by investing in innovative science and preserving the national research and development infrastructure. As the new LPSO for the INEEL, program direction also funds expenses associated with the infrastructure operations and safeguards and security activities at the Idaho site. NE plans to perform its mission, goals, and activities with excellence in accordance with the President's Management Agenda by implementing a reorganization that will more effectively implement the Secretary's priorities, completing the independent Human Capital and Succession Plan, and continuing to recruit a well-qualified diverse workforce.

Background

In considering these objectives, the Nation's *National Energy Policy*, issued in May 2001, provides excellent guidance. In particular, the *Policy* makes the following key points about nuclear energy:

- "Nuclear energy accounts for 20 percent of total 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."

- "There is growing interest in new technology known as accelerator transmutation, which could be used in combination with reprocessing to reduce the quantity and toxicity of nuclear waste."

Nuclear energy, which is already a vital component of our balanced energy portfolio, presents some of 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 factors 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.

Initiatives such as the **Advanced Fuel Cycle Initiative** and the **Generation IV Nuclear Energy System Initiative** serve as an example of an important principle the Department has understood since the days when President Eisenhower tasked the Atomic Energy Commission to lead his *Atoms for Peace* initiative: U.S. leadership in nuclear technology is a vital component of the Nation's foreign policy. American prominence in nuclear technology enables the United States to exercise considerable influence on the manner in which nuclear technologies are applied worldwide—nuclear materials proliferation practices, nuclear safety, and other areas of policy import are directly advanced by U.S. international technical leadership.

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, government-industry cooperative research to improve the operation, reliability, and security of the Nation's 103 operating nuclear power plants, and development of new technology approaches to the civilian nuclear fuel cycles.

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, issued on October 31, 2001, 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. This near-term deployment roadmap recommends the cost-shared demonstration of the federal regulatory processes for designing, siting, and operating new nuclear power plants.

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. NE will leverage its scarce R&D resources through our **Generation IV Energy Systems Initiative**, **Advanced Fuel Cycle Initiative** and International **Nuclear Energy Research Initiative** programs. NE will cost-share with industry on research and development activities within the **Nuclear Power 2010** program and matching grants within the **University Reactor Fuel Assistance and Support** program. NE will support the President's goal of reducing greenhouse gas intensity by 18% by 2012 by demonstrating the technical and economic production of hydrogen using nuclear energy through the new **Nuclear Hydrogen Initiative**. In addition, NE will maintain and improve our facility infrastructure through the **Radiological Facilities Management**, **Idaho Facilities Management**, and **Idaho Sitewide Safeguard and Security** programs. Finally, NE will preserve and improve our human capital infrastructure to perform its mission, goals, and activities with excellence in accordance with the President's Management Agenda through the **Program Direction** activities. Specific program accomplishments that will enable NE to achieve its mission are identified in the detailed program budget submissions.

As a means of measuring the effectiveness of these Nuclear Energy Research and Development programs, OMB's Program Assessment Rating Tool (PART) was used to evaluate the research results achieved thus far. The programs evaluated received very high scores for the purpose, planning and management sections of PART. Lower scores for the results and accountability section of PART were received due to the fact that NE's R&D programs are in early stages of development. NE has committed to implementing a number of actions to help measure the effectiveness of its programs.

Funding Summary

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Congressional Request	FY 2003 Adjustments	FY 2003 Comparable Appropriation	FY 2004 Request
Energy Supply-Function 270					
University Reactor Fuel Assistance and Support	17,500	17,500	0	17,500	18,500
Nuclear Energy Plant Optimization	6,293	0	0	0	0
Nuclear Energy Research Initiative	31,081	25,000	0	25,000	12,000
Nuclear Energy Technologies	11,867	46,500	0	46,500	48,000
Nuclear Hydrogen Initiative	0	0	0	0	4,000
Advanced Fuel Cycle Initiative	77,219	18,221	0	18,221	63,025
Radiological Facilities Management	58,933	54,180	0	54,180	62,655
Idaho Facilities Management	43,590	42,770	0	42,770	44,145
Program Direction	22,503	22,899	0	22,899	24,800
Use of Prior Year	-818	0	0	0	0
Subtotal, Energy Supply-Function 270	268,168	227,070	0	227,070	277,125
Energy Supply-Function 050					
Idaho Facilities Management	19,699	25,655	0	25,655	21,415
Idaho Sitewide Safeguards and Security	40,295	40,215	0	40,215	53,651
Program Direction	34,734	33,935	0	33,935	35,407
Subtotal, Energy Supply – Function 050	94,728	99,805	0	99,805	110,473
Total, NE	362,896	326,875	0	326,875	387,598

Major Changes

Beginning in FY 2004, the Department will initiate a new program titled: "Nuclear Hydrogen Initiative". This program will address the need for greater utilization of our energy resources by investigating the uses for nuclear power on an integrated basis as both a heat source, an electricity source, and a source of clean hydrogen which can supplant fossil fuels in our transportation system. Hydrogen produced by nuclear energy can be developed into a practical source of energy that will reduce the environmental impacts of meeting growing hydrogen fuel demand. This activity will study

potential nuclear energy configurations, conduct research and development on enabling technologies, demonstrate nuclear-based hydrogen producing technologies, and evaluate deployment scenarios to meet future needs for increased hydrogen consumption.

In July 2002, the Secretary of Energy announced a major mission realignment for the Idaho National Engineering and Environmental Laboratory (INEEL), establishing the site as the Nation's leading center of nuclear research and development. As a result, oversight of the INEEL transferred from Office of Environmental Management (EM) to NE. INEEL will become the "command center" for NE's strategic nuclear energy research and development enterprise, INEEL's revised mission will play a major role in Generation IV's nuclear energy systems development, advanced fuel cycle development, and space nuclear power and propulsion applications. The INEEL will transition its research and development focus from environmental programs to nuclear energy programs while maintaining its multi-program national laboratory status to best serve ongoing and future DOE and national needs. While INEEL will focus on its new role as the center for nuclear research and development as a multi-program national laboratory, the INEEL will continue to pursue appropriate roles in national security, environmental and other activities.

In addition to the transfer of INEEL, the Department is proposing a new structure for NE's FY 2004 budget. The new Idaho Facilities Management program includes the Argonne National Laboratory West (ANL-W) Operations program, previously funded under Radiological Facilities Management and a new account, INEEL Infrastructure. The INEEL Infrastructure program incorporates the Idaho Landlord program, previously funded under EM, and the Test Reactor Area Landlord program, previously funded in NE's Radiological Facilities Management program, into one program. Also, beginning in FY 2004, the safeguards and security programs at the Idaho National Engineering and Environmental Laboratory and the Argonne National Laboratory-West will be integrated into a single program: Idaho Sitewide Safeguards and Security. These changes more accurately reflect the activities being performed at the Idaho sites and facilities.

Other proposed structure changes in FY 2004 include incorporating the facilities and infrastructure activities previously funded in the Advanced Radioisotope Power Systems and Medical Isotope programs, into the Radiological Facilities Management. In addition, the titles of these programs have been changed to Space and Defense Infrastructure and the Medical Isotope Infrastructure. These changes more accurately reflect the activities being performed at NE managed sites and facilities.

Major Issues

NE's mission is to promote the responsible use of nuclear technology by investing in innovative science and preserving the national research and development infrastructure. NE sponsors nuclear energy technology research by the national laboratories, by U.S. universities, and by industry and cooperates with a wide range of international partners. NE manages the safe operation and maintenance of critical nuclear infrastructure and provides nuclear technology goods and services to industry and to other government organizations. NE's technology research programs also secure our long-term national security interests by developing advanced technologies that advance our non-proliferation goals. 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.

NE is one of the most programmatically diverse organizations in the Department and is faced with critical human capital challenges to pursue its mission and programs. Several years ago, NE went through extensive downsizing that resulted in numerous skill imbalances. Wherever possible, employees will be redeployed from lower priority programs to higher priority programs to meet mission needs. However, the organization has reached a point, with expanding programs, limited resources, and skill imbalances, that it is struggling to meet the requirements set for it by the President and the Secretary of Energy. NE currently has a staff of about 132 personnel and nearly half of those will be eligible to retire within five years.

NE has plans to aggressively address the mismatch between the growth in its national responsibilities and the decline in its skilled personnel. NE's recent reorganization, in conjunction with the Human Capital and Succession Plan, will enable NE to perform its mission, goals, and activities with excellence in accordance with the President's Management Agenda. These proposed actions and NE's broadening mission create additional requirements for Program Direction funds.

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.

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

University Reactor Fuel Assistance and Support

Program Mission

The United States has led the world in the development and application of nuclear technology for many decades. This leadership, which spans national security, energy, environmental, medical and other applications, has been possible only because the United States Government fostered advanced nuclear technology education at many universities and colleges across the Nation. Government's role has not diminished over the years and is in fact now essential to the preservation of these 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 offers essential support to U.S. university nuclear engineering programs and university research reactors. 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 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 that will be needed as the United States continues its reliance on advanced nuclear technologies into the future. This program is essential to the continued operation of the Nation's university research and training reactors which play a vital role in supporting nuclear education and training.

The independent Nuclear Energy Research Advisory Committee (NERAC) established a Blue Ribbon Panel to consider 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 in general and its university research reactors in particular.

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 grants for instrumentation and equipment upgrades; 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 for 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 1990s were not encouraging and more students need to be educated in nuclear engineering to provide the trained nuclear scientists and engineers the Nation will require 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 their April 2001 report, NERAC recommended that the Department provide increased financial support to keep essential reactor facilities in operation. The Department is implementing this recommendation beginning in FY 2002 through the Innovations in Nuclear Infrastructure and Education (INIE) program. INIE encourages participating universities to form ground breaking partnerships with national laboratories, the private sector and other universities to strengthen nuclear engineering education in the United States. In FY 2002, four INIE grants, involving 14 universities with reactors and/or nuclear engineering programs, were awarded.

Over the last several years our initiatives in support of students, faculty and facilities have yielded positive results. Undergraduate enrollments in nuclear engineering, which had suffered steady declines for two decades, have increased dramatically at many schools due to the availability of more student scholarships, research funding, faculty support and funding support by the private sector resulting from our Matching Grant program. Minority participation and support has also risen sharply with our program pairing nuclear engineering schools with minority institutions enabling students from a minority university to achieve degrees in both nuclear engineering and their chosen technical field.

Program Strategic Performance Goal

ER7-4: Maintain and enhance national nuclear capabilities by producing highly-trained nuclear scientists and engineers to meet the Nation's energy, environmental, health care, and national security needs; preserving critical user facilities in a safe, secure, environmentally-compliant, and cost-effective manner to support national priorities; replenishing Federal technical and management staff with emphasis on obtaining high-caliber junior professionals with diverse backgrounds; and delivering 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 such that by December 2004, deliveries continue to be made to customers as needed.

Performance Indicator: Progress will be measured by:

- Annual increase in undergraduate and graduate enrollments in nuclear engineering and science.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
Support U.S. universities' nuclear energy research and education capabilities by: - Providing fresh fuel to university reactors requiring this service; - Funding all of the 23 universities with research reactors that apply for reactor upgrades and improvements; - Partnering with private companies to fund 20 to 25 DOE/Industry Matching Grants for universities; - Providing funding for Reactor Sharing with the goal of enabling all of the 28 eligible schools that apply for the program to improve the use of their reactors for teaching, training, and education; and - Award two or more Innovations in Nuclear Infrastructure and Education awards. (MET GOAL) Attract outstanding U.S. students to pursue nuclear engineering degrees by: - Providing 18 graduate student fellowships with higher stipends beginning in FY 2002; - Supporting 50 university Nuclear Engineering Education Research Grants to encourage creative and innovative research at U.S. universities; and - Providing scholarships and summer on-the-job training to approximately 40 sophomore, junior and senior nuclear engineering and science scholarship recipients. (MET GOAL)	Protect national nuclear research assets by funding 4 regional reactor centers; providing fuel to University Research Reactors; funding 20 to 25 DOE/Industry Matching Grants, 18 equipment and instrumentation upgrades, and 50 Nuclear Engineering Education Research grants; and providing 18 fellowships and 40 scholarships.	Protect national nuclear research assets by continuing to fund the 4 existing and one additional regional reactor centers; providing fuel to University Research Reactors; funding 20 to 25 DOE/Industry Matching Grants, 18 equipment and instrumentation upgrades, and 50 Nuclear Engineering Education Research grants; and providing 18 fellowships and 40 scholarships.

Significant Accomplishments and Program Shifts

- In FY 2004, funding is requested 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. Much of this assistance will occur through the INIE program.

Funding Profile

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
University Reactor Fuel Assistance and Support.....	17,500	17,500	18,500	+1,000	+5.7%
Total, University Reactor Fuel Assistance and Support.....	17,500	17,500	18,500	+1,000	+5.7%

Funding by Site

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Chicago Operations Office					
Argonne National Laboratory	128	270	270	0	0.0%
Total, Chicago Operations Office	128	270	270	0	0.0%
Idaho Operations Office					
Idaho Operations Office	13,750	14,100	15,100	+1,000	+7.1%
Idaho National Engineering and Environmental Laboratory	3,181	2,800	2,800	0	0.0%
Total, Idaho Operations Office	16,931	16,900	17,900	+1,000	+5.9%
Savannah River Site	300	300	300	0	0.0%
Oak Ridge National Laboratory	65	30	30	0	0.0%
Washington Headquarters	76	0	0	0	0.0%
Total, University Reactor Fuel Assistance and Support	17,500	17,500	18,500	+1,000	+5.7%

Site Description

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 programs 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 Innovations in Nuclear Infrastructure and Education program, which establishes regional research and training centers to further strengthen the university

research infrastructure. ID also 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 nuclear scientists and engineers to industry in fields such as electricity generation, medicine, 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 27 campuses in 21 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, and needed for conducting basic and applied research critical to U.S. technological competitiveness. In addition, with the help of the Innovations in Nuclear Infrastructure and Education and Reactor Sharing programs, 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. The Nuclear Engineering Education Research (NEER) program funds innovative research at university reactors permitting both faculty and students to benefit from hands-on research. The Matching Grant program permits universities to strengthen their nuclear engineering course of study in a way that best fits each institution and the private sector match in this program leverages DOE funding. The key component to nuclear engineering infrastructure continues to be the quality of students produced by the universities. DOE's fellowships and scholarship programs not only help assure that sufficient students are attracted to nuclear engineering but that the best and brightest students pursue this discipline.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
University Reactor Fuel Assistance and Support	17,500	17,500	18,500	+1,000	+5.7
Total, University Reactor Fuel Assistance and Support	17,500	17,500	18,500	+1,000	+5.7

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
University Reactor Fuel Assistance and Support	**17,500**	**17,500**	**18,500**
▪ **University Nuclear Infrastructure (UNI)**	**9,815**	**9,815**	**10,815**

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 UNI program will continue to supply fresh fuel to and ship spent fuel from university reactors requiring these services in FY 2004. In FY 2004, 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 FY 2004, 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 2002, 22 grants were made. In FY 2003 and FY 2004 the number of reactor sharing 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 23 university reactors in FY 2002 and about 18 reactors in FY 2003 and FY 2004.

The funding in FY 2004 will support the Innovations in Nuclear Infrastructure and Education (INIE) initiative to assist the universities in continuing the integration of academics and reactor research, enhancing the quality of student education, and encouraging universities to better work with the Department's national laboratories, private industry and other universities 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. INIE began in FY 2002 with awards to four partnerships in geographically diverse areas of the United States. These four awards are providing support for 14 universities with nuclear engineering programs and/or nuclear research and training reactors. The awards are for one year, renewable annually, for up to five years. The increase of $1,000,000 is due to funding an additional university consortium.

▪ **DOE/Industry Matching Grants Program**	**800**	**800**	**800**

In FY 2004, the DOE/Industry Matching Grants program which supports education, training, and innovative research at participating U.S. universities will continue. This program provided grants of up to $60,000, which are matched by industry. In FY 2002, 21 universities received awards and an expected 20-25 will receive awards in FY 2003 and FY 2004.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Fellowships/Scholarships to Nuclear Science and Engineering Programs at Universities**.....	**1,200**	**1,200**	**1,200**

In FY 2004, fellowships and scholarships will be provided 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 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, stipends for these fellowships were increased to keep them competitive with non-nuclear engineering fellowships. A total of 23 fellowships and more than 50 scholarships were awarded in FY 2002 with 18 fellowships and 40 scholarships expected in FY 2003 and FY 2004.

The University Partnership program was initiated in FY 2000 to encourage students enrolled in minority serving institutions to pursue a nuclear engineering degree in cooperation with universities that grant those degrees. In FY 2002, the Department funded four university partnerships and expects to fund five in FY 2003 and FY 2004.

▪ **Nuclear Engineering Education Research (NEER) Grants**	**5,000**	**5,000**	**5,000**

In FY 2002, existing and new NEER grants totaled approximately 50; the same number of grants is planned for FY 2003 and FY 2004.

▪ **Nuclear Engineering Education Opportunities**.....	**385**	**385**	**385**

The Nuclear Engineering Education Opportunities program 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 funding enables 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 educational materials; and permits 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 train teachers and students, keeping costs down. Since this program began in FY 2000, more than 100 workshops have been held throughout the country. The workshops planned for FY 2004 will reach thousands of teachers enabling them to explain nuclear science and engineering principles to their students.

▪ **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.

Total, University Reactor Fuel Assistance and Support.....	**17,500**	**17,500**	**18,500**

Explanation of Funding Changes from FY 2003 to FY 2004

	FY 04 vs. FY 03 ($000)
University Reactor Fuel Assistance and Support	
• The increase of $1,000,000 is due to expanded INIE efforts to assist universities in continuing the integration of academics and reactor research	+1,000
Total Funding Change, University Reactor Fuel Assistance and Support	**+1,000**

Research and Development

Program Mission

The benefits of nuclear science and technology to our society are numerous and 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. Nuclear energy presents some of 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 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*, the *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, government-industry cooperative research to improve the operation, reliability, and security of the Nation's 103 operating nuclear power plants, and development of new technology approaches to the civilian nuclear fuel cycles.

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, issued on October 31, 2001, 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. This near-term deployment roadmap recommends the cost-shared demonstration of the federal regulatory processes for designing, siting, and operating new nuclear power plants.

Our technology research programs also secure our long-term national security interests by developing advanced technologies that advance our non-proliferation goals. For example, programs such as Generation IV Nuclear Energy Systems and Advanced Fuel Cycle Initiative are at the heart of the Department's response to the initiatives announced by the President of the United States and the President of the Russian Federation to consider ways the nations could work together to improve the proliferation-resistance of civilian nuclear energy systems.

Our Nation's investments in nuclear energy R&D are made to improve the quality of life, energy security, and economic prospects for the American people. Currently, 20 percent of our Nation's electricity is produced 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 three critical objectives:

Protecting Existing Nuclear Generation

The current United States fleet of 103 commercial nuclear power plants accounts for 20 percent of the Nation's electricity production and is one of the least expensive options for power production available on the national grid. Current nuclear power plants are expected to operate for at least 60 years—well into the middle of the century. Electricity demand in the United States is expected to grow sharply in the 21st century, requiring significant additions of new generation capacity. Forecasts indicate that the United States will need about 428,000 megawatts of new generating capacity by 2025, even if ambitious assumptions are made regarding energy efficiency practices and technologies.

The Nuclear Energy Research Initiative (NERI) program funds new innovative investigator-initiated, peer-reviewed R&D at U.S. universities, national laboratories, and industry to advance nuclear energy technology. The research conducted under NERI program brings innovative, investigator-initiated research to support continued operation of existing nuclear power plants for at least 60 years in addition to innovative research activities needed for next generation plants. To address these issues, NERI is currently sponsoring R&D in areas including novel next generation, proliferation-resistant reactor designs, advanced nuclear fuel development, and fundamental nuclear science that can:

- improve reactor materials for existing and future plants,
- provide advanced methods of monitoring long-term material performance,
- advance state-of-the-art plant instrumentation, control and monitoring technologies, and
- develop safer, higher performing nuclear fuels.

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 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.

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). While the Department continues to support the objectives of the NEPO program, no funding is requested for NEPO in FY 2004.

Deploying New Nuclear Generation to Meet Energy and Climate Goals

U.S. electricity demand continues to grow at approximately two percent per year. While historically modest, this growth, which powers the United States economy, would require the United States to build between 1,400 and 2,100 new power plants by 2025. This equates to building and commissioning 60 to 90 power plants each year over the next 25 years. To meet this need, the *National Energy Policy* recommends the expansion of nuclear energy in the United States, including the construction of new nuclear plants.

The Nuclear Power 2010 program is focused on resolving the technical, institutional, and regulatory barriers to the deployment of new nuclear power plants by 2010, consistent with the recommendations of the NERAC report, *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010*. In order to support the *National Energy Policy* and the President's goal of reducing greenhouse gas intensity by 18 percent by 2012, the Nuclear Power 2010 program will achieve:

- completion of the NRC staff review and issuance of the Final Safety Evaluation Report (SER) for an advanced reactor Design Certification application,
- NRC approval of Early Site Permit applications and Combined Construction and operating License applications by 2008, and
- an industry decision to deploy at least one new advanced nuclear power plant by the end of the decade.

The Nuclear Power 2010 program will pave the way for near-term deployment of new power plants in the United States through cost-shared demonstration of the new, untested regulatory processes and cost-shared development of advanced nuclear power plant technologies. The regulatory demonstration tasks include the Early Site Permit (ESP) and combined Construction and Operating License (COL) regulatory processes to reduce licensing uncertainties and the attendant financial risks to the licensee. The technology development activities support research and development to finalize and certify those advanced nuclear power plant designs which U.S. power generation companies are willing to build.

The Nuclear Power 2010 program incorporates competitive procurement processes for the regulatory demonstration and technology development activities and requires a minimum of 50 percent industry cost share for most program activities. Through the competitive procurement process, it is expected that innovative business arrangements will be formed between power generating companies and reactor vendors with strong and common incentives to successfully build and operate new plants in the United States.

While contributing 17 percent of electricity generation worldwide, nuclear energy currently contributes only seven percent to the overall global energy requirements. Considering emerging issues such as sustainable development of world economies, the capacity of nuclear energy to deliver energy that is free from greenhouse gas emissions or other air pollutants offers a renewed incentive to consider a broadened, energy-intensive product mix. Nuclear technology, combined with advanced thermochemical technologies, presents a very promising approach to produce hydrogen in a sustainable and environmentally friendly manner. A large market for hydrogen already exists in the fertilizer and oil industries. Hydrogen and other synthetic chemical fuels are expected to find broadening application on world energy markets; the transportation sector has already begun a transition to hydrogen enrichment of fuels. The Nuclear Hydrogen Initiative mission is focused on the development and demonstration of a commercially viable, reactor-driven process for the large-scale production of hydrogen. To address these issues, the Nuclear Hydrogen Initiative will:

- demonstrate the economic deployment of thermo-chemical water splitting techniques for hydrogen production by 2006, and
- achieve operation of a commercial-scale hydrogen production system prototype by 2008.

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 Initiative will meet these needs by:

- developing advanced reactor and fuel cycle systems characterized by improved safety and reliability, economics, sustainability, and proliferation resistance and physical protection, for commercial deployment after 2010 but before 2030.
- developing advanced reactor and fuel cycle systems that can be used to produce electricity, hydrogen, and clean water economically and without emitting harmful pollutants to the environment, after 2010 but before 2030.

The Generation IV Nuclear Energy Systems Initiative includes strong international participation. 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, the Republic of Korea, the 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. Switzerland has since joined this group of countries.

Although the Generation IV Technology Roadmap to guide Generation IV R&D will not be issued until early 2003, the GIF made a final selection of the six most promising nuclear reactor and fuel cycle concepts at its May 2002 meeting. The Department will select the systems of greatest interest to the U.S. and initiate the research and development identified in the Roadmap in cost-shared cooperation with other GIF member countries.

Maximizing Energy from Nuclear Fuel

As the United States considers the expansion of nuclear energy (as recommended in the *National Energy Policy*), it is clear that the Nation must optimize its approach to managing spent nuclear fuel. While the planned geologic repository at Yucca Mountain is sufficient for all commercial spent fuel generated in the United States through 2015, the current "once-through" approach to spent fuel will require the United States to build additional repository space to assure the continued, safe management of nuclear waste from currently-operating plants and a new generation of nuclear plants. Further, long-term issues associated with the toxicity of nuclear waste and the eventual proliferation risks posed by plutonium in spent fuel remain.

To address these issues, the Department has embarked, with its international partners, on a new research effort with both an intermediate-term (2015) and a long-term (2030) component. This program, the Advanced Fuel Cycle Initiative, aims to develop advanced nuclear fuel cycle technologies that can:

- enhance the design and reduce the long-term cost of the Nation's first geologic repository,
- recover the energy value of commercial spent nuclear fuel,
- reduce or eliminate the technical need for an additional repository,
- reduce by a factor of four the quantity of high-level waste requiring disposition in a repository,
- permanently destroy the plutonium that is contained within spent nuclear fuel, and
- reduce by a factor of 1,000 the radiotoxicity hazard posed by spent nuclear fuel

If successful, the Advanced Fuel Cycle Initiative will enable the United States to fully optimize its geologic repository – increasing its performance and reducing its costs – and do so in a proliferation-resistant manner. This research is also central to the agreement between President Bush and President Putin of the Russian Federation to explore potential cooperation in advanced proliferation-resistant fuel cycles.

Program Strategic Performance Goal

ER7-1: Deploy new nuclear generation to meet energy and climate goals by enabling an industry decision to deploy at least one new advanced nuclear power plant in the U.S. by 2010 to support the President's goal of reducing greenhouse gas intensity by 18 percent by 2012; completing design of an economic, commercial-scale hydrogen production system using nuclear energy by 2015; and developing a next-generation nuclear system for deployment after 2010 but before 2030 that provides significant improvements in proliferation and terrorism resistance, sustainability, safety and reliability, and economics.

Performance Indicators: Progress will be measured by:

- Number of milestones met toward achieving a private sector decision to deploy a new commercial nuclear power plant in the United States by 2010.
- Number of thermo-chemical water splitting techniques tested by 2005
- Number of milestones met in determining hydrogen production efficiencies by 2006 toward development and demonstration of a commercially viable, reactor-driven process for the large-scale production of hydrogen.
- Improvements in sustainability, safety, and reliability, proliferation-resistance, and economics as compared to current operating nuclear power plants.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
Complete and issue the government/industry roadmap to build new nuclear plants in the United States by 2010. (MET GOAL)	Under the cooperative agreements with U.S. power generation companies, submit at least two Early Site Permit applications for commercial sites to NRC.	Demonstrate the combined Construction and Operating License (COL) process by awarding a cost shared project with a power generating company.
Complete at least two cooperative agreements with U.S. power generating companies to jointly proceed with at least two Nuclear Regulatory Commission (NRC) Early Site Permit applications for specific DOE and/or commercial sites. (MET GOAL)	Following a competitive process, award at least one industry cost-shared cooperative agreement for technology development and regulatory demonstration activities.	Complete a technology roadmap for the Nuclear Hydrogen Initiative identifying the research and development required to determine the competitiveness of large-scale hydrogen production using nuclear energy.
Complete the draft Generation IV Technology Roadmap for development of the next generation nuclear energy systems. (MET GOAL)	Issue the Generation IV Technology Roadmap to develop the most promising next generation nuclear energy system concepts.	Complete pre-conceptual system designs and identify technical requirement envelopes for concept-specific reactor systems, energy conversion systems, and fuel cycle facilities.

Program Strategic Performance Goal

ER7-2: Maximize energy from nuclear fuel by enabling a decision by 2010 to forgo the technical need for a second repository while still supporting expanded nuclear power in the U.S. and develop the technology to reduce commercial high-level waste by a factor of four by 2015; and commercializing technology to reduce long-term radiotoxicity and heat load of spent fuel by 2030.

Performance Indicators: Progress will be measured by:

- Complete fabrication, in FY 2005, of proliferation-resistant light water reactor test fuel for prototypic irradiation beginning in FY 2006.
- Demonstration of proliferation-resistant separation of actinides by 2006.
- Reductions in radiotoxicity and heat load of spent fuel as compared to existing inventories of commercial spent fuel.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
Successfully manufacture advanced transmutation non-fertile fuels and testing containers for irradiation testing in the Advanced Test Reactor. (MET GOAL)	Complete fabrication of test articles containing proliferation resistant transmutation fuels for irradiation in the ATR beginning in FY 2004.	Complete fabrication of advanced light water reactor proliferation-resistant transmutation fuel samples and initiate irradiation.
Demonstrate separation of uranium from spent nuclear fuel at a level of 99.9 percent using the Uranium Extraction (UREX) process to support the development of advanced fuel cycles for enhanced repository performance. (MET GOAL)	Demonstrate a laboratory scale separation of plutonium and neptunium as well as cesium and strontium from other actinides and fission products to support the development of advanced fuel cycles for enhanced repository performance.	Demonstrate a laboratory scale separation of americium and curium as well as cesium and strontium from spent nuclear fuel to support the development of advanced fuel cycles for enhanced repository performance.

Program Strategic Performance Goal

ER7-3: Protect existing nuclear generation to support the *National Energy Policy* to maintain and expand the Nation's electricity generation infrastructure by sponsoring innovative, investigator-initiated R&D to enhance the performance of light-water reactor technology to increase generating output from existing plants by at least an additional 500 megawatts by 2020.

Performance Indicators: Progress will be measured by:

- Number of advanced methods of monitoring long-term material performance developed by 2008.
- Development of an advanced sensing, monitoring, control and diagnostics technology by 2009.
- Number of new material applications (e.g. ceramics) to address component aging issues by 2009.
- Number of component technologies developed towards the establishment of advanced power conversion technologies by 2010.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
Complete the first 3-year phase of NERI research and development. (MET GOAL) Complete funding for the 10 NERI projects initiated in FY 2000; provide funding for the 13 NERI projects initiated in FY 2001; and award at least 16 new NERI projects (currently 20 awards are expected). (MET GOAL)	Complete 29 NERI projects initiated in FY 1999 and FY 2000 in the areas of advanced reactor technology, advanced reactor fuel, fundamental nuclear science technology, and/or nuclear waste management. Award approximately eight new I-NERI projects in the areas of next generation reactor and fuel cycle technology, innovative nuclear plant design and advanced nuclear fuels and materials – five with the Republic of Korea and three under another international agreement.	Complete 11 NERI projects initiated in FY 2000 and FY 2001 in the areas of advanced reactor technology, advanced reactor fuel, fundamental nuclear science technology, and/or nuclear waste management.

Significant Accomplishments and Program Shifts

Nuclear Energy Research Initiative

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

- In FY 2002, 23 NERI research and development projects initiated in FY 1999 were completed. The program will complete funding of projects awarded and continue the NERI projects awarded in FY 2001, and award 24 new NERI projects.

- In FY 2002, continued the three French I-NERI research projects awarded in FY 2001 and initiated nine new I-NERI projects--two with France, six with Korea, and one with the Nuclear Energy Agency.

- In FY 2003, 29 of the NERI projects awarded in FY 1999 and FY 2000 are planned to be completed. The program will complete funding of projects initiated in FY 2001, and provide funding for projects initiated in FY 2002.

- In FY 2003, continue the I-NERI research projects awarded in FY 2001 and FY 2002. Initiate 5 new projects with the Republic of Korea in early FY 2003 and 3 projects under another international agreement. Establish bilateral I-NERI agreements with Brazil, Canada, the Republic of South Africa, and Japan.

- In FY 2004, 11 of the NERI projects initiated in FY 2000, and FY 2001 are planned to be completed and continue the NERI projects initiated in FY 2002. The program will complete funding of projects initiated in FY 2002. No new projects will be initiated in FY 2004.

- In FY 2004, research activities on the I-NERI projects initiated with France in FY 2001 will be completed. The I-NERI projects initiated with France, Korea, and the Nuclear Energy Agency in FY 2002 and FY 2003 will be continued; no new I-NERI projects will be initiated in FY 2004.

Nuclear Energy Plant Optimization

- In FY 2002 through FY 2004, 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.* Activities in FY 2003 and FY 2004 will be conducted with prior-year funding.

- In FY 2003, complete 10 projects initiated in prior years associated with managing the effects of plant aging and improving electricity generation with prior year funding.

- In FY 2004, complete seven 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 2002, completed the near-term deployment roadmap, *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010,* 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, the Secretary announced the Nuclear Power 2010 initiative aimed at building new nuclear power plants in the United States by 2010.

- In FY 2002, completed competitively selected cost-shared Early Site Permit (ESP) scoping studies by power generating companies to evaluate site suitability and to develop schedule and resource estimates for siting new nuclear power plants at both federal and commercial sites.

- In FY 2002, completed a Nuclear Business Case Study, developed with expert input from U.S. financial and nuclear industries, to identify the necessary conditions under which utilities would add new nuclear capacity, and to develop strategies to close the financial gaps which pose the highest risk.

- In FY 2002, continued cooperation with the Nuclear Regulatory Commission (NRC) on the development of a gas reactor regulatory and licensing framework, including conduct of an evaluation of the gas-cooled reactor technologies and identification of technical issues and research required for licensing.

- In FY 2002, initiated cost-shared regulatory demonstration projects with industry to jointly proceed with NRC Early Site Permit (ESP) applications for specific commercial sites.

- In FY 2002, finalized the planning of the gas-cooled reactor fuel irradiation, test, and qualification program.

- In FY 2003, initiate cost-shared advanced nuclear power plant technology development, selection, and licensing activities. The Early Site Permit applications will be submitted to the NRC.

- In FY 2003, initiate laboratory-scale gas reactor fuel coating and compact process development at the Oak Ridge National Laboratory and manufacture coated particle fuel for irradiation testing and fuel performance model development.

- In FY 2003, initiate a nuclear plant project cost and construction assessment to evaluate cost, schedule, and construction methods needed to support new nuclear power plant deployment in this decade.

- During FY 2003, initiate a solicitation for competitively selecting a cost-shared project with a power generation company to demonstrate the combined Construction and Operating License (COL) process.

- In FY 2004, complete the design of a gas reactor fuel test vehicle for future irradiations in the Advanced Test Reactor at the Idaho National Engineering and Environmental Laboratory.

- In FY 2004, initiate new coating and compacting technologies for gas reactor fuel at ORNL.

- In FY 2004, the nuclear plant project cost and construction assessment initiated in FY 2003 will be completed.

- In FY 2004, cost-shared regulatory demonstration projects for ESP and the advanced nuclear power plant technology development project will continue.

- In FY 2004, finalize selection and award a utility cost-shared project to demonstrate the COL process.

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 to jointly develop the Generation IV Technology Roadmap and to establish cooperative partnerships for Generation IV research and development.

- In FY 2002, Switzerland joined the GIF.

- In FY 2002, selected the six most promising nuclear energy concepts with full GIF endorsement.

- In FY 2002, completed the final draft of the Roadmap in accordance with the original Roadmap objectives.

- In FY 2003, submit the Generation IV Technology Roadmap to Congress.

- In FY 2003, formulate a U.S. Generation IV implementation plan based on the Roadmap and submit to Congress.

- In FY 2003, establish collaborative agreements with GIF member countries to jointly perform the viability R&D identified in the Roadmap.

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

- In FY 2003, the Very High Temperature Reactor (VHTR) was selected by the Department as the system of greatest interest, because of its capability to produce hydrogen efficiently and its relatively small technology gaps. Three reactor concepts with fast-neutron spectrum were also selected for viability R&D. Development of these systems, after the development of advanced fuel cycle systems in the Department's Advanced Fuel Cycle Initiative program, would lead to a highly proliferation-resistant, cost-effective nuclear fuel cycle that could continue to supply energy to the U.S. for hundreds of years to come.

- In FY 2004, complete screening of concept-specific fuel options and selection of reference and backup fuel forms; initiate preparation of fuel samples to support property measurements and small-scale irradiation tests in FY 2005 and beyond.
- In FY 2004, perform reactor and balance-of-plant concept development studies and initiate conceptual design and trade studies for a new gas-cooled test and research reactor.

Nuclear Hydrogen Initiative

- In FY 2004, the program will be initiated; a research and technology development roadmap will be completed and research and development will be initiated to establish the technical basis for, and demonstrating the viability of a commercial-scale hydrogen production capability using nuclear energy.

Advanced Fuel Cycle Initiative

- In FY 2001, the Advanced Accelerator Applications (AAA) 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, established a science and engineering based research program for transmutation technologies and initiated systems studies to 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. (In FY 2004, this program is continuing.)

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

- In FY 2002, transferred the Russian Lead-bismuth Spallation Target to the University of Nevada at Las Vegas for experiment studies.

- In FY 2002 and FY 2003, experienced personnel, facilities, and equipment being used for electrometallurgical treatment technology are being redirected to the research and development activities required to support, in FY 2002, the AAA program, and in FY 2003, the Spent Fuel

Pyroprocessing and Transmutation program. Therefore, the Department has requested no new funds for the Nuclear Facilities Management program for FY 2003.

- In FY 2004, the Spent Fuel Pyroprocessing and Transmutation program will be renamed the Advanced Fuel Cycle Initiative to more closely identify the program with its goals of developing advanced fuel cycles to deal with spent nuclear fuel issues.

- In FY 2004, the program will build on technologies already developed, such as UREX, to investigate the near term ability to destroy plutonium in existing reactor systems.

- In FY 2004 initiate conceptual design on an advanced proliferation-resistant spent fuel separations facility.

- In FY 2004, manufacture, irradiate, and test advanced transmutation, non-fertile fuels and targets.

Funding Profile

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
Research and Development					
Nuclear Energy Plant Optimization	6,293	0	0	0	0.0%
Nuclear Energy Research Initiative	31,081	25,000	12,000	- 13,000	- 52.0%
Nuclear Energy Technologies	11,867	46,500	48,000	+ 1,500	+ 3.2%
Nuclear Hydrogen Initiative	0	0	4,000	+ 4,000	+ 100.0%
Advanced Fuel Cycle Initiative	77,219[a]	18,221	63,025	+ 44,804	+ 245.9%
Total, R&D	126,460	89,721	127,025	+ 37,304	+ 41.6%

[a] Includes $27.250M previously funded under the Nuclear Facilities Management program and $49.2M previously funded under the Advanced Accelerator Applications program funded under Other Defense Activities.

Funding by Site

(dollars in thousands)

	FY 02	FY 03	FY 04	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	7,036	0	1,500	+ 1,500	+ 100.0%
Los Alamos National Laboratory	15,544	422	12,153	+ 11,731	+ 2,780.0%
University of Nevada, Las Vegas	4,500	0	4,500	+ 4,500	+ 100.0%
Sandia National Laboratories	4,298	2,527	2,230	- 297	- 11.8%
Total, Albuquerque Operations Office	31,378	2,949	20,383	+ 17,434	+ 591.2%
Chicago Operations Office					
Ames Laboratory	315	325	0	- 325	- 100.0%
Argonne National Laboratory	47,683	22,903	36,068	+ 13,165	+ 57.5%
Babcock and Wilcox	388	0	0	0	0.0
Brookhaven National Laboratory	1,326	0	600	+ 600	+ 100.0%
Total, Chicago Operations Office	49,712	23,228	36,668	+ 13,440	+ 57.9%
Idaho Operations Office					
Idaho Operations Office	1,414	0	0	0	0.0%
Idaho National Engineering and Environmental Laboratory	6,527	3,664	10,967	+ 7,303	+ 199.3%
Total, Idaho Operations Office	7,941	3,664	10,967	+ 7,303	+ 199.3%
Oakland Operations Office					
Oakland Operations Office	3,900	0	0	0	0.0%
Lawrence Berkeley National Laboratory	51	52	0	- 52	- 100.0%
Lawrence Livermore National Laboratory	1,377	795	200	- 595	- 74.9%
Total, Oakland Operations Office	5,328	847	200	- 647	- 76.4%
Oak Ridge Operations Office					
Oak Ridge National Laboratory	8,969	6,416	7,435	+ 1,019	+ 15.9%
Oak Ridge Institute of Science and Education	700	0	0	0	0.0%
Total, Oak Ridge Operations Office	9,669	6,416	7,435	+ 1,019	+ 15.9%

Richland Operations Office					
Pacific Northwest National Laboratory	2,039	2,166	1,129	- 1,037	- 47.9%
Total, Richland Operations Office	2,039	2,166	1,129	- 1,037	- 47.9%
Savannah River Site	1,714	0	300	+ 300	+ 100.0%
Washington Headquarters	5,139	6,818	5,680	- 1,138	- 16.7%
All Other Sites	16,040	43,633	44,263	+ 630	+ 1.4%
Total, Research and Development	128,960	89,721	127,025	+ 37,304	+ 41.6%

Site Description

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 2002, 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 2002, ANL supported the NERI program as the lead organization for six projects and collaborated in eight other projects in the areas of proliferation resistant reactor and fuel technology, advanced nuclear fuels, waste management and fundamental nuclear sciences. ANL was also selected in FY 2002 to be the lead in three new NERI projects and a collaborator in two projects in the areas of advanced nuclear energy systems, advanced nuclear fuels/fuel cycles, and materials science. 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 four 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 (Gen IV) Roadmap, which includes an R&D plan for conducting nuclear energy system R&D in international collaboration. These laboratories perform necessary coordination activities with the Generation IV International Forum and with NERAC. In FY 2003, the Department will initiate research and development on the most promising candidate Generation IV nuclear energy system concepts of interest to the United States which will continue in FY 2004. ANL and INEEL will continue to play a leading role in conducting the R&D as integrators of the U.S. participation in the international collaborations and by conducting, for one of more concepts, R&D in accordance with the Gen IV Roadmap.

Because of ANL's extensive experience with the development of fuel and separation technologies, the Laboratory has important responsibilities in the Advanced Fuel Cycle Initiative including pyroprocessing research of EBR-II fuel and resulting waste forms. The capabilities of ANL 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.

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 2002, BNL was the lead organization on two NERI projects and was collaborating with a university on one other R&D project. BNL is a collaborating laboratory on one French I-NERI project involving advanced gas-cooled reactor research. BNL also provides technical support to the R&D in accordance with 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.

The Department of Energy's BNL 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 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.

INEEL is serving as the command center for nuclear energy technology research and development and as host for a variety of unique nuclear facilities. INEEL assists and works 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 2002, INEEL participated in the NERI program as the lead organization on four projects and collaborated on two other awards; INEEL research was in the areas of low output reactor technology and advanced proliferation resistant fuel technology. INEEL was selected in FY 2002 as the lead in three new NERI projects and as collaborator in four projects in the areas of advanced nuclear energy systems and advanced nuclear fuels/fuel systems. 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.

In FY 2002, INEEL, in cooperation with the ORNL, completed the gas-cooled reactor fuel development and qualification program plan. INEEL will, in FY 2003, develop improvements to coated particle fuel performance computer models, and design an advanced irradiation test fixture.

In FY 2002, INEEL and ANL coordinated the preparation of the Generation IV Technology (Gen IV) Roadmap, which includes an R&D plan for conducting nuclear energy system R&D in international collaboration. These laboratories performed necessary coordination activities with the Generation IV International Forum and with NERAC. In FY 2003, the Department will initiate research and development on the most promising candidate Generation IV nuclear energy system concepts of interest to the United States. This research will continue in FY 2004. INEEL and ANL will continue to play a leading role in conducting the R&D as integrators of the U.S. participation in the international collaborations and by conducting, for one of more concepts, R&D in accordance with the Gen IV Roadmap. Preliminary system descriptions for test and research capabilities required for the development of next generation gas-cooled systems will be developed in FY 2004.

In FY 2002, INEEL initiated work to assess the transportation and fuel cycle impacts of advanced reactor designs in support of the Early Site Permit applications to be submitted to NRC under the Nuclear Power 2010 program. This work will be completed in FY 2003.

Lawrence Berkeley National Laboratory

Lawrence Berkeley National Laboratory (LBNL) is a U.S. Department of Energy scientific research laboratory located in California. LBNL is collaborating in a NERI research project on reactor materials.

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. In FY 2002, LLNL was the lead organization in three projects and collaborated 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). LLNL also provides technical support to the Generation IV Technology Roadmap effort. LLNL in collaboration with ANL, is performing studies as part of the NEPO Program to understand the mechanical behavior of irradiated structure stainless steels. LLNL also provides the AFCI program with expertise in the impact of separation technologies on the geological repository.

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. In FY 2002, LANL was the lead organization for one NERI project and the collaborating organization on two other projects. LANL was selected in FY 2002 as a collaborator on a new NERI project in the area of materials science. LANL also provides technical support to the Generation IV Technology Roadmap.

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 AFCI program through development of the conceptual design for the target material test station. 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).

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 2002, 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. ORNL was selected in FY 2002 as the lead on two NERI projects and as collaborator on one project in the areas of advanced nuclear energy systems, instrumentation and control systems, and advanced nuclear fuels/fuel cycles. ORNL is the lead collaborator on one French I-NERI project awarded in FY 2001 involving 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, in cooperation with INEEL, completed the gas-cooled reactor fuel development and qualification program plan. In FY 2004, ORNL will fabricate gas reactor fuel in a laboratory-scale facility to supply demonstration fuel for irradiation testing and fuel performance modeling.

ORNL 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.

ORNL also maintains 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

Pacific Northwest National Laboratory (PNNL) is a multi-program laboratory is approximately 640 acres located on the Department’s Hanford site in Washington. In FY 2002, PNNL conducted research and development on the Nuclear Energy Research Initiative (NERI) as the lead organization on four projects and as a collaborator on one project. These projects involve advanced reactor and fuel technology and fundamental nuclear science. PNNL was selected in FY 2002 as the lead on two projects and as collaborator on one new NERI project in the areas of instrumentation and control systems and materials science. PNNL provides technical assistance and peer-review assistance in support of the bilateral research and development conducted under the I-NERI program.

PNNL is conducting research and development on a dry cask storage project for high burn-up light water reactor fuel under the NEPO program and also provides technical support to the Generation IV Technology Roadmap.

The Department of Energy's PNNL 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.

Sandia National Laboratories

Sandia National Laboratories (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. In FY 2002, 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. SNL was selected in FY 2002 as the lead on one new NERI project and as collaborator on two projects in the areas of advanced nuclear energy systems, instrumentation and control systems, and materials science. SNL is also the lead for an I-NERI project with Korea on advanced methods for equipment condition monitoring. SNL was 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 also provides technical support to the Generation IV Technology Roadmap. SNL also serves as NE's technical integrator for the Advanced Fuel Cycle Initiative, including coordination of all participating laboratories.

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 2003 and FY 2004.

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 is contracting with the Electric Power Research Institute for NEPO research and development activities.

For the Nuclear Power 2010 program, this category includes funding for the regulatory demonstration projects, including the Early Site Permit (ESP) scoping study and the ESP demonstration project, and advanced reactor design certification and other reactor technology development activities for which decisions on the performing organizations have not been made.

The Department has prepared a Generation IV Technology Roadmap that provides the sequencing and initial cost estimates of research tasks, and identifies potential national and international advanced design nuclear energy system collaboration. In FY 2003, the Department will initiate research and development on the most promising candidate Generation IV nuclear energy system concepts of interest to the United States; this research and development will continue in FY 2004.

Starting in FY 2004, several sites will participate in the Nuclear Hydrogen Initiative with the ultimate goal of developing the technical basis and demonstrating the commercial feasibility of large-scale hydrogen production using nuclear energy.

The University of Nevada, Las Vegas (UNLV) involves graduate students in Advanced Fuel Cycle Initiative research activities leading to masters or doctoral degrees. The goal of the university participation program at UNLV is that UNLV will establish interdisciplinary engineering degrees in subjects directly involving AFCI research programs. In addition, UNLV supports R&D related to accelerator-driven transmutation technology.

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 being 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, the Nuclear Regulatory Commission (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. No NEPO projects are designed to support utility efforts to obtain NRC operating license renewals.

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, commercial contractors, and universities.

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. Examples of recent results from the NEPO program include the development of new electrical cable monitoring techniques for improved prediction of cable lifetimes; and the development of techniques to qualify smart transmitters to replace existing analog transmitters which are less accurate and difficult to maintain. Further information about current projects and recent results of the NEPO program are contained in the *Nuclear Energy Plant Optimization Program 2001 Annual Report* issued in February 2002 (see http://nepo.ne.doe.gov).

While the Department continues to support the objectives of the NEPO program, no funding is requested for this activity in FY 2004.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Nuclear Energy Plant Optimization					
Nuclear Energy Plant Optimization.....	5,904	0	0	0	0%
Uranium Conversion R&D.....	389	0	0	0	0%
Small Business Innovative Research/Small Technology Transfer Program.....	0	0	0	0	0%
Total, Nuclear Energy Plant Optimization.....	6,293	0	0	0	0%

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
Nuclear Energy Plant Optimization	**6,293**	**0**	**0**
▪ **Nuclear Energy Plant Optimization**	**5,904**	**0**	**0**

Projects initiated in FY 2000 and FY 2001, and those being 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 was provided to continue R&D activities on ten projects initiated in prior years; seven new projects are being initiated. In FY 2003, R&D activities on approximately ten projects initiated in prior years will be completed utilizing prior year funds. No funds were requested for FY 2003 and no funding is being requested for FY 2004.

▪ **Uranium Conversion R&D**	**389**	**0**	**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. In FY 2002, funding provided improvements in catalysts and processing flows that are expected to result in improved operating efficiency at the Nation's only uranium conversion facility. No further funding is requested beyond FY 2002.

▪ **Small Business Innovative Research and Small Business Technology Transfer Programs**	**0**	**0**	**0**
Total, Nuclear Energy Plant Optimization	**6,293**	**0**	**0**

Explanation of Funding Changes from FY 2003 to FY 2004

	FY 04 vs. FY 03 ($000)
Nuclear Energy Plant Optimization	
▪ There are no funding changes from FY 2003 to FY 2004	0

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. NERI is an essential element in the Department's approach toward fostering innovation in areas such as improving light water reactor technology, advanced nuclear fuels for current nuclear power plants, and enhancing the proliferation-resistance of civilian nuclear technology in order to enhance the ability of nuclear energy to help meet the Nation's 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 include the economics of using fission to generate electricity, concerns regarding safety and proliferation resistance, and the continuing challenges associated with nuclear waste. The PCAST Energy Research and Development Panel, in its November 1997 report, *Federal Energy Research and Development for the Challenges of the Twenty-First Century*, concluded that these issues can be solved by technology research. To implement the PCAST panel's recommendations, the Department established the NERI program. This program funds innovative, investigator-initiated scientific and engineering research to solve difficult technical issues facing nuclear energy.

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. This nation operates more nuclear power plants than any other country and most of the world's operating nuclear power plants are based on U.S. light water reactor technology. Given the projected growth in global energy demand as developing nations industrialize; our strategic interests in addressing global climate change, nuclear non-proliferation, nuclear safety, 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 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 enhances the Department's ability to leverage its limited research funding with 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 international aspects of advanced nuclear energy took on even greater relevance in 2002, as the need to develop new, proliferation-resistant nuclear power options become part of the Nation's key dialogues with other countries. In the most recent example, President Bush and Russian President Putin agreed in May 2002 to establish a new bilateral working group designed to suggest technology cooperation between the two nations that would lead to the development of advanced, proliferation-resistant nuclear technologies. Both NERI and I-NERI, which have specific objectives of improving the proliferation-resistance of civilian nuclear power technology, directly support this priority nonproliferation objective.

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.

The NERI program will also focus on developing innovative technologies to support continued efficient operation of today's nuclear power technology. The NERI program will spark new innovation to enhance the performance of light water reactor technology, including new research in advanced digital instrumentation and control, and automation technologies to improve plant performance; development of advanced nuclear fuels and fuel systems; and development of advanced ceramic materials to increase performance.

NERI features a competitive, investigator-initiated, peer-reviewed selection process to fund innovative nuclear energy-related research. Modeled after successful research programs such as those conducted by the National Science Foundation and DOE's own Office of Science, 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 participation of research organizations funded by overseas governments. 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 critical program execution activities such as the independent, objective merit-peer review process used to evaluate the proposals submitted.

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.

The international component of NERI, the I-NERI program, also uses a competitive peer-review process to select research 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. technical 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 research programs are being conducted with France's Commissariat a l'Energie Atomique (CEA) and the Republic of Korea's Ministry of Science and Technology (MOST); negotiations are proceeding with several other countries to expand these activities.

As a means of measuring the effectiveness of the Nuclear Energy Research and Development programs, OMB's Program Assessment Rating Tool (PART) was used to evaluate the research results achieved thus far. NERI received very high scores for the purpose, planning, and management sections of PART. Lower scores for the results and accountability section of PART were received due to the fact that initial NERI projects are just being completed and results are to be evaluated. NE has committed to implementing a number of actions to help measure the effectiveness of NERI.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Nuclear Energy Research Initiative					
Nuclear Energy Research Initiative	21,964	17,523	7,378	-10,145	-57.9%
International Nuclear Energy Research Initiative	9,117	6,814	4,286	-2,528	-37.1%
SBIR/STTIR	0	663	336	-327	-49.3%
Total, Nuclear Energy Research Initiative	31,081	25,000	12,000	-13,000	-52.0%

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Nuclear Energy Research Initiative**	**21,964**	**17,523**	**7,378**

The current 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, making improvements in light water reactor technology 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 2002, 23 NERI research and development projects initiated in FY 1999 were completed. The program completed funding of projects initiated in FY 2000, provided funding for projects initiated in FY 2001, and awarded 24 new projects. Beginning in FY 2002, NERI focused prominently on research required to support implementation of the *National Energy Policy* and exploring the large-scale generation of hydrogen using nuclear power.

In FY 2003, 29 of the NERI projects initiated in FY 1999 and FY 2000 are planned to be completed. The program will complete funding of projects initiated in FY 2001 and provide funding for projects initiated in FY 2002. No new awards will be initiated in FY 2003.

In FY 2004, 11 of the NERI projects initiated in FY 2000 and FY 2001 are planned to be completed. The program will complete funding of projects initiated in FY 2002. No new projects will be awarded in FY 2004.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **International Nuclear Energy Research Initiative (I-NERI)**	**9,117**	**6,814**	**4,286**

In FY 2002, six collaborative I-NERI research projects were initiated under the bilateral agreement with the Republic of Korea, two collaborative I-NERI projects were initiated under the bilateral agreement with France, and one collaborative I-NERI project with the Nuclear Energy Agency (NEA). Funding for the three I-NERI research projects initiated with France in FY 2001 were also continued.

In FY 2003, bilateral research projects initiated in FY 2001 and FY 2002 will be continued. The Department expects to complete bilateral I-NERI agreements with Brazil, Canada, the Republic of South Africa, and Japan. Five new projects with the Republic of Korea were awarded in early FY 2003; three additional new projects are expected to be initiated.

In FY 2004, the I-NERI projects with France, the Republic of Korea, and the Nuclear Energy Agency initiated in FY 2002, and the I-NERI projects initiated with the Republic of Korea in early FY 2003 will be continued; the additional three new projects initiated in FY 2003 will also be continued. No new projects will be initiated in FY 2004.

▪ **Small Business Innovative Research and Small Business Technology Transfer Programs**	**0**	**663**	**336**
Total, Nuclear Energy Research Initiative	**31,081**	**25,000**	**12,000**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Nuclear Energy Research Initiative	
▪ The decrease in funding of $10,145,000 is due to no new projects being awarded in FY 2004	-10,145
International Nuclear Energy Research Initiative	
▪ The decrease in funding of $2,528,000 is due to no new projects being awarded in FY 2004	-2,528
Small Business Innovative Research and Small Business Technology Transfer Programs	
▪ The SBIR/STTR funding rate has been increased from 2.65 percent to 2.80 percent. The decreased funding of $327,000 corresponds to the decrease in the NERI and I-NERI funding	-327
Total Funding Change, Nuclear Energy Research Initiative	**-13,000**

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 428,000 megawatts of new generating capacity by 2025 - even if ambitious assumptions are made regarding implementation of energy efficiency practices and technologies. If United States electricity demand continues to grow at current rates, even more generating capacity will be needed. This growth, which powers economic expansion, would require the United States to build between 1,400 and 2,100 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* (NEP) has recommended expansion of nuclear energy in the United States as a major component of our Nation's energy picture. The NEP specifically recommends government support for licensing new nuclear power plants and development of next generation nuclear energy technologies for the future.

Fully 20 percent of our Nation's current electricity production is generated 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 develop long-term technologies.

To enable the deployment 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 Nation's 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, proliferation resistance and physical protection, safety, 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 and waste management. Advances in proliferation resistance and physical protection will further decrease the possibility that nuclear plants could prove to be viable targets for terrorist groups or that nuclear materials present in civilian fuel cycles could be diverted by proliferants. Advances in safety—with a goal of eliminating entirely the need for offsite emergency response—will improve public confidence in the safety of nuclear energy 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.

The Generation IV Nuclear Energy Systems Initiative is also at the heart of major initiatives announced by the President of the United States and the President of the Russian Federation to consider ways the two nations could work together to improve the proliferation-resistance of civilian nuclear energy systems.

Nuclear Power 2010 - The Department believes it is important 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 and certify advanced reactor technologies and demonstrate new regulatory processes such that U.S. industry would be in a position to order new nuclear power plants by 2005. Nuclear Power 2010 is an integrated program that aggressively pursues regulatory approvals and reactor technology development in a phased approach, leading to deployment of new nuclear plants in the United States by 2010.

A Near-Term Deployment Working Group, operating under the auspices of the Department's independent Nuclear Energy Research Advisory Committee, and composed of representatives from the nuclear industry, national laboratories, and United States 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 the end of the decade. On October 31, 2001, the working group 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.

The Nuclear Power 2010 program will achieve near-term deployment of new power plants in the United States through cost-shared demonstration of the new, untested regulatory processes and cost-shared development of advanced reactor technologies. The regulatory tasks include the demonstration of the Early Site Permit (ESP) and combined Construction and Operating License (COL) processes to reduce licensing uncertainties and minimize the attendant financial risks to the licensee. The technology development activities support research and development to finalize and certify those advanced reactor designs which U. S. power generation companies are willing to build.

The Nuclear Power 2010 program incorporates competitive procurement processes for the regulatory demonstration and technology development activities and requires a minimum of 50 percent industry cost share for most program activities. Through the competitive procurement process, it is expected that innovative business arrangements will be formed between power generating companies and reactor vendors with strong and common incentives to successfully build and operate new plants in the United States.

The Nuclear Power 2010 program will pursue competitively-selected, cost-shared cooperative agreements with nuclear power generating companies for the preparation and submittal of Early Site Permit (ESP) and combined Construction and Operating License (COL) applications to the Nuclear Regulatory Commission (NRC). The successful demonstration of the ESP and COL regulatory processes will lead to the licensing of multiple sites for locating new nuclear power plants, and the issuance of a license to construct and operate at least one advanced nuclear power plant.

In FY 2002, ESP scoping studies were completed to evaluate site suitability and to develop schedule and resource estimates for siting new nuclear power plants at both federal and commercial sites. ESP demonstration projects, cost-shared with three U.S. power generation companies, were also initiated in FY 2002 to prepare actual ESP applications and submit them to the NRC for approval. The ESP applications will be submitted to the NRC in the last quarter of FY 2003. ESP activities in FY 2004 will focus on working with the industry and the Commission to pursue this process to conclusion. Final NRC issuance of Early Site Permits is expected in 2005. The ESP applicants will be expected to:

- conduct pre-application interactions with NRC to achieve resolution on the use of existing site data and on the technical bases for site seismic analysis;
- prepare a plant parameters envelope for each application providing site, plant design and operating information related to environmental protection, site safety, and emergency planning;
- prepare the safety analysis report, the environmental report, and emergency planning report required for the ESP application; and
- submit an ESP application to the NRC for approval and respond to NRC requests for information.

During FY 2003 and FY 2004, the Department will solicit and competitively select a cost shared project with power generating companies to demonstrate the combined Construction and Operating License (COL) process. The activities for COL demonstration will result in NRC approval of a COL application by 2008.

The COL applicant will be expected to:

- prepare a final safety analysis report and probabilistic risk assessment for a specific advanced reactor design;
- prepare an Inspection, Testing, Analyses, and Acceptance Criteria (ITAAC) report for use in demonstrating that the facility has been constructed and will operate in conformity with NRC regulations;
- develop a detailed construction plan including construction sequence and schedule; and
- submit a COL application to the NRC for approval.

The Department will also pursue activities focused on the development and utility selection of at least one advanced reactor in time to allow an industry decision for a new plant deployment by the end of the decade. The Department will explore the development of consortia or joint venture project teams comprised of power generation companies and reactor vendors to develop the technology necessary for NRC design certification and conduct other activities associated with deployment of advanced nuclear reactors. The reactor technology development activities will be cost-shared, with industry contributing at least 50 percent of the required funds. The Department will initiate in FY 2003 a nuclear power plant project cost and construction evaluation to assess the cost, schedule construction methods for the most likely advanced reactor designs to be built in the near term. This study will independently examine the reactor vendor design and cost estimates, assess the modular and unique construction techniques and construction schedules. The study will also identify promising improvements to the construction methods, techniques and sequences needed to support new nuclear power plant deployment in this decade. In particular, the Department will investigate successful techniques used to reduce the time it takes to construct nuclear plants in countries such as Japan. These techniques involve modular construction, factory fabrication, and heavy lift techniques on major nuclear plant buildings and components.

During FY 2002 and early FY 2003, the Department conducted an evaluation of the business case for new nuclear power plants in the United States and the associated financial risks faced by nuclear power companies. In addition, risk mitigation techniques were identified and are being evaluated for potential affect on the financial risks. In FY 2003, the Department will also initiate a study on economic policy benefits and impacts resulting from the deployment of new nuclear power plants in the United States. The information obtained from these studies will be used to focus the program's activities on issues of the greatest impact.

In FY 2004, the Department will also continue its advanced gas-cooled reactor fuel development and qualification program in cooperation with the NRC. This important program supports future deployment of advanced gas reactor technology by reducing market entry risks posed by the technical uncertainties associated with fuel production and performance. The fuel development and qualification program is a cooperative government and industry effort being led by the Idaho National Engineering and Environmental Laboratory (INEEL) and the Oak Ridge National Laboratory (ORNL). The Department is also coordinating these research activities with the NRC to leverage planned fuel irradiation tests to meet their research needs. The development of a comprehensive gas reactor fuel development and qualification plan will be completed in FY 2002.

In FY 2003, the fuel development effort will identify the important coated-particle properties that lead to satisfactory fuel performance, develop a laboratory scale coated-particle fuel fabrication process, produce demonstration fuel for fuel performance testing, and manufacture the test fixture for inserting the fuel into the ATR. During FY 2004, the Department, in cooperation with the NRC and industry, will produce gas reactor kernels and develop coating and compacting technologies. The design and development of irradiation test capsules for testing gas-cooled reactor fuel in the Advanced Test Reactor (ATR) will be initiated. The fuel testing, starting in FY 2006, will be required to demonstrate gas reactor fuel performance and generate the fuel performance data needed for licensing gas-cooled reactors in the United States. The fuel performance data is required for establishing the technical basis for regulating gas-cooled reactor technologies in the United States.

As a means of measuring the effectiveness of the Nuclear Energy Research and Development programs, OMB's Program Assessment Rating Tool (PART) was used to evaluate the research results achieved thus far. Nuclear Power 2010 received very high scores for the purpose, planning and management sections of PART. Lower scores for the results and accountability section of PART were received due to the fact that Nuclear Power 2010 is in the early stages of development. NE has committed to implementing a number of actions to help measure the effectiveness of Nuclear Power 2010.

Generation IV Nuclear Energy Systems Initiative – Generation IV nuclear energy systems are 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. These systems will be designed to offer significant advances toward challenging sustainability, safety, proliferation resistance and economics requirements developed by the Department's Nuclear Energy Research Advisory Committee and vetted with the international research community.

The Generation IV Technology Roadmap is being prepared under the auspices of the Nuclear Energy Research Advisory Committee (NERAC) and the Generation IV International Forum (GIF). The GIF is a formal, chartered organization of governments with representatives from Argentina, Brazil, Canada, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, United Kingdom, and the United States. The Roadmap, prepared by nearly one hundred experts from GIF countries and international organizations, will be issued in FY 2003, and will outline the benefits, the technical and institutional barriers, and the research needs for the most promising nuclear energy system concepts. The Roadmap, which will be provided to Congress in early 2003, will serve as the organizing basis for national, bilateral, and multilateral research and development activities for the development of Generation IV systems.

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.

The Generation IV Technology Roadmap will identify the six most promising nuclear energy systems, complete with front and back end of the fuel cycle, power conversion systems, waste management, and other nuclear infrastructure elements. Generation IV nuclear energy systems also include energy conversion systems that produce non-electricity products such as hydrogen, desalinated water, and process heat. Although the Roadmap will not be complete until FY 2003, the GIF made a final selection of the six most promising concepts at its May 2002 meeting. While the Department has not yet decided upon which of the concepts it will eventually focus, all of the technologies are of considerable interest.

The six innovative, next-generation systems selected include two gas-cooled, one water-cooled, two liquid-metal-cooled, and one molten-salt-based reactor concept.

Key research objectives for these technologies will include such items as demonstration of advanced fuels and materials - including irradiation performance of recycled fuel and passive safety confirmation tests; development of fuels and structural materials capable of withstanding the conditions in the supercritical regime; and development of advanced proliferation-resistant fuels capable of high burn-up and materials capable of withstanding the corrosive environment of a lead/bismuth coolant.

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 by the private sector.

Most of the early viability issues relate to materials capabilities for fuel, core, and components, although viability issues also exist in actinide recovery during spent fuel recycling and safety approaches for certain of the reactor concepts. FY 2003 efforts will focus on establishing conceptual designs for the nuclear energy systems of most interest to the Department. In developing the conceptual designs, the technical requirement envelopes for the specific technology development areas for the reactor, energy conversion, and fuel cycle facilities will also be identified. These requirements will guide the development of new fuels, core designs, in-core and out-of-core structural materials, direct-cycle turbomachinery, and process-heat applications for Generation IV nuclear energy systems based on reactors such as the Very High Temperature Reactor, the Supercritical Water Cooled Reactor, or the Gas-Cooled Fast Reactor. In addition, crosscutting R&D on new materials, new fuel concepts, safety approaches, and turbomachinery that are applicable to most energy systems will be initiated. Laboratory-scale test loops will be planned and/or erected to test materials at high temperatures in helium, supercritical water, lead alloys, and supercritical carbon dioxide.

The Generation IV Nuclear Energy Systems Initiative research and development will be closely coordinated with the Advanced Fuel Cycle Initiative which is developing the advanced, proliferation-resistant fuels and fuel cycle systems for the Generation IV reactors. The Advanced Fuel Cycle Initiative and Generation IV Nuclear Energy Systems Initiative are pursuing challenging technologies that require the development of advanced, proliferation-resistant transmutation fuels, associated treatment technologies, and fast neutron systems to destroy long-lived radioactive components of spent fuel responsible for the long-term radiotoxicity and heat generation. These new technologies will be capable of operating with far higher content of plutonium and other actinides than is presently feasible.

In FY 2004, these efforts will be expanded and, using early results, focused on crucial viability issues and technology choices.

As a means of measuring the effectiveness of the Nuclear Energy Research and Development programs, OMB's Program Assessment Rating Tool (PART) was used to evaluate the research results achieved thus far. Generation IV Nuclear Energy Systems Initiative received very high scores for the purpose, planning and management sections of PART. Lower scores for the results and accountability section of PART were received due to the fact that Generation IV Nuclear Energy Systems Initiative is in the early

stages of development. NE has committed to implementing a number of actions to help measure the effectiveness of Generation IV Nuclear Energy Systems Initiative.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Nuclear Energy Technologies					
Nuclear Power 2010.....	7,867	35,328	34,973	-355	-1.0%
Generation IV Nuclear Energy Systems Initiative.....	4,000	7,788	9,720	+1,932	+24.8%
National Climate Change Technology Initiative.....	0	2,279	2,279	0	0.0%
SBIR/STTR	0	1,105	1,028	-77	-7.0%
Total, Nuclear Energy Technologies.....	11,867	46,500	48,000	+1,500	+3.2%

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Nuclear Power 2010**	**7,867**	**35,328**	**34,973**

In October 2001, the Nuclear Energy Research Advisory Committee (NERAC) issued the results of its evaluation, initiated in FY 2001, to identify the technical, institutional and regulatory barriers to the near-term deployment of new nuclear power plants in a report entitled *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010*. This report identifies 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 and deployment 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, and combined Construction and Operating License (COL).

In FY 2002, the Department:

- Completed competitively selected cost-shared Early Site Permit (ESP) scoping studies by power generating companies to evaluate site suitability and to develop schedule and resource estimates for siting new nuclear power plants at both federal and commercial sites.
- Established cooperative agreements with three power generation companies for a competitively selected cost-shared demonstration project to prepare ESP applications and submit them to the NRC for approval in order to fully demonstrate the NRC regulatory process (10 CFR Part 52) for the siting of nuclear power plants at commercial sites having existing nuclear power plants.
- Completed a detailed plan for an advanced gas-cooled reactor fuel development and qualification program, and complete the commercial advanced gas reactor feasibility study initiated in FY 2001.
- Continued its cooperation with the NRC on the development of a gas reactor regulatory and licensing framework initiated in FY 2001 including conduct of an evaluation of gas-cooled reactor technologies and identification of technical issues and research required for licensing.
- Completed a Nuclear Business Case Study, developed with expert input from the financial and nuclear industries, to identify the necessary conditions under which utilities would add new nuclear capacity, and to develop strategies to close the financial and technology gaps which pose the highest risk.

(dollars in thousands)

FY 02	FY 03	FY 04

In FY 2003, the Department will:

- Continue the cost-shared ESP demonstration project initiated with industry in FY 2002, and completed ESP applications will be submitted by the power generating companies for review and approval to NRC in the last quarter of FY 2003.
- Continue the advanced gas-cooled reactor fuel development and qualification activities initiated in FY 2001 and begin fuel fabrication process development in laboratory-scale equipment, manufacture and characterize demonstration fuel for irradiation testing.
- Initiate cost-shared advanced nuclear power plant technology development, selection and licensing activities with utility and vendor consortia that will support a new plant deployment by the end of the decade.
- Initiate a nuclear power plant project cost and construction assessment to independently evaluate the cost, schedule and construction methods of advanced nuclear plant designs and identify promising improvements to the construction methods and techniques to support new nuclear power plant deployment in this decade.
- Initiate solicitation for a utility cost-shared project to demonstrate the COL process.

In FY 2004, the Department will:

- Continue the competitively selected cooperative ESP demonstration project with resolution of site-specific issues arising from the NRC review of the ESP applications submitted in FY 2003. Successful resolution of these site issues will lead to issuance of Early Site Permits in 2005.
- Finalize selection and award a utility cost-shared project to demonstrate the COL process.
- Complete the nuclear construction technology assessment initiated in FY 2003.
- Initiate the design of the gas-cooled fuel irradiation test fixture.
- Develop new coating technology for gas reactor fuel and initiate fuel characterization 8A/8C methods.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Generation IV Nuclear Energy Systems Initiative**...	**4,000**	**7,788**	**9,720**

In FY 2002, *A Technology Roadmap for Generation IV Nuclear Energy Systems* was completed, including the selection of six innovative, candidate next-generation nuclear energy system concepts and the development of R&D plans for each of the concepts. In FY 2003, the Department will address comments from NERAC and GIF and submit the Roadmap to Congress.

In FY 2003, research and development will be conducted in the following concept-specific activities:

Very High Temperature Reactor (VHTR)

- Complete selection of VHTR candidate materials.
- Develop the reference point design for VHTR.
- Establish International partnering arrangements for VHTR.

Supercritical Water Cooled Reactor (SCWR)

- Prepare detailed plan for all SCWR-related research activities including design and materials.
- Complete selection of candidate materials for the SCWR.

Gas-Cooled Fast Reactor (GFR)

- Conceptual design and evaluation of safety systems for decay heat removal.
- Down-select passive/active systems for reference and optional designs.

Lead-Cooled Fast Reactor (LFR)

- Provide screening report identifying material candidates for LFR core internals.
- Develop irradiation test needs document.
- Provide results of initial screening studies of candidate materials in lead or lead-bismuth coolant.

Also in FY 2003, crosscutting activities that support the next-generation reactor system concepts noted above will be conducted. These include establishing performance metrics for measuring proliferation resistance and physical protection of Generation IV reactor and fuel cycle systems and completing a detailed program plan for the development of advanced materials for use in high-temperature, high-radiation environments.

(dollars in thousands)

FY 02	FY 03	FY 04

In FY 2004, the Department will focus its research and development on the following concept-specific activities:

Very High Temperature Reactor (VHTR)

- Initiate VHTR-specific materials testing.
- Conduct major VHTR system trade studies on the intermediate heat exchanger and gas turbine approach.
- Conduct VHTR-specific energy conversion trade studies.

Supercritical Water Cooled Reactor (SCWR)

- Complete supercritical-water test facilities and initiate heat transfer and critical flow experiments.

Gas-Cooled Fast Reactor (GFR)

- Complete report on GFR fuels feasibility and applicability studies.

Lead-Cooled Fast Reactor (LFR)

- Interim annual report on LFR-specific structural materials development.
- Interim report on preconceptual design, analysis tool development, and refueling approach.

Also in FY 2004, crosscutting issues that support the next-generation reactor system concepts noted above will be conducted. These include initiating mechanical tests and irradiation tests on commercially-available materials and advanced materials and validating computer models for use in design and safety analysis applications.

▪ **National Climate Change Technology Initiative**	**0**	**2,279**	**2,279**

NE's contribution to support a National Climate Change Technology Initiative competitive solicitation aimed at exploring concepts, technologies and technical approaches that could meet the Presidential goals associated with greenhouse gas emissions.

▪ **Small Business Innovative Research and Small Business Technology Transfer Programs**.....	**0**	**1,105**	**1,028**
Total, Nuclear Energy Technologies	**11,867**	**46,500**	**48,000**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Nuclear Power 2010	
▪ The decrease of $355,000 reflects a decrease in the level of activities for reactor development and certification, and gas reactor fuel research	-355
Generation IV Nuclear Energy Systems Initiative	
▪ The increased funding of $1,932,000 reflects increased research and development to advance the design of promising concepts in accordance with the Generation IV Technology Roadmap.....	+1,932
Small Business Innovative Research and Small Business Technology Transfer Programs	-77
Total Funding Change, Nuclear Energy Technologies.....	**+1,500**

Nuclear Hydrogen Initiative

Mission Supporting Goals and Objectives

Hydrogen offers significant promise as a future energy technology, particularly for the transportation sector. Significant progress in hydrogen combustion engines and fuels cells is bringing the day closer when transportation using hydrogen fuel is a reality. The primary challenges to using large quantities of hydrogen as part of the Nation's overall energy infrastructure are the cost and environmental impacts associated with its production, storage, and delivery. As an efficient, emission-free energy source, nuclear energy provides a unique opportunity to produce hydrogen economically and without greenhouse gas emissions.

Currently, the only economical, large-scale method of hydrogen production involves the conversion of methane into hydrogen through a steam reforming process. This process is efficient, but produces ten kilograms of greenhouse gases for every kilogram of hydrogen, defeating the primary advantage of using hydrogen—its environmental benefits. Another existing method, electrolysis, converts water into hydrogen using electricity. Electrolysis is typically used for small production quantities and will probably be uneconomical for large-scale production. Additionally, the environmental benefits of electrolysis are reduced unless a non-emitting technology is used to produce the electricity, such as nuclear energy.

Recent research conducted under the Nuclear Energy Research Initiative (NERI) has indicated strong potential for using a thermo-chemical water splitting process to produce hydrogen economically on a commercial scale without the release of greenhouse gases. One of the characteristics of these thermo-chemical processes is that they all require very high temperatures—as high as 800 to 1000°C. Generating these extreme process temperatures in an environmentally benign way is very challenging. The Department believes that advanced, high temperature nuclear energy systems can provide the heat necessary for these processes. In fact, preliminary estimates indicate that hydrogen produced using nuclear-driven thermo-chemical processes would be only slightly more expensive than gasoline *without* emissions-avoidance incentives. Japan has developed a program to pursue nuclear production of hydrogen using their High Temperature Test Reactor (HTTR), and several other countries have shown great interest in developing the technology as well.

The Nuclear Hydrogen Initiative will address the need for greater utilization of our energy resources by investigating the uses for nuclear power on an integrated basis as both a heat source, an electricity source, and a source of clean hydrogen which can supplant fossil fuels in our transportation system. With nuclear technology producing process heat and hydrogen as well as electric power, the vision outlined by President Bush in his June 11, 2002, speech on global climate change, in which future energy use need not result in the emission of greenhouse gases, can be brought to reality much sooner than might be commonly believed. In order to realize this vision, the Nuclear Hydrogen Initiative will study potential nuclear energy configurations, conduct research and development on enabling technologies, demonstrate nuclear-based hydrogen producing technologies, and develop deployment alternatives to meet future needs for increased hydrogen consumption.

An integrated Hydrogen Posture Plan, a joint effort of the Offices of Nuclear Energy, Science and Technology (NE), Energy Efficiency and Renewable Energy (EE), Fossil Energy (FE), Science (SC), and Management, Budget, and Evaluation (ME), will highlight program planning for R&D on potential production sources of hydrogen, the infrastructure required to support the distribution of hydrogen, and end-use applications such as those being explored through FreedomCAR. NE will build upon this plan and the National Hydrogen Energy Roadmap, announced by Secretary Abraham in November 2002, by developing a nuclear hydrogen technology roadmap, which will be completed in FY 2004. Domestic and international experts on hydrogen generation and nuclear technology will be assembled to define the research and development requirements for implementing an integrated nuclear hydrogen production plant. This effort will be coordinated with other departmental elements and involve experts from industry, universities, and national laboratories. This roadmap will be reviewed by the Nuclear Energy Research Advisory Committee (NERAC), an independent federal advisory committee, and will further define the course of research, development and demonstration activities for the Nuclear Hydrogen Initiative.

Investigating and demonstrating these nuclear-based applications will require the advancement of the science and technologies to produce hydrogen through thermo-chemical water splitting. Research and development will be conducted that focuses on the development of the thermo-chemical water splitting technologies that can be driven by nuclear systems and the underlying sciences supporting these advanced technologies such as high temperature and corrosive resistant materials and advanced chemical systems analysis. The research and development will involve laboratory and pilot-scale technology demonstrations. This program will complement the research conducted by the Office of Energy Efficiency and Renewable Energy on hydrogen infrastructure and end-uses to evaluate future nuclear energy systems and their potential to meet growing demands for emission-free energy generation, distribution, and transportation systems in a fully integrated fashion.

Funding Schedule

(dollars in thousands)

	FY 02	FY 03	FY 04	$ Change	% Change
Nuclear Hydrogen Initiative					
Nuclear Hydrogen Initiative	0	0	3,888	+3,888	+100.0%
Small Business Innovative Research/Small Business Technology Transfer Program	0	0	112	+112	+100.0%
Total, Nuclear Hydrogen Initiative	0	0	4,000	+4,000	+100.0%

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Nuclear Hydrogen Initiative**	**0**	**0**	**3,888**

The purpose of this program is to develop and demonstrate the feasibility of nuclear energy for the large-scale, emission-free production of hydrogen. The development of a detailed concept of an integrated reactor and hydrogen production plant is an important part of this process, since several advanced high-temperature reactor concepts are compatible with thermo-chemical hydrogen generation processes.

By the end of FY 2004, the Department will develop a Nuclear Hydrogen Technology roadmap to evaluate potential chemical processes and nuclear technologies for the production of hydrogen, evaluate the economic benefits and environmental impacts of each process, identify the most promising candidate(s), and define the research and development necessary to support future demonstration of an integrated nuclear hydrogen production plant. The Department will investigate the most promising nuclear hydrogen-production processes. Upon completion of the roadmap, a facility concept will be developed that integrates a nuclear hydrogen production system with an advanced reactor design. As part of the concept evaluation, process flow models will be developed to determine efficiencies and production rates of the combined nuclear hydrogen system. Research and development on key enabling technologies such as high temperature and corrosion-resistant materials, chemical process reaction rates and phase separation data will be initiated. Laboratory scale testing of the selected thermo-chemical process will be initiated to determine hydrogen production rates and system efficiencies.

▪ **Small Business Innovative Research and Small Business Technology Transfer Programs**	**0**	**0**	**112**
Total, Nuclear Hydrogen Initiative	**0**	**0**	**4,000**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Nuclear Hydrogen Initiative	
▪ The increase of $3,888,000 will allow for the initiation of a new program focused on nuclear based hydrogen production in an environmentally friendly and economic manner	+3,888
Small Business Innovative Research and Small Business Technology Transfer Programs	
▪ SBIR/STTR	+112
Total Funding Change, Nuclear Hydrogen Initiative	**+4,000**

Advanced Fuel Cycle Initiative

Mission Supporting Goals and Objectives

Of the issues that must be addressed to enable a future expansion in the use of nuclear energy in the United States and worldwide, none is more important or more difficult than that of dealing effectively with spent nuclear fuel. While compared to other industrial waste, spent fuel is relatively small in quantity, it is highly toxic for many thousands of years, and its disposal requires that many political, societal, technical, and regulatory issues be addressed. As a result, researchers in the U.S. and other countries who believe that the world cannot turn its back on the benefits that nuclear energy offers—lack of harmful emissions; reliable, economic baseload energy; *etc*.—have developed concepts for new, advanced technologies for dealing with spent fuel.

For many years, several countries around the world have pursued advanced technologies that could treat and transmute spent nuclear fuel from nuclear power plants. These technologies have the potential to dramatically reduce the quantity and toxicity of waste requiring geologic disposal. Over the last three years, the United States has joined this international effort and found considerable merit in this area of advanced research.

While these technologies are not an alternative for a geologic repository, they could provide a means to optimize use of the first U.S. repository and reduce the technical need for additional repositories. These technologies could also provide other important benefits such as enhancing national security by reducing inventories of commercially-generated plutonium (which is contained in all commercial spent fuel and can, over succeeding decades, become easier to extract) and enhancing national energy security by recovering the significant energy value contained in spent nuclear fuel. (The 44,000 metric tonnes of spent nuclear fuel currently stored at nuclear power plant sites across the country contain the energy equivalent of over 6 billion barrels of oil, or about two full years of U.S. oil imports.) Through the research conducted by the Department and its international partners, sufficient evidence exists to warrant cautious optimism that the benefits of these technologies can be realized in a proliferation-resistant manner.

The Advanced Accelerator Applications (AAA) program (predecessor to AFCI) and the Generation IV Nuclear Energy Systems Initiative have enabled the Department to clearly identify the goals and approach for a comprehensive program to realize the benefits possible from spent nuclear fuel treatment and transmutation. Research completed thus far points to a multi-phased Advanced Fuel Cycle Initiative (AFCI) program comprising of two elements that would be conducted in parallel as part of an integrated research effort. The first element would be an intermediate-term technology program element—AFCI Series One—which emphasizes advanced technical enhancements to the current commercial nuclear power infrastructure. The goal of the AFCI Series One technology effort is to develop advanced proliferation-resistant fuel treatment and fabrication technologies that could be deployed by 2015. AFCI Series Two consists of a phased approach to developing the technologies needed to address the long-term issues associated with spent nuclear fuel management—namely, reducing long-term radiotoxicity and heat load. These two program elements are part and parcel of the integrated AFCI effort. Each builds on research and development conducted under the other element and both will be necessary to enable the United States to develop a long-term approach to the nuclear fuel cycle that meets its energy, environment, and nonproliferation policy imperatives.

Based on research conducted to date, the following objectives are attainable through the AFCI program:

- **Reduce Spent Fuel Volume**: Develop and implement, by the middle of the next decade, proliferation-resistant technology to significantly reduce the absolute volume of high-level nuclear waste and lower the cost of its disposal;

- **Separate Long-Lived, Highly Toxic Elements** (*i.e.*, actinides such as plutonium and americium): Develop and deploy, by approximately 2030, advanced, proliferation-resistant treatment and transmutation technologies that will both significantly reduce the volume and heat generation of spent nuclear fuel and create waste forms sufficiently clean of long-lived, highly toxic species to reduce the time it is hazardous from 300,000 years to less than 1,000 years; and

- **Reclaim Spent Fuel's Valuable Energy**: Develop and deploy, by the middle of the next decade, advanced nuclear fuels that will enable the proliferation-resistant consumption of plutonium in existing light water reactors or advanced gas-cooled reactors that may be available in the future.

This work can realize the vision anticipated by the *National Energy Policy* to explore advanced technologies to deal with spent nuclear fuel in cooperation with our international partners. The AFCI program also implements the recommendations of the *National Energy Policy* with respect to reconsideration of 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."

Working closely in an integrated manner with the Department's Generation IV Nuclear Energy Systems Initiative, the AFCI program will also develop advanced, proliferation resistant fuels and fuel cycle technologies needed for the next-generation reactor systems under cooperative development on an international basis through the Generation IV program.

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 reached agreements with the country of France for technical expertise in aqueous separations, fuels, and test facilities. Furthermore, Russia is supplying information regarding lead-bismuth technology, fabrication and testing of neutron targets, expertise in fuels and separations, and advanced reactor development. Other potential international partners include Italy, Spain, Japan, and South Korea.

As a means of measuring the effectiveness of the Nuclear Energy Research and Development programs, OMB's Program Assessment Rating Tool (PART) was used to evaluate the research results achieved

thus far. AFCI received very high scores for the purpose, planning, and management sections of PART. Lower scores for the results and accountability section of PART were received due to the fact that the AFCI program is still in the early stages of its development. NE has committed to implementing a number of actions to help measure the effectiveness of AFCI.

Advanced Fuel Cycle Initiative Series One

AFCI Series One will address the intermediate-term issues associated with spent nuclear fuel, primarily by reducing the volume and heat generation of material requiring geologic disposition. Doing so will support the Nation's first repository and reduce and possibly eliminate the technical need for additional repositories. This area of work will include creating the proliferation-resistant processes and fuels to enable the destruction of significant quantities of commercially generated plutonium in light water reactors or high temperature gas-cooled reactors in operation during the middle of the next decade.

The goal of the AFCI Series One technology effort is to develop advanced proliferation-resistant spent fuel treatment and proliferation-resistant fuel technologies that could be deployed by 2015. Significant advancements have been made in proliferation-resistant spent fuel treatment technologies (UREX). The UREX process removes the uranium from the spent fuel at such a high level of purity that it is sufficiently free of high-level radioactive contaminants to allow it to be disposed of as low-level waste or reused as reactor fuel. Laboratory scale UREX tests have proven uranium separation at purity levels of 99.999 percent, making it sufficiently free of high level contaminates to allow it to be disposed of as low level waste or re-used as reactor fuel. If spent fuel were processed in this manner, the potential exists to significantly reduce the quantity of high level waste requiring disposal in a geologic repository.

This technology will require additional research and development to provide specific feed material from an advanced derivative of UREX technology (*i.e.*, "UREX+") to manufacture proliferation-resistant transmutation fuels for both light water reactors (existing and new) and gas-cooled reactors (which could be built in the U.S. in the next decade). The real challenge is, therefore, development of proliferation-resistant fuels and the technology to fabricate these fuels.

Transmutation of plutonium and other actinides contained in spent nuclear fuel in nuclear power plants can provide a 25 percent increase in the energy extracted from nuclear fuel compared with a once-through fuel cycle. This increase will make a significant contribution to the Nation's energy security. However, transmutation may provide an even more important contribution by eliminating the plutonium present in spent nuclear fuel. In the U.S. alone, commercial spent nuclear fuel contains about 4,400 metric tons of plutonium – which becomes increasingly accessible as spent fuel cools over succeeding decades.

The Administration has made impressive progress towards the development of the Nation's first repository, but this progress—which is essential to the future of nuclear energy in the United States, has come after a long and difficult process. Based on that experience, contemplating a time when a second—and perhaps a third—deep geologic repository may be needed is not a comforting prospect for those who anticipate an expanded role for nuclear energy in the future. Spent fuel treatment and transmutation can expand the technical capacity of the first repository by providing significant reductions in waste volume and reducing the scientific need for additional capacity. While a geological repository is required even if this research is fully successful, AFCI technologies can help reduce the cost of geologic disposal and optimize the planned facility at Yucca Mountain, Nevada. This

technology, therefore, can help ensure that nuclear energy will be able to contribute to the Nation's energy supply far into the future.

Advanced Fuel Cycle Initiative Series Two

AFCI Series Two will address the long-term issues associated with spent nuclear fuel. Specifically, this effort will develop fuel cycle technologies that could sharply reduce the long-term radiotoxicity and heat load of high-level waste sent to a geologic repository, and support development of potential Generation IV fuel cycles.

AFCI Series One and AFCI Series Two are complementary and, as a result, they will be managed in tandem as part of a multi-phased effort to develop advanced spent fuel treatment and transmutation technologies. For example, treatment technologies that emerge from AFCI Series One may prove to be invaluable front-end steps to more advanced processes targeted in AFCI Series Two. Integrating these technology programs will be essential to the success of the overall effort.

AFCI Series Two consists of a phased approach to developing the technologies needed to address the long-term issues associated with spent nuclear fuel management – specifically, reducing long-term radiotoxicity and heat load. AFCI Series Two will further develop the AFCI Series One spent fuel treatment technologies to fully separate the most toxic, long-lived radioactive components of the spent fuel responsible for the long-term radiotoxicity and heat generation.

AFCI Series Two will also develop the transmutation technologies needed to destroy these long-lived radioisotopes. Current commercial spent fuel would take about 300,000 years to decay to the same level of toxicity as natural uranium ore. By destroying these radioactive components in spent fuel, it may be possible to reduce the time it takes for the waste in a repository to decay to the toxicity of natural uranium ore in 1,000 years or less. While a deep geologic repository is still needed, this technology can optimize its cost and technical performance. This is an aggressive technology goal and achieving it will require the development of advanced transmutation fuels and associated treatment technologies that will enable the use of fast neutron systems to destroy long-lived radioactive species. These new technologies must be capable of operating with far higher content of plutonium and other actinides than is presently feasible.

The AFCI Series Two research and development will be closely coordinated with the Generation IV Nuclear Energy Systems Initiative which is developing the fast neutron reactor systems that will use transmutation fuels. AFCI Series Two will develop the advanced, proliferation-resistant fuels and fuel cycle systems for the Generation IV reactors.

The AFCI Series Two research and development will capitalize on the Department's previous investments in pyroprocessing technology development that is being demonstrated on a laboratory-scale at ANL-W with the treatment and management of EBR-II sodium bonded spent nuclear fuel. The Department remains committed to meeting its obligations to the state of Idaho to treat and remove the EBR-II fuel. The Series Two activities also include investigation of scaling up to a commercial-scale the pyroprocessing technologies currently being demonstrated at ANL-W and research into advanced technologies that could accelerate the disposition of the EBR-II fuel.

The AFCI Series Two research will develop the enabling technologies and provide a practical demonstration of transmutation technologies. Detailed information needed for the commercial deployment of this technology, including specific capabilities, operational methods, waste characteristics and estimated volumes, costs, hardware, software, and facility requirements will be developed on the basis of the research results.

Transmutation Science Education

This portion of the AFCI program continues the successful fellowship program established under the AAA program to support the development of new U.S. scientists and engineers needed to develop the technologies 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 research and development effort. This important program supports the development of new U.S. scientists and engineers needed to develop transmutation technologies, and provides the basic research in material science, spent fuel treatment, and other key areas of basic research needed to support development of AFCI Series Two technologies.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Advanced Fuel Cycle Initiative					
EBR-II Shutdown.....	4,200[a]	0	0	0	0.0%
Disposition of Legacy Materials.....	388[a]	0	0	0	0.0%
AFCI Series One	0	0	31,720	+31,720	+100.0%
AFCI Series Two	66,081[b]	18,221	23,343	+5,122	+28.1%
Transmutation Science Education	6,550[c]	0	7,500	+7,500	+100.0%
Small Business Innovative Research and Small Business Technology Transfer Programs	0	0	462	+462	+100.0%
Total, Advanced Fuel Cycle Initiative	77,219	18,221	63,025	+44,804	+245.9%

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

[b] In FY 2002, $22.6M was funded under Nuclear Facilities Management and $42.7M was funded under Advanced Accelerator Applications.

[c] Funded under Advanced Accelerator Applications in FY 2002.

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **EBR-II Shutdown**	**4,200**	**0**	**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. Deactivation was completed in FY 2002.

▪ **Disposition of Legacy Materials Activities**	**388**	**0**	**0**

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. The funds for the disposition of legacy materials activities have been transferred to the Radiological Facilities Management program in FY 2003.

▪ **AFCI Series One**	**0**	**0**	**31,720**

In FY 2004, the Department will:

- Develop advanced chemical and pyroprocessing spent fuel separation technologies with emphasis on proliferation resistance. Develop associated waste form technologies.
- Design transmutation fuels for future use in light water reactors and advanced gas cooled reactors. Fabricate test articles and initiate testing of these transmutation fuels in irradiation facilities such as the Advanced Test Reactor, the High Flux Isotope Reactor, or other test facilities to verify their suitability as commercial reactor fuel.
- Develop and demonstrate technologies that separate spent nuclear fuel into usable fuel and waste through advanced fuel recycling and conditioning technologies at the Idaho National Engineering and Environmental Laboratory (INEEL). Prepare, irradiate, and conduct post-irradiation examination of candidate fuels for AFCI Series One and AFCI Series Two at the INEEL Advanced Test Reactor and hot cell facilities. Develop flow sheets for the advanced aqueous separations technology development program.

This $31,720,000 investment will enable the development of technologies to significantly reduce the volume of spent fuel requiring geologic disposal and reduce inventories of civilian plutonium contained in spent fuel.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **AFCI Series Two**	**66,081**	**18,221**	**23,343**

In FY 2002, the Department demonstrated 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. Advanced transmutation non-fertile fuels and testing containers were manufactured for irradiation testing in the Advanced Test Reactor in FY 2003. The construction and bench testing of two super-efficient "Spoke Resonators" for use in future transmutation accelerators was completed. Also, completed was the transfer of the Russian Lead-bismuth Spallation Target from Russia to the University of Nevada at Las Vegas for material testing. The ANL-W pyroprocessing facilities were operated in accordance with Record of Decision (ROD) for treatment and management of stored sodium-bonded fuels and to develop fuel material and waste products in support of advanced pyroprocessing research and development.

In FY 2003, the Department will continue to operate ANL-W pyroprocessing facilities in accordance with Record of Decision (ROD) for treatment and management of stored sodium-bonded fuels. The Department will also develop fuel material and waste products in support of advanced pyroprocessing research and development. The testing of laboratory scale oxide reduction using pyroprocessing technologies will also be initiated in FY 2003.

In FY 2004, the Department will:

- Demonstrate the feasibility of toxicity reduction of spent nuclear fuel including fabrication and testing of transmutation fuel forms that can be used in fast reactors as well as accelerator driven systems;
- Complete screening of fuel options for next-generation reactor concepts, complete plans for irradiation and post-irradiation testing of fuel forms and initiate preparation of fuel samples;
- Support the process and development and hot demonstration of advanced proliferation-resistant, pyroprocessing technologies to manufacture transmutation fuels from the actinides found in spent nuclear fuel. Investigate the recovery of actinides from irradiated fuel and remote fabrication of fuel assemblies containing recycled actinides. Perform a feasibility analysis for industrial scale-up of the pyroprocessing technology; and
- Maintain metallic and ceramic material samples resulting from the pyroprocessing process in heated storage to evaluate their long-term suitability as repository waste forms.

The increase of $5,122,000 will enable the development of AFCI Series Two advanced fuels and fuel recycle technologies, the demonstration of toxicity reduction through irradiation testing, and evaluation of long-term waste forms.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Transmutation Science Education**.....	**6,550**	**0**	**7,500**

This program supports the development of new U.S. scientists and engineers needed to develop transmutation technologies by continuing the university support program initiated in the Advanced Accelerator Application program.

In FY 2002, the Department awarded ten new fellowships for Master and Ph.D. degrees in nuclear science and engineering, and continued the complementary university research program based at the University of Nevada-Las Vegas.

In FY 2003, transmutation science education and university support programs are suspended due to budget constraints.

In FY 2004, the Department will:

- Award eight to ten M.S. and two Ph.D. fellowships to assure that new engineers will enter the field of transmutation science;
- Resume the complementary university research program based at the University of Nevada-Las Vegas to fully integrate other universities into the larger AFCI research and development effort.

The increase of $7,500,000 will support reinstatement of this program and will provide ten to twelve additional fellowships to increase the number of U.S. Master and Ph.D. graduate engineers and scientists pursuing fields of study relevant to transmutation.

▪ **Small Business Innovative Research and Small Business Technology Transfer Programs**.....	**0**	**0**	**462**
Total, Advanced Fuel Cycle Initiative.....	**77,219**	**18,221**	**63,025**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
AFCI Series One	
▪ The increase of $31,720,000 will enable the development of technologies to significantly reduce the volume of spent fuel requiring geologic disposal and reduces inventories of civilian plutonium contained in spent fuel.....	+31,720
AFCI Series Two	
▪ The increase of $5,122,000 will enable the development of AFCI Series Two advanced fuels and fuel recycle technologies, the demonstration of toxicity reduction through irradiation testing, and evaluation of long-term waste forms..	+5,122
Transmutation Science Education	
▪ The increase of $7,500,000 is due to reinstatement of this program and will provide ten to twelve additional fellowships to expand the number of U.S. Master and Ph.D. graduate engineers and scientists	+7,500
Small Business Innovative Research and Small Business Technology Transfer Programs	
▪ The increase of $462,000 is due to the increased funding for research and development activities.....	+462
Total Advanced Fuel Cycle Initiative	**+44,804**

Infrastructure

Program Mission

The Infrastructure program provides for the stewardship of the vital field infrastructure maintained by the Office of Nuclear Energy, Science and Technology (NE). This program ensures 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. The Infrastructure program keeps unique DOE facilities and supporting infrastructure in a user-ready status. Facilities supported by this program include reactors, hot cells, and other vital infrastructure needed to carry out advanced nuclear energy technology research and development, construct power systems essential for important national security missions and space exploration, and produce, package and ship radioisotopes for medical and scientific applications. DOE stimulates great advances in science by making its nuclear facilities available to a large user base. While we do not believe it is appropriate for DOE to subsidize the operational costs of our users, the Department does have the responsibility to maintain its unique facility capabilities in a manner that supports their application to missions funded by various governmental and scientific users.

In July 2002, the Secretary of Energy announced a major mission realignment for the Idaho National Engineering and Environmental Laboratory (INEEL), establishing the site as the Nation's leading center of nuclear research and development. As a result, oversight of the INEEL transferred from Office of Environmental Management (EM) to the Office of Nuclear Energy, Science and Technology (NE). INEEL will become the "command center" for NE's strategic nuclear energy research and development enterprise, INEEL's revised mission will play a major role in Generation IV nuclear energy systems development, advanced fuel cycle development, and space nuclear power and propulsion applications. The INEEL will transition its research and development focus from environmental programs to nuclear energy programs while maintaining its multi-program national laboratory status to best serve ongoing and future DOE and national needs. While INEEL will focus on its new role as the center for nuclear research and development as a multi-program national laboratory, the Department will enhance its focus and implementation of essential environmental cleanup activities. The INEEL will continue to pursue appropriate roles in national security, environmental and other activities. The FY 2004 budget reflects the transfer of the Idaho infrastructure operations and safeguards and security activities, as well as safeguards and security activities for ANL-W from EM to NE.

In March 2000, the Nuclear Energy Research Advisory Committee (NERAC) led the creation of the *Nuclear Science and Technology Infrastructure Roadmap* for the entire Department. This study examined the capabilities of the DOE's accelerators, reactors, and hot cells. It also evaluated current nuclear technology missions and facility staffing levels. Finally, the roadmap estimated future mission requirements and compared them to available and planned facility capabilities, highlighting capability gaps. The Department is refining this analysis with a series of more detailed, site-specific assessment that will not only highlight infrastructure gaps, but also identify requirements regarding to maintenance and upgrade of existing facilities. As a first step, NERAC is examining the nuclear R&D infrastructure at the Idaho National Engineering and Environmental Laboratory and Argonne National Laboratory-West to identify the maintenance and upgrades required to meet the Department's nuclear R&D activities planned at Idaho. This initial assessment will be completed in February 2003.

In a preliminary analysis of its infrastructure requirements, NE has identified the following major mid-term performance goals that require initial funding in FY 2004:

- By FY 2005, complete equipment installation for Uranium-233 downblending; and
- By FY 2006, eliminate the backlog of essential maintenance at critical user and support facilities.

Program Strategic Performance Goal

ER7-4: Maintain and enhance national nuclear capabilities by producing highly-trained nuclear scientists and engineers to meet the Nation's energy, environmental, health care, and national security needs; preserving critical user facilities and nuclear materials in a safe, secure, environmentally-compliant, and cost-effective manner to support national priorities; replenishing Federal technical and management staff with emphasis on obtaining high-caliber junior professionals with diverse backgrounds; and delivering 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 such that by December 2004, deliveries continue to be made to customers as needed.

Performance Indicators: Progress will be measured by:

- Percent on time/within budget for cost and schedule milestones for upgrades and construction of key nuclear facilities.
- Percent unscheduled downtime for each key nuclear facility.
- Number of annual deliveries for isotope products and services.
- Percent of customer specifications met for isotope products and services.
- A 95 percent success rate for preventing unauthorized intrusions into security areas; including cyber systems, that result in site degradation.

Annual Performance Results and Targets

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
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. (MET GOAL)	Keep cost and schedule milestones for upgrades and construction of key nuclear facilities within 10 percent of approved baselines.	Keep cost and schedule milestones for upgrades and construction of key nuclear facilities within 10 percent of approved baselines.
Meet the milestones for legacy waste cleanup at Test Reactor Area (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. (MET GOAL)	Operate each key nuclear facility within 10 percent of the approved plan.	Operate each key nuclear facility within 10 percent of the approved plan.
Demonstrate the operational capability of radioisotope power systems infrastructure by fabricating quality products at each of the major facilities (i.e., at least eight iridium clad vent sets at ORNL and at least eight encapsulated Pu-238 fuel pellets at LANL). (MET GOAL)	Demonstrate the operational capability of radioisotope power systems infrastructure by fabricating flight quality products at each of the major facilities (i.e., at least eight iridium clad vent sets at ORNL and at least eight encapsulated Pu-238 fuel pellets at LANL), and by processing at least 2 kilograms of scrap Pu-238 at LANL.	Demonstrate the operational capability of radioisotope power systems infrastructure by fabricating flight quality products at each of the major facilities (i.e., at least eight iridium clad vent sets at ORNL and at least eight encapsulated Pu-238 fuel pellets at LANL), and by processing at least 3 kilograms of scrap Pu-238 at LANL.
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. (MIXED RESULTS)	Complete the Idaho Integrated Safeguards and Security Plan to assure appropriate protective measures are taken commensurate with the risks and consequences for both the laboratories on the Idaho site.	Complete 100 percent of NE Idaho sitewide cyber security protection plans and Facility Security Surveys.
During FY 2002, no national security incidents occurred within NE Idaho sitewide cyber systems and security areas that caused unacceptable risk or damage to the Department. (MET GOAL)		

Significant Accomplishments and Program Shifts

- In FY 2002, initiated a competitive procurement of a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG). This effort will be conducted using funding provided by NASA.
- In March 2002, upon the successful and on-time completion of the EBR-II Shutdown activity, the required long-term surveillance and maintenance activities for the deactivated EBR-II plant systems and equipment were incorporated into the ANL-W Operations Infrastructure activity.

- In FY 2002, following the events of September 11, 2001, the Department identified the need to enhance security for its radioisotope power system heat source and assembly and test operations at the Mound Site in Ohio or to transfer the operations to another site where security was already in place. After completing an Environmental Assessment and cost evaluations of four alternative sites, the Department decided to locate these operations at the ANL-W site in Idaho.

- By September 2003, complete construction of the Isotope Production Facility (IPF) at the Los Alamos Neutron Science Center (LANCE) to produce medical and research short-lived accelerator isotopes.

- Beginning in FY 2003, the Department will limit its request for isotope production funds to the amount necessary to maintain its essential isotope production infrastructure in a safe, environmentally sound, reliable operating condition ready to serve the needs of the isotope customers. No appropriated funds will be used for the direct cost of isotope production. Instead, customers will be asked to pay all direct production costs.

- Beginning in FY 2004, the Uranium-233 (U-233) project will transfer from Defense Programs to NE. In FY 2004, Phase I, Planning and Design of the U-233 Project, which includes detailed project planning, process and facility modification designs, development of safety documentation, and development of Phase II cost estimates, will be accomplished.

- Beginning in FY 2004, the facilities and infrastructure activities previously funded in the Advanced Radioisotope Power Systems program and the Medical Isotope Program have been included in the Radiological Facilities Management program. In addition, the titles of these programs will change to the Space and Defense Infrastructure program and the Medical Isotopes Infrastructure program. This will more accurately reflect the activities being performed at NE managed sites and facilities.

- Beginning in FY 2004, responsibility for oversight of the INEEL will transfer to the Office of Nuclear Energy, Science and Technology, where it will become a major contributor to initiatives such as Generation IV nuclear energy systems and development of advanced, proliferation-resistant fuel cycle technology. The Idaho landlord activities previously funded by EM will be merged with the TRA landlord activities, previously funded under NE's Radiological Facilities Management account, into a single program, INEEL Infrastructure. In addition, the ANL-W Operations program and the new INEEL Infrastructure program will be funded under the Idaho Facilities Management account.

- In FY 2003, the safeguards and security budget for Argonne National Laboratory – West was transferred from the Office of Science to the Office of Environmental Management. In FY 2004, the safeguards and security funding for Idaho National Engineering and Environmental Laboratory and Argonne National Laboratory – West will transfer to the Office of Nuclear Energy Science and Technology. The ANL-W safeguards and security activities and the Idaho safeguards and security activities will be merged into a single NE program, Idaho Sitewide Safeguards and Security.

Funding Profile

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
Infrastructure					
Radiological Facilities Management	58,933	54,180	62,655	+8,475	+15.6%
Idaho Facilities Management	63,289	68,425	65,560	-2,865	-4.2%
Idaho Sitewide Safeguards and Security	40,295	40,215	53,651	+13,436	+33.4%
Total, Infrastructure	162,517	162,820	181,866	+19,046	+11.7%

Funding Profile – Function 270

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
Infrastructure – Function 270					
Radiological Facilities Management	58,933	54,180	62,655	+8,475	+15.6%
Idaho Facilities Management	43,590	42,770	44,145	+1,375	+3.2%
Total, Infrastructure – Function 270	102,523	96,950	106,800	+9,850	+10.2%

Funding Profile – Function 050

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Request	FY 2004 Request	$ Change	% Change
Infrastructure – Function 050					
Idaho Facilities Management	19,699	25,655	21,415	-4,240	-16.5%
Idaho Sitewide Safeguards and Security	40,295	40,215	53,651	+13,436	+33.4%
Total, Infrastructure – Function 050	59,994	65,870	75,066	+9,196	+14.0%

Funding by Site

(dollars in thousands)

	FY 02	FY 03	FY 04	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	10	0	0	0	0.0%
Los Alamos National Laboratory	15,189	15,168	15,330	+162	+1.1%
Sandia National Laboratory	1,900	1,800	1,750	-50	-2.8%
Total, Albuquerque Operations Office	17,099	16,968	17,080	+112	+0.7%
Chicago Operations Office					
Argonne National Laboratory	33,594	40,315	49,765	+9,450	+23.4%
Brookhaven National Laboratory	1,600	1,800	2,373	+573	+31.8%
Babcock and Wilcox	0	500	500	0	+0.0%
Total Chicago Operations Office	35,194	42,615	52,638	+10,023	+23.5%
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory	70,727	77,025	87,596	+10,571	+13.7%
Total, Idaho Operations Office	70,727	77,025	87,596	+10,571	+13.7%
Oak Ridge Operations Office					
Oak Ridge National Laboratory	25,124	24,612	24,100	-512	-2.1%
Total, Oak Ridge Operations Office	25,124	24,612	24,100	-512	-2.1%
Oakland Operations Office					
Oakland Operations Office	1,050	0	0	0	0.0%
Total, Oakland Operations Office	1,050	0	0	0	0.0%
Ohio Operations Office					
Mound	9,310	1,200	0	-1,200	-100%
Total, Ohio Operations Office	9,310	1,200	0	-1,200	-100%
Richland Operations Office					
Richland Operations Office	10	0	0	0	0.0%
Total, Richland Operations Office	10	0	0	0	0.0%
Washington Headquarters	4,003	400	452	+52	+13.0%
All Other Sites	0	0	0	0	0.0%
Total, Infrastructure	162,517	162,820	181,866	+19,046	+11.7%

Site Description

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. In addition, the Zero Power Physics Reactor Mock Up Building (Building 792) will be upgraded and outfitted for the radioisotope power systems heat source and test and assembly operations being transferred from the Mound Site. Due to security issues, these activities are being transferred to ANL-W.

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 is being used to treat the EBR-II spent fuel inventory. 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 was deactivated in March 2002 on schedule and within budget.

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 Transient Reactor Test Facility 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.

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 a 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. An initial 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 radiopharmaceutical scientists.

Idaho National Engineering and Environmental Laboratory

The Office of Nuclear Energy (NE) will assume Lead Program Secretarial (LPSO) responsibility for the Idaho Operations Office (ID). As the LPSO, NE will be responsible for providing guidance and direction to the field office; reviewing contracting decisions made by the field office; ensuring adequacy of field office resources; and resolving disputes involving the field office and other Secretarial Officers. NE will have responsibility for the institutional health and long-term planning at assigned sites, for landlord activities, and has accountability for overall site integration and operations. NE will also have overall line accountability for site-wide environment, safety and health, safeguards and security, and implementation of policy promulgated by headquarters staff and support functions. With the transfer of INEEL from EM to NE, INEEL will become the "command center" for NE's strategic nuclear energy research and development enterprise, INEEL's revised mission will play a major role in Generation IV nuclear energy systems development, advanced fuel cycle development, and space nuclear power and propulsion applications. The INEEL will transition its research and development focus from environmental programs to nuclear energy programs while maintaining its multi-program national

laboratory status to best serve ongoing and future DOE and national needs. While INEEL will focus on its new role as the center for nuclear research and development as a multi-program national laboratory, the INEEL will continue to pursue appropriate roles in national security, environmental and other activities.

NE manages the Advanced Test Reactor (ATR) and other non-reactor nuclear facilities at INEEL including day-to-day oversight with responsibility for safe operations; startup authority; safety basis documentation approval; accomplishment of program missions on schedule and within budget; and protection of the workers, the public, and the environment. The Idaho National Engineering and Environmental Laboratory, established as the National Reactor Testing Station in 1949, occupies 890 square miles in the Snake River Plain of Southeastern Idaho. Over the years, 52 reactors have been constructed and operated at the Idaho National Engineering and Environmental Laboratory. This site is owned by DOE and as of October 1999, is managed by Bechtel, Babcock and Wilcox Inc. There are nine primary facilities at the Idaho National Engineering and Environmental Laboratory as well as administrative, engineering, and research laboratories in Idaho Falls, approximately 50 miles east of the site. Other activities at the Idaho National Engineering and Environmental Laboratory over the last five decades include nuclear technology research, defense programs, engineering testing and operations, as well as ongoing projects to develop, demonstrate, and transfer of advanced engineering technology and systems to private industry. 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 ATR. The ATR is one of the world's largest and most advanced test reactors. It currently provides vital irradiation testing for reactor fuels and core components, primarily for the U.S. Navy Nuclear Propulsion Program. The ATR can also produce isotopes critically needed by medicine and industry. The 250-megawatt ATR has nine major locations where independent loops can be used for experimental 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 ATR is currently not producing isotopes, but isotope production is anticipated to resume in FY 2003. The three most important isotopes normally produced in the 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's 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. The INEEL Infrastructure 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 was 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 DOE funded activity will be phased out in FY 2003. Related space reactor technology efforts will continue in FY 2003 and FY 2004 using user agency funding.

Once in operation, after completion of the 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 neurological 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. The Department had planned to maintain the radioisotope power system assembly and test operations at the Mound site. However, security issues subsequent to the events of September 11, 2002, obligated the Department to reconsider whether these operations should remain at Mound or be transferred to another site. After completing an Environmental Assessment and cost evaluations of a range of alternative actions, a decision was made to transfer the radioisotope power system heat source and assembly and test operations from Mound to ANL-W.

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. Targets were irradiated at the High Flux Isotope Reactor (HFIR) located at ORNL and the Advanced Test Reactor in Idaho. ORNL is preparing to receive and store the Np-237 inventory currently stored at Savannah River. 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.

NE manages the High Flux Isotope Reactor (HFIR) and other non-reactor nuclear facilities at ORNL including day-to-day oversight with responsibility for safe operations; startup authority; safety basis documentation approval; accomplishment of program missions on schedule and within budget; and protection of the workers, the public, and the environment. The 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.

Additionally, the ORNL is storing 1.5 metric tons of uranium, containing 450 kilograms of U-233, in Building 3019. Storage of this material presents several safety issues due in part to the fact that Building 3019 was built during the Manhattan Project and that the storage containers have not been inspected in over twenty years. The Uranium-233 Disposition, Medical Isotope Production, and

Building 3019 Complex Shutdown Preliminary Project (U-233 Project) will resolve these safety issues while increasing the availability of medically valuable isotopes that will be extracted from the U-233 during processing. The down-blending of U-233 will reduce the global nuclear danger by making this material unsuitable for use in weapons. No new funds are requested in FY 2004 for this activity, however, this request reflects the transfer of funds related to activities at Building 3019 from the Office of Defense Program.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. NE manages the Annular Core Research Reactor (ACRR) and other non-reactor nuclear facilities at SNL including day-to-day oversight with responsibility for safe operations; startup authority; safety basis documentation approval; accomplishment of program missions on schedule and within budget; and protection of the workers, the public, and the environment. 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 ACRR is a 2-megawatt, pool-type research reactor that with the capability 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. National security programs use the ACRR's short duration high-power pulse capabilities for component testing.

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-West (ANL-W), Oak Ridge National Laboratory (ORNL), Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), and Brookhaven National Laboratory (BNL). These funds assure that NE facilities meet essential safety and environmental requirements, as well as assuring that various NE-managed facilities are maintained at user ready levels. Operations, production, research, and other additional activities are funded by DOE, industrial, research, and other Federal agency users.

In FY 2004, the facilities and infrastructure activities previously funded in the Advanced Radioisotope Power Systems and Medical Isotope program have been included in the Radiological Facilities Management program. In addition, the titles of these programs have been changed to Space and Defense Infrastructure and the Medical Isotope Infrastructure. These changes more accurately reflect the activities being performed at NE managed sites and facilities. The mission of the Radiological Facilities Management program is to maintain the Department's nuclear research and production facilities in a user-ready status to support vital U.S. Government missions.

In addition, the Radiological Facilities Management program has been maintaining the heat source and power system assembly and testing facilities at the Mound, Ohio Plant for radioisotope power systems. Following the events of September 11, 2001, the Department identified the need to enhance security at the Mound Site or to transfer operations to another site where security was already in place. The components and systems at Mound containing Pu-238 were transferred to ANL-W on an interim basis for safe and secure storage pending a final decision. After completing an Environmental Assessment and cost evaluations of a range of alternative actions, the Department decided to permanently locate the operations at ANL-W as the most cost-effective alternative. The transfer of certain equipment should be completed in FY 2003 with some capabilities operational by mid FY 2004 and the full capability in place during FY 2005.

At ORNL, the Radiological Facilities Management program maintains the unique infrastructure for iridium fabrication. Iridium is the cladding used to encapsulate Pu-238 for use in space and national security missions and ORNL maintains the only unique U.S. capability to process and fabricate iridium into the necessary cladding configuration. In addition, ORNL is preparing to receive and store the Np-237 inventory currently stored at Savannah River. This Np-237 is the required target material to establish a domestic capability to produce Pu-238.

At ORNL, the program maintains Building 3047 Hot Cells in a safe and environmentally compliant condition and state of readiness for the production, packaging, and shipment of radioisotopes used in medicine, homeland security applications, and other scientific research. The Chemical and Materials

Laboratories in Building 9204-3 are used for stable isotope processing. Stable isotopes are used as feed material for radioisotopes and in medical and scientific research.

Additionally, the ORNL is storing 1.5 metric tons of uranium, containing 450 kilograms of U-233, in Building 3019. Storage of this material presents several safety issues due in part to the fact that Building 3019 was built during the Manhattan Project and that the storage containers have not been inspected in over twenty years. The Uranium-233 Disposition, Medical Isotope Production, and Building 3019 Complex Shutdown Preliminary Project (U-233 Project) will resolve these safety issues while increasing the availability of medically valuable isotopes that will be extracted from the U-233 during processing. The down-blending of U-233 will reduce the global nuclear danger by making this material unsuitable for use in weapons. No new funds are requested in FY 2004 for this activity, however, this request reflects the transfer of funds related to activities at Building 3019 from the Office of Defense Program.

At LANL, this program maintains the Pu-238 encapsulation and scrap recovery facilities in the Plutonium Facility (designated PF-4) in Technical Area-55. These facilities provide the capability to process, pelletize and encapsulate the Pu-238 so that it can be safety transported and used in radioisotope power systems.

In addition, the Radiological Facilities Management program maintains 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 which is used for isotope processing at BNL. Also, a conceptual design report has been developed for a dedicated isotope production 70 MeV cyclotron at BNL. In conjunction with the LANL Isotope Production Facility, the 70 MeV cyclotron at BNL could provide for continued year-round production of vital research isotopes. Currently, BLIP utilizes the excess beam of a linear accelerator that injects 200 million electron volt protons into the 33 gigaelectron volt Alternating Gradient Synchrotron (AGS). The AGS future is uncertain because of lack of funding and a reduced mission. If the AGS does not accelerate protons in FY 2004, the BLIP would become prohibitively expensive to operate. The proposed cyclotron would replace the BLIP and provide capacity to meet future U.S. medical research isotope production requirements. It would also serve as a training facility for the next generation of nuclear/radiochemists. The FY 2004 budget request continues pre-conceptual design activities for the cyclotron.

The FY 2004 budget requests funding to manage the Department's vital resources and capabilities at ANL-W, ORNL, LANL, SNL, BNL, and Mound to ensure that DOE missions can be met in a safe, environmentally-compliant and cost effective manner.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Radiological Facilities Management					
Space and Defense Infrastructure	28,365	26,450	36,230	+9,780	+37.0%
Medical Isotopes Infrastructure[a]	30,568	27,730	26,425	-1,305	-4.7%
Total, Radiological Facilities Management .	58,933	54,180	62,655	+8,475	+15.6%

[a] Includes U-233 which was funded under NNSA in FY 2003 and FY 2004. Transferred to NE in FY 2004.

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
Space and Defense Infrastructure	**28,365**	**26,450**	**36,230**
Argonne National Laboratory- West (ANL-W)	**9,547**	**10,400**	**18,650**

- **Transfer of Radioisotope Power Systems Operations from Mound to ANL-W** ..... **6,237**[a] **6,550** **9,350**

  The Department has maintained and operated facilities at the Mound Plant in Ohio that enable the Department to conduct heat source and power system assembly and testing operations for radioisotope power systems. In FY 2002, based upon an environmental assessment, a cost evaluation, and safeguard and security considerations, a decision was made to transfer these operations from Mound to ANL-W. The transfer efforts were initiated in late FY 2002 with the movement of any radioactive materials. During FY 2003, the transfer of critical equipment that is to be moved from Mound will be completed and efforts will begin on the design of new equipment and required facility modifications. The new equipment and facility designs will be completed during FY 2004 and the procurement of equipment and the actual facility modifications will begin. The goal is to have capabilities that could support a critical national security application operational by mid FY 2004 with the full capability reestablished by early FY 2005. The increase of $2,800,000 is required to support the design efforts, to initiate preparation of operating procedures and to obtain the capability to perform operational and analytical reviews.

- **Capital Equipment Related to Transfer of Radioisotope Power System Assembly Operations from Mound** **0** **550** **2,000**

  In FY 2003 and FY 2004, procure equipment required for the heat source and test and assembly operations being transferred from Mound. This increase of $1,450,000 is necessary to procure equipment for the radioisotope power system operations.

- **General Plant Project (GPP) for Modifying ANL-W's Building 792 to Receive the Radioisotope Efforts from Mound** **0** **0** **4,000**

  In FY 2004, ANL-W will initiate modifications to Building 792 and site improvements for radioisotope power system operations being transferred from Mound. The building modifications include building extensions, electrical modifications, inert gas capabilities, and general modifications to fire and exhaust systems. This $4,000,000 increase will support modifications of Building 792 to support radioisotope power system operations being transferred from Mound.

[a] The majority of this funding was spent at Mound prior to the decision to transfer these functions.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Safety Analysis and Testing Infrastructure**	**3,310**	**3,300**	**3,300**

The Department maintains an analytical and testing infrastructure enabling the Department to assure the safety of its radioisotope power systems. This capability includes the operation and update of sophisticated analytical codes that can analyze the behavior of materials and systems under potential accident environments. In addition, this capability enables the conduct of specialized tests and maintenance of equipment that can simulate the environments that these materials and systems could be subjected to during potential extreme accident or operational scenarios.

Los Alamos National Laboratory (LANL)	**10,195**	**11,000**	**12,180**
▪ **Pu-238 Encapsulation and Scrap Recovery Facilities**	**9,495**	**10,000**	**10,600**

The Department maintains and operates dedicated Pu-238 processing, encapsulation, and scrap recovery facilities within the Plutonium Facility (PF-4) at Technical Area 55 at LANL. In FY 2002, the full-scale scrap recovery line was scheduled for full operational status. This line should be in full operation by FY 2003. In FY 2003 and 2004, the Pu-238 processing and encapsulation facilities to produce encapsulated pellets will also be in full operation. In FY 2004, performance will be measured by fabricating at least eight encapsulated Pu-238 fuel pellets and by processing at least 3 kilograms of Pu-238 through the scrap recovery facilities. The FY 2004 funding increase of $600,000 is associated with operating the full scale scrap recovery line for the entire fiscal year.

▪ **Capital Equipment for the Pu-238 Facilities**	**700**	**1,000**	**1,580**

Maintenance of the Pu-238 facilities requires regular upgrades and replacement of gloveboxes and equipment in the processing, encapsulation, and scrap recovery lines. During FY 2002 and FY 2003, replacement of gloveboxes in the processing and encapsulation facilities continued and equipment was purchased to initiate consolidation of the Pu-238 chemical and isotopic analyses within the TA-55 complex at LANL. In FY 2004, installation of new gloveboxes will continue and consolidation of the isotopic analysis within TA-55 will proceed. The FY 2004 funding increase of $580,000 will be used to purchase and initiate installation within TA-55 of a DC arc analyzer required to analyze the purity of the Pu-238.

(dollars in thousands)

	FY 02	FY 03	FY 04
Oak Ridge National Laboratory (ORNL)	**5,050**	**5,050**	**5,400**
▪ **Iridium Fabrication Facilities for Radioisotope Power Systems**	**3,900**	**3,900**	**4,000**

The Department maintains a 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. Funding will continue to assure the operational capability of this facility. The increase of $100,000 is needed to refine iridium scrap so that the iridium material can be reused.

▪ **Capital Equipment for Iridium Fabrication Facilities**	**0**	**150**	**400**

The FY 2004 funding increase of $250,000 will be used to replace aging equipment at the Iridium Fabrication facility at ORNL.

▪ **Long Term Pu-238 Supply**	**1,150**	**1,000**	**1,000**

The Department issued a Record of Decision in January 2001 that called for the reestablishment of a domestic Pu-238 production capability at facilities at ORNL and INEEL. In FY 2003 and FY 2004, the Department will prepare for the transfer and storage of the Np-237 supply that is the required initial target element for establishing a Pu-238 production capability. This material is currently stored at the Savannah River Site as part of the Environmental Management program. The Department has committed to complete the stabilization of this material by FY 2006, which requires stabilization efforts to begin in FY 2004. Therefore, the Nation's ability to produce Pu-238 requires that the capability to begin accepting Np-237 at ORNL be in place by late FY 2004. U.S. production of Pu-238 is essential to future national security missions. The need for this capability has been highlighted in a recent letter from the Deputy Secretary of Defense to the Secretary of Energy.

Other Activities	**3,573**	**0**	**0**
▪ **Generic Technology and Related Activities for Radioisotope Power Systems**	**573**	**0**	**0**

In FY 2002, the Department conducted a limited technology effort in power system and heat source enhancements. Also, it completed environmental and vulnerability assessments related to the radioisotope power systems program. No funds are requested for this activity in FY 2003 and FY 2004.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Special Purpose Fission Technology**	**1,000**	**0**	**0**

Efforts in FY 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 completed and future activities will be expanded and funded by NASA under its Nuclear Systems Initiative.

▪ **Special Applications**	**2,000**	**0**	**0**

Efforts in FY 2002 were focused on development and safety activities related to national security applications. In FY 2003, funding for this activity was transferred to the DOD with the intent that the funds would return to DOE as part of the DOD funded efforts.

Medical Isotopes Infrastructure	**30,568**	**27,730**	**26,425**
Oak Ridge National Laboratory (ORNL)	**19,874**	**19,562**	**18,700**
▪ **Building 3047 Hot Cells**	**2,300**	**2,350**	**2,650**

Maintain facility in a safe and environmentally compliant condition for the continued 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. Isotope customers will pay the full cost of isotope processing in this facility. The increase of $300,000 will permit needed minor repairs and support an on-time maintenance schedule.

▪ **Building 9204-3 – Chemical and Material Laboratories**	**2,200**	**2,250**	**2,500**

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. The increase of $250,000 will permit needed minor repairs and support an on-time maintenance schedule.

(dollars in thousands)

	FY 02	FY 03	FY 04
▪ **Building 9204-3 – Calutron Shutdown**.....	**850**	**600**	**0**

No additional funds are requested in FY 2004. The calutrons at the Y-12 Site have been placed in a standby but operable condition. This suspension will provide interested parties additional opportunities to consider their use. Completed activities in FY 2003 will include disposition of all waste, chemicals, and unusable equipment, transfer of all usable isotopes and equipment, and establishment of a stable isotope materials and chemical labs at the X-10 site. Further, in accordance with the National Historic Preservation Act, no item with any historical significance will be removed from the building until a consultation with the Commission is performed.

▪ **Alpha Emitting Isotopes**..... **300** **0** **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, future processing of thorium-229 will be financed by the private sector.

▪ **Isotope Production**..... **833** **450** **450**

In accordance with PMA "Improved Financial Performance", NE has integrated and automated its isotope business management information and consolidated it from three national laboratories to one laboratory thus reducing overall costs beginning in FY 2003. Such activities include isotope order processing, billing, official quotations, shipping schedules, cash collections, advance payments, and accounting for products and services provided by all Department isotope producing sites. In addition, starting in FY 2002 with full implementation in FY 2003, the Department is applying a more formal, peer-review structure to the selection of research isotopes for production and distribution of research isotopes called the Nuclear Energy Protocol for Research Isotopes (NEPRI). The NEPRI process was also centralized at ORNL along with the new automated business system.

▪ **Uranium 233 (U-233) Project** **13,391** **13,912** **13,100**

Continue base line operation and maintenance of Building 3019 and surveillance of U-233 material. FY 2004 funding will also be used for Phase I – Planning and Design – of the U-233 Project including detailed project planning, process and facility modification designs, development of safety documentation, and development of detailed Phase II cost estimates. This project is being transferred from the Department of Defense Program.

(dollars in thousands)

	FY 02	FY 03	FY 04
Los Alamos National Laboratory (LANL)	**4,494**	**4,168**	**3,150**
▪ **TA-48 Hot Cell, Building RC-1**	**1,500**	**1,597**	**1,750**

Maintain facility in a safe and environmentally compliant condition and state of readiness for the processing, packaging, and shipment of radioisotopes and other services needed in medical diagnostic, therapeutic applications, and other scientific research used by Federal and non-Federal entities. Activities include maintenance, radiological monitoring, and facility inspections. Isotope customers will pay the full cost of isotope processing in this facility. The $153,000 increase will permit hot cell hardware purchases.

▪ **Isotope Production Facility**	**2,494**	**1,721**	**0**

Isotope Production Facility – Line Item Construction Project: In FY 2003, the Department will complete the construction of the Los Alamos Isotope Production Facility for the production of accelerator isotopes needed for medical and scientific research. The decrease in $1,721,000 is due to the Los Alamos Isotope Production Facility (IPF) being completed in FY 2003.

▪ **Isotope Production Facility – Other Project and Start-up and Maintenance Costs**	**500**	**850**	**1,400**

In FY 2002 and FY 2003, prepare procedures and documentation to define system operational and safety basis; perform Readiness Review based on the facility categorization as a low-hazard non-nuclear radiological facility and to prepare commissioning of the 100 MeV Isotope Production Facility.

Beginning in FY 2004, provide funding for start-up expenses associated with the IPF target station and beam line to include such items as target development and testing, beam line testing, target station testing, and demonstrating operational safety. In addition, funding will maintain the IPF target station and beam line in a safe and environmentally compliant condition and state of readiness for the irradiation/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. Once all the required procedures and documentation needed to commission the IPF are completed and approved, the $550,000 increase will allow the Department to initiate facility operations.

Sandia National Laboratory (SNL)	**1,700**	**1,800**	**1,750**
▪ **TA-5 ACRR & Hot Cells**	**1,700**	**1,800**	**1,750**

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 decrease of $50,000 in FY 2004 defers maintenance activities.

(dollars in thousands)

	FY 02	FY 03	FY 04
Brookhaven National Laboratory (BNL)	**1,600**	**1,800**	**2,373**
▪ **Brookhaven Linear Isotope Producer (BLIP) Building 931 and Hot Cell Building 801**	**1,600**	**1,800**	**2,075**

Maintain the Brookhaven Linear Isotope Producer (BLIP) Building 931 and Hot Cell Building 801 facilities in a safe and environmentally compliant condition and state of readiness for the production of radioisotopes and other services needed in medical diagnostic, therapeutic applications, and other scientific research used by Federal and non-federal entities. Activities include maintenance, radiological monitoring, and facility inspections. Isotope customers will pay the full cost of isotope processing in this facility. In addition, funding will permit continuation of engineering, design, and development (pre Title 1) for the Cyclotron Isotope Research Center. The increase of $275,000 is to address additional maintenance requirements.

▪ **Capital Equipment**	**0**	**0**	**298**

In FY 2004, funds will provide for the one-time purchase and installation of the gamma ray spectroscopy, which is needed to replace a failing 12 year-old detector and allow direct measurement of unprocessed targets to get an initial target assay. In addition, funds will also be used to purchase a spare manipulator to eliminate prolonged down time of the cell by enabling staff to remove a defective manipulator and immediately replace it with a working one, without waiting for parts and repair.

Other Activities	**2,900**	**400**	**452**
▪ **Advanced Nuclear Medicine Initiative**	**2,500**	**0**	**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. No funding is requested in FY 2003 and FY 2004.

▪ **Associated Nuclear Support**	**400**	**400**	**452**

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. In FY 2004, the increase of $52,000 will support the higher costs associated with the certification of shipping casks by the NRC.

Total, Radiological Facilities Management	**58,933**	**54,180**	**62,655**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Space and Defense Infrastructure	
ANL-W	
▪ Transfer of Radioisotope Power Systems Operations from Mound to Building 792: The $2,800,000 increase is required to support design, procurement, and operational activities related to the transfer of the radioisotope power system operations from Mound.	+ 2,800
▪ Capital Equipment related to transfer of radioisotope power system assembly operations from Mound: The increase of $1,450,000 is to procure equipment for the radioisotope power system operations being transferred from Mound	+ 1,450
▪ General Plant Project (GPP) for Modifying Building 792 to receive the radioisotope efforts from Mound: The $4,000,000 increase is to modify Building 792 to support radioisotope power system operations being transferred from Mound	+ 4,000
Total, ANL-W	+ 8,250
LANL	
▪ Pu-238 Encapsulation and Scrap Recovery Facilities: The FY 2004 funding increase of $600,000 is associated with operating full scale scrap recovery line for the entire fiscal year.	+ 600
▪ Capital Equipment for Pu-238 Facilities: The FY 2004 funding increase of $580,000 will be used to purchase and initiate installation of a DC arc analyzer required to analyze the purity of Pu-238	+ 580
Total, LANL	+ 1,180
ORNL	
▪ Iridium Fabrication Facilities for Radioisotope Power Systems: The FY 2004 increase of $100,000 is needed to refine iridium scrap so that the iridium material can be reused.	+ 100
▪ Capital Equipment for Iridium Fabrication Facilities: The FY 2004 funding increase of $250,000 will be used to replace aging equipment at the iridium fabrication facility at ORNL	+ 250
Total, ORNL	+350
Total, Space and Defense Infrastructure	**+ 9,780**

	FY 04 vs. FY 03 ($000)
Medical Isotopes Infrastructure	
ORNL	
▪ Building 3047 Hot Cells: The increase of $300,000 will permit needed minor repairs and support on time maintenance schedule	+ 300
▪ Building 9204-3 – Chemical and Material Laboratories: The increase of $250,000 will permit needed minor repairs and support an on-time maintenance schedule	+ 250
▪ Building 9204-3 – Calutron Shutdown: The decrease of $600,000 is due to completing the disposition of all waste, chemicals, and unusable equipment, transferring all usable isotopes and equipment, and establishing stable isotope material and chemical labs at the X-10 site in FY 2003.	- 600
▪ Uranium-233 Project – The decrease of $812,000 is due to safeguards and security requirements in FY 2003 that are not funded in NE's budget in FY 2004	- 812
Total, ORNL	-862
LANL	
▪ TA-48 Hot Cell, Building RC-1: The $153,000 increase will permit hot cell hardware purchases.	+ 153
▪ Construction: The decrease in $1,721,000 is due to the Los Alamos Isotope Production Facility (IPF) being completed in FY 2003	- 1,721
▪ IPF– Other Project and Start-up and Maintenance Costs: The increase of $550,000 will allow startup activities that include such items as target development and testing, target station testing, and demonstrating operational safety and operational safety. In addition, the increase includes funding to provide for maintenance, radiological monitoring, and facility inspections	+550
Total, LANL	-1,018
SNL	
▪ TA-5 ACRR & Hot Cells: The decrease of $50,000 defers maintenance activities	- 50
Total, SNL	-50
BNL	
▪ BLIP Building 931 and Hot Cell Building 801: The increase of $275,000 is to address additional maintenance requirements	+ 275

	FY 04 vs. FY 03 ($000)
▪ Capital Equipment: The increase of $298,000 will be used for a one-time purchase of and installation of a gamma ray spectroscopy to replace a failing 12 year-old detector and allow direct measurement of unprocessed targets; and purchase hot cell manipulators needed for isotope processing and purchase and installation of the radioactive aqueous neutralization for solidifying waste remotely.	+ 298
Total, BNL.....	+573
Other	
▪ Associated Nuclear Support: The increase of $52,000 will support the higher costs associated with the certification of shipping casks by the NRC.	+ 52
Total Other Activities.....	+52
Total, Medical Isotopes Infrastructure	**-1,305**
Total Funding Change, Radiological Facilities Management	**+ 8,475**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Capital Equipment	700	1,700	4,278	+2,578	+ 151.6%
General Plant Projects/General Purpose Equipment	0	0	4,000	+4,000	+ 100.0%
Total, Capital Operating Expenses	700	1,700	8,278	+6,578	+ 386.9%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp.	FY 2002	FY 2003	FY 2004	Unapprop. Balance
99-E-201, Isotope Production Facility, LANL	19,999	15,784	2,494	1,721	0	0
Total, Construction	19,999	15,784	2,494	1,721	0	0

Isotope Production and Distribution Program Fund

Program Mission

The mission of the Department's Medical Isotope Infrastructure program 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 a 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 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.

Starting in FY 2002 with full implementation in FY 2003, the Department is applying a more formal, peer-review structure to the selection of research isotopes for 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. Each isotope will be priced such that its cost of production is paid by the customer for that isotope. No Radiological Facilities Management program funds will be expended on the development or production of these isotopes.

The DOE will continue to sell commercial isotopes at full-cost recovery. The commercial isotopes will also be discussed with an independent Isotope Review Advisory Panel and a list issued in parallel with the NEPRI list. A portion of revenue from the sales of commercial isotopes contributes to defray facility infrastructure expenses that would otherwise require an appropriation.

Generally, the program has functioned as a traditional vendor-purchaser relationship as found in any business, e.g. billing at the time of shipment and collection in 30 days. Since the annual Radiological Facilities Management appropriations will be restricted to isotope infrastructure expenses, no funds will be available as working capital. Hence, all isotope production costs must be financed by revenue from sales.

Program Strategic Performance Goal

ER7-4: Maintain and enhance national nuclear capabilities by producing highly-trained nuclear scientists and engineers to meet the Nation's energy, environmental, health care, and national security needs; preserving critical user facilities in a safe, secure, environmentally-compliant, and cost-effective manner to support national priorities; replenishing Federal technical and management staff with emphasis on obtaining high-caliber junior professionals with diverse backgrounds; and delivering 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 such that by December 2004, deliveries continue to be made to customers as needed.

Performance Indicator: Progress will be measured by:

- Number of annual deliveries for isotope products and services.
- Percent of customer specifications met for isotope products and services.

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.

- In FY 2003, NEPRI will be fully implementation. This new, more formal procedure will guide the selection of research isotopes for production, development, and distribution. All research isotopes will be priced to recover direct costs of production. Starting in FY 2002, DOE, with comments from the Isotope Review Advisory Panel (IRAP), will decide which research isotopes it will schedule for production in the following fiscal year. In February 2002, a Notice of Program Interest (NOPI) was posted in the Department's Industry Interactive Procurement System. Announcements of this NOPI were made in *FedBizOps,* the *Federal Register* and on the DOE website. To assure wide distribution to the research community letters were also sent to current and past customers. A web-based Town Hall Meeting was held in March 2002 to further assist with any questions on the NEPRI process and research isotope selection. Researchers were requested to submit their isotope needs for FY 2003 along with a description of their research, financial resources, and other information. The Isotope Review Advisory Panel has reviewed each of the 63 responses and evaluated them based on the information contained therein. Based on the recommendation of the Panel, DOE has compiled a list of research isotopes it will produce in FY 2003. The list was made public at the annual meeting of the Society of Nuclear Medicine in mid-June 2002, in *FedBizOps,* the *Federal Register,* the DOE website and other program briefings. From July to August, the DOE will process research isotope orders with financial commitments and start scheduling production for FY 2003.

- 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 for several reactor-produced isotopes. The Department is considering other suppliers in Russia and South Korea to further enhance supply.

- Privatization of selected Isotope activities will result in a decrease in both expenses and resources. The Medical Isotope Infrastructure 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. In FY 2002, the program has arranged with a private company to produce Ra-224/Bi-212 generators for studies in treating cancer and other debilitating diseases. The Department entered into a cooperative agreement with this company and provided a one-time payment of $50,000, as well as certain materials.

Funding Profile

No funds are requested for the Isotope Production and Distribution Fund. Isotopes are currently produced and processed at 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.

Idaho Facilities Management

Mission Supporting Goals and Objectives

In July 2002, the Secretary of Energy announced a major mission realignment for the Idaho National Engineering and Environmental Laboratory (INEEL), establishing the site as the Nation's leading center of nuclear research and development. As a result, oversight of the INEEL transferred from the Office of Environmental Management (EM) to the Office of Nuclear Energy, Science and Technology (NE). INEEL will become the "command center" for NE's strategic nuclear energy research and development enterprise, INEEL's revised mission will play a major role in Generation IV's nuclear energy systems development, advanced fuel cycle development, advanced gas-cooled reactor development, vital nuclear reactor testing, isotope production, fusion energy research, irradiation testing of Naval reactor fuels and components, and space nuclear power and propulsion applications. The INEEL will transition its research and development focus from environmental programs to nuclear energy programs while maintaining its multi-program national laboratory status to best serve ongoing and future DOE and national needs. While INEEL will focus on its new role as the center for nuclear research and development as a multi-program national laboratory, the INEEL will continue to pursue appropriate roles in national security, environmental and other activities.

The FY 2004 budget for Idaho Facilities Management incorporates the Idaho Landlord program, previously funded under EM, and the Test Reactor Area Landlord program, previously funded in NE's Radiological Facilities Management program, into one program: INEEL Infrastructure. In addition, to the INEEL Infrastructure program, Idaho Facilities Management also includes the Argonne National Laboratory West (ANL-W) Operations program, previously funded under Radiological Facilities Management. These changes more accurately reflect the activities being performed at the Idaho sites and facilities.

The purpose of the Idaho Facilities Management program is to provide non-programmatic, sitewide infrastructure needs to support the multi-program missions of the INEEL and ANL-W. Idaho Facilities Management program supports meeting *National Energy Policy* goals by maintaining and operating important facilities required for advanced nuclear energy technology research and development. The program manages all site equipment, facilities, land, and supporting services that are not supported by other programs. Key activities conducted under these programs include assuring that all NE facilities meet essential safety and environmental requirements, and assuring that various NE-managed facilities are maintained at user ready levels. Other key activities include maintaining essential facilities safely and securely, managing all special nuclear materials contained in these facilities, and managing the disposition of DOE legacy materials. In addition, this program also maintains the essential Test Reactor Area facilities required in achieving the objectives of the *National Energy Policy* and national security goals of the U.S. The only reactors currently operating at this site are the Advanced Test Reactor (ATR) and its supporting ATR Critical Facility. ATR currently conducts virtually all irradiation testing of Navy reactor fuels and core components and is vital to achieving the Department's Strategic Plan's National Nuclear Security Objective NS3 - providing the U.S. Navy with safe, militarily effective nuclear propulsion plants and ensuring their continued safe and reliable operation.

Key elements of the ANL-W Operations program include:

- *Nuclear Facilities Support*: perform 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.

- *Balance of Plant Support*: perform maintenance for 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.

- *Site Materials and Services:* provide contractual services such as electricity and power management, fuel oil, telecommunications, dosimetry, solid waste management, fire department, emergency management, transportation, and occupational medicine.

- *General Plant Projects (GPP)/ General Purpose Capital Equipment:* provide operational and capital funds for infrastructure upgrade projects and equipment.

- *Disposition of DOE Legacy Materials:* provides for the management and disposition of the Department's legacy materials associated with DOE's past nuclear energy activities at the Babcock and Wilcox facility in Lynchburg, VA. 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 the above facility. Before the DOE legacy material can be shipped from this commercial facility to disposition sites, this material must be characterized and repackaged; shipping cask components designed, fabricated, and tested; licensing amendments prepared and approved; and appropriate safety analysis reviewed and updated.

Key elements of the INEEL Infrastructure program include:

- *Operational Services:* perform various non-programmatic, common use activities such as seismic monitoring and underground storage tank monitoring and testing; maintaining technical expertise in the area of architectural and engineering standards.

- *Facility surveillance and maintenance:* perform preventative maintenance and repair on common use TRA facilities and utilities; and approximately 183 INEEL inactive facilities and structures pending final disposition.

- *Integrated Facility Planning:* provide facility planning to support the management of the INEEL Integrated Land and Facility Planning function; facility inspections; space and planning utilization; facility inventory; and maintenance of associated databases.

- *Environmental compliance:* provide environmental compliance measures for current waste streams and cleanup of legacy waste at the TRA facilities 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.

- *Program management and development:* manage and administer operations associated with the INEEL Infrastructure program, including engineering, planning, development, design, project validation and construction management.

- *Roads and grounds:* provide inspection and maintenance of 781 miles of improved and unimproved roads.

- *Facility decommissioning (non-radiological, non-contaminated):* provide planning, characterization, and disposition of excess non-radiological, non-contaminated INEEL facilities.

- *General Plant Projects (GPP)/ General Purpose Capital Equipment:* provide operational and capital funds for infrastructure upgrade projects and equipment.

- *Line Item Construction Projects (LICP):* provide operational and capital funds for major infrastructure upgrade projects.

- *Other:* provide for various crosscutting contracts and obligations between the Department of Energy, and various entities including the National Oceanic and Atmospheric Administration, the Shoshone-Bannock Indian Tribe, the State of Idaho, and Payments in Lieu of Taxes (PILT) for the four counties in which the INEEL is located.

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Idaho Facilities Management					
ANL-W Operations	34,857	31,615	31,615	0	0.0%
INEEL Infrastructure	28,432	36,810	33,945	-2,865	-7.8%
Total, Idaho Facilities Management	63,289	68,425	65,560	-2,865	-4.2%

Funding Schedule – Function 270

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Idaho Facilities Management – Function 270					
ANL-W Operations	34,857	31,615	31,615	0	0.0%
INEEL Infrastructure[a]	8,733	11,155	12,530	+1,375	+12.3%
Total, Idaho Facilities Management – Function 270	43,590	42,770	44,145	+1,375	+3.2%

Funding Schedule – Function 050

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Idaho Facilities Management – Function 050					
INEEL Infrastructure[b]	19,699	25,655	21,415	-4,240	-16.5 %
Total, Idaho Facilities Management – Function 050	19,699	25,655	21,415	-4,240	-16.5 %

[a] Funding for TRA Landlord activities previously funded under Radiological Facilities Management in Energy Supply.

[b] Funding for Idaho Landlord activities previously funded under Defense EM.

Detailed Program Justification

	FY 02	FY 03	FY 04
Argonne National Laboratory-West (ANL-W) Operations	**34,857**	**31,615**	**31,615**
▪ **Nuclear Facilities Support**	**21,817**	**21,428**	**20,246**

Continue engineering, technical, operator, and technician support for maintaining the nuclear and radiological facilities at ANL-W in compliance with DOE Orders, and applicable environmental and industrial safety requirements. The FY 2004 decrease of $1,182,000 defers maintenance activities.

▪ **Advanced Test Reactor Research and Development Upgrade Initiative**	**2,000**	**0**	**0**

In FY 2002, a special clean room to be called the Test Train Assembly Area (TTAA) is being 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 2004.

▪ **Balance-of-Plant Support**	**3,871**	**2,685**	**3,554**

Continue maintenance of non-nuclear and non-radiological facilities. The FY 2004 increase of $869,000 is due principally to increased costs of resources, including materials and supplies; partial restoration of periodic and corrective maintenance activities that were deferred in FY 2003 and increased monitoring (e.g. soil contamination) associated with CERCLA and other environmental regulatory activities.

▪ **Site Materials and Services**	**6,719**	**7,002**	**7,267**

Continue support for site materials and services. The FY 2004 increase of $265,000 is due principally to the increased cost of fuel oil, electricity, and other services.

▪ **General Plant Project (GPP)/General Purpose Equipment (GPE) Funding**	**450**	**0**	**48**

In FY 2004, funding provides for the repair of leaking underground steam and condensation pipes.

	FY 02	FY 03	FY 04
▪ **Disposition of Legacy Materials Activities**	**0[a]**	**500**	**500**

Continue storage of DOE legacy spent fuel and other legacy materials in the Babcock and Wilcox commercial, non-government facility at Lynchburg, Virginia, and perform some minor assessments and planning activities needed to determine the best path for characterization, repackaging, removal, and disposition of these materials. Funding in FY 2004 covers material storage costs at the above facility and other minimal tasks associated with this activity.

INEEL Infrastructure	**28,432**	**36,810**	**33,945**
▪ **Infrastructure Operations**	**18,123**	**19,825**	**21,410**

Infrastructure Operations includes operational services; facility surveillance and maintenance; integrated facility planning; environmental compliance; roads and grounds; facility decommissioning; and various crosscutting contracts and obligations between the Department of Energy, and various entities including the National Oceanic and Atmospheric Administration, the Shoshone-Bannock Indian Tribe, the State of Idaho, and Payments in Lieu of Taxes (PILT) for the four counties in which the INEEL is located. The backlog of TRA maintenance and repair has grown from $3,600,000 to approximately $5,000,000 due to the maintenance responsibility of the TRA Hot Cells returning to the Department from the private sector. The increase of $1,585,000 in funding will be used to accomplish anticipated emerging maintenance and repair in FY 2004 and reduce the maintenance backlog at the TRA facilities 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.

[a] In FY 2002, funding of $388,000 was provided under Nuclear Facilities Management.

	FY 02	FY 03	FY 04
▪ **General Plant Projects**.....	**3,144**	**8,092**	**4,800**

In FY 2004, funding will provide for projects such as:

- Minimum Safe/Caretaker Operations – GPPs will be used to reduce or eliminate emerging emergency infrastructure-related Environment, Safety, and Health problems
- Upgrade the site's obsolete Supervisory Control and Data Acquisition System
- Upgrade the site's fiber optics system and protective relays
- Upgrade network switch and cable system within the INEEL Super Computer Center
- Develop designs for necessary upgrades to the Central Facility Area Cafeteria
- Upgrade the Central Facilities Area Calibration Laboratory's heating, ventilation and air conditioning system
- Complete construction of a new potable water well and water system to meet new State and Federal drinking water standards on-site and the TRA Radioactive Water Retention Basin Isolation project. These projects were scheduled for completion in FY 2003, however, they were deferred to FY 2004 to allow for an emerging urgent project to replace 30-inch diameter buried radioactive waste piping that was found to be seriously deteriorated.

The decrease of $3,292,00 is due to deferring GPP projects to future years.

▪ **General Purpose Capital Equipment**	**4,597**	**6,553**	**5,395**

In FY 2004, funding will provide equipment such as electronic, information resource management, laboratory, shop and miscellaneous, and vehicles and heavy equipment. Funding also provides equipment to support TRA facilities, such as raw water feed pumps and a mobile crane. The decrease of $1,158,000 is due to deferring equipment purchases to future years.

▪ **TRA Fire and Life Safety Improvements**.....	**500**	**500**	**500**

In FY 2004, continue the TRA Fire & Life Safety LICP that corrects numerous significant violations of fire safety codes and regulations across the site.

▪ **TRA Electrical Utility Upgrade**.....	**950**	**1,840**	**1,840**

Continue the TRA Electrical Utility Upgrade LICP which replaces most of the obsolete site high voltage electrical distribution system that 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.

	FY 02	FY 03	FY 04
▪ **Sitewide INEEL Information Network**	**1,118**	**0**	**0**

Sitewide INEEL Information Network LICP – In FY 2002, final design was completed for this project for upgrades and replacement of essential equipment to support critical life safety and emergency response systems to meet current and future mission needs. No follow-on funds are requested in FY 2004.

Total, Idaho Facilities Management	**63,289**	**68,425**	**65,560**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Argonne National Laboratory-West Operations	
▪ Nuclear Facilities Support: The FY 2004 decrease of $1,182,000 defers maintenance activities	-1,182
▪ Balance-of-Plant Support: The FY 2004 increase of $869,000 is due to increased cost of resources, including materials and supplies; partial restoration of increased periodic and corrective maintenance, activities that were deferred in FY 2003, and increased surveillance and monitoring (S&M) of CERCLA and other environmental regulatory activities.	+869
▪ Site Materials and Services: The FY 2004 increase of $265,000 is due principally to the increased cost of fuel oil, electricity, and other services	+265
▪ General Plant Projects/General Purpose Equipment: The FY 2004 increase of $48,000 provides funding to repair leaking underground steam and condensation pipes	+48
Total, Argonne National Laboratory-West Operations	**+0**
INEEL Infrastructure	
▪ Infrastructure Operations: The increase of $1,585,000 will be used to reduce by 20% the TRA maintenance backlog that has increased due to the maintenance responsibility of the TRA Hot Cells returning to the Department from the private sector and reflects minor changes to various operations accounts	+1,585
▪ General Plant Projects: The decrease of $3,292,000 is due to deferring GPP projects to future years.	-3,292
▪ General Purpose Capital Equipment: The decrease of $1,158, is due to deferring equipment purchases to future years	-1,158
Total, INEEL Infrastructure	**-2,865**
Total Funding Change, Idaho Facilities Management	**-2,865**

Capital Operating Expenses

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Capital Equipment	4,597	6,553	5,395	- 1,158	- 17.7%
General Plant Projects/General Purpose Equipment	3,594	8,092	4,848	- 3,244	- 40.1%
Total, Capital Operating Expenses	8,191	14,645	10,243	- 4,402	- 30.1%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior-Year Approp.	FY 2002	FY 2003	FY 2004	Unapprop. Balance
95-E-201, TRA Fire and Life Safety Improvements (LICP)	18,323	13,297	500	500	500	3,526
99-E-200, TRA Electrical Utility Upgrade (LICP)	7,709	1,643	950	1,840	1,840	1,436
04-D-404, INEEL Information Network (LICP)	30,096	0	1,118	0	0	28,978
Total, Construction	56,128	14,940	2,568	2,340	2,340	33,940

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

(Changes from FY 2003 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

Due to 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 2003, therefore delaying physical construction until 4Q 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.

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	2Q 1999	4Q 2001	2Q 2002	4Q 2005	7,709	8,856
FY 2004 Budget Request (Current Baseline Estimate)	2Q 1999	4Q 2001	4Q 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	343
2001	877[b]	877	131
2002	950	950	1,804
2003	1,840	1,840	1,840
2004	1,840	1,840	1,840
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

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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 2002	FY 2003	FY 2004	Outyears	Total
Project Cost						
Facility Cost						
Design	789	0	114	0	0	903
Construction	0	1,804	1,726	1,840	1,436	6,806
Total, Line item TEC	789	1,804	1,840	1,840	1,436	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	209	102	184	184	326	1,005
Total other project costs	351	102	184	184	326	1,147
Total, Project Cost (TPC)	1,140	1,906	2,024	2,024	1,762	8,856

7. Related Annual Funding Requirements

(FY 2004 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 2003 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

There are no significant changes from the FY 2003 Congressional Budget data sheet. All tables and schedules have been updated for the new budget year. Some minor corrections to Section 2, Financial Schedule, have been made, but these have no impact on the TEC or TPC.

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	2Q 1995	3Q 2008	3Q 1995	2Q 2011	18,323	22,345
FY 2004 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	3,601
2000	1,474	1,474	2,958
2001	457[a]	457	1,468
2002	500	500	658
2003	500	500	500
2004	500	500	500
2005	500	500	500
2006	500	500	500
2007	500	500	500
2008	500	500	500
2009	500	500	500
2010	500	500	500
2011	526	526	545

[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 Test Reactor Area (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 minimal 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	1,581
Design Management Costs (0.3% of TEC)	51	51
Project Management Costs (0.5% of TEC)	86	86
Total, Design and Management Costs (9.4% of TEC)	1,718	1,718
Construction Phase		
Improvements to Land	152	152
Buildings	6,548	6,548
Utilities	3,343	3,343
Standard Equipment	636	636
Inspection, design and project liaison, testing, checkout, and acceptance	1,657	1,657
Construction Management (11.3% of TEC)	2,065	2,065
Project management (9.3% of TEC)	1,704	1,704
Total, Construction Costs	16,105	16,105
Contingencies (2.7% of TEC)	500	500

(dollars in thousands)

	Current Estimate	Previous Estimate
Total, Line Item costs (TEC).....	18,323	18,323

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 2002	FY 2003	FY 2004	Outyears	Total
Project Cost						

Facility Cost						
Design	1,465	0	240	0	0	1,705
Construction	11,655	658	260	500	3,545	16,618
Total, Line Item TEC	13,120	658	500	500	3,545	18,323
Other Project Costs						
Conceptual design costs	350	0	0	0	0	350
NEPA documentation costs	63	0	0	0	0	63
Other project-related costs	1,398	215	200	258	1,538	3,609
Total Other Project Costs	1,811	215	200	258	1,538	4,022
Total, Project Cost (TPC)	14,931	873	700	758	5,083	22,345

7. Related Annual Funding Requirements

(FY 2004) 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 2004 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. This system has been installed and was placed in service in FY 2002.

Idaho Sitewide Safeguards and Security
Energy Supply – Function 050

Mission Supporting Goals and Objectives

The mission of the Office of Nuclear Energy, Science and Technology (NE) Safeguards and Security (S&S) program is to protect DOE interests from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts, which may cause unacceptable adverse impacts on national security; program continuity; or the health and safety of employees, the public, or the environment. Beginning in FY 2004, the safeguards and security programs at the Idaho National Engineering and Environmental Laboratory and the Argonne National Laboratory-West will be integrated into a single sitewide Idaho Safeguards and Security program. The site's Integrated Safeguards and Security Plan will be developed in FY 2003 to assure appropriate protective measures taken commensurate with the risks and consequences for both the laboratories on the Idaho site.

The following is a brief description of the type of activities performed:

Protective Forces
The Physical Protection Protective Forces activity provides for security guards or other specialized personnel and equipment, training, and management needed to effectively carry out the protection tasks during normal and security emergency conditions.

Security Systems
The Physical Security Protection Systems activity provides for equipment to protect vital security interests and government property per the local threat. Equipment and hardware includes performance testing, intrusion detection and assessment, fences, barriers, secure storage, lighting, sensors, entry/access control devices, locks, explosive detection, and vital components and tamper-safe monitoring.

Transportation
The Transportation activity provides for all security-related transportation for intra-site transfers of special nuclear materials (including safe havens), weapons, and other classified material that is not funded through NNSA=s Office of Transportation Safeguards (OTS). Programs pay for preparation of transferring special nuclear materials within site boundaries that are not covered by OTS. The safeguards and security program pays for cost of protection and secure movement.

Information Security
This activity ensures that classified and sensitive unclassified matter is adequately protected. The scope of this activity includes export controls, classified matter protection and control, technical surveillance countermeasures, and operations security.

Personnel Security
The Personnel Security activity includes clearance program, adjudication, security awareness and education, visit control, Personnel Security Assurance Program, psychological/medical assessments, and administrative review costs. Security Investigations (SI) activities performed by the Federal Bureau of Investigation (FBI) and the Office of Personnel Management (OPM) associated access authorizations is funded by the Office of Security and is not requested/displayed in NE's budget.

Material Control and Accountability
The Material Control and Accountability (MC&A) activity provides for the protection of special nuclear materials (SNM), nuclear weapons, test devices, and weapons components and parts. The cost of activities such as MC&A training, proper measurement of materials, and performing a physical inventory are included in the budgets of those programs responsible for processing or storing SNM, and nuclear weapons components and parts, and are not included here.

Program Management
The Program Management activity includes policy oversight and development and updating of security plans, assessments, and approvals to determine if assets are at risk. Also encompassed are contractor management and administration, planning and integration of security activities into facility operations.

Cyber Security
The Cyber Security activity includes security-related unclassified computer security and classified computer security, protecting the transmission of sensitive unclassified and classified information telecommunications methods (COMSEC), TEMPEST and cyber infrastructure.

Funding Schedule – Function 050

(dollars in thousands)

	FY 2002 Comparable Appropriation	FY 2003 Comparable Current Appropriation	FY 2004 Request	$ Change	% Change
Nuclear Energy Safeguards and Security					
Protective Forces	25,017	24,616	31,726	+7,110	+28.9%
Security Systems	8,841	8,184	11,382	+3,198	+39.1%
Transportation	47	52	55	+3	+5.8%
Information Security	1,605	1,587	1,850	+263	+16.6%
Personnel Security	1,524	1,607	1,862	+255	+15.9%
Material Control & Accountability	2,483	2,484	2,774	+290	+11.7%
Program Management	1,197	1,484	1,979	+495	+33.4%
Cyber Security	3,045	3,204	5,026	+1,822	+56.9%
Subtotal, Safeguards & Security[a]	43,759	43,218	56,654	+13,436	+31.1%
Less: Security Charge for Reimbursable Work	-3,464	-3,003	-3,003	0	0.0%
Total, Safeguards and Security	40,295	40,215	53,651	+13,436	+33.4%

[a] Program levels reflect Work for Others (WFO) before the bottom line reduction to the NE appropriation for a "Security Charge for Reimbursable Work." This offset is displayed above by fiscal year. The new budget authority, as well as the offsetting collections, for the WFO portion of the NE S&S budget is included in Departmental Administration's Cost of Work for Others program, which is managed by the Department's Office of Management, Budget and Evaluation.

Detail Funding Profile – Function 050

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$Change	% Change
Idaho Operations Office					
Protective Forces	25,017	24,616	31,726	+7,110	+28.9%
Security Systems	8,841	8,184	11,382	+3,198	+39.1%
Transportation	47	52	55	+3	+5.8%
Information Security	1,605	1,587	1,850	+263	+16.6%
Personnel Security	1,524	1,607	1,862	+255	+15.9%
Material Control and Accountability	2,483	2,484	2,774	+290	+11.7%
Program Management	1,197	1,484	1,979	+495	+33.4%
Subtotal, Physical Security	40,714	40,014	51,628	+11,614	+29.0%
Cyber Security	3,045	3,204	5,026	+1,822	+56.9%
Total, Idaho Operations Office	43,759	43,218	56,654	+13,436	+31.1%
Subtotal, Nuclear Energy Safeguards and Security	43,759	43,218	56,654	+13,436	+31.1%
Less: Security Charge for Reimbursable Work	-3,464	-3,003	-3,003	0	0.0%
Total, Nuclear Energy Safeguards and Security	40,295	40,215	53,651	+13,436	+33.4%

Detailed Program Justification

(dollars in thousands)

	FY 2002	FY 2003	FY 2004
Idaho Sitewide Safeguards and Security	**43,759**	**43,218**	**56,654**

The Idaho Sitewide Safeguards and Security program provides protection of nuclear materials, classified matter, government property, and other vital assets from unauthorized access, theft, diversion, sabotage, espionage, and other hostile acts that may cause risks to national security, the health and safety of DOE and contractor employees, the public or the environment. Program activities include security systems, material control and accountability, information and cyber security, and personnel security. In addition, a protective force is maintained. These activities ensure that the site, personnel, and assets remain safe from potential threats. An increase in physical security (+$11,614,000) supports heightened security requirements resulting in increased posts, patrols, and other safeguards and security activities. Also includes capital improvements to obsolete and unsupported Stellar alarm multiplexers, and upgraded or new security systems. An increase in cyber security (+$1,822,000) provides continuation of current cyber security initiatives to protect Idaho cyber resources against emerging threat scenarios.

Subtotal, Nuclear Energy Safeguards & Security	**43,759**	**43,218**	**56,654**
Less: Security Charge for Reimbursable Work	-3,464	-3,003	-3,003
Total, Nuclear Energy Safeguards & Security	**40,295**	**40,215**	**53,651**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Idaho Sitewide Safeguards and Security	
▪ An increase of $11,614,000 in physical security supports heightened security requirements resulting in increased posts, patrols, and other safeguards and security activities.	+11,614
▪ An increase of $1,822,000 in cyber security provides continuation of current cyber security initiatives.	+1,822
Total Funding Change, Idaho Sitewide Safeguards and Security	**+13,436**

Program Direction

Mission Supporting Goals and Objectives

The Office of Nuclear Energy, Science and Technology (NE) promotes secure, competitive, and environmentally responsible nuclear technologies to serve the present and future energy needs of the country. Because of the Nation's reliance on nuclear energy, DOE's investments in services, products, and technologies are essential to the future. NE's mission is to promote the responsible use of nuclear technology by investing in innovative, higher risk science and preserving the national research and development (R&D) infrastructure. NE is responsible for leading the Federal Government's investment in nuclear science and technology by sponsoring research at the national laboratories, U.S. universities, and private industry. NE also manages the safe operation and maintenance of critical nuclear infrastructure and provides nuclear technology goods and services to industry and government.

In July 2002, the Secretary of Energy announced a major mission realignment for the Idaho National Engineering and Environmental Laboratory (INEEL), establishing the site as the Nation's leading center of nuclear research and development. As a result, oversight of the INEEL transferred from Office of Environmental Management (EM) to NE. INEEL will become the "command center" for NE's strategic nuclear energy research and development enterprise, INEEL's revised mission will play a major role in Generation IV's nuclear energy systems development, advanced fuel cycle development, advanced gas-cooled reactor development, vital nuclear reactor testing, isotope production, fusion energy research, irradiation testing of Naval reactor fuels and components, and space nuclear power and propulsion applications. The INEEL will transition its research and development focus from environmental programs to nuclear energy programs while maintaining its multi-program national laboratory status to best serve ongoing and future DOE and national needs. While INEEL will focus on its new role as the center for nuclear research and development as a multi-program national laboratory, the INEEL will continue to pursue appropriate roles in national security, environmental and other activities.

The FY 2004 budget reflects the transfer of 225 FTEs at the Idaho Operations Office and 20 FTEs at Headquarters from EM to NE along with funding to support infrastructure operations and safeguards and security activities. Program direction at the Idaho Operations Office provides the Federal staffing resources and associated costs required to support overall management and execution of the multi-program activities carried out at the INEEL. The Federal staff includes scientific, engineering, and technical personnel as well as program support personnel in the areas of budget, finance, general administration, procurement, grants, contracts, information resource management, policy review and coordination, infrastructure management, construction management, labor relations, personnel and human resources management, and legal support.

During FY 2002, NE took a number of steps to make progress in implementing the President's Management Agenda (PMA). Effective June 30, 2002, NE reorganized to better reflect Administration priorities, improve overall management, and reduce the number of primary organizational units from eight to three. To ensure accountability, PMA performance measures were cascaded from the Directors, to the responsible Senior Executive Service managers and Team Leaders. NE furthered the goal of replenishing technical and management staff by hiring five junior professional staffers—three that enhanced the diversity of NE's workforce, and implementing a university co-op program. High emphasis was placed on development of meaningful R&D investment criteria and the application thereof to NE research and development programs. NE is also supporting the Department's efforts to

make progress in the areas of competitive sourcing, improving financial performance, and expanding e-government by participating in Department-wide reviews and reengineering teams. In furtherance of the President's Management Agenda, as NE assumes management responsibility for the Idaho Operations Office, we will seek to optimize the workflow processes and to improve the overall operation and efficiency of this office.

Much of the research needed to advance the nuclear energy option for the Nation is far beyond the province of the private industry; thus, the role of Government in establishing a long-term future for nuclear power remains clear. The programs within NE fully support the *National Energy Policy* recommendations to expand the use of nuclear energy in the United States and thus improve the Nation's energy security. In response to guidance in the *National Energy Policy* and to the Secretary of Energy's strategic priorities, NE set its vision for its programs to include the following program strategic performance goals:

ER7-1: Deploy new nuclear generation to meet energy and climate goals by enabling an industry decision to deploy at least one new advanced nuclear power plant in the U.S. by 2010 to support the President's goal of reducing greenhouse gas intensity by 18 percent by 2012; completing design of an economic, commercial-scale hydrogen production system using nuclear energy by 2015; and developing a next-generation nuclear system for deployment after 2010 but before 2030 that provides significant improvements in proliferation and terrorism resistance, sustainability, safety and reliability, and economics.

ER7-2: Maximize energy from nuclear fuel by enabling a decision by 2010 to forgo the technical need for a second repository while still supporting expanded nuclear power in the U.S. and develop the technology to reduce commercial high-level waste by a factor of four by 2015; and commercializing technology to reduce long-term radiotoxicity and heat load of spent fuel by 2030.

ER7-3: **Protect existing nuclear generation** to support the *National Energy Policy* objectives to maintain and expand the Nation's electricity generation infrastructure by sponsoring innovative, investigator-initiated R&D to enhance the performance of light-water reactor technology to increase generating output from existing plants by at least an additional 500 megawatts by 2020.

ER7-4: **Maintain and enhance national nuclear capabilities** by producing highly-trained nuclear scientists and engineers to meet the Nation's energy, environmental, health care, and national security needs; preserving critical user facilities and nuclear materials in a safe, secure, environmentally-compliant, and cost-effective manner to support national priorities; replenishing Federal technical and management staff with emphasis on obtaining high-caliber junior professionals with diverse backgrounds; and delivering 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 such that by December 2004, deliveries continue to be made to customers as needed.

NE is one of the most programmatically diverse organizations in the Department and is faced with critical human capital challenges to pursue its mission and programs. Several years ago, NE went through extensive downsizing that resulted in numerous skill imbalances particularly impacting NE's

retention of technical and scientific specialists. Wherever possible, employees were redeployed from lower priority programs to higher priority programs to meet mission needs. However, the organization has reached a point, with expanding programs, limited resources, and skill imbalances that it is struggling to meet the requirements set for it by the President and the Secretary of Energy.

NE's human capital vision is to develop, recruit, and maintain a diverse organization of highly skilled professionals with the competency and motivation to contribute to the development and implementation of national energy policies and programs and help lead the Nation in achieving its nuclear technology goals into the next century.

NE is aggressively addressing the mismatch between the growth in its national responsibilities and the decline in its skilled personnel. NE has developed a detailed *Human Capital and Succession Plan* identifying required resources and skills mix needed to support current and expanding missions such as: implementing the President's *National Energy Policy*, directing our R&D budgets at ideas and innovations that are relatively immature in their development, and ensuring the greater application of mature technologies. NE has a staff of 132 personnel and nearly half of those will be eligible to retire within 5 years. Over the past year, NE has been trying to address this aging workforce issue through the recruitment of several entry-level engineering, scientific, project managers, and administrative positions and these efforts must continue. The NE *Human Capital and Succession Plan* indicates that NE does have a skills mix issue, especially in the area of project management, that must be addressed in the near term as well as the need to increase staffing. Over the next five years NE plans a moderate increase of the Headquarters workforce to 153 FTEs in accordance with the NE *Human Capital and Succession Plan*. The required staffing level is restrained because NE expects to continue its successful practice of aggressive matrix management and assuring the fullest possible utilization of staff resources. NE's recent reorganization, in conjunction with implementation of the NE *Human Capital and Succession Plan*, will enable NE to perform its mission, goals, and activities with excellence in accordance with the President's Management Agenda. The proposed actions from the NE *Human Capital and Succession Plan* plus NE's evolving mission create small, additional requirements for Program Direction funds.

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 technical project managers needed to assure the safe operation of the Department's various reactor facilities, and to effectively manage the expanding R&D programs, such as Nuclear Energy Research Initiative, Generation IV Nuclear Energy Systems Initiative, Nuclear Hydrogen Initiative, and Advanced Fuel Cycle Initiative.

Travel includes funding for transportation of Headquarters and operations office personnel 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 personnel. NE is far less dependent upon support service contractors

than most other similar organizations and has made significant reductions in its support services over the last four years. 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 Washington metropolitan area. To reduce support services costs, NE has retrained existing staff and recruited technical staff to reduce dependence on contractors while meeting growing needs in programs such as the Nuclear Power 2010, Generation IV Nuclear Energy Systems Initiative, Nuclear Hydrogen Initiative, and Advanced Fuel Cycle Initiative.

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 operates a Working Capital Fund (WCF) to provide funding for mandatory administrative costs, such as, rent and telephone services. Payments into the WCF reflect usage of Fund services, which are priced and charged to users in accordance with policies established by the WCF Board. The Other Related Expenses category also includes support for the activities of the Nuclear Energy Research Advisory Committee (NERAC).

Funding Schedule

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Program Direction					
Salaries and Benefits	43,131	44,389	47,597	+3,208	+7.2%
Travel	1,506	1,481	1,700	+219	+14.8%
Support Services	3,385	3,365	2,432	-933	-27.7%
Other Related Expenses	9,215	7,599	8,478	+879	+11.6%
Total Program Direction	57,237	56,834	60,207	+3,373	+5.9%
Additional net budget authority to cover the cost of fully accruing retirement (non-add)	(2,251)	(2,345)	(2,371)	(+26)	(+1.1%)

Funding Schedule- Function 270

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Program Direction- Function 270					
Salaries and Benefits	16,250	16,868	18,904	+2,036	+12.1%
Travel	721	727	918	+191	+26.3%
Support Services	2,676	2,615	1,629	-986	-37.7%
Other Related Expenses	2,856	2,689	3,349	+660	+24.5%
Total Program Direction –Function 270	22,503	22,899	24,800	+1,901	+8.3%
Headquarters FTEs	112	116	123	+7	+6.0%
Field FTEs	27	27	27	0	0.0%

Funding Schedule- Function 050

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Program Direction –Function 050					
Salaries and Benefits	26,881	27,521	28,693	+1,172	+4.3%
Travel	785	754	782	+28	+3.7%
Support Services	709	750	803	+53	+7.1%
Other Related Expenses	6,359	4,910	5,129	+219	+4.5%
Total Program Direction- Function 050	34,734	33,935	35,407	+1,472	+4.3%
Headquarters FTEs[a]	20	20	20	0	0.0%
Field FTEs[a]	225	225	225	0	0.0%

[a] HQ and Idaho Field Office FTE's transferred from EM.

Funding by Site[a]

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Chicago					
Salaries and Benefits	1,048	1,044	1,063	+19	+1.8%
Travel	88	71	80	+9	+12.7%
Support Services	36	52	78	+26	+50.0%
Other Related Expenses	85	67	75	+8	+11.9%
Total, Chicago	1,257	1,234	1,296	+62	+5.0%
Full Time Equivalents	8	8	8	0	0.0%
Idaho					
Salaries and Benefits	25,533	26,073	26,941	+868	+3.3%
Travel	721	695	715	+20	+2.9%
Support Services	671	712	766	+54	+7.6%
Other Related Expenses	6,044	4,622	4,947	+325	+7.0%
Total, Idaho	32,969	32,102	33,369	+1,267	+3.9%
Full Time Equivalents	236	236	236	0	+0.0%
Oak Ridge					
Salaries and Benefits	798	847	871	+24	+2.8%
Travel	13	14	15	+1	+7.1%
Support Services	40	22	23	+1	+4.5%
Other Related Expenses	10	12	43	+31	+258.3%
Total, Oak Ridge	861	895	952	+57	+6.4%
Full Time Equivalents	7	7	7	0	0.0%

[a] On December 20, 2002, National Nuclear Security Administration (NNSA) disestablished the Albuquerque, Oakland, and Nevada Operations Offices, renamed existing area offices as site offices, established a new Nevada Site Office, and established a single NNSA Service Center to be located in Albuquerque. Other aspects of the NNSA organizational changes will be phased in and consolidation of the Service Center in Albuquerque will be completed by September 30, 2004. For budget display purposes, DOE is displaying non-NNSA budgets by site in the traditional pre-NNSA organizational format.

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Oakland					
Salaries and Benefits	109	110	116	+6	+5.5%
Travel	5	5	6	+1	+20.0%
Support Services	0	0	0	0	0.0%
Other Related Expenses	12	12	12	0	0.0%
Total, Oakland	126	127	134	+7	+5.5%
Full Time Equivalents	1	1	1	0	0.0%
Headquarters					
Salaries and Benefits	15,643	16,315	18,606	+2,291	+14.0%
Travel	679	696	884	+188	+27.0%
Support Services	2,638	2,579	1,565	-1,014	-39.3%
Other Related Expenses	3,064	2,886	3,401	+515	+17.8%
Total, Headquarters	22,024	22,476	24,456	+1,980	+8.8%
Full Time Equivalents	132	136	143	+7	+5.1%
Total Nuclear Energy					
Salaries and Benefits	43,131	44,389	47,597	+3,208	+7.2%
Travel	1,506	1,481	1,700	+219	+14.8%
Support Services	3,385	3,365	2,432	-933	-27.7%
Other Related Expenses	9,215	7,599	8,478	+879	+11.6%
Total, Program Direction	57,237	56,834	60,207	+3,373	+5.9%
Full Time Equivalents	384	388	395	+7	+1.8%

Detailed Program Justification

(dollars in thousands)

	FY 02	FY 03	FY 04
Salaries and Benefits	**43,131**	**44,389**	**47,597**

- NE Headquarters has retrained and redeployed staff to reduce dependence on contractors; and continuously redirected and realigned staff to accomplish program goals efficiently and effectively. However, NE's expanding role in the Department to support the *National Energy Policy* and to improve the proliferation-resistance of civilian nuclear energy systems will require additional staff. In addition, staff will be needed to assure the safe operation of the Department's various reactor facilities and provide adequate Federal oversight of essential programs. NE believes that it is not only essential to hire senior engineers and project managers for new and changing programs, but also to recruit junior staff for succession planning purposes, and efforts to hire additional junior staff are continuing. NE currently has a staff of 132 personnel (headquarters and field) and nearly half of those will be eligible to retire within 5 years, and it is essential that program direction resources are available to compete for needed skills. NE field employees include: Chicago Operations Office (8), Idaho Operations Office (236), Oakland Operations Office (1), and Oak Ridge Operations Office (7).

Travel	**1,506**	**1,481**	**1,700**

- The increase in travel for FY 2004 is based on a projected increase in international travel for collaboration activities in the Nuclear Hydrogen Initiative, Generation IV Nuclear Energy Systems Initiative, and Advanced Fuel Cycle Initiative programs to support the Department's nuclear non-proliferation objectives.

Support Services	**3,385**	**3,365**	**2,432**

- NE has reduced Headquarters support services contracting from $10.6 million in support services contracts in FY 1995 to approximately $2.4 million in FY 2004. NE continues its concerted effort to minimize support services and will reduce funding by 28 percent from our FY 2003 level.

Other Related Expenses	**9,215**	**7,599**	**8,478**

- The single largest expenditure ($2.068 million in FY 2004, up from $1.9 million in FY 2003) in the other related expenses category is earmarked for the Headquarters WCF. The Department's Office of Management, Budget, and Evaluation (ME) established a WCF to provide funding for mandatory administrative costs, such as, office space and telephone services. The FY 2004 estimate was provided by ME and requires an increase in the cost of building occupancy rates based on current General Services Administration (GSA) rates and an increase in telephone services. FY 2004 funding also reflects continued support of the Department-wide initiative to support the NERAC, IT investments, such as replacement and upgrading of employee workstations, and training. Finally, this category includes expenses for computer hardware and software support, training, periodicals and subscriptions, etc.

Total, Program Direction	**57,237**	**56,834**	**60,207**

Explanation of Funding Changes

	FY 04 vs. FY 03 ($000)
Salaries and Benefits	
▪ Additional funding is required for new hires ($1,217K) to manage expanding research and development programs, such as the Nuclear Hydrogen Initiative, Generation IV Nuclear Energy Systems Initiative, and Advanced Fuel Cycle Initiative to support the Department's nuclear non-proliferation objectives while simultaneously preparing for a significant number of retirements of senior staff over the coming five years. This also includes a 3.4 percent escalation in accordance with established guidelines ($1,539K) and funds for promotions and within-grade salary increases ($452K)	+3,208
Travel	
▪ The increase in travel for FY 2004 is based on a projected increase in international travel for collaboration activities in Nuclear Hydrogen Initiative, Generation IV Nuclear Energy Systems Initiative, and Advanced Fuel Cycle Initiative to support the Department's nuclear non-proliferation objectives	+219
Support Services	
▪ The FY 2004 request for support services reflects a decrease as NE continues its Department-leading effort to reduce its reliance on support service contractors	-933
Other Related Expenses	
▪ The increase in other related expenses is primarily due to an increase in the WCF for the cost of building occupancy rates based on current GSA rates and an increase in telephone services. Additional increases reflect continued support of the Department-wide initiative to support the NERAC and IT investments, such as replacement and upgrading of employee workstations and training.	+879
Total Funding Change, Program Direction	**+3,373**

Support Services

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Technical Support Services	2,465	2,442	1,420	-1,022	-41.9%
Management Support Services	920	923	1,012	+89	+9.6%
Total, Support Services	3,385	3,365	2,432	-933	-27.7%

Other Related Expenses

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	$ Change	% Change
Working Capital Fund	1,979	1,930	2,068	+138	+7.2%
Nuclear Energy Research Advisory Committee	400	300	360	+60	+20.0%
ADP/TeleVideo Hardware and Software	440	428	625	+197	+46.3%
Subscriptions/Publications	20	19	25	+6	+31.6%
Training	65	63	90	+27	+42.9%
Other Miscellaneous	6,311	4,859	5,310	+452	+9.3%
Total, Other Related Expenses	9,215	7,599	8,478	+879	+11.6%