Nuclear Energy

Executive Budget Summary

Mission

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

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

The Department obtains advice on the direction of the Nuclear Energy R&D program 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* to guide nuclear energy research out to the year 2020 and the *Nuclear Science and Technology Infrastructure Roadmap*. NERAC is also providing expert advice to help guide development of the Generation IV Technology Roadmap. In addition, NERAC provides recommendations regarding government-industry cooperative research in support of the Nation's 103 licensed nuclear power plants.

The Long-Term R&D Plan, developed by NERAC with significant input from the wider research community, recommends that R&D budget levels be increased in order to enable the Nation to realize further value from our currently operating nuclear plants; provide for economic technologies and approaches to build enhanced advanced reactors in the United States; complete a design for a Generation IV nuclear energy system; and support a range of enduring missions within the Department. NERAC has established a goal of conducting $240 million in nuclear energy research by 2005.
This committee, chaired by Dr. James Duderstadt, former president of the University of Michigan, is comprised of 28 eminent senior policy, science and technology experts from academia, industry, environmental organizations, and our national laboratories. The membership of this committee is diverse, including

environmental advocates, senior officials from industry, researchers in nuclear medicine, laboratory directors, and a former member of the U.S. Senate.

NERAC has several very active subcommittees examining various aspects of nuclear technology. These subcommittees have issued or plan to issue in the near future, reports that address the future of nuclear technology. These reports are comprehensive efforts developed by conducting workshops, public and working group meetings, and by utilizing input from the nuclear community and public obtained through notices in journals, professional meetings, and the world wide web. The *Long-Term Nuclear Technology Research and Development Plan*, to guide nuclear energy research out to the year 2020 and the *Nuclear Science and Technology Infrastructure Roadmap* are about to be issued. A report of a Blue Ribbon Panel on *The Future Direction of University Nuclear Engineering Programs* and the *Final Report, NERAC Subcommittee for Isotope Research and Production Planning* have been issued. These reports provide independent, 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). In these reports, NERAC determined:

- the Nation must act now to restore an adequate investment in basic and applied research in nuclear energy if it is to sustain a viable U.S. capability in the 21st century;
- the most important role for the Department in the nuclear energy area at the present time is to ensure that the education system and its facility infrastructure are in good shape;
- the capabilities of currently operating DOE facilities will not meet projected U.S. needs for research and development, testing, or materials production, and
- of particular need over the longer term are dependable sources of research isotopes and reactor facilities providing high-volume flux irradiation for nuclear fuel and materials testing.

A report on technology opportunities for increasing proliferation resistance, is to be issued in October. In addition, NERAC provides recommendations regarding operating nuclear power plant research coordination and planning and the accelerator transmutation of waste program. With these assessments and recommendations in mind, NE's budget request reflects the Department's commitment to ensure the conduct of effective nuclear research and development, promotion and maintenance of a nuclear science and technology infrastructure, and realization of the benefits of nuclear technology.

NE's Goals Support DOE Strategic Objectives

NE's request is linked to the DOE Strategic Plan issued in September 2000 and NE's many diverse programs contribute to the success of a number of the Department's commitments. Working with industry, academia, the national laboratories, other Government agencies, and international partners, the Office has established goals that derive from the Department's strategic plan and guide our day-to-day activities.

*DOE Science Objective 4* - Provide the extraordinary tools, scientific workforce, and multidisciplinary research infrastructure that ensures success of DOE's science mission and supports our Nation's leadership in the physical, biological, environmental, and computational sciences.

NE Goal: Provide compact, safe, reliable nuclear power systems and related technologies to space and national security customers (see *Advanced Radioisotope Power Systems*)

DOE Science Objective 3 - Explore matter and energy as elementary building blocks from atoms to like, expanding our knowledge of the most fundamental laws of nature spanning scales from the infinitesimally small to the infinitely large.

NE Goal: Develop new or improved isotope products and services that enable medical diagnoses and therapy and other applications that are in the national interest, and encourage private sector investment in new isotope production ventures and sell or lease facilities and inventories for commercial purposes (see *Medical Isotope Program*)

Energy Resources Objective 2 - Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.

NE Goals:

- **S** Promote and maintain a nuclear engineering and science education infrastructure to meet the Nation's future nuclear technology needs (see *University Reactor Fuel Assistance and Support*)
- **S** Address the complex technical issues associated with managing the long-term degradation effects of plant aging while improving plant reliability, availability and productivity (see *Research and Development-Nuclear Energy Plant Optimization*)
- **S** Address the key issues affecting the future use of nuclear energy and to preserve the nations's nuclear science and technology leadership (see *Research and Development-Nuclear Energy Research Initiative*)
- **S** Develop the next generation of nuclear energy systems designed to make nuclear energy the most sustainable, cost-competitive, reliable, and secure means of generating electricity for the 21st century that advanced nuclear technology and prior experience can produce as well as the regulatory and licensing framework needed to deploy advanced reactor concepts in the United States. (see *Research and Development-Nuclear Energy Technologies*)
- **S** Develop advanced technologies to manage U.S. spent nuclear fuel (see *Advanced Accelerator Applications*)

Environmental Quality Objective 3 - Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.

NE Goals:

- **S** Ensure both the reliability of site landlord services for the long term and compliance with Federal, State of Idaho, and Department environment, safety, and health laws and regulations (see *Infrastructure-Test Reactor Area Landlord*)
- **S** Safely and cost-effectively complete permanent deactivation, and establish minimal required surveillance and maintenance, in full compliance with all applicable state and Federal safety and environmental regulations (see *Infrastructure-Fast Flux Test Facility*)

- Ensure ANL-W sites are maintained in a user ready or standby condition as required to meet the Department's important missions and are operated in a safe, secure, environmentally compliant and cost-effective manner to ensure the protection of the workers, public, and environment (see *Infrastructure-Argonne National Laboratory-West Operations*)
- Shutdown and deactivate the Experimental Breeder Reactor-II and other surplus facilities at ANL-W (see *Nuclear Facilities Management-EBR-II Shutdown Activities*)
- Responsibly and effectively carry out the long-term treatment of and management of DOE's sodium-bonded spent nuclear fuel (see *Nuclear Facilities Management-Disposition of Spent Fuel and Legacy Materials Activities*)
- Further develop electrometallurgical treatment technology to improve spent fuel treatment efficiency (see *Nuclear Facilities Management-Disposition Technology Activities*)

Strategy

In accomplishing its program mission, the Office of Nuclear Energy, Science and Technology will engage research institutions in industry, U.S. universities, national laboratories, international organizations, and other countries in cooperative and collaborative efforts. The major program elements that contribute to the mission are: Advanced Radioisotope Power Systems, Medical Isotope Program, University Reactor Fuel Assistance and Support, Nuclear Energy Plant Optimization, Nuclear Energy Research Initiative, Nuclear Energy Technologies, Test Reactor Area Landlord, Fast Flux Test Facility, Argonne National Laboratory-West, Nuclear Facilities Management, Program Direction, and Advanced Accelerator Applications (AAA). Program accomplishments that will enable NE to achieve it's mission are identified in the detailed program budget submissions.

Funding Summary

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
Energy Supply					
Advanced Radioisotope Power Systems	29,295	32,200	-406	31,794	29,094
Medical Isotope Program	18,953	19,215	-538	18,677	18,177
University Reactor Fuel Assistance and Support	12,000	12,000	-26	11,974	11,974
Research & Development	34,774	47,500	-202	47,298	27,079
Infrastructure	68,180	92,160	-13,781	78,379	81,279
Nuclear Facilities Management	42,100	34,850	-77	34,773	30,457
Program Direction	21,885	22,000	1,042	23,042	25,062
Use of Prior Year Balances	-1,570	0	0	0	0
Offset from Revenue	0	-2,352	0	-2,352	0
Total, Energy Supply	225,617	259,925	-13,988	243,585	223,122
Other Defense					
AAA	0	34,000	-75	33,925	0
Total, Other Defense	0	34,000	-75	33,925	0
Total, NE	225,617	293,925	-13,913	277,510	223,122

Major Changes

In FY 2001, the Department decided that safeguards and security activities within the Department of Energy complex are so important that they should be direct-funded programs rather than an indirect cost of doing business. Therefore, all funding included in the FY 2002 budget for Nuclear Energy, Science and Technology (NE) reflects the transfer of funds to other program offices for safeguard and security activities. In addition, the FY 2001 appropriation language transferred Uranium Programs from NE to the Office of Environmental Management (EM). Therefore, the FY 2002 budget for NE does not include a request for Uranium Program activities.

In October 2000 the Department initiated the development of a Generation IV Technology Roadmap to identify and establish research and development activities for the most promising nuclear energy system technologies for deployment no later than 2030. The most promising systems are those that most nearly meet the goals of being able to successfully compete in all markets with the most cost-efficient technologies expected to be available over the next three decades and beyond while further enhancing nuclear safety, minimizing the nuclear waste burden, and further reducing risk of proliferation. The Roadmap initiative is drawing on a wide community of researchers, designers, and operators from industry, academia, and the national laboratories. The Generation IV Technology Roadmap will evaluate a wide variety of nuclear energy system concepts using

goals developed by NERAC and will define the R&D paths for the most promising concepts. The Roadmap will provide additional detail to the Department's long-term R&D plan for nuclear technology. The FY 2002 budget request includes funding to complete the roadmap.

In January 2001, the Department issued a Record of Decision (ROD), based on the Nuclear Infrastructure Programmatic Environmental Impact Statement and related reports. FY 2002 budget request reflects the investment required to implement the ROD for the Nuclear Infrastructure (PEIS), which directed the permanent deactivation of the FFTF.

Major Issues

In FY 2001, the Advanced Accelerator Applications program was formally established within the Office of Nuclear Energy, consistent with Congressional direction and funding for FY 2001. For FY 2002, the Department has requested no new funds for the AAA Program. The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program.

Another issue facing NE is the need for additional funding to maintain the Department's vital resources and capabilities at NE-managed sites. A significant increase in TRA Landlord funding is needed. The site is more than 40 years old, and the aging TRA facilities and utility infrastructure are urgently in need of upgrading in the very near term to ensure safety and reliability and to avoid violations under Federal and State of Idaho environmental and worker safety regulations. It is projected that the site will be in operation until well into the 21st century. If this goal is to be met, the Department needs to accelerate its investment in upgrading or replacing the TRA Landlord facilities and utility infrastructure.

Site Funding

Site funding is provided in individual decision units.

Program Performance Measures

Key program performance measures used to judge the effectiveness of each program element are shown below. In addition to the technical effectiveness measures shown, program progress, customer satisfaction, and employee satisfaction are monitored to ensure that NE's programs are relevant and managed in a cost-effective manner.

Advanced Radioisotope Power Systems (SC4)

- In FY 2000, complete bench scale demonstration of the process to recover Pu-238 scrap for reuse in power systems for future missions using radioisotope power systems.

In FY 2000, develop and baseline a Stirling Radioisotope Power System for the 2006 Europa Orbiter mission and maintain the viability of using spare RTGs and assembling a spare converter from the Cassini mission as backups for the Europa Orbiter mission.

In FY 2001, competitively select system integration contractor to develop a flight qualified Stirling Radioisotope Power System for future space exploration missions.

In FY 2001, complete installation of the full scale scrap recovery line to process Pu-238 scrap that will be required to provide radioisotope power systems for planned NASA and national security missions.

In FY 2001, complete initial assessment of special purpose fission technologies that is focused on concepts and technologies for space applications.

In FY 2002, develop preliminary design of Stirling Radioisotope Power System suitable for space exploration missions.

In FY 2002, 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.

In FY 2002, complete assessment of special purpose fission technology options required to power advanced spacecraft to the outer planets and on the surface of Mars.

Medical Isotope Program (SC3)

In FY 2000, supply quality stable and radioactive isotopes for industrial, research, and medical applications that continue to meet customer specifications and maintain 95 percent on-time deliveries.

In FY 2000, complete at least 40 percent of the construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived isotopes for medical research.

In FY 2000, invest in two new process development technologies as requested by researchers that enhance isotope production, services and delivery application systems.

In FY 2000, implement the Advanced Nuclear Medicine Initiative by providing isotopes or financial assistance for at least five researchers.

In FY 2001 and FY 2002, supply quality stable and radioactive isotopes for industrial, research, and medical applications that continue to meet customer specifications no less than 97 percent and maintain 95 percent on-time deliveries.

In FY 2001, complete 75 percent of the facility construction and equipment installation for the new 100 MeV Isotope Production Facility which is needed to continue production of short-lived radioisotopes essential for U.S. medical research.

In FY 2001, provide 5 grants under the Advanced Nuclear Medicine Initiative.

In FY 2002, complete 80 percent of the construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived isotopes for medical research.

In FY 2002, complete research and curriculum development funded by 14 three-year Advanced Nuclear Medicine Initiative grants to universities, hospitals and research institutions.

University Reactor Fuel Assistance and Support (ER2)

Support U.S. universities' nuclear energy research and education capabilities by:
  - S Providing fresh fuel to university reactors.
  - S Funding approximately 23 universities each year with research reactors for reactor upgrades and improvements
  - S Partnering with private companies to fund DOE/Industry Matching Grants for universities (17 in FY 2000, 18 or more in FY 2001 and FY 2002).
  - S Providing funding for Reactor Sharing with the goal of enabling each of the 29 schools eligible for the program to improve the use of their reactors for teaching, training, and education.

Attract outstanding U.S. students to pursue nuclear engineering degrees by:
  - S Providing graduate student fellowships (18-20 in FY 2000, 24 in FY 2001, and 20-24 in FY 2002).
  - S Supporting university Nuclear Engineering Education Research Grants to encourage creative and innovative thinking at U.S. universities (45 in FY 2000, 50 in FY 2001 and FY 2002).
  - S Providing scholarships and summer on-the-job training to approximately 50 sophomore, junior and senior nuclear engineering and science scholarship recipients each year.

Nuclear Energy Plant Optimization (ER2)

In FY 2000, implement a cooperative cost-shared R&D program by working with industry, universities, national laboratories, and the Nuclear Regulatory Commission, to address technical issues that could prevent continued operation of current nuclear power plants.

In FY 2000, issue the first update to the *Joint DOE/EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants.*

In FY 2001, continue R&D activities associated with managing long term effects of plant aging and improving the reliability and productivity of existing nuclear power plants.

In FY 2002, continue ongoing R&D and initiate new R&D associated with managing the long-term effects of plant aging and improving the reliability and productivity of existing nuclear power plants.

Nuclear Energy Research Initiative (ER-2)

In FY 2000, continue Nuclear Energy Research Initiative to improve the understanding of new reactor and fuel cycle concepts, and nuclear waste management technologies and begin to develop a preliminary feasibility assessment of the concepts and technologies.

In FY 2000, advance the state of scientific knowledge and technology to enable incorporation of improved proliferation resistance, safety and economics in the potential future design and development of advanced reactor and nuclear fuel systems.

In FY 2001, establish bilateral research programs with other countries to improve the cost, and enhance the safety, nonproliferation and waste management of future nuclear energy systems.

In FY 2001, complete funding for the first 3-year phase of Nuclear Energy Research Initiative research and development, select feasible and important reactor and fuel cycle concepts for continued development, and issue approximately 15 new awards.

In FY 2002, complete the first 3-year phase of Nuclear Energy Research Initiative research and development awards.

In FY 2002, identify innovative nuclear energy research concepts developed under Nuclear Energy Research Initiative for further development.

In FY 2002, continue the bilateral research programs with other countries.

Nuclear Energy Technologies (ER2)

In FY 2001, formally establish the Generation IV International Forum to assist in identifying and conducting cooperative R&D. Initiate development of a Generation IV Technology Roadmap for development of next generation nuclear energy systems.

In FY 2002, complete the Near Term Deployment section of the Generation IV Technology Roadmap.

In FY 2002, complete the draft Generation IV Technology Roadmap for development of next generation nuclear energy systems. The Roadmap is to be submitted to Congress by March 2003.

Test Reactor Area Landlord (EQ3)

In FY 2002, meet the milestones for legacy waste cleanup at TRA in the Voluntary Consent Order between the State of Idaho and DOE and efficiently manage resources to limit growth in backlog of maintenance to no more than 10 percent.

Fast Flux Test Facility (FFTF) (EQ3)

In FY 2000, maintain the FFTF in a safe, environmentally-compliant standby condition while implementing a Secretarial decision to conduct a National Environmental Policy Act review of the environmental impacts of enhancing the Department's nuclear research facility infrastructure.

In FY 2001, complete the National Environmental Policy Act review of the environmental impacts of enhancing the Department's nuclear research facility infrastructure and issue a Record of Decision.

In FY 2001, issue detailed, resource-loaded plan for deactivation of the FFTF which is needed to place the facility in an industrially and radiologically safe condition while minimizing annual surveillance and maintenance costs.

In FY 2002, maintain the FFTF in a safe, environmentally-compliant condition while conducting shutdown activities.

In FY 2002, complete upgrades on the FFTF Sodium Removal System.

ANL-West Operations (EQ3)

In FY 2002, complete the conceptual design and National Environmental Policy Act determination for the Remote Treatment Facility to dispose of highly radioactive waste at Argonne National Laboratory-West.

Nuclear Facilities Management (EQ3)

In FY 2000, complete the conversion and disposition of 100 percent of the secondary sodium coolant from the Experimental Breeder Reactor-II and 40 percent of the Fermi reactor sodium coolant in storage at Argonne National Laboratory-West.

In FY 2000, initiate draining sodium from EBR-II primary system and processing it for disposal.

In FY 2000, depending upon the conclusion of the NEPA analysis currently underway, complete Fuel Conditioning Facility maintenance and resume sodium-bonded fuel treatment activities.

In FY 2001, complete the conversion and disposition of 100 percent of the Fermi reactor sodium coolant in storage at Argonne National Laboratory-West.

- In FY 2001, complete draining the EBR-II primary system and process 100 percent of all EBR-II sodium in compliance with the INEEL Site Treatment Plan.

- In FY 2001, treat a minimum of 0.5 MTHM of EBR-II spent nuclear fuel.

- In FY 2002, following completion of primary sodium drain, complete deactivation of EBR-II and all directly related surplus facilities by March 2002.

- In FY 2002, treat a minimum of 0.5 MTHM of EBR-II spent nuclear fuel.

Advanced Accelerator Applications (formerly ATW) (ER2)

- In FY 2000, establish a science and engineering based research program into ATW technology development.

- In FY 2000, commence systems studies to establish and evaluate technology options and narrow the choices.

- In FY 2000, issue a Program Plan for the conduct and management of the ATW research program.

- In FY 2001, establish new international agreement on advanced accelerator applications programs with at least one country that significantly leverages financial and technical resources to the mutual benefit of both countries particularly in areas such as safety, fuels and materials development, and facility operations.

- In FY 2001, establish a new Advanced Accelerator Applications university fellowship program with the goal of funding 10 new graduate students in engineering and science each year beginning in 2001.

- In FY 2002, support revitalization of the domestic nuclear infrastructure by funding 10 new graduate students in engineering and science under the Accelerator Applications university fellowship program (using FY 2001 carryover funding).

In FY 2002, continue studies on the Advanced Accelerator Applications proof-of-performance and designs (using FY 2001 carryover funding). The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program.

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

Advanced Radioisotope Power Systems

Program Mission

The Advanced Radioisotope Power Systems program supports the development, demonstration, fabrication, testing, and delivery of power systems required by the United States to support space exploration and special national security activities. Radioisotope power systems (RPS) are the enabling technology for space and national security applications that require proven, reliable and maintenance-free power supplies capable of producing up to several kilowatts of power and operating under severe environmental conditions such as space for many years. Over the past 40 years, 26 space missions have used 44 of these power systems in a variety of applications, including earth orbit observations, lunar surface exploration, scientific satellites flying close to the outer planets, and probes on the surface of Mars. Space exploration will continue as a national priority and many of the future planned space missions cannot be accomplished without these power systems. National security applications using these systems have also been under way for many years and will continue in the future.

In order to support these important national missions, the Department is responsible for sustaining the unique program and facility infrastructure that enables the Department to produce and deliver radioisotope power systems. The Department's infrastructure constitutes the sole national capability to develop and produce these unique power systems and the Department sustains these capabilities as part of its charter under the Atomic Energy Act of 1954, as amended, and in accordance with its responsibilities outlined in the National Space Policy published in 1996. Without this infrastructure, radioisotope power systems could not be produced, and without these power systems, critical national security activities and NASA missions to explore deep space and the surfaces of neighboring planets would not be possible.

The unique program and facility infrastructure involves both the capability to develop and produce the heat sources and power systems, including a stable long term supply of the isotope plutonium-238 (Pu-238), and a strong technology and safety competence base that allows the Department to assure that the systems can be developed and deployed in a safe and environmentally responsible manner. The actual development of mission specific systems for particular applications is accomplished by the Department using funding provided by the user agencies. In association with this infrastructure, the program will also assess and explore the potential need and planning for higher power space fission systems. Development of these systems is cited as a priority activity by the Nuclear Energy Research Advisory Committee (NERAC). As a result, NERAC has formed a new subcommittee of independent experts which is chartered to assess and advise the Department's activities in this area.

DOE Strategic Objective

Science 4 - Provide the extraordinary tools, scientific workforce, and multidisciplinary research infrastructure that ensures success of DOE's science mission and supports our Nation's leadership in the physical, biological, environmental, and computational sciences.

Program Goal

Provide compact, safe, reliable nuclear power systems and related technologies to space and national security customers.

Program Objective

Maintain in an operational mode the unique program and facility infrastructure required to meet commitments to other Federal agencies to provide radioisotope and fission power systems that enable critical space and national security missions.

FY 2002 Program Strategies

- Maintain and upgrade the program and facility infrastructure, including the installation and operation of a Pu-238 scrap recovery process.

- Pursue development of advanced radioisotope power systems in response to user agency requirements and mission needs, including design of an advanced system that can operate unattended with greater than 20 percent efficiency for several years in the remote harsh environments of space.

- Begin planning activities for implementing the Department's Record of Decision to reestablish a Pu-238 domestic production capability.

- Continue assessment of special purpose fission technology with special emphasis on space power systems and applications.

Significant Accomplishments And Program Shifts

- As a result of a Nuclear Infrastructure Programmatic Environmental Impact Statement (PEIS) process, the Department has issued a Record of Decision (ROD) that supports the reestablishment of a domestic capability to produce the isotope Pu-238 that is used in all radioisotope power systems. The program will shift in FY 2002 from just maintaining this as an option as it has done for the past several years to beginning the planning necessary to install this production capability. Full implementation of the ROD to reestablish a domestic production capability is targeted to begin in FY 2003.

- The program is nearing completion of the full scale processing line that will allow scrap Pu-238 to be recycled and reused for ongoing and future missions. In FY 2002, the line will become operational and will

begin to process Pu-238 scrap for reuse in ongoing and future missions. Startup of the line was delayed several months as a result of the contamination incident at Los Alamos in early Spring 2000.

Selection of a single systems integration contractor for development of the advanced Stirling Radioisotope Power System (SRPS) for use in future space missions will be completed in FY 2001 and development will proceed in FY 2002 using funding provided by NASA.

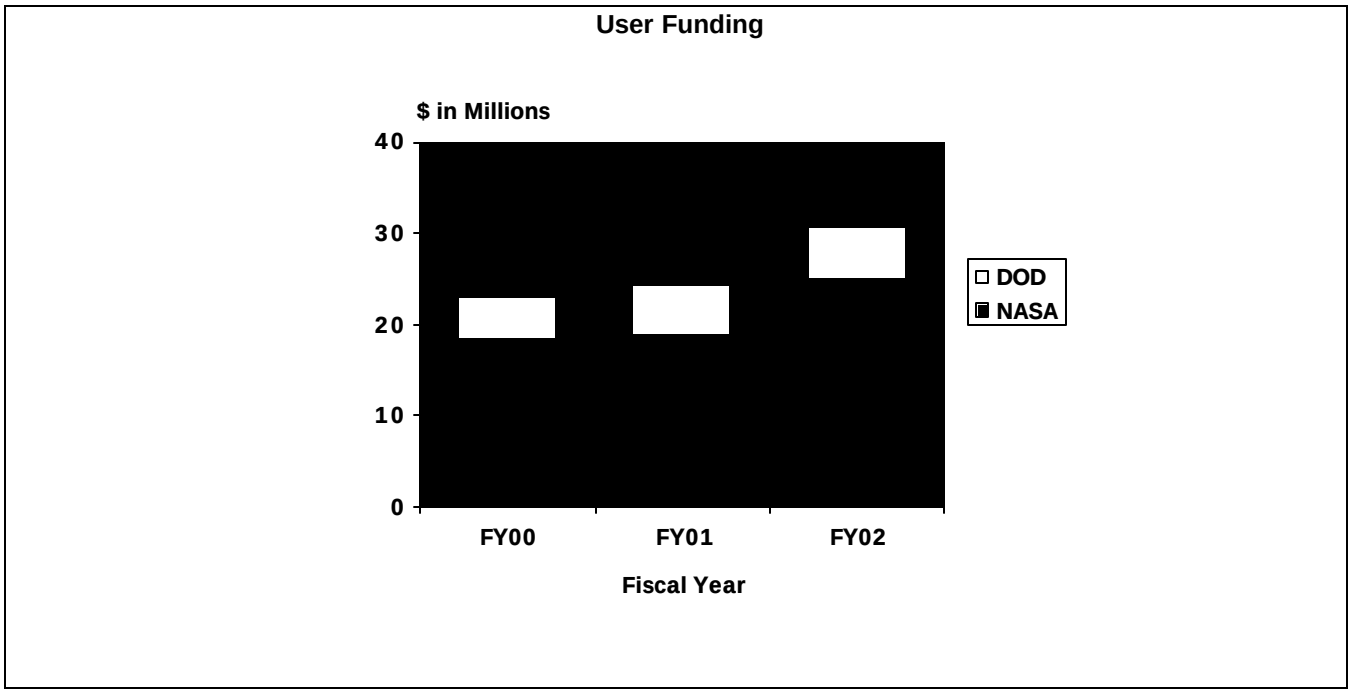
Funding Profile

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
Advanced Radioisotope Power Systems					
Advanced Radioisotope Power Systems	29,295	32,200	-406	31,794	29,094
Total, Advanced Radioisotope Power Systems	29,295	32,200	-406 [a]	31,794	29,094

The DOE funding requested for this program is used primarily to sustain the unique program and facility infrastructure that is essential for the Department to be able to develop and provide radioisotope power systems to the user agencies; however, the user agencies provide to DOE the funding for mission specific development and hardware fabrication. DOE manages the combined effort and develops and provides the power systems to the user agencies for specific missions. Currently, as shown below, NASA is projected to provide $25 million in FY 2002 and DOD will provide $5.7 million.

[a] Includes $71,000 for FY 2001 rescission and $336,000 comparability adjustment for the transfer of safeguards and security.



Funding by Site

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	0	10	10	0	0.0%
Los Alamos National Laboratory	10,288	10,435	10,400	-35	-0.3%
Sandia National Laboratory	0	450	175	-275	-61.1%
Total, Albuquerque Operations Office	10,288	10,895	10,585	-310	-2.8%
Chicago Operations Office					
Argonne National Laboratory	0	350	200	-150	-42.9%
Brookhaven National Laboratory	0	100	0	-100	-100.0%
Total, Chicago Operations Office	0	450	200	-250	-55.6%
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory	235	555	400	-155	-27.9%
Total, Idaho Operations Office	235	555	400	-155	-27.9%
Oakland Operations Office					
Oakland Operations Office	3,647	2,590	2,300	-290	-11.2%
Total, Oakland Operations Office	3,647	2,590	2,300	-290	-11.2%
Ohio Operations Office					
Mound Plant	7,400	6,800	6,000	-800	-11.8%
Total, Ohio Operations Office	7,400	6,800	6,000	-800	-11.8%

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Oak Ridge Operations Office					
Oak Ridge National Laboratory	4,825	5,910	5,310	-600	-10.2%
Total, Oak Ridge Operations Office	4,825	5,910	5,310	-600	-10.2%
Savannah River Site	800	715	700	-15	-2.1%
Washington Headquarters	2,100	3,879	3,599	-280	-7.2%
All Other Sites	0	0	0	0	
Total, Advanced Radioisotope Power Systems	29,295	31,794	29,094	-2,700	-8.5%

Site Descriptions

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 are being expanded to include establishing a Pu-238 scrap recovery capability to recycle Pu-238 scrap for use in future missions. LANL technical expertise is also used in analyzing the reactor core aspects of fission power concepts that may be required to satisfy future higher power space applications.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. SNL has unique analytical and testing capability used to evaluate radioisotope power system response during hypothetical launch accidents. These capabilities are used on an as required basis to support preparation of Safety Analysis Reports. Sandia technical expertise is also used in defining overall system concepts involving space fission energy systems that may be required to satisfy higher power space applications.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is an extensive research and engineering complex that has focused on some of the most advanced energy research in the world since 1949. In recent years, in addition to continued operation of complex nuclear and non-nuclear facilities, the INEEL has initiated technology development in applied environmental science and engineering. The technical expertise at INEEL is being used to identify potential system concepts for multi-megawatt space fission energy systems that might be required in the future and to assist in assessing and evaluating the ground testing implications that would be associated with potential future space fission power or propulsion systems. The Advanced Test Reactor (ATR) was also identified in the ROD as the primary irradiation facility for irradiating the Np-237 targets that would be used in the domestic production of Pu-238.

Mound Plant

The Mound Plant is located in southwest Ohio adjacent to the city of Miamisburg. Previously, the main mission of the Mound 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 site to the Office of Environmental Management for cleanup

and transition of the facilities and properties to commercial operations. Only the facilities used to assemble and test radioisotope power systems used for NASA space exploration missions and national security applications would remain in use by DOE Programs. During FY 1999, the Secretary of Energy instructed the program to conduct a study on whether to consolidate and maintain the radioisotope power system assembly and test capability as a stand-alone operation at the Mound site or transfer the operation to another Department site. After detailed analysis, the Department found that operations could be safely and cost-effectively conducted at Mound, and that it would cost more to relocate the operation to another site than to retain them at the Mound site. On March 22, 1999, the Secretary announced that program operations would remain at Mound. Mound is preparing the assembly and test and associated facilities for stand-alone operations.

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. The 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 and national security applications. 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.

ORNL has also been selected as the site for doing the target assembly and the processing of irradiated targets associated with establishing a domestic Pu-238 production capability. Some of these targets may be irradiated at the High Flux Isotope Reactor (HFIR) located at ORNL. However, most of the targets will be shipped to the Advanced Test Reactor in Idaho for irradiation. Although implementation of this decision will be deferred to FY 2003, ORNL continues to develop target fabrication and processing requirements that will be needed for Pu-238 production. Technical reactor expertise at ORNL will also be used 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.

Savannah River Site

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

All Other Sites

Included within this overall category are the commercial contract activities funded through headquarters and the various operations offices as well as minor activities at other sites not listed above. These commercial contract activities involve efforts in developing radioisotope power systems for national security missions and safety analyses for the use of radioisotope power systems in space applications.

Advanced Radioisotope Power Systems

Mission Supporting Goals and Objectives

Future NASA and national security missions will continue to use radioisotope power systems. NASA has requested that the Department be prepared to support several space exploration missions over the next decade. These missions include a Europa Orbiter mission that is targeted for launch in 2007/2008 and a Pluto/Kuiper Express mission that was initially targeted for 2004 but whose status and schedule is currently under review. Another mission that could require radioisotope power systems is the Solar Probe mission that was targeted for launch in 2007. In addition, the recent failure of two Mars missions has resulted in NASA revising its Mars mission planning to include the use of radioisotope power systems. Current projections include the use of radioisotope power systems on both the Mars Rover mission targeted for as early as 2007 and the Mars Sample Return mission targeted for as early as 2011. DOE will also provide radioisotope heater units (RHUs) for these missions and earlier NASA Mars lander missions. A new national security mission is also underway which will require delivery of several radioisotope power systems over the next decade.

With NASA's current emphasis on smaller and less expensive spacecraft, the Department has been pursuing the development of an advanced power system that is more efficient, lighter weight, and uses less plutonium-238 fuel. Efforts were initially focused on developing a new technology called Alkali-Metal Thermal to Electric Conversion (AMTEC). This was a very advanced high risk technology that offered significant reductions in mass. However, the technical challenges did not allow this technology to be developed on a schedule to meet the projected launch dates. Therefore, the development emphasis has shifted to a dynamic Stirling Radioisotope Power System (SRPS) that offers the potential for conversion efficiencies in excess of 20% as contrasted with the 7% available with the existing Radioisotope Thermoelectric Generators (RTGs) that have been used in all previous missions.

In FY 2000, the Department competitively contracted for several potential system integration contractors to develop a conceptual design of a Stirling power system. In FY 2001, one of these contractors will be selected to proceed with the development and demonstration of a flight-ready radioisotope power system for potential use on future missions, e.g. the Europa Orbiter, Solar Probe or Mars Rover missions. In FY 2002 a preliminary design of a Stirling flight system will be completed and efforts will continue to conduct safety and environmental analysis in support of NASA's Environmental Impact Statement (EIS) process for specific NASA space missions.

Until the development of the Stirling power system has made sufficient progress to reasonably assure its success, existing spare RTG flight systems from earlier missions may be considered for use on some of the projected missions. The spare RTG (F-5) from Galileo, Ulysses and Cassini missions may be tested and re-qualified during FY 2001 and FY 2002 for potential use on the Pluto/Kuiper Express or Europa Orbiter missions. An additional RTG may also be fabricated from existing spare components that were built but not assembled during the Cassini program. This RTG may also be used on either the Pluto/Kuiper Express or Europa Orbiter missions.

As an expansion of ongoing national security applications, the Department is developing a new thermoelectric generator. This new generator will use a more efficient thermoelectric element specifically designed for mission environments. The higher efficiency allows the power requirements to met with minimum weight and less Pu-238 fuel. In FY 2002 the program will continue long-term testing of the improved thermoelectric element, proceed with fabrication of an engineering unit of the new RTG, and continue development of the safety test data and safety analyses.

The Department is also supporting NASA in the potential use of Radioisotope Heater Units (RHUs) on planned Mars lander missions. The near-term emphasis was on the first mission originally scheduled for 2001. In FY 2000, the Department supported preparation of the environmental documentation for this mission. However, NASA is re-planning the Mars exploration missions with the first lander mission potentially using RHU's tentatively scheduled for 2003. In 2001 and 2002, the Department will support NASA's environmental documentation and planning for the missions and proceed to prepare Safety Analysis Reports for launch approval.

As the Department responds to these near-term planned missions, it must maximize the use of the existing finite inventory of Plutonium-238 (Pu-238) that is the basic building block of these systems. A new Pu-238 scrap recovery line will be completed and brought to full-scale operation at Los Alamos National Laboratory and scrap or waste material or material that was used in test programs or did not initially meet specifications will be recycled to be used again. In FY 2002, scrap recovery operations will be used to begin processing Pu-238 scrap for reuse in ongoing and future missions.

In the longer term, a key issue facing the program is assuring that there is a long term supply of the Pu-238 isotope. Most of the current inventory of Pu-238 was produced in the reactors and processing facilities at Savannah River. However, the facilities used to produce the material are either shutdown or being phased out. A sufficient inventory of Pu-238 exists for the foreseeable national security missions. However, the currently planned space missions will exhaust the portion of the inventory set aside for these applications by the middle of the decade. Unless an assured supply is established, the ability to support future space missions will be lost. Therefore, the Department evaluated the potential for reestablishing a domestic Pu-238 production capability to produce this non-weapons form of plutonium as part of a Nuclear Infrastructure Programmatic Environmental Impact Statement (PEIS) that was recently completed. The PEIS also evaluated the option to purchase Pu-238 from Russia under an existing contract set to expire in 2002. In order for this option to remain viable, a contract extension would have to be negotiated for purchases beyond 2002.

The Record of Decision (ROD) for this PEIS was issued in early 2001. The ROD calls for the Department to reestablish a domestic capability to produce Pu-238 for future space missions. It also allows for interim purchases from Russia, if required, to meet near term space missions before the new domestic production capability is operational. The budget request for FY 2002 includes initial funding to begin preliminary planning for the implementation of this decision to reestablish a domestic production capability. Limited funding is also included for the continuation of prototypical target demonstrations in the Advanced Test Reactor and the continued development of conceptual designs for the ORNL target fabrication and processing facility.

Many future space exploratory activities, particularly aggressive research on planetary bodies and human exploration, will require nuclear fission energy technology to provide sufficient power to support mission equipment and activities. The Department, in close cooperation with NASA, will continue evaluation activities in FY 2002 that are directed at special purpose fission technologies. The Department's unique nuclear technology expertise is required to plan, lead, and implement a comprehensive assessment of the technologies the United States will need to carry out its program of space exploration in the 21st Century. This assessment, carried out as a part of the Department's broad nuclear technology R&D charter (as recommended by the Nuclear Energy Research Advisory Committee), requires an intimate understanding of the Department's technical capabilities, available research facilities, and the state of nuclear technology. The initial phase of this technology assessment for civilian space exploration area is to be completed in FY 2001. The FY 2002 effort will focus on refining selected concepts and on evaluating programmatic factors associated with these concepts, including safety, cost, and schedule associated with potential development and delivery of these concepts. This activity will continue to be conducted as part of an interagency effort focused on assessing needs and requirements for special purpose fission systems for potential future applications.

As previously stated, a major part of the Department's efforts in the Advanced Radioisotope Power System program is to sustain the program and facility infrastructure that enables the Department to produce and deliver radioisotope power systems. The facility infrastructure for producing these power systems has been consolidated over the past few years to the three main operations described below. In addition, general program support efforts are conducted in new materials, heat source configurations or conversion technologies to improve the overall operation of the infrastructure and to enhance the performance and safety of the radioisotope power systems.

 # Iridium and Carbon Heat Source Component Fabrication Facilities at Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) has developed the unique capability of fabricating carbon insulators and iridium cladding used to encapsulate and contain the Pu-238 fuel pellets. These sophisticated heat source components are necessary for the safe operation of the radioisotope heat source during normal operation and in the event of launch, reentry or other deployment accidents. The Department maintains its capabilities in this area through small scale production campaigns of these components for upcoming space missions and national security applications. Advanced fabrication processes are being developed to improve the performance and to reduce the cost of fabricating these components. The material properties of these components are characterized for input to mission safety analyses for the launch or deployment approval process. ORNL also performs materials testing and precious metal iridium inventory management to support the program's activities at other sites.

 # Plutonium-238 Processing and Encapsulation Facilities in the Technical Area-55 Complex at Los Alamos National Laboratory

The Department maintains a dedicated Pu-238 processing facility within the Plutonium Facility-4 at Technical Area-55 at the Los Alamos National Laboratory (LANL). This is the only facility in the United States that can perform these operations. LANL receives the Pu-238 oxide powder, performs incoming inspections, processes the powder through a complex set of operations to a pellet form, encapsulates the pellets in iridium cladding fabricated at ORNL, performs final inspection, and ships the encapsulated pellets to Mound for assembly into heat sources. The Department maintains these operations through small-scale fabrication campaigns of encapsulated pellets for use in upcoming missions. LANL maintains the Pu-238 inventory for the Department and is establishing a Pu-238 scrap recovery line to recycle scrap Pu-238 for reuse in future programs. To minimize waste disposal costs, a new process is also being developed to recover Pu-238 from process wastes and dispose of the remaining byproducts. LANL conducts safety and qualification tests on Pu-238 heat source components and also fuels and assembles radioisotope heater units used on NASA space missions.

An important element of maintaining the operational readiness of these facilities is the repair and upgrading of equipment. Over the past several years, LANL has been replacing equipment and glove boxes that have reached their useful lifetimes as a result of the Pu-238 processing campaign required for the Cassini mission. This glove box replacement program and equipment maintenance and upgrade will be accelerated in FY 2002.

 # Heat Source and Power System Assembly and Testing Facilities at the Mound Site

The Department maintains and operates facilities at the Mound site for heat source and power system assembly and testing. These operations are being consolidated into a small stand alone operation that will continue after the rest of the site is deactivated and made available for commercial use. Support services such as electrical power, water, heating are being severed from the rest of the site. These actions have already resulted in an overall reduction in the heat source assembly and testing costs at Mound of nearly $2 million per year. As part of this consolidation effort, a new administrative building will be completed in FY 2001.

The encapsulated Pu-238 fuel that is received from LANL is assembled into heat sources and then these heat sources are inserted into the converters that are provided by the industrial system integration contractors. The generators are then acceptance tested and shipped to the launch or user site. Shipment is accomplished using the special shipping trailers developed for the program and which are maintained by Mound. Mound also stores and maintains spare RTGs and components from previous programs. For example, the F-5 spare from the Galileo, Ulysses, and Cassini missions is maintained in monitored storage. This unit may be retested and re-qualified in FY 2002 for possible use in future missions. Mound also fabricates components for heater units which are fueled and assembled at LANL.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Radioisotope Power Systems	22,935	22,734	21,834	-900	-4.0%
Special Applications	1,400	2,000	2,000	0	0.0%
Special Purpose Fission Technology	0	2,000	1,000	-1,000	-0.5%
Plutonium-238 Acquisition and Processing	4,960	4,900	4,100	-800	-16.3%
SBIR/STTR	0	160	160	0	0.0%
Total, Advanced Radioisotope Power Systems	29,295	31,794	29,094	-2,700	-8.5%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Radioisotope Power Systems	**22,935**	**22,734**	**21,834**

Provides support for maintaining the program and facility operations and capabilities to provide radioisotope power systems for current and future space and national security missions including the radioisotope power system assembly and testing facilities at the Mound site and preparing for stand-alone operation of the facilities; the Pu-238 processing and encapsulation operations at LANL; and iridium clad vent set fabrication operations at ORNL. Support is also provided to the program to maintain casks to ship Pu-238; to perform safety analyses and testing to support the environmental documentation and launch approval process; and to investigate advanced materials, heat source technologies, and converter concepts and power systems for potential applicability and use in future missions. In addition to maintaining the basic infrastructure, an FY 2001 performance measure is to competitively select a system integration contractor to develop a flight qualified Stirling Radioisotope Power System for potential use on future space exploration missions. Performance will be measured in FY 2002 by continuing to maintain the infrastructure and by completing the preliminary design of a Stirling Radioisotope Power System suitable to be flight qualified for space exploration missions.

		FY 2000	FY 2001	FY 2002
#	**Maintain Iridium and Carbon Heat Source Component Operations at ORNL**	**3,500**	**3,585**	**3,500**

In FY 2000, completed qualification runs for the improved iridium production. In FY 2001, fabricate the first flight quality components using the new process. In FY 2002, continue production of flight quality components for future missions. The FY 2002 funding decrease of $85,000 reflects reduced fabrication costs using the new process.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
# **Maintain Pu-238 Processing and Encapsulation Operations at LANL**	**5,988**	**6,300**	**6,750**

Continue repair, upgrade, and maintenance of Pu-238 glove boxes and equipment. In FY 2001, pelletize and encapsulate Pu-238 purchased from Russia for qualification testing. Also, in FY 2001 initiate encapsulation activities for testing of heat source components fueled with Pu-238 for the improved RTG for the new national security mission. In FY 2002, complete qualification testing of Russian Pu-238 and continue testing of heat source components for the improved RTG, move and consolidate Pu-238 chemical and isotopic analyses capability within TA-55 complex in close proximity to processing lines, and accelerate replacement of glove boxes. The FY 2002 funding increase of $450,000 is to consolidate Pu-238 chemical and isotopic analyses within close proximity of processing lines at TA-55 and to accelerate replacement of glove boxes.

# **Maintain and Operate Mound Facilities and Maintain Shipping Casks**	**5,600**	**6,200**	**5,600**

In FY 2001, continue preparation of assembly and testing operations for NASA space missions and new national security mission, and fabricate heat source components for the safety test program for the new national security mission. In FY 2002, complete qualification of the F-5 RTG for possible use on future space missions, i.e. the Pluto/Kuiper Express or Europa Orbiter missions. The FY 2002 funding decrease of $600,000 reflects completion of several consolidation activities associated with the establishment of a stand-alone facility that will be compatible with the surrounding industrial park.

# **Safety Analyses, Testing and Launch Approval Support . .**	**3,125**	**3,480**	**3,480**

Perform safety model development and analyses, review safety analyses reports, conduct performance and safety testing of advanced concepts, prepare environmental documentation, perform safety analyses and prepare safety analyses reports for shipping casks, maintain and certify shipping casks and conduct special studies. In FY 2001, provide analyses to support the environmental documentation for use of RHUs on the Mars 03 spacecraft. In 2002, perform safety analysis to support preparation of the Final Safety Analysis Report for the Mars 03 mission, support emergency response planning for the Mars 03 launch, and support the environmental documentation for the potential use of RTGs for the Pluto/Kuiper Express and Europa Orbiter missions initially targeted for launch in 2004 to 2006 but whose schedules are currently under review.

# **Power System and Heat Source Improvement Support . . .**	**2,222**	**1,669**	**1,204**

Identify and implement power system enhancements, including improvements in the design, materials selection, fabrication, processing and shipping to increase power, efficiency, and reliability or reduce weight and costs covering a range of systems and power levels. In FY 2001, demonstrate a milliwatt generator compatible with using a RHU as a heat source. In FY 2002, the decrease of $465,000 will result from termination of contract efforts related to development of the Alkali Metal Thermal to Electric Conversion technology.

# Plutonium Fuel Form Facility (PuFF)	**700**	**700**	**700**

(dollars in thousands)

FY 2000	FY 2001	FY 2002

Maintain PuFF facility in a safe shutdown mode.

# **General Plant Project**	**1,300**	**200**	**0**

General plant project (GPP) funding to build an administrative facility and to make facility upgrades at Mound as part of the Secretary's decision to consolidate program activities for stand-alone operations at that site. The decrease of $200,000 in FY 2002 funding reflects completion of the administrative building.

# **Capital Equipment**	**500**	**600**	**600**

Capital equipment funding for routine equipment replacement at ORNL, LANL, and Mound and for developing, assembling and testing new power systems being developed. FY 2002 capital funding will focus on replacing old worn out glove boxes at LANL and on purchasing equipment to consolidate the Pu-238 chemical and isotopic analyses within the TA-55 complex at LANL.

Special Applications	**1,400**	**2,000**	**2,000**

Satisfy user requirements to support the ongoing and new national security programs. In FY 2000, initiate the safety test program to support heat source safety analyses for the improved RTG. In FY 2001 and FY 2002, continue long-term testing to support the heat source design, safety analyses, and preparation of safety analysis reports.

Special Purpose Fission Technology	**0**	**2,000**	**1,000**

During FY 2001, performance will be measured by completing initial assessment of space fission concepts, including concept definition and independent review activities. In FY 2002, performance will be measured by refining the technical assessment of selected concepts and focusing on programmatic requirements associated with the potential engineering development effort for at least one reference concept. The decrease in FY 2002 funding results from deferring the initiation of technology development efforts that would support the reference concept(s).

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Plutonium-238 Acquisition and Processing	**4,960**	**4,900**	**4,100**

Develop Pu-238 scrap and waste recovery and disposal capabilities at Los Alamos National Laboratory for reuse of Pu-238 for future national security and NASA space missions and execute the Record of Decision signed into effect in January 2001 to reestablish a domestic Pu-238 production capability to meet the radioisotope power systems requirements of future NASA space missions.

In FY 2001, the performance measure is to complete installation of the full-scale Pu-238 scrap recovery line. In FY 2002, performance will be measured by bringing the full-scale scrap recovery line to full operation and beginning to process Pu-238 scrap material that will be required for future missions.

# **Pu-238 Scrap and Waste Recovery (Operations) . . . . . .**	**3,200**	**3,000**	**3,000**

In FY 2001, the full-scale scrap recovery line will be installed to process Pu-238 scrap for use in radioisotope power systems for planned national security and NASA missions. In FY 2002, the full-scale Pu-238 scrap recovery line will be brought into full operation and processing of Pu-238 will be initiated using the new scrap recovery line.

# **Pu-238 Scrap and Waste Recovery (Capital Equipment) . .**	**300**	**300**	**0**

Capital equipment funding for developing scrap recovery and waste recovery lines at LANL. The FY 2002 decrease of $300,000 reflects completion of installing the full-scale Pu-238 scrap recovery line.

# **Domestic Pu-238 Production . . . . . .**	**1,460**	**1,600**	**1,100**

In FY 2000 and FY 2001, efforts were focused on maintaining the option for reestablishing a domestic supply while a NEPA review was being conducted. These activities included conceptual design studies of processing and storage facilities and lab-scale target development and irradiation testing. A Record of Decision was signed in January 2001, directing the reestablishment of a domestic production capability to produce 2 to 5 kilograms per year. FY 2002 activities will be directed at developing preliminary plans for implementing this Record of Decision, including planning for the transportation of the Department's Neptunium-237 inventory from the Savannah River Site to ORNL, development of conceptual designs for the target fabrication and processing facility at ORNL, and prototype target demonstrations at the Advanced Test Reactor at INEEL. Full-scale implementation of the ROD will be deferred to FY 2003. The decrease of $500,000 in FY 2002 funding is related to the deferral of post irradiation examination of targets that were irradiated in the Advanced Test Reactor and the High Flux Isotope Reactor.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Small Business Innovative Research and Small Business Technology Transfer Programs	**0**	**160**	**160**

Small Business Innovative Research and Small Business Technology Transfer Programs.

Total, Advanced Radioisotope Power Systems	**29,295**	**31,794**	**29,094**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Radioisotope Power Systems	
# Maintain Iridium and Carbon Heat Source Component Operations at ORNL: A $85,000 decrease reflects reduced fabrication costs using a new process.	-85
# Maintain Pu-238 Processing and Encapsulation Operations at LANL: A $450,000 increase is necessary to accelerate the replacement of glove boxes and to consolidate Pu-238 chemical and isotopic analysis in building TA-55	+450
# Maintain and Operate Mound Facilities and Maintain Shipping Casks: A $600,000 decrease reflects completion of several consolidation activities associated with the establishment of a stand-alone operation at Mound.	-600
# General Plant Project: A decrease of $200,000 in GPP at Mound is related to completion of the administrative facility.	-200
# Power system and Heat Source Improvement Support: A decrease of $465,000 is associated with the termination of development of the AMTEC technology	-465
Plutonium-238 Acquisition and Processing	
# Pu-238 Scrap and Waste Recovery (Capital Equipment) at LANL: A $300,000 decrease in capital equipment reflects completion of installing the full-scale Pu-238 scrap recovery line	-300
# Domestic Pu-238 Production: A decrease of $500,000 reflects the deferral of post irradiation examination of targets irradiated in the Advanced Test Reactor and the High Flux Isotope Reactor.	-500
Special Purpose Fission Technology	
# A decrease of $1,000,000 reflects deferring the initiation of technology efforts that would support the development of selected reference concepts for space fission power systems.	-1,000
Total Funding Change, Advanced Radioisotope Power Systems	-2,700

Capital Operating Expenses & Construction Summary
Capital Operating Expenses

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Capital Equipment	800	900	600	-300	-33.3%
General Plant Projects	1,300	200	0	-200	-100.0%
Total, Capital Operating Expenses	2,100	1,100	600	-500	-45.5%

Medical Isotope Program

Program Mission

The mission of the Office of Nuclear Energy, Science and Technology's (NE), Office of Isotopes for Medicine and Science (Medical Isotope Program) is to serve the national need for a reliable supply of isotope products, services, and related technology used in medicine, industry, and research and support advanced research exploring the use of isotopes to advance medical technology. This mission applies the unique expertise and capabilities of the Department to address technology issues associated with the production, handling, and use of isotopes.

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. Also, a substantial national and international infrastructure has been built around the use of isotopes. Currently, more than 12 million nuclear medicine procedures are performed each year in the United States, and it is estimated that one in every three hospitalized patients has a nuclear medicine procedure performed in the management of his or her illness. 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.

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

The ANMI was established in response to repeated suggestions made by nuclear medicine experts inside and outside the Federal government. This initiative supports U.S. broad-based research in nuclear medicine-based diagnosis and therapy (including use of alpha emitters). The ANMI partially fills an important national need not previously covered by the National Institutes of Health and other programs. It builds upon the Department's current programs and activities and takes advantage of its unique facilities and laboratory capabilities to apply advanced nuclear technologies to the challenge of curing cancer and other life-threatening illnesses. In addition, the ANMI support the development of science and technology programs at U.S. universities and colleges to address the critical need to train experts in fields relevant to nuclear medicine such as radio chemistry and radiopharmaceutical. The ANMI uses a peer-review process in which members of the Nuclear Energy Research Advisory Committee (NERAC) and other prominent experts judge the scientific merits of projects proposed by universities, hospitals, and the national laboratories for funding. The first solicitation of applications under the ANMI was made in FY 2000, the first year that the ANMI has been funded. In response, 64 applications for assistance have been received from a wide range of research institutions. Given

the limited funding available, nine research grants were made in September, 2000 to the Garden State Cancer Center, Oak Ridge National Laboratory, Regents of the University of Michigan, University of Chicago, University of California Davis, University of Washington, Westinghouse Electric Company LLC, and two awards to the Curators of the University of Missouri. The five educational grants to support nuclear medicine disciplines at universities and colleges were made in March 2001 to Washington University, Purdue University, University of New Mexico Health Sciences, Regents of the University of Wisconsin System, and Washington State University.

The Department has also placed special emphasis on the production and application of alpha-emitting isotopes, which are the subjects of important research in several medical research centers across the United States. When linked to monoclonal antibodies or other biological agents, these isotopes have been demonstrated to destroy cancer cells with minimal damage to surrounding tissue. It is expected that expanded human clinical trials, based on early successes, will substantially increase the demand for these isotopes over the next several years. The Department will need to make investments to increase its production capability.

The Department relies on outside, independent experts to guide many aspects of the program. In determining which isotopes to produce and what research to support, the Department has engaged the Nuclear Energy Research Advisory Committee (NERAC) as an active partner. This partnership began to take shape in September, 1998, when a panel of recognized experts in the medical isotope community issued a report entitled *Forecast Future Demand for Medical Isotopes*. This report was prepared for and endorsed by the NERAC and it projects a significant annual demand growth for isotopes produced by the Medical Isotope Program and encourages a more extensive collaborative effort between the Isotope Programs and the National Institutes of Health in the areas of basic medical isotope research. More recently, in May 2000, Nuclear Energy Research Advisory Committee (NERAC) issued a report entitled, " Isotope Research and Production Planning" which recommends that the Department make new investments in its production infrastructure–with a primary focus on research isotopes rather than commercial isotopes–and increase support for academic training programs and for the Advanced Nuclear Medicine Initiative.

The Medical Isotope Program, which operates under a revolving fund as established by the FY 1990 Energy and Water Appropriations Act (Public Law 101-101), maintains its financial viability by utilizing a combination of Congressional appropriations and revenues from the sale of isotopes and services. It is important to note that unlike most Federal programs, the isotope program operates with a revolving fund and operates like a business. Unobligated or uncosted balances that include customer advances and revenues generated by isotope sales serve as "working capital" and will increase or decrease monthly depending on sales, timing of cash collections, production efficiencies, and availability of facilities. A working capital balance of about $5 million is needed to enable the program to continue to fill customer orders in a reliable fashion on a year-round basis. Moreover, working capital will enable the Program to maintain production capability and equipment purchases, thus avoiding delays or interruptions to research and clinical trials for new medical treatments. Without this working capital fund, the Department would require significantly higher appropriations to meet the isotope needs of U.S. researchers, hospitals, and other users.

Over the last several years, the program has emphasized the privatization of commercially-viable isotope activities by offering to sell or lease existing facilities, equipment, and material for commercial purposes or through the licensing of new patent technologies. Privatization of commercially viable isotopes, although successful, has placed additional pressure on the program's working capital. Commercial product revenues, which contributed to the infrastructure fixed cost, are no longer available. Both the Expert Panel and NERAC Subcommittee reports observed that Federal appropriations have not permitted the Department's isotope supply to adequately keep pace with the changing needs of the research community. As a result, the infrastructure that enables the Department to provide vital isotopes to the nation's researchers is under great financial strain. In response, the program is continuing to streamline its capability. However, in order to maintain a core competency of research and production staff and facilities for the production of research isotopes, the program is becoming more reliant on appropriations.

To that end, the Department will have to make capital investments in new, replaced, or enhanced processing equipment and infrastructure to improve production and processing of isotopes to meet current and anticipated future increases in demand. For example, hot cell facilities and associated equipment are the cornerstone for isotope processing. Repairs, refurbishment, and upgrades are a continuous requirement for the maintenance of efficient and safe hot cells. The oil-shielded window in cell C, building 3047, at ORNL has become discolored and has developed noticeable leakage. The window will need to be removed, refurbished, and reinstalled. A second item, the alpha hot cell will also have to be modified to include a gaseous hold/trap to permit radon-220, a radioactive gas in the uranium decay chain, from escaping the facility and the addition of significantly more shielding. Some equipment needs include; the installation of a Kollmorgan periscope, a magnification device used in processing to visually and accurately measure and count small isotope products; the repair or replacement of manipulators; and the purchase and licensing of a Type B container for transporting irradiated targets for processing. These are few examples of facility needs that have been deferred and are urgently needed to avoid production interruptions or delays in the supply of medical and research isotopes. Unless these repairs are made, the Department will soon lose irreplaceable parts of its isotope production infrastructure.

The Department has taken early steps to address these facility issues and to support nuclear medicine research. An example of such investment is the Isotope Production Facility (IPF), a new production capability at the Los Alamos Neutron Science Center that will enable almost year-round production of accelerator isotopes many that are not typically available elsewhere. These medical isotopes will provide for the continuation of human clinical trials and future advancement of nuclear medicine applications. A conceptual design has been developed for a dedicated isotope production 70 MeV cyclotron at Brookhaven National Laboratory. Together with the IPF at Los Alamos, this accelerator could supply the projected need for short-lived accelerator-produced isotopes for the next twenty years. These actions are responsive to some of the most important recommendations made by the NERAC Subcommittee.

Another key initiative of the Medical Isotope Program is the processing and extraction of alpha-emitting isotopes from residual uranium materials stored at the Oak Ridge National Laboratory. Researchers throughout the United States are assessing alpha-emitting radioisotopes that can destroy cancer cells and reduce tumors. Alpha-emitters such as Bismuth-213 have been demonstrated to be successful for cancer

therapy. In an effort to meet increased demand to support human clinical trials, the Department is expanding its processing to achieve a 30% increase in supply over the next year. For the long term, the Department plans to double the supply of Bismuth-213 by 2002. However, this will require installation of a new processing line at ORNL. As additional supply is made available, researchers will increase human clinical trials and develop treatments for other serious cancers including cancer of the pancreas, kidneys and other organs.

DOE Strategic Objective

Science 3 - Explore matter and energy as elementary building blocks from atoms to like, expanding our knowledge of the most fundamental laws of nature spanning scales from the infinitesimally small to the infinitely large.

FY 2002 Program Strategy

The Department will develop new or improved isotope products and services that enable medical diagnoses and therapy and other applications that are in the national interest, and encourage private sector investment in new isotope production ventures and sell or lease facilities and inventories for commercial purposes.

Program Goals

- In collaboration with other Federal Agencies and Advisory Committees, develop new isotopes and isotope application technology to meet future national needs.
- Provide a reliable supply of quality products and services based on customers' needs.
- Support nuclear medicine research and development.

Program Objectives

- Work with stakeholders, customers, and advisory groups to identify and develop new applications utilizing isotope products and technologies.
- Support and encourage advanced research applying research isotopes produced by the Department.
- Invest in new product processes and application development initiatives.
- Continue to improve product quality and services and enhance customer satisfaction.
- Ensure that environmental safety, health, and transportation safeguards requirements are met in the conduct of Isotope Programs site activities.

Achieve maximum private sector involvement in isotope activities by identifying those with privatization potential and then assisting the private sector in privatizing those that are commercially viable.

Significant Accomplishments and Program Shifts

Continue to serve at least 250 commercial and research customers 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 research reactors or large accelerators, or where non-Federal production capacity is insufficient to meet U.S. needs.

Establish in FY 2001 an Isotope Review Advisory Panel as recommended by the NERAC subcommittee to review and recommend production of isotopes of interest and preferred sites for production.

As a result of Los Alamos Neutron Science Center (LANSCE) management's decision to extend the accelerator operations and move the planned outage, construction of the shield wall (a critical activity) could not be competed, and because of reduced funding in FY 2000, a revision of the cost estimate for the same scope of work, and the Cerro Grande Fire, the Los Alamos Isotope Production Facility cannot be completed until FY 2003. The 99-E-201 Project Design and Construction Data Sheets provide a full explanation and revised cost and schedule. Once the facility is operational, production will be coordinated among the Department's facilities at Brookhaven National Laboratory (BNL), Los Alamos National Laboratory (LANL), the Tri-University Meson Physics Facility in Canada, and other collaborating institutions outside the United States to achieve year-round availability of these isotopes. Because of the importance of this project to U.S. medical research, the Department has decided to instruct LANL to subcontract additional portions of the construction project and will put in place an independent project management oversight expert who will report directly to Nuclear Energy on LANL's progress and potential problems that could impact completion of the IPF.

A Conceptual Design Report (CDR) 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 national resource for the education and training of future radio chemists and radio pharmaceutical scientists.

Substantially expand the availability of selected isotopes by operating the newly installed remote-controlled radioisotope separator at LANL. The separator was completed and cold-tested in the 1999-2000 time frame. Studies on separation of phosphorous isotopes will also be completed in FY 2001. Separation of a number of isotopes will greatly enhance the programs portfolio of isotopes. For example phosphorus-31/phosphorous-33 which are used as a cancer treatment, bone pain therapy, and as biological tracers in studying DNA.

Complete the iridium chemistry research in FY 2001 and start production in FY 2002 at HFIR for platinum-195m using iridium-193 targets. Platinum-195m is used in pharmacokinetic studies of anti-tumor

agents.

- Complete in FY 2001 the development of the liquid-liquid extraction process for the separation of radium-225 and actinium-225 from the stock of thorium-229. Researchers are assessing whether alpha-emitting isotopes can destroy cancer cells and reduce tumors, and demand for these isotopes is increasing. Phase one of this project is complete. Preliminary data indicates that the extraction process will shorten the production time by almost 50 percent resulting in higher yield of actinium-225 and lower processing cost.

- The calutrons at Oak Ridge National Laboratory (ORNL) can no longer produce and sell economic quantities of commercial stable isotopes. Foreign competitors sell stable isotopes below cost and there is a world-wide oversupply of electromagnetically separated stable isotopes. Unless there is private sector interest in operating the calutrons, the Department will no longer operate these machines. A large inventory of research isotopes exists at ORNL sufficient to serve research demand for at least four years. Transfer all stable isotope activities (IRML, IDO, and Chem Lab) out of Y-12 to X-10. This effort may be curtailed if some of the activities are privatized.

- Design by FY 2001, a stable isotope enrichment machine that will provide low-volume, enriched stable isotopes to researchers at affordable prices and at reduced operating cost.

- Rhenium-188, a beta-emitting isotope that is obtained using tungsten/rhenium generators, is showing great promise for treatment of cancer, bone pain relief, and prevention of coronary restenosis. Demand for this isotope is expected to increase substantially in the next year. In order to optimize tungsten-188/rhenium-188 production, the Department has developed a pressed metallic tungsten-186 target that greatly increased production yield. This will result in a decrease in production costs.

- Iodine-125 is an important isotope in the treatment of prostate cancer. The Annular Core Research Reactor (ACRR) at Sandia National Laboratories (SNL), New Mexico, has been converted from defense work to isotope production. The ACRR is well suited to produce iodine-125 and other isotopes. The reactor will also be used to produce other isotopes and service irradiations, but will remain on standby for mobilization in case of an interruption in the supply of molybdenum-99.

- Researchers throughout the United States are assessing alpha-emitting radioisotopes that can destroy cancer cells and reduce tumors. Alpha-emitters such as bismuth-213 have been demonstrated to be successful for cancer therapy. The Department will increase its support for production of these isotopes. Any large changes or increases in demand, due to success in pre-clinical trials, may require a change in production capability and additional resources.

- The Department has established cooperative supply agreements with facilities in Russia and South Africa, and Isotope Programs will seek additional cooperative supply agreements with other isotope manufacturers to assure that the U.S. has a reliable diverse supply of important isotopes.

Privatization of selected Isotope Programs activities will result in a decrease in both expenses and resources. As a result, the program is shifting its efforts to low volume, high cost research isotopes. The isotope program will continue to seek opportunities for the private sector to assume commercially attractive activities.

Funding Profile

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
Isotope Expenses					
Isotope Production	9,683	12,065	-532	11,533	11,033
Advanced Nuclear Medicine Initiative	2,500	2,500	0	2,500	2,500
Alpha Isotope Processing	0	900	0	900	1,000
Stable Isotope Enrichment Unit	0	300	0	300	0
Calutron Shutdown and Transfer of Inventory and Equipment	0	900	0	900	900
Research and Development	0	50	0	50	250
Construction	6,770	2,500	-6	2,494	2,494
Total Isotope Support	18,953	19,215	-538 [a]	18,677	18,177

All appropriations for the Isotope Support decision unit fund a payment into the Isotope Production and Distribution Fund as required by P.L. 101-101 and as modified by P.L. 103-316. Requested funding is required to maintain financial continuity of radioactive and stable isotope research, development, production, processing, distribution, and associated services to commercial and research customers. Funding will also be used to provide radioisotopes and enriched stable isotopes for research and development, medical diagnosis and therapy, isotope applications, and to support nuclear medicine research.

[a] Includes $41,000 for FY 2001 rescission and $497,000 comparability adjustment for the transfer of safeguards and security.

Funding by Site [a]

(dollars in thousands)

	FY2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Los Alamos National Laboratory	7,500	5,212	5,212	0	0.0%
Sandia National Laboratories	2,450	2,200	1,700	-500	-22.7%
Total, Albuquerque Operations Office	9,950	7,412	6,912	-500	-6.7%
Chicago Operations Office					
Brookhaven National Laboratory	2,100	2,900	2,900	0	0.0%
Oak Ridge Operations Office					
Oak Ridge National Laboratory	3,300	5,300	5,300	0	0.0%
Richland Operations Office					
Pacific Northwest National Laboratory	200	0	0	0	0.0%
All Other Sites	3,403	3,065	3,065	0	0.0%
Total, Isotope Support	18,953	18,677	18,177	-500	-2.7%

Site Descriptions

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a U.S. Department of Energy (the Department) scientific research laboratory located in New Mexico. The new 100 MeV Isotope Production Facility (IPF) at LANL will use the proton beam of the Los Alamos Neutron Science Center (LANSCE) Linear Accelerator. The IPF may operate up to 8 months per year in conjunction with other programs. This will be an increase in operating time of 20 weeks from FY 1999. The unique characteristics of the LANSCE accelerator include a high-energy, high-current beam that allows production of higher quality radioisotopes, as well as exotic radioisotopes that cannot be produced in other facilities. Three major products produced at the site are germanium-68, a calibration source for Positron Emission Tomography (PET) scanners; strontium-82, the parent of rubidium-82, used in cardiac PET imaging; and sodium-22, a positron-emitter used in neurologic research.

[a] Since Isotope Programs operates like a business, funding at isotope production sites can increase or decrease depending on demand, cash collections, production efficiencies, and availability of facilities.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a Department of Energy (the Department) scientific research laboratory located in New Mexico. SNL's Annular Core Research Reactor (ACRR) is a 2-megawatt, pool-type research reactor that is used to produce isotopes for medical applications. The ACRR is a highly flexible facility applied to the mission requirements of the Department in both isotope and national security applications. Because of limited operating funds the reactor will be placed in standby.

In addition, all major capital investments at the Hot Cell Facility and scheduled modifications of the ACRR for emergency production of molybdenum-99 have been completed. Molybdenum-99 is a precursor of technetium-99m, an isotope that is used in over 36,000 medical procedures per day in the United States to diagnose maladies such a cancer and heart disease. The Hot Cell Facility and portions of Chemical and Metallurgy Research Facility used for molybdenum-99 have been placed in a standby mode, pending privatization of the Department's molybdenum-99 production capability.

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 16 weeks per year and produces radioisotopes such as strontium-82, germanium-68, copper-67, and others that are used in medical diagnostic applications. BNL is also active in the development of new isotope processes and delivery systems. A Conceptual Design Report (CDR) 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 national resource for the education and training of future radio-
chemists and radiopharmaceutical scientists.

Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) is a U.S. Department of Energy scientific research laboratory located in Oak Ridge, Tennessee. The High Flux Isotope Reactor (HFIR) at ORNL provides one of the world's highest steady-state neutron fluxes. The reactor is normally scheduled to operate about 43 weeks per year to support primary missions other than isotope production. Isotope products made at this facility include: tungsten-188, rhenium-186, californium-252, and iridium-192. One target position, with hydraulic capability to simultaneously load and unload up to eight targets is available and is heavily used for medical radioisotope production. Additional peripheral target positions became available in the second half of FY 1999. The program depends heavily on HFIR for isotope production. The program also maintains the Hot Cell Facility, Building 3047, at ORNL to process and package its radioisotope. 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. Unless other options appear soon, in FY 2001 the calutrons will be shut down and transferred to the Department's Environmental Management Program for disposition. The FY 2002 request includes funding for this transition. All laboratory equipment and stable isotope inventories will be transferred to site area X-10 at Oak Ridge or to the private sector.

All Other Sites

This category includes providing direct assistance to universities or research institutions, or to the Department's laboratories yet to be determined for producing isotopes or related reviews or to fund isotope related research based on a peer-reviewed selection process.

Operating Expenses

Mission Supporting Goals and Objectives

The U.S. Department of Energy, through the Medical Isotope Program, provides radioactive and stable isotope products and associated services to a wide and varied domestic and international market. In addition, the Medical Isotope Program supports research by exploring the use of isotopes to advance medical technology through ANMI. Ultimate applications of isotope products include medical research and health care, industrial research and manufacturing, education, and national defense. The Medical Isotope Program mission is to serve the national need for a reliable supply of isotope products and services and related science and technology used in medicine, industry, and research. The Medical Isotope Program supports development of new or improved isotope products and services that enable medical diagnoses and therapy and other applications that are in the national interest. Prices charged for these products and services may not always achieve full-cost recovery to the Government. If private sector production becomes well established, the Department will no longer supply that particular isotope.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Operation Expenses	12,183	16,183	15,683	-500	-3.1%
Construction	6,770	2,494	2,494	0	0.0%
Total, Isotope Support	18,953	18,677	18,177	-500	-2.7%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Operating Expenses	**12,183**	**16,183**	**15,683**

This funding will serve the national need for a reliable supply of isotope products and services and related science and technology used in medicine, industry, and research. It will support development of new or improved isotope products and services that enable medical diagnoses and therapy and other applications that are in the national interest.

#	**Isotope Production**	**9,683**	**11,533**	**11,033**

This funding will enable the Medical Isotope Program to maintain essential capabilities at four sites, enabling the production, packaging, and distribution of radioactive and stable isotopes for about 20 major products and related services and processing of hundreds of forms and types of isotopes for medical and scientific research. This estimate was based on serving about 250 customers and over 700 deliveries. Supply quality stable and radioactive isotopes for industrial, research, and medical applications that meet customer specifications no less than 97 percent and maintain 95 percent on-time deliveries and respond to customer requests for information within 48 hours (performance measure). Also, hold three annual stakeholder meetings in conjunction with international and regional trade shows and professional conferences (performance measure). Consolidation and automation of radioisotopes business activities either at one Operating and Management Contractor or at a private organization by July 2001. The decrease of $500,000 is due to placing the Annular Core Research Reactor (ACRR) in standby mode.

#	**Alpha Emitting Isotopes**	**0**	**900**	**1,000**

(dollars in thousands)

FY 2000	FY 2001	FY 2002

Alpha-emitting radioisotopes are being demonstrated to be successful for cancer therapy. Specifically, bismuth-213 (a daughter radioisotope of Ac-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. Alpha emitting isotopes are in short supply and steps have been taken to increase supply. In FY 2001 upgrades to ORNL's alpha facility's capability to produce and distribute additional quantities of Ac-225 will be completed. This upgrade along with additional FY 2001 Th-229 extractions (Th-229 being the parent material for Ac-225) will permit the distribution of Ac-225 to increase by one-third by October 2001 (from 400 mCi of Ac-225 annually to approximately 550 mCi annually).

Plans for FY 2002 will include the support for additional Th-229 extractions (to permit the distribution of an additional 100-150 mCi/yr of Ac-225). This increase in Ac-225 supply will be required to support the initiation of Phase II human clinical trials. Additional FY 2002 efforts will be directed towards securing a cooperative effort relating to the production of radium-224 (a daughter of U-232). Radium-224 is the parent of Bi-212, another alpha-emitting radioisotope showing promise for cancer therapy. It is anticipated that in FY-2002 a Ra-224 production facility can be established that will provide quantities of Ra-224 suitable for both ongoing research and future clinical trials. The increase of $100,000 is needed to increase the processing of uranium material to obtain additional alpha-emitting isotopes needed for medical research and human clinical trials.

#	**Stable Isotope Enrichment Unit . . . . . .**	**0**	**300**	**0**

Design a stable isotope enrichment unit that will provide stable isotopes to researchers at affordable prices and will reduce the Government's cost to operate. The isotope enrichment device will be a small modular calutron or other device whose capacity could be altered in the future to meet increases in demand. The design activity will be completed in FY 2001. Total estimated cost for this activity is $4.5 million. The decrease of $300,000 is due to completing the design work for the stable isotope enrichment unit in FY 2001.

#	**Calutrons Shut Down . . . . . .**	**0**	**900**	**900**

Shut down calutrons and transfer to the Office of Environmental Management for final environmental cleanup and transfer of all stable isotope activities out of Y-12 to X-10. In FY 2001 the Record Disposition activities and Equipment Disposition activities in the building 9204-3 at Y-12 will be completed. Both activities are necessary as facility stabilization activities for the transfer of the ownership to EM in FY 2003. The Record Disposition activities will sort out documents currently stored in more than 100 file cabinets throughout the building to either discard or maintain. A site location at X-10 and a needs analysis and cost estimate for moving the material and chemical laboratory equipment will also be completed in FY 2002.

#	**Isotope Product and Process Improvement . . . . . .**	**0**	**50**	**250**

(dollars in thousands)

FY 2000	FY 2001	FY 2002

Conduct research to make new or existing isotope products more efficient, more cost effective, and enable the program to respond to the evolving needs of research customers. Making investments now will avoid future delays or interruption in the supply of isotope products. For example: develop a process for producing silicon-32 at BNL using cesium chloride targets. Si-32 is used in environmental studies and to improve efficiency of actinium-225 (an alpha emitting isotope) processing by 30% using a liquid-liquid process. In FY 2001 and FY 2002, invest in two new process development technologies each year, as requested by researchers, that enhance isotope production, services, and delivery application systems (performance measure). The increase of $200,000 will provide funding to invest in new products and process improvements which will result in new or improved isotope products or more efficient isotope production methods to continue to meet the growing needs of the medical and scientific community.

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
# **Advanced Nuclear Medicine Initiative . . . . . .**	**2,500**	**2,500**	**2,500**

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

- Encourage the training of individuals in nuclear medicine methods by establishing university scholarships and fellowships for nuclear medicine specialists and by sponsoring summer internships at appropriate institutions. In FY 2001, five educational grants were given to universities (performance measure);

- Initiate a focused program in the U.S. to support research applications, in particular alpha-emitting isotopes, to fight a spectrum of malignant diseases including most common cancers and infectious diseases such as meningitis. In FY 2000, nine research grants were given to universities and research institutions (performance measure).

In FY 2002, funding will provide for the continuation of the grants awarded in FY 2000 and FY 2001. These research and curriculum development awards will be completed in FY 2002 (performance measure). Progress will also be measured by monitoring the 9 research and 5 educational grants by reviewing technical semiannual reports, milestone plans and site visits.

Construction	**6,770**	**2,494**	**2,494**

Commission the Isotope Production Facility at the Los Alamos Neutron Science Center. Complete engineering, design, and construction work inside the existing beam tunnel. Engineering and design of the new tunnel section and target station will be completed. Construction of the target station and new beam tunnel section was started in FY 1999 and will be 75 percent complete by FY 2001 (performance measure). In FY 2002 the construction of the Los Alamos Isotope Production Facility, which is needed for the production of short-lived isotopes for medical research, will be 80 percent complete (performance measure). As a result of shifts in the Los Alamos Neutron Science Center (LANSCE) accelerator outage schedule, and increases in the design, fabrication and installation of the new procurement beam line, all remaining construction activities will be rescheduled to accommodate the anticipated funding profile.

Total, Medical Isotope Program	**18,953**	**18,677**	**18,177**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# **Operating Expenses**	
C Isotope Production: The decrease of $500,000 is due to placing the ACRR in standby mode.	-500
C Alpha Emitting Isotopes: The increase of $100,000 is needed to increase the processing of uranium material to obtain additional alpha-emitting isotopes needed for medical research and human clinical trials	+100
C Stable Isotope Enrichment Unit: The decrease of $300,000 is due to completing the design work for the stable isotope enrichment unit in FY 2001. This unit when installed will enable the Department to continue its supply of stable isotopes to U.S. researchers	-300
C Isotope Product and Process Improvement: The increase of $200,000 will provide funding to invest in new products and process improvements which will result in new or improved isotope products or more efficient isotope production methods to continue to meet the growing needs of medical and scientific community.	+200
Total Funding Change, Medical Isotope Program	-500

Capital Operating Expenses & Construction Summary

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000 Approp.	FY 2001 Approp.	FY 2002 Request	Unapprop. Balance
99-E-201, Isotope Production Facility, TA-53	20,751	6,000	6,770	2,494	2,494	2,993
Total, Construction	20,751	6,000	6,770	2,494	2,494	2,993

Isotope Production and Distribution Program Fund

Program Mission

The mission of the Office of Isotopes for Medicine and Science (Medical Isotope Program) is to serve the national need for a reliable supply of isotope products, services and related technology used in medicine, industry, and research. The Medical Isotope Program operates under an Isotope Production and Distribution Fund, which is a revolving fund. All program sales transactions and costs are financed by revenues from sales of isotopes products and services and through payments from the Isotope Support decision unit in Energy Supply. The Fund's revenue and expenses are audited annually consistent with Government Auditing Standards and other relevant acts, such as the Chief Financial Officers Act of 1990 and the Government Performance and Results Act of 1993. Included in the Annual Financial Statements and Program Overview are the performance measures results.

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

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. In 1998, over 13 million nuclear medicine procedures were performed in more than 4,000 nuclear medicine facilities in the United States. 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 supports nuclear medicine research through direct financial assistance and by providing isotopes to researchers at reduced prices.

Currently, the Department develops, produces, sells and leases hundreds of types and forms of stable and radioactive isotopes for commercial, medical, and research applications throughout the United States and to approximately 25 foreign countries. Isotopes are sold by the Department only when there is no U.S. private sector capability or when other sources do not have sufficient capacity to meet U.S. needs. The Department encourages private sector investment by offering to sell or lease existing facilities, equipment, and material for commercial purposes or through the licensing of new patent technologies.

Program Goals

Program goals for the Isotope Production and Distribution Fund are discussed in the Isotope Support section.

Program Objectives

Program objectives for the Isotope Production and Distribution Fund are discussed in the Isotope Support section.

Performance Measures

Performance measures for the Isotope Production and Distribution Fund are discussed in the Isotope Support section.

Funding Profile

No funds are requested for the Isotope Production and Distribution Fund. The budgetary resources for the Fund are received as spending authority from offsetting collections from two sources: (1) expenditure transfers of all appropriated funds from Energy Supply-Isotope Support; and (2) revenues from the sales of goods and services to the public. See the Isotope Support section for justification of the $18.177 million appropriations request. Sales in FY 2000 will be $8.7 million, and the projected sales for FY 2001 and FY 2002 are estimated to be about $9 million. The FY 2002 combined budget request and projected revenue should provide the Fund sufficient cash to meet total estimated program expenses of $27.177 million.

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

(Changes from FY 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

| This request of $2.494M for the Isotope Production Facility (IPF) in the FY 2002 is being submitted to accommodate the following project impacts: 1) increased design costs, principally for Special Facilities Equipment, 2) detailed re-estimates of the costs of future work, 3) several significant changes in the LANSCE operating schedule, 4) increased project management costs due to the schedule delays, 5) and increased awarded cost for facility construction and Special Facilities Equipment (SFE) procurement and installation. The new cost estimate is based on actual costs and a complete bottom-up cost estimate of the remaining work which has identified several areas where the current baseline budgets are not consistent with the new estimates. These inconsistencies include: (1) the target handling hot cell construction estimate, which increased by $334K, (2) the instrumentation and controls (I&C) estimate, which increased by $1,120K, and (3) the beam line electrical cabling estimate, which increased by $316K. Actual design costs for the facility increased by $353K and the design costs for the SFE increased by $835K. Actual awarded facility construction contract and Special Facility Construction contract increased by $2,234K and $1,974K, respectively. The LANSCE accelerator outage, necessary for the critical path construction of the radiation shield wall and modifications to the existing accelerator, was moved from March 2000 to October 2000, and then finally to December 2000. The outage date was changed to provide extended accelerator beam time to the Office of Science and Defense Program users, in part, to compensate for the loss of beam time due to the Cerro Grande Fire.
|
| The FY 2001 and FY 2002 funding allocations of $2.494M per fiscal year are insufficient to support the existing baseline schedule and require the rescheduling of a large number of activities into FY 2002 and FY 2003. The shifts in the accelerator outage schedule combined with the work rescheduling into FY 2002 and FY 2003 resulted in an overall schedule delay for completion from May 2001 to September 2003. In response to the revised project costs, an independent review was conducted by the Princeton Group Office on February 7-8, 2001, that examined the estimated cost overruns, causes of the problem, and associated corrective actions. Other than the inconsistencies noted above, the review team identified no other major technical and management issues. The review team recommended additional funds in FY 2001 to avoid further cost increases and deferral of work to FY 2002. In response to the independent review recommendations, the Office of Nuclear Energy, Science and Technology is considering options to provide additional funding in FY 2001 to ensure completion of facility construction activities. Federal oversight of the project will be strengthen by placing an additional person at the site who will report directly to the Office of Nuclear Energy, Science and Technology. In addition, NE is considering awarding a subcontract to complete the I&C work, instead of having this work performed by the Los Alamos National Laboratory. This project data sheet incorporates revised estimates deemed necessary to successfully complete the project.

1. Construction Schedule History

	Fiscal Quarter					
	A-E Work Initiated	A-E Work Completed	Physical Construction Start	Physical Construction Complete	Total Estimate Cost	Total Project Cost
FY 1999 Budget Request (*Preliminary Estimate)*	1Q 1998	4Q 1998	1Q 1998	2Q 2000	12,065	12,843
FY 2000 Budget Request	1Q 1999	1Q 2000	1Q 1999	3Q 2001	14,000	15,520
FY 2001 Budget Request	1Q 1999	1Q 2000	1Q 1999	3Q 2001	14,000	15,520
FY2002 Budget request (Current)	1Q 1999	1Q 2000	1Q 2000	4Q 2003	20,751	23,140

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design			
1999	2,805	2,805	2,634
2000	1,028	1,028	1,199
Construction			
1999	3,195	3,195	232
2000	5,742	5,742	5,250
2001	2,494	2,494	5,642
2002	2,494	2,494	2,635
2003	2,993	2,993	3,159

3. Project Description, Justification and Scope

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

The proposed target irradiation facility will replace the existing isotope production capability at the end of the LANSCE beam, which is located at TA-53 in building MPF-3 at the east end of Area A of LANSCE. However, Area A, where the existing Isotope Production Facility is located, will be rendered inoperable by the

proposed reconfiguration of the LANSCE accelerator complex thereby preventing Los Alamos from producing these isotopes. As noted in the program mission statement, the use of nuclear medicine reduces health care cost and improves the quality and effectiveness of patient care. Currently, more than 12 million nuclear medicine procedures are performed each year in the United States, and it is estimated that one in every three hospitalized patients has a nuclear medicine procedure performed in the management of his or her illness.

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

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

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

The IPF facility design contract was completed in September 1999 and the facility construction contract awarded in January 2000, with contractor mobilization in April 2000. An accelerator outage is necessary for the installation of new beam line equipment and to allow the excavation of the soil that serves as a radiation shield during normal operations and the construction of a concrete radiation shield wall. In late December 1999, LANSCE management delayed the scheduled accelerator outage from March 2000, to October 2000 to provide extended accelerator beam time to the Office of Science and Defense Program users. This delay

forced a rescheduling of all critical path work activities. The Cerro Grande Fire in May 2000, forced another change to the accelerator outage, pushing the new outage date to late December 2000. All major beam line components have been delivered and staged in a mock-up area to facilitate rapid installation during the accelerator outage.

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

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

In March 2000, the project cost and schedule baselines were revised to reflect the actual costs to date, to incorporate fabrication and construction estimates based on awarded contracts, and to accommodate the impact of the delayed accelerator outage. The resulting TEC was increased by 18% (from $14,000K to $16,500K) to cover the estimated cost impact and to provide adequate contingency ($995K or about 9% of the construction budget) based on the identified risks during the remaining construction period. Subsequent to the March 2000, rebase-lining, the Cerro Grande Fire shutdown LANL and resulted in further delaying the accelerator outage to late December 2000. In response to this delay, in conjunction with the FY 2000 funding reductions, increased construction costs for the target handling hot cell and beam line equipment, the project management performed a detailed, bottom-up estimates for the costs and schedule work remaining to complete the project, including incorporation of actual costs. The revised baseline reflects the rescheduling of a large number of activities into FY 2002 and FY 2003. In response to the revised project costs, an independent review was conducted by the Princeton Group Office on February 7-8, 2001, that examined the estimated cost overruns, causes of the problem, and associated corrective actions. This review concluded that: 1) the risk on the remaining technical issues is very low and well understood; 2) that the cost drivers are due to the increased special facility equipment design and construction costs and low initial estimates for instrumentation and controls; and, 3) the schedule changes are due to delayed accelerator outages, and adjustments to accommodate funding profiles. In spite of the relatively large cost and schedule increases, the independent review concluded that the aggressive

management actions implemented by the project team greatly minimized the impact of these drivers. The Office of Isotopes for Medicine and Science has received a written commitment from Defense Programs, (headquarters organization with overall programmatic operations for LANSCE) that the IPF will receive first priority of staff resources during the current outage and that future accelerator outages will be scheduled to support timely project completion. In response to the independent review recommendations, the Office of Nuclear Energy, Science and Technology is considering options to provide additional funding in FY 2001 to ensure completion of facility construction activities. This project data sheet incorporates revised estimates deemed necessary to successfully complete the project.

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

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design (Design, Drawings, and Specifications)	2,414	2,215
Design Management costs (2.6% of TEC)	535	466
Project Management costs (4.3% of TEC)	884	848
Total, Design and Management Costs (18.5% of TEC)	3,833	3,529
Construction Phase		
Improvements to Land	486	521
Buildings	5,980	3,746
Special Equipment	5,254	3,280
Utilities	102	55
Inspection, design and project liaison, testing, and acceptance	1,417	1,056
Construction Management (2.4% of TEC)	487	162
Project Management (11% of TEC)	2,338	945
Total, Construction Costs	16,064	9,765
Contingencies		
Design	0	0
Construction	854	706
Total, Contingencies (4.1% of TEC)	854	706
Total, Line Item costs (TEC)	20,751	14,000

5. Method of Performance

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

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 1999	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost							
Facility Cost							
Design	0	2,634	1,199	0	0	0	3,833
Construction	0	232	5,250	5,642	2,635	3,159	16,918
Total, Line Item TEC	0	2,866	6,449	5,642	2,635	3,159	20,751
Other Project Costs							
Conceptual design costs	643	0	0	0	0	0	643
Other ES&H costs	0	100	4	445	0	0	549
Other project-related costs	682	200	0	0	0	315	1,197
Total Other Project Costs	1,325	300	4	445	0	315	2,389
Total, Project Cost (TPC)	1,325	3,166	6,453	6,087	2,635	3,474	23,140

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

	Current Estimate	Previous Estimate
Annual facility operating costs	285	285
Annual facility maintenance/repair costs	111	111
Utility costs	39	39
Total related annual funding	435	435
Total operation cost (operating from FY 2003 through FY 2022)	8,700	8,700

University Reactor Fuel Assistance and Support

Program Mission

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

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

The Blue Ribbon Panel report recommends that the Federal investment in nuclear science and technology programs at U.S. universities, funded under the University Reactor Fuel Assistance and Support program, be increased to approximately $45 million. With this increase, NERAC believes, the United States will be able to maintain a strong and vibrant nuclear science and engineering infrastructure well into the twenty-first century. In addition, the Blue Ribbon Panel recommends 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 engineering by increasing funding for the NEER program to $20 million per year; and better supporting our university research reactors through the existing upgrade program and establishing a new competitive program for more costly equipment upgrades.

During the past year, several studies have been completed in an attempt to ascertain the current status and future outlook for nuclear engineering education in the U.S. and recommend initiatives to strengthen this vital sector of the university education curriculum. The Organization of Economic Cooperation and Development/Nuclear Energy Agency conducted a review of nuclear engineering education in its member

countries and the Nuclear Energy Department Heads Organization surveyed U.S. industry and universities concerning manpower requirements. The conclusion of these two studies was that the enrollment trends of the 1990's was not encouraging and more students need to be educated in nuclear engineering to provide the manpower required today and in the future. A third study by an expert panel appointed by the independent Nuclear Energy Research Advisory Committee recommended major increases in funding to maintain the nuclear engineering infrastructure in the U.S. A three person panel of experts from NERAC is collecting and assessing information on all university reactors including their research and training capabilities and operating costs. By April 2001, this panel will report back to the Department so a strategy can be formulated to support the maintenance of vital university research reactor facilities in the U.S. Taken together, these studies form the basis for the FY 2002 budget request for University Reactor Fuel Assistance and Support.

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

Other areas have not fared as well. University research reactors and facilities are under constant pressure with several confronting decommissioning if funding and usage problems are not addressed immediately. This development has far reaching and very damaging implications for research in the United States. For example, after learning that the University of Michigan is preparing a plan to shut down its Ford reactor facility, the Nuclear Regulatory Commission announced that it would be forced to seek access to overseas research facilities to continue vital nuclear related research.

DOE Strategic Objective

Energy Resources 2 - Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.

FY 2002 Program Strategy

The University Reactor Fuel Assistance and Support program supports the Nation’s science and engineering infrastructure to help meet our future needs for nuclear scientists and engineers in energy technology, medical research, and national security. The program provides fellowships, scholarships, and grants to students enrolled in nuclear science and engineering programs at U.S. universities; DOE/Industry matching grants for participating U.S. universities; and other assistance to students and U.S. universities in cooperation with industry. The program also provides fuel assistance and reactor upgrade funding for university-owned research reactors.

Program Goal

Promote and maintain a nuclear engineering and science education infrastructure to meet the Nation's future nuclear technology needs.

Program Objective

Support and promote the Nation's university, college, and preparatory technology programs that deliver information and contribute to learning in nuclear science and engineering education; enable advanced educational research opportunities; build capabilities at educational institutions; and improve educational opportunities for diverse groups.

Funding Profile

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
University Reactor Fuel Assistance and Support	12,000	12,000	-26	11,974	11,974
Total, University Reactor Fuel Assistance and Support	12,000	12,000	-26 [a]	11,974	11,974

[a] FY 2001 rescission.

Funding by Site

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Los Alamos National Laboratory	25	25	25	0	0.0%
Total, Albuquerque Operations Office	25	25	25	0	0.0%
Chicago Operations Office					
Chicago Operations Office	2,575	0	0	0	0.0%
Argonne National Laboratory	60	0	0	0	0.0%
Total, Chicago Operations Office	2,635	0	0	0	0.0%
Idaho Operations Office					
Idaho Operations Office	0	8,824	8,924	100	1.1%
Idaho National Engineering and Environmental Laboratory	8,645	2,800	2,800	0	0.0%
Total, Idaho Operations Office	8,645	11,624	11,724	100	0.9%
Oakland Operations Office					
Oakland Operations Office	356	25	25	0	0.0%
Total, Oakland Operations Office	356	25	25	0	0.0%
Oak Ridge Operations Office					
Oak Ridge Institute of Science and Education	32	0	0	0	0.0%
Total, Oak Ridge Operations Office	32	0	0	0	0.0%
Savannah River Site	300	300	200	-100	-33.3%
Washington Headquarters	7	0	0	0	0.0%
All Other Sites	0	0	0	0	0.0%
Total, University Reactor Fuel Assistance and Support	12,000	11,974	11,974	0	0.0%

Site Descriptions

Argonne National Laboratory

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

In July 1999, the Department selected 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.

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 U.S. and several foreign nations providing nuclear engineering and science students from all countries to work oversees in national laboratories and increase their training opportunities.

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 the INEEL, along with the ANL, 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.

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 and the University Reactor Upgrade program that provides funding for improvements and maintenance of the 29 university research reactors.

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. LANL administers the Department's Neighborhood Environmental Watch Network (NEWNET) program, which provides internships for Native American students from the University of Alaska-Fairbanks. This program is focused on the science and technology support for environmental monitoring stations in Alaska.

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 provides support for training, study, research participation, and academic enrichment of undergraduate and graduate students at participating Historically Black Colleges and Universities.

All Other Sites

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

Included in the category is funding for the matching grants and reactor sharing programs; 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 U.S. These programs are administered by the South Carolina University Research and Education Foundation.

The Idaho Operations Office (ID) administers the NEER program that provides research grants to nuclear engineering schools and the University Reactor Upgrades 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.

The Oakland Operations Office administers a program at the Luna Vocational Technical Institute located in northern New Mexico, that provides career development and enhanced educational opportunities for minority students in preparing for scientific and technical energy-related careers.

University Reactor Fuel Assistance and Support

Mission Supporting Goals and Objectives

University nuclear engineering programs supply highly skilled workers to industry active in fields such as electricity generation, medical research and supply, environmental restoration, and national security, as well as to government agencies and national laboratories. To help ensure the continued viability of these programs, the Department provides assistance to university nuclear science and engineering and related programs. Assistance includes the DOE/Industry Matching Grants program, which leverages public sector funds with private contributions in a 50/50 cost share arrangement; the Nuclear Engineering Education Research program, which provides vital research funding to university nuclear technology programs; academic assistance to outstanding students and faculty through the Scholarships and Fellowships program with an added dimension begun in FY 2000 that supports 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 29 operating university research reactors at 27 campuses in 20 states. University reactors are the source of neutrons for research in such diverse areas as medical isotopes, human health, life sciences, environmental protection, advanced materials, lasers, energy conversion, and food irradiation. University research reactors directly support the development of highly qualified, technically knowledgeable personnel needed by national laboratories, private industry, the Federal government and academia, for basic and applied research critical to U.S. technological competitiveness. In addition, with the help of the Reactor Sharing program, many of the reactors serve as centers for education programs offered to other colleges and universities and high school students and teachers who visit the reactor for instructional programs and research.

The University Reactor Fuel Assistance and Support program funds the supply of fresh fuel to and 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 Education Training program prepares students for nuclear engineering and science careers. This program began in FY 2000 to address the knowledge gap of incoming college freshmen in the area of nuclear science and engineering.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
University Reactor Fuel Assistance and Support	12,000	11,974	11,974	0	0.0%
Total, University Reactor Fuel Assistance and Support	12,000	11,974	11,974	0	0.0%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
University Reactor Fuel Assistance and Support	**12,000**	**11,974**	**11,974**
# **Supply Fresh Fuel**	**2,800**	**2,800**	**2,800**

Continue to supply fresh fuel to and ship spent fuel from university reactors requiring these services (performance measure). Starting in FY 2001, purchase TRIGA fuel material for the McClellan reactor, now operated by the University of California-Davis. In FY 2002, provide fuel for MIT, Missouri (Columbia), Cornell, Kansas State, Utah, and Michigan (performance measure).

# **DOE/Industry Matching Grants Program**	**1,000**	**800**	**800**

In FY 2002, continue the DOE/Industry Matching Grants Program, which supports education, training, and innovative research at participating U.S. universities. Provide grants of up to $60,000, which are matched by industry, to 22 universities in FY 2000 and about 18 in FY 2001 and FY 2002 (performance measure).

# **Fellowships/Scholarships to Nuclear Science and Engineering Programs at Universities**	**1,400**	**1,374**	**1,374**

In FY 2002, provide fellowships and scholarships to students enrolled in nuclear science and engineering programs at U.S. universities. Fellowships will be provided to M.S. and PhD. students and scholarships will be provided to undergraduate students. A total of 24 fellowships and 50 scholarships were awarded for FY 2000 and the same level is expected for FY 2001. Approximately 20-24 fellowships and 50 scholarships are expected to be awarded for FY 2002 (performance measure). In FY 2000, the Department initiated support to students enrolled in minority serving institutions to pursue a nuclear engineering degree in cooperation with universities that grant those degrees. In FY 2001, the Department expects to fund 3 minority/majority partnerships and in FY 2002 up to 6 minority/majority partnerships.

		(dollars in thousands)		
		FY 2000	FY 2001	FY 2002
#	**Reactor Sharing Program**	**600**	**600**	**600**

The Reactor Sharing program allows students and faculty at institutions without reactors to have access to university reactors for training, education, and research purposes. This program also allows the universities with reactors to conduct educational outreach programs in their local communities. In FY 2000, 25 grants were made. In FY 2001 and FY 2002 the number of grants is expected to remain relatively constant (performance measure).

#	**Reactor Upgrade Program**	**845**	**900**	**900**

Continue in FY 2002 with the fifth year of the reactor upgrade program to assist in addressing the backlog of maintenance and upgrade of equipment confronting university research reactors. The program provides for replacement of outdated equipment, maintenance of reactor systems, and upgrading of experimental capabilities at 21 university reactors in FY 2000, and at least 23 reactors each year in FY 2001 and FY 2002 (performance measure). The purpose of this program is to ensure that these valuable educational and research tools are available for training.

#	**Nuclear Engineering Education Research Grants**	**5,000**	**5,000**	**5,000**

The Nuclear Engineering Education Research Grants Program was reinstated in FY 1998 at the request of Congress to increase nuclear research opportunities for students and faculty. For FY 2000, existing and new grants totaled 45 and in FY 2001 and FY 2002 existing and new grants will total approximately 50 to provide for innovative research in nuclear science and engineering at U.S. universities (performance measure).

#	**Nuclear Education Training Program**	**155**	**200**	**200**

Continue the Nuclear Education Training Program, a program that began in FY 2000 to support nuclear engineering education recruitment activities in conjunction with a professional society with expertise in nuclear science and technology to ensure a highly informed group of students are available to enter university nuclear engineering and related scientific courses of study. In FY 2001, three teacher workshops will be held in the United States. In FY 2002, additional teacher workshops will be held throughout the country.

#	**Radiochemistry Awards**	**200**	**300**	**300**

In FY 2002, new radiochemistry awards will be made for the first time since FY 1999. The three-year awards provide faculty support and student fellowships to help educate a new generation of radiochemists to address the technical challenges associated with radioactive wastes and contaminated sites. The level funding for this program is only sufficient to make new awards every three years and support those awards during the intervening years.

Total, University Reactor Fuel Assistance and Support	**12,000**	**11,974**	**11,974**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
University Reactor Fuel Assistance and Support	0
Total Funding Change, University Reactor Fuel Assistance and Support	0

Research and Development

Program Mission

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

Our Nation's investments in Nuclear Energy R&D are made in response to the benefits that are now routinely expected and in anticipation of those new benefits that are likely to accrue. Fully 20 percent of our Nation's electricity is made today with emission-free nuclear power plants. Government, industry, and academia alike face similar challenges in sustaining the critical nuclear science and technology infrastructures – our research facilities and human resources – that are required to maintain and expand upon our past success.

The Department obtains advice on the direction of the Nuclear Energy R&D program 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* to guide nuclear energy research out to the year 2020 and the *Nuclear Science and Technology Infrastructure Roadmap*. NERAC is also providing expert advice to help guide development of the Generation IV Technology Roadmap. In addition, NERAC provides recommendations regarding government-industry cooperative research in support of the Nation's 103 licensed nuclear power plants.

The Long-Term R&D Plan, developed by NERAC with significant input from the wider research community, recommends that R&D budget levels be increased in order to enable the Nation to realize further value from our currently operating nuclear plants; provide for economic technologies and approaches to build enhanced advanced reactors in the United States; complete a design for a Generation IV nuclear energy system; and support a range of enduring missions within the Department. NERAC has established a goal of conducting $240 million in nuclear energy research by 2005.

The draft *Nuclear Energy Science and Technology Infrastructure Roadmap* was developed by NE and NERAC to evaluate 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 draft Roadmap concludes that although we are meeting

most of our current needs with existing facilities, the Department must add significant new neutron generation capacity if it is to meet expected infrastructure demands over the next decade.

In October 2000, the Department initiated the development of a Generation IV Technology Roadmap to identify and establish research and development activities for the most promising nuclear energy system technologies for deployment no later than 2030. The most promising systems are those that most nearly meet the goals of being able to successfully compete in all markets with the most cost-efficient technologies expected to be available over the next three decades and beyond while further enhancing nuclear safety, minimizing the nuclear waste burden, and further reducing the risk of proliferation. The Roadmap initiative is drawing on a wide community of researchers, designers, and operators from industry, academia, and the national laboratories. The Generation IV Technology Roadmap will evaluate a wide variety of nuclear energy system concepts using goals developed by NERAC and will define the R&D paths for the most promising concepts. The Roadmap will provide additional detail to the Department's long-term R&D plan for nuclear technology.

In FY 2001, the Department initiated several studies and planning activities on specific reactor categories. These activities include a study of feasibility issues associated with the use of small reactors in remote areas; an assessment of the changes needed to existing Advanced Light Water Reactor (ALWR) designs to be considered viable in the U.S. marketplace; and planning and implementation activities to commercialize the gas reactor technology under development for surplus weapons material disposition.

DOE Strategic Objective

Energy Resources Objective 2 - Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.

FY 2002 Program Strategies

Nuclear Energy Plant Optimization (NEPO)

The NEPO program supports a key national objective by conducting the R&D necessary to ensure that most of the current fleet of 103 operating commercial nuclear reactors are available beyond the 2020-2025 time frame. The program was recommended by the President's Committee of Advisors on Science and Technology (PCAST) Panel on Federal Energy Research and Development in its November 1997 report. NEPO R&D activities are identified based on input from industry, national laboratories, universities, the Nuclear Regulatory Commission (NRC) and other stakeholders and are cost-shared with industry; industry cost-share is at least 50 percent. The NEPO program is guided by an industry-government committee called the Coordinating Committee for the *Joint DOE-Electric Power Research Institute (EPRI) Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* (hereafter referred to as the Coordinating Committee) with oversight by the NERAC Subcommittee on Operating Nuclear Power Plant Research, Coordination, and Planning. The projects for the NEPO program are conducted at industrial companies, national laboratories, and universities. The focus of the issue specific R&D is on developing technologies to

increase the number of years of operation, number of operating hours per year, and electrical output per hour of operation for existing nuclear power plants.

Nuclear Energy Research Initiative (NERI)

The NERI program has been the cornerstone for renewed interest in nuclear science and technology development in this country since its introduction in FY 1999. In FY 2002, the Department will continue to conduct investigator-initiated, peer-reviewed research and development at universities, industrial companies, and national laboratories to address the principal obstacles to the expanded use of nuclear energy (*i.e.*, cost, safety, waste, and non-proliferation), advance the state of nuclear technology for a competitive marketplace, and help maintain a nuclear science and technology infrastructure to meet future challenges. While it is still very early in the life of this program, NERI has already achieved considerable success. NERI has helped return the United States to a key leadership role in the international exploration of nuclear technology, prompting the interest and support of many other nations and leading to expanded research and development collaboration. The NERI program has re-energized research in U.S. laboratories, universities, and industry, and has begun to identify opportunities for overcoming the key obstacles to the future expansion of nuclear power.

NERI is currently sponsoring R&D in areas including novel next generation, proliferation-resistant reactor designs, advanced nuclear fuel development, fundamental nuclear science, and nuclear waste technologies. During FY 2002, the Department will complete 43 research projects awarded in FY 1999, continue the 10 research projects awarded in FY 2000 and approximately 15 projects expected to be awarded in FY 2001. No new research projects will be awarded in FY 2002. During FY 2002, a process will also be developed to identify and select for further funding those NERI projects that have successfully completed the first three-year phase of research and warrant additional investment. The Department will continue the bilateral cost-shared research in cooperation with other nations initiated in FY 2001, which will be 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. In FY 2002, it is expected that the 5 bilateral international projects from FY 2001 will continue; however, no new international projects will be awarded. Advice on the conduct of the NERI research and development program is provided by the NERAC Subcommittee on Long Range Planning for Nuclear Energy Research.

Nuclear Energy Technologies

The U.S. and international community has deployed over 400 nuclear reactors to produce power, with new projects underway in several countries. Most operating plants are based on the experience gained from the first generation of nuclear plants that were built and operated in the late 1950's and early 1960's. These demonstrations of the practicality of nuclear power enabled the second generation plants to be built all over the world, including over 100 in the United States. The lessons learned from the second generation plants led directly to the development and deployment of third generation (*i.e.*, advanced light water) nuclear plants beginning in the 1990's. The goal of the fourth generation of nuclear energy systems will be to make nuclear energy the most sustainable, cost-competitive, reliable, and secure means of generating electricity for the 21st century that advanced nuclear technology and prior experience can produce. The goals defined for this program focus not only on the traditional goals of safety and cost-competitiveness, but of equal importance, on the fuel cycle and overall systems aspects that make nuclear energy sustainable in terms of the consumption of fuel and structural materials, and its ultimate radioactive waste products. The Generation IV Technology Roadmap will provide a comprehensive R&D plan to close existing technology gaps and permit the design and construction of Generation IV systems.

The Department initiated studies in FY 2001 to assess improvements needed to Advanced Light Water Reactor (ALWR) technology to improve economic competitiveness; assess the feasibility of small reactors in remote regions; and planning and implementing activities for commercial applications of the gas reactor technology being developed for nuclear weapons material disposition. In FY 2002, only the advanced gas reactor development activities will continue. FY 2002 activities will include continuation of the regulation and licensing framework for the technology and the development of fuel inspection capability for the uranium-bonded fuel micro spheres.

Program Goals

Nuclear Energy Plant Optimization (NEPO)

The cooperative, cost-shared R&D program with industry addresses the complex technical issues associated with managing the long-term degradation effects of plant aging while improving plant reliability, availability and productivity. The overall goal of this program is to ensure that existing U.S. nuclear power plants can continue to deliver reliable and affordable energy supplies up to and beyond their initial license period.

Nuclear Energy Research Initiative (NERI)

Conduct long-term research and development to address the key issues affecting the future use of nuclear energy and to preserve the nations's nuclear science and technology leadership.

Nuclear Energy Technologies

- Generation IV Nuclear Energy Systems - Identify, assess, and develop the next generation of nuclear energy systems designed to make nuclear energy the most sustainable, cost-competitive, reliable, and secure means of generating electricity for the 21st century that advanced nuclear technology and prior experience can produce.

- Advanced Gas Reactor Technology - Conduct fuel research and develop the regulatory and licensing framework needed to deploy advanced reactor concepts in the United States.

Program Objectives

Nuclear Energy Plant Optimization (NEPO)

Pursue selected applied research activities for managing plant aging and improving plant efficiency and productivity from the *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* in cooperation with the utility industry, universities, national laboratories, and the NRC.

Nuclear Energy Research Initiative (NERI)

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

- Advance U.S. nuclear technology to maintain the Nation's international leadership in nuclear issues and a competitive position in overseas markets and future domestic markets.

- Promote and maintain a nuclear science and technology research infrastructure to meet future challenges.

- Collaborate with international agencies and research organizations to address and influence nuclear technology development on a worldwide, leveraged cost-shared basis.

- Promote U.S. leadership and partnership in bilateral and multilateral research opportunities.

Nuclear Energy Technologies

- Define comprehensive technology-independent goals for Generation IV nuclear energy systems that articulate a vision of nuclear energy in the next three decades and beyond.

Prepare a Generation IV Technology Roadmap that:

- identifies nuclear energy system concepts and associated fuel cycles that offer the greatest potential for meeting the Generation IV goals; and

- sets forth a long-term research and development plan for those concepts and fuel cycles.

Obtain significant international participation in the preparation of the Roadmap and the subsequent long-term research and development activities for next-generation nuclear power systems.

Identify the regulatory, technical and institutional issues to support near-term deployment of new nuclear power plants in the United States.

Significant Accomplishments And Program Shifts

Nuclear Energy Plant Optimization

In FY 2000, established the NEPO program as a joint DOE-industry cost-shared research partnership to work with industry, national laboratories, universities, and the NRC to conduct R&D on long-term reliability of steam generators and electrical cables, behavior of irradiated structural materials, long- term fatigue, assessment of aging effects on critical components and structures, regulatory qualification of digital instrumentation and control (I&C) upgrades, smart diagnostic transmitters, optimum fuel burnup and cycle length, pressurized water reactor (PWR) water chemistry, and human factors. The program is guided by the Coordinating Committee and NERAC.

In FY 2001 and FY 2002, continue cooperative research and development activities initiated in FY 2000, consistent with the updated *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* under the guidance of the Coordinating Committee and NERAC.

Nuclear Energy Research Initiative

In FY 2000, continued the 46 multi-year advanced reactor, fuel cycle, nuclear waste and fundamental nuclear science R&D projects awarded in FY 1999. Issued the second phase of grants and cooperative agreements for the FY 1999 awards and issued 10 new awards to address nuclear energy economics, nuclear waste and proliferation concerns. Completed two research and development projects awarded in FY 1999.

In FY 2001, continue 45 projects awarded in FY 1999 and 10 projects awarded in FY 2000. Award approximately 15 new NERI R&D projects and complete the research on two NERI projects initiated in prior years.

In FY 2001, establish bilateral research with other countries, awarding approximately 5 new R&D collaborative projects to improve the cost, and enhance the safety, non-proliferation and waste of future nuclear energy systems.

In FY 2002, continue the 68 R&D projects initiated in prior years and the 5 international research projects initiated in FY 2001.

In FY 2002, identify innovative nuclear energy research concepts developed under NERI for further development.

Nuclear Energy Technologies

In FY 2001, initiate development of the Generation IV Technology Roadmap.

In FY 2001, complete the study on the feasibility of small reactors and issue a report to Congress; complete the assessment of ALWR improvements; and initiate planning and implementation of activities for a commercial version of the gas reactor being developed for surplus weapons material disposition.

In FY 2002, complete the Near-Term Deployment section of the Generation IV Technology Roadmap identifying the technological and institutional gaps that must be closed to enable one or more orders for commercial nuclear power plants in the United States by 2005 for deployment by 2010.

In FY 2002, complete the draft Generation IV Technology Roadmap for submittal to Congress in March 2003.

Funding Profile

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
Research and Development					
Nuclear Energy Plant Optimization . .	4,845	5,000	-11	4,989	4,500
Nuclear Energy Research Initiative . .	21,709	35,000	-174	34,826	18,079
Nuclear Energy Technologies	0	7,500	-17	7,483	4,500
Civilian Research and Development (ATW)	8,220 [a]	0	0	0	0

[a] Activities for Civilian Research and Development (ATW) are discussed in the Advanced Accelerator Applications (AAA) budget.

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
Total, R&D	34,774	47,500	-202 [b]	47,298	27,079

Funding by Site

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	93	0	0	0	0.0%
Los Alamos National Laboratory	5,497	485	450	-35	-7.2%
Sandia National Laboratories	2,978	1,654	0	-1,654	-100.0%
Total, Albuquerque Operations Office	8,568	2,139	450	-1,689	-79.0%
Chicago Operations Office					
Chicago Operations Office	2,710	0	0	0	0.0%
Argonne National Laboratory	6,022	4,543	300	-4,243	-93.4%
Brookhaven National Laboratory	679	470	200	-270	-57.4%
Total, Chicago Operations Office	9,411	5,013	500	-4,513	-90.0%
Idaho Operations Office					
Idaho Operations Office	0	2,967	4,000	1,033	34.8%
Idaho National Engineering and Environmental Laboratory	823	2,287	0	-2,287	-100.0%
Total, Idaho Operations Office	823	5,254	4,000	-1,254	-23.9%
Oakland Operations Office					
Oakland Operations Office	0	1,300	0	-1,300	-100.0%
Lawrence Livermore National Laboratory	545	520	450	-70	-13.5%
Total, Oakland Operations Office	545	1,820	450	-1,370	-75.3%
Oak Ridge Operations Office					
Oak Ridge National Laboratory	1,864	2,111	353	-1,758	-83.3%
Oak Ridge Institute of Science and Education	550	600	600	0	0.0%
Total, Oak Ridge Operations Office	2,414	2,711	953	-1,758	-64.8%
Richland Operations Office					
Fluor Daniel Hanford	0	0	0	0	0.0%
Pacific Northwest National Laboratory	1,603	2,143	1,000	-1,143	-53.3%
Total, Richland Operations Office	1,603	2,143	1,000	-1,143	-53.3%
Savannah River Site	0	0	0	0	0.0%

[a] Includes $105,000 for FY 2001 rescission and $97,000 comparability adjustment for the transfer of safeguards and security.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Washington Headquarters	80	28,218 [b]	19,226[a]	-8,992	-31.9%
All Other Sites	11,330	0	500	500	100.0%
Total, Research and Development	34,774 [b]	47,298	27,079	-20,219	-42.7%

Site Descriptions

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. LANL is a collaborating organization on two NERI projects. One of these NERI projects is scheduled to be completed during FY 2002. LANL also provides technical support to the Generation IV Technology Roadmap.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. SNL is the lead organization for five NERI awards and the collaborating organization on three other awards involving proliferation resistant reactor design, improved reactor performance and nuclear waste management. These eight NERI projects are scheduled to be completed during FY 2002. SNL was awarded two research tasks under NEPO in FY 2000. 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 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.

Argonne National Laboratory

Argonne National Laboratory (ANL) is a U.S. Department of Energy's 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.

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[a] Distribution of awards in NEPO and NERI to be determined in FY 2001 and FY 2002

[b] Activities for Civilian Research and Development (ATW) are discussed in the Advanced Accelerator Applications (AAA) budget.

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.

ANL is supporting the NERI program as the lead organization for seven projects and collaborating in five other projects in the areas of proliferation resistant reactor and fuel technology, advanced nuclear fuels, waste management and fundamental nuclear sciences. Eleven of these twelve NERI projects have planned completions during FY 2002.

ANL-East was awarded a research task under the NEPO program in FY 2000 to provide a steam generator non-destructive examination (NDE) test mockup facility, a tube degradation data base, and a specification for an advanced ultrasonic technique for sizing cracks in steam generator tubes.

ANL is providing technical assistance to the Department's development of the Generation IV Technology Roadmap.

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. BNL is the lead organization on two projects and is collaborating with a university on one other R&D project. Two of the NERI projects will be completed during FY 2002. BNL also provides technical support to the Generation IV Technology Roadmap.

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 some of the most advanced nuclear energy research in the world since 1949. In recent years, in addition to continued operation of complex nuclear and non-nuclear facilities, INEEL has initiated technology development in applied environmental science and engineering.

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

INEEL is participating in the NERI program as the lead organization on three projects and collaborating on two other awards; INEEL research is in areas of low output reactor technology and advanced proliferation resistant fuel technology. The five NERI projects that INEEL is participating in have planned completion dates during FY 2002.

INEEL is providing technical assistance to the Department's development of the Generation IV Technology Roadmap.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) is a U.S. Department of Energy scientific research laboratory located in California. In support of the Nuclear Energy Research Initiative (NERI), LLNL is collaborating with university, laboratory, and industry partners in three awards, conducting research on proliferation resistant reactor, fuel technology, and isomers. Two of the three NERI projects have scheduled completions during FY

2002. LLNL also provides technical support to the Generation IV Technology Roadmap.

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 is participating in the NERI program as the lead research organization on five projects and as a collaborator on one project. These projects involve advanced reactor and control concepts, reactor materials research and advanced fuel components. Four of the six NERI projects have planned completion dates during FY 2002.

ORNL was awarded two research tasks under the NEPO program in FY 2000. One task is to develop a model for the temperature dependence of zinc oxide solubility at near clad temperatures. For the second task, ORNL is to provide data on the impact of nickel oxide solubility on Axial Offset Anomaly (AOA) in pressurized water reactors.

ORNL also performs R&D on materials science, technology and radiation effects which focuses on the following areas: (a) advanced materials, *e.g.*, metals, ceramics, composites, and graphite; (b) structural materials; (c) fuel and cladding materials; (d) radiation shielding research, (e) radiation effects and transport phenomena, and (f) nuclear chemistry. Materials performance within radiation fields and at high temperatures must be well-known and predictable with a high degree of accuracy and certainty. The development and testing of high-performance materials and structures at ORNL will continue to be a major component in the engineering development of new nuclear systems, e.g., NERI research projects. New reactor designs with new materials (*i.e.*, new ceramics, cladding, non-metals or metals) will result in the need to evaluate mechanical behavior, radiation damage, corrosion effects, welding/joining methods, and stress corrosion cracking resistance at the ORNL materials laboratories and High Flux Reactor.

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

ORNL also provides technical support to the Generation IV Technology Roadmap.

Oak Ridge Institute for Science and Education

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

Pacific Northwest National Laboratory

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

PNNL was awarded a research task under the NEPO program in FY 2000 to support revision of Appendix L of the ASME Code through analysis of the probability of detecting fatigue cracks.

PNNL will provide technical assistance in support of the bilateral research and development conducted under the I-NERI program.

All Other Sites

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

For the Nuclear Energy Research Initiative, a peer-reviewed competitive, investigator-initiated research and development program, 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 solicitation and award processes in FY 2001 and FY 2002.

Included in this category for FY 2000 is the funding for those NEPO program research projects for which decisions on the performing organizations have not yet been made. All of the NEPO program funding for FY 2001 and FY 2002 is also shown in this category. Decisions regarding the specific cost-shared, research and development activities to be conducted and the performing organizations for FY 2001 and FY 2002 will be made based on the updates to the *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* consistent with guidance from the Coordinating Committee and the NERAC Subcommittee on Operating Nuclear Power Plant Research, Coordination and Planning.

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 goal of the NEPO program is to ensure that current nuclear plants can continue to deliver reliable and affordable energy supplies up to and beyond their initial 40-year license period by resolving open issues related to plant aging, and by applying new technologies to improve plant reliability, availability, and productivity. The NEPO program, which relies on industry to fund at least half of its research agenda, is designed to encourage the electric utility industry to explore technologies beyond its current scope of research, making U.S. nuclear power plants more efficient and reliable than they would have been without the Department's involvement.

The U.S. electricity sector has entered a period of change and uncertainty. With the deregulation of electricity production, many unprecedented issues are challenging utilities, regulators, and the Federal Government. New technologies are altering the fuel choices made by utility planners. Environmental regulations and economic competition are resulting in the closure of older fossil-fuel plants, and many U.S. nuclear plant owners are approaching a critical decision point as to whether their plants should be shutdown at or before their initial license period, or whether they should apply for a twenty-year license extension.

The DOE's Energy Information Administration (EIA) anticipates that, even with aggressive implementation of energy efficiency measures, U.S. electricity consumption will increase an average of 1.8 percent annually through 2020 – the equivalent of building fifteen large 1000-megawatt power plants every year. Additionally, EIA projects that between FY 2000 and FY 2020, approximately 69,000 megawatts of existing electricity generating capacity will be retired because of age and competitive pressures, and as part of U.S. utility efforts to meet clean air standards. As a result, the EIA estimates the U.S. must build the equivalent of 1,310 new fossil-fuel generating plants by 2020 to meet growth in demand and offset plant retirements. Building these plants will require a huge economic investment in new baseload generating capacity during the next two decades, and when in operation, these plants will emit large quantities of air emissions. According to EIA, nuclear energy could be key to reducing carbon emissions.

Continued operation of existing nuclear plants through their original license term and a 20-year renewed license term would partially mitigate the need to build more baseload power plants. Existing U.S. nuclear power plants are a vital component of the U.S. energy diversity strategy. Nuclear power plants have operated safely and reliably in the U.S. for decades and are capable of doing so for many decades to come. These plants provide nearly a fifth of the electricity generated in the United States. They operate year-round, in all weather conditions without emitting air pollutants.

Nuclear energy is the only proven large-scale baseload power source that has unlimited potential to provide reliable electricity without producing environmentally damaging air emissions. Between 1973 and 1999, nuclear

generation avoided emission of 2.61 billion metric tons of carbon. Over the same period, use of nuclear energy avoided emission of more than 60 million tons of sulfur dioxide and 30 million tons of nitrogen oxides. As much as 90 percent of the carbon dioxide avoided by U.S. utilities over the last 25 years is attributable to nuclear energy. Continued operation of existing nuclear power plants annually avoids over 150 million metric tons of carbon, five million tons of sulfur dioxide, and 2.4 million tons of nitrogen oxides. Nuclear energy's avoidance of greenhouse gas emissions and other pollutants, therefore, is necessary to help the U.S. meet its international commitments on global warming.

Globally, nuclear energy is growing in importance as an energy source for expanding economies. U.S. nuclear technology is often the preferred option for countries seeking the best in safety, efficiency, and economics. U.S. leadership in these markets has been of great strategic importance to the United States, because it provides this Nation with a prime seat at the table with other countries as they explore and implement nuclear power technologies. This presence has enabled the U.S. to exercise great international leadership in areas such as nuclear safety, non-proliferation, trade, and environmental quality.

The U.S. is at a critical juncture with regard to the continued operation of its nuclear power plants. Licenses for U.S. nuclear power plants will begin to expire in large numbers in 2010; licenses for 13 plants representing some 11,700 MWe will expire in 2014 alone. Many of the existing nuclear power plants are among the most cost-effective producers of electricity in the country. Reliance and demand on nuclear power plants will continue to increase because of environmental concerns and deregulation of the electric power industry. Recognizing the economic potential of continued operation, it is now expected that virtually all current nuclear power plants will apply for 20-year license renewal of their plants. NRC approved license renewal applications for five nuclear reactors in 2000. License renewal applications for an additional five reactors are under NRC review and plant operators of 28 reactors have already announced their intention to apply for license renewal over the next five years. The industry has also begun exploratory discussions to identify the market conditions and business structures that could culminate in construction of new nuclear power plants.

Despite the United States' long experience with nuclear power, it is important to recognize that no nuclear power plant has yet operated for its full 40-year initial license period. Continued reliable operation of these plants will require that complex technical issues associated with long-term operation be addressed. As long-term operation of existing nuclear power plants serves strategic national interests of economic strength, energy security, and environmental quality, the Government has a responsibility to partner with industry to address the difficult technology issues which the industry cannot address on its own.

The R&D performed by the utility industry - totaling approximately $80 million each year - is critical to the safe and economic operation of U.S. nuclear power plants. However, the nuclear industry's primary interest is to invest most of its R&D funding on short-term, low-risk activities needed to enhance day-to-day operational performance and safety. The Department's role in nuclear energy R&D is the same as in other areas of DOE energy research: to address the difficult technology issues that it is better equipped to solve than industry--because of the unique facilities and capabilities available to DOE, the lack of market incentive for industry to develop technologies important to the national interest, or because of the long-term and/or high-risk nature of the research.

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 panel recommended that DOE fund such a program at $10 million per year, to be matched by industry.

Recognizing the broad national strategic interests served by nuclear power, the Department proposed a new NEPO program starting in FY 2000 in response to the recommendations of PCAST. As a cost-shared program with industry, the NEPO program seeks to develop and apply 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 could be performed during this decade and is beyond the scope and plans of industry research. In this manner, a modest DOE investment could produce important results that will enhance the long-term operation of existing nuclear power plants beyond what would have otherwise been achieved. The plan, first issued in March 1998 and later updated in October 2000, is based upon input from utilities, DOE national laboratories, NRC, and other key stakeholders. Research funded under the NEPO program is based upon this joint strategic plan. At least half (and typically considerably more) of NEPO work is funded by industry.

The Nuclear Energy Research Advisory Committee (NERAC) Subcommittee on Operating Nuclear Power Plant Research, Coordination, and Planning provide the Department independent, expert advice on the conduct of the NEPO program including criteria for prioritizing the research. A Coordinating Committee, with representatives from NRC, utilities, national laboratories, universities, Nuclear Energy Institute (NEI) and Institute of Nuclear Power Operations (INPO), works directly with the NERAC operating plant subcommittee to prioritize the R&D tasks and update the Joint DOE-EPRI strategic R&D plan.

The technical objectives of the NEPO program include:

- Managing long-term effects of component aging: component and structural material degradation occurs in nuclear plants as a result of long-term operation and exposure of materials to harsh environmental conditions. R&D conducted under NEPO will provide a better understanding of degradation mechanisms and how they occur, enabling development of cost-effective aging management strategies to prevent, detect or repair the effects of degradation.

- Improving efficiency and productivity of existing nuclear power stations: this objective focuses on improving the long-term economic performance of current plants through development of technologies that will improve equipment reliability, lower operating costs, and increase power output while maintaining high levels of safety. Current nuclear plants were designed and are operating with technology developed over twenty-five years ago. As these nuclear plants age, components and parts degrade or become obsolete, introducing inefficiencies, added costs, and reduced reliability. There have been significant technology

advancements over the past twenty-five years that are applicable to power generation, particularly in computers, communications, materials, sensors and digital electronics, and artificial intelligence. R&D conducted under the NEPO program will develop the technical basis required for regulatory approval to use these more accurate, reliable and cost-effective technologies at existing nuclear power plants. The program will also produce new technology applications that will make nuclear plant operation and maintenance processes more economical and increase overall plant output.

In addition to this vital coordination with industry, the Department and the Nuclear Regulatory Commission (NRC) have established close coordination in research program planning to assure that the work performed by each organization is complementary to the other, cost-effective, and without duplication. A DOE-NRC Memorandum of Understanding was signed on August 16, 1999, to cooperate and share information and costs for research associated with nuclear power technology. The role of the DOE is very different from that of NRC. DOE's role is to develop technologies to address operational issues at nuclear power plants. NRC's role is to assure that it can provide the public with independent assurance that the technologies developed by DOE or industry for use in nuclear power plants are safe. NRC conducts confirmatory research as part of its responsibility to develop rules or regulations for use of new technology in nuclear power plants. The Department anticipates a close, ongoing relationship with NRC to assure that the two agencies make the best use of taxpayer resources.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Nuclear Energy Plant Optimization	4,845	4,857	4,381	-476	-9.8%
SBIR/STTR	0	132	119	-13	-9.8%
Total, Nuclear Energy Plant Optimization	4,845	4,989	4,500	-489	-9.8%

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Nuclear Energy Plant Optimization	**4,845**	**4,857**	**4,381**

The NEPO program will continue projects initiated in FY 2000 and FY 2001 on long-term reliability of steam generators and electrical cables, behavior of irradiated structural materials, long-term fatigue, and assessment of aging effects on critical components and structures. R&D conducted under these projects will contribute towards: (1) a better understanding of plant component and structural material degradation mechanisms and how they occur, enabling development of cost effective aging management technologies to detect, prevent or repair the long-term effects of material degradation; and (2) improved equipment dependability, lower operating costs, and increased power output while maintaining a high level of safety. Other critical issues to be addressed through the NEPO program include regulatory qualification of digital instrumentation and control upgrades, smart diagnostic transmitters, optimum fuel burnup and cycle length, and pressurized water reactor water chemistry. The activities funded under NEPO are closely coordinated with the Nuclear Regulatory Commission and are based on the critical R&D needs defined in the *Joint DOE-EPRI Strategic R&D Plan to Optimize U.S. Nuclear Power Plants.* The reduction of $476,000 reflects fewer research and development projects being conducted in FY 2002.

The NEPO performance measures are:

- In FY 2000, implement a cooperative cost-shared R&D program by working with industry, universities, national laboratories, and the Nuclear Regulatory Commission, to address technical issues that could prevent continued operation of current nuclear power plants.

- In FY 2001, continue R&D activities associated with managing long term effects of plant aging and improving the reliability, availibility, and productivity of existing nuclear power plants.

- In FY 2002, continue ongoing R&D activities initiated in FY 2000 and FY 2001 associated with managing long term effects of plant aging and improving the reliability, availibility, and productivity of existing nuclear power plants. Initiate new R&D to address critical issues identified through stakeholder input and completion of projects in FY 2001 and based on recommendations of NERAC.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Small Business Innovative Research and Small Business Technology Transfer Programs	**0**	**132**	**119**
The decrease of $13,000 in SBIR/STTR reflects the decrease in funding for research and development.			
Total, Nuclear Energy Plant Optimization	**4,845**	**4,989**	**4,500**

Explanation of Funding Changes from FY 2001 to FY 2002

		FY 2002 vs. FY 2001 ($000)
#	**Nuclear Energy Plant Optimization**	
	• The reduction of $476,000 reflects fewer research and development projects being conducted in FY 2002	-476
#	**Small Business Innovative Research and Small Business Technology Transfer Programs**	
	• The decrease of $13,000 in SBIR/STTR reflects the decrease in funding for research and development	-13
Total Funding Change, Nuclear Energy Plant Optimization.		-489

Nuclear Energy Research Initiative

Mission Supporting Goals and Objectives

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

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

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

Recognizing that nuclear power presents significant environmental and other benefits, the PCAST Panel on Federal Energy Research and Development determined in 1997 that maintaining nuclear energy as a viable and expandable option was important, and recommended that the Department establish a NERI program to address the key issues affecting the future use of nuclear energy. This advice was followed by the June 1999 PCAST report on "The Federal Role in International Cooperation on Energy Innovation" recommended that $10 million be included in the FY 2001 budget for an international component to NERI. The report specifically describes the need for an explicit international NERI component 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). The I-NERI will enhance the Department's ability to leverage the nuclear technology research funding available in other countries while also providing the United States greater credibility and influence in international activities associated with the application of nuclear technologies.

The NERI program is directed toward accomplishing the following objectives:

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

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

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

- Provide an effective means to collaborate on a cost-shared basis with international agencies and research organizations to address and influence nuclear technology development world-wide;

- Promote U.S. leadership and partnerships in bilateral and multilateral nuclear energy research.

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

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

The international component of NERI, the I-NERI program also benefits from a peer-review to select projects. The I-NERI program allows for research opportunities with foreign collaborators through a specified cost share arrangement with each participating country. The peer review selection process for the I-NERI includes both U.S. reviewers as well as international expert reviewers from the participating country. Specific research topics will be identified and selected in conjunction with the international partnering countries but will focus on new, "Generation IV" nuclear energy plant and fuel cycle technology concepts. These concepts are of considerable interest to the international community and U.S. participation in collaborative international projects will depend substantially on the I-NERI program.

In FY 1999 and FY 2000, the Department received 434 NERI research proposals representing about $430 million in research in response to the NERI solicitations. 46 proposals were selected for award in FY 1999 and 10 proposals were selected for award in FY 2000 based on the recommendations of the peer-review process. The 56 NERI projects represent the individual and collaborative research efforts of 52 separate domestic research organizations including 24 universities, 8 national laboratories, 19 industrial organizations, and a U.S. Government R&D organization. The 56 NERI projects also included significant international collaboration with participation by 20 foreign research organizations including 6 foreign universities, 8 industrial companies, and 6 government or R&D organizations. This international participation is funded by the foreign government or corporation. This international collaboration in NERI research provides additional value to the program by leveraging U.S. funding with foreign research funds and providing U.S. researchers with access to additional scientific and technical expertise and research facilities not available in the United States.

In FY 2000, one NERI project was completed. In FY 2001, it is expected that approximately 15 new NERI research projects will be funded, and 55 remaining projects initiated in prior years will continue, two of which will be completed during the year. In the I-NERI program, up to 5 collaborative R&D projects are expected to be awarded in cost share arrangements with international partners such as Japan, South Korea, France, South Africa, and the European Commission.

In FY 2002, it is expected that the 68 NERI projects and the 5 bilateral international projects from prior years will continue; 43 of the NERI projects will be completed during the year. No new NERI or international projects will be awarded in FY 2002. During FY 2002, an independent peer review process will be developed to identify and select for further funding those NERI projects that have successfully completed the first three-year phase of research and warrant additional investment.

In implementing the NERI program, the Office of Nuclear Energy, Science and Technology consults with the Office of Science to ensure that the program's approach to peer review is consistent with the good practices established by that office and 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 Nuclear Energy Research

Advisory Committee (NERAC) provides ongoing oversight and advice on the planning and implementation of the NERI program.

In June 2000, NERAC issued a long-range R&D plan developed in conjunction with the nuclear community, *The Long Term Nuclear Technology Research and Development Plan*, 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 Global Civilian Nuclear Power Systems (TOPS), and to recommend to DOE appropriate areas of research. The TOPS report, approved by NERAC in January 2001, provides a variety of R&D recommendations to improve the intrinsic and extrinsic barriers to the proliferation of nuclear materials. The *Long Term Nuclear Technology Research and Development Plan* and the *Technical Opportunities to Increase the Proliferation Resistance of Global Civilian Nuclear Power Systems (TOPS)* report are used by the Office of Nuclear Energy, Science and Technology to help guide the research conducted under NERI.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Nuclear Energy Research Initiative	21,709	33,903	17,600	-16,303	-48.1%
SBIR/STTR	0	923	479	-444	-48.1%
Total, Nuclear Energy Research Initiative	21,709	34,826	18,079	-16,747	-48.1%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Nuclear Energy Research Initiative	**21,709**	**33,903**	**17,600**
# **Nuclear Energy Research Initiative**	**21,709**	**27,089**	**10,786**

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

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

Performance of the NERI program will be measured by the following:

- < In FY 2000, continue research under the NERI program to improve the understanding of new reactor and fuel cycle concepts, and nuclear waste management technologies and begin to develop a preliminary feasibility assessment of the concepts and technologies.

- < In FY 2000, advance the state of scientific knowledge and technology to enable incorporation of improved proliferation resistance, safety and economics in the potential future design and development of advanced reactor and nuclear fuel systems.

- < In FY 2001, complete funding for the first 3-year phase of NERI research and development, select feasible and important reactor and fuel cycle concepts for continued development, and issue 15 new awards.

- < In FY 2002, complete the first 3-year phase of NERI research and development awards.

In FY 2002, identify innovative nuclear energy research concepts developed under NERI for further development.

The funding will allow continuation of the existing NERI research ensuring that successful innovative reactor and fuel technologies are developed and that the issues affecting expanded use of nuclear technology are being addressed. The funding level will also allow the continuation of research and development for those NERI projects that have completed their first three-years of research and are judged to have a very high potential for success. During FY 2002, the Department will complete 43 research projects awarded in FY 1999, continue the 10 research projects awarded in FY 2000, and approximately 15 projects expected to be awarded in FY

(dollars in thousands)

	FY 2000	FY 2001	FY 2002

2001. At this funding level, no new NERI awards will be made in FY 2002. During FY 2002, a process will also be developed to identify and select for further funding those NERI projects that have successfully completed the first three-year phase of research and warrant additional investment. Decrease in funding of $16,303,000 is due to no new awards in FY 2002.

#	**International Nuclear Energy Research Initiative (I-NERI)**	**0**	**6,814**	**6,814**

In FY 2001, I-NERI was initiated to promote international collaborative research focused on development of advanced technologies, such as Generation IV nuclear energy systems, which represent improvements in nuclear technology in terms of economic performance, proliferation resistance, and other key factors. The collaborative international research projects awarded in FY 2001 will be cost-shared with other countries and include new and innovative nuclear science and engineering selected under bilateral agreements. In FY 2001, the Department plans to complete and implement I-NERI agreements with countries such as Japan, France, South Korea, South Africa, and the European Commission.

Performance of the I-NERI program will be measured by the following:

- In FY 2001, initiate bilateral research programs with other countries to improve the cost, and enhance the safety, non-proliferation and waste management of future nuclear energy systems.

- In FY 2002, continue the bilateral research projects with other countries initiated in FY 2001.

In FY 2002, the Department will continue the 5 bilateral international projects initiated in FY 2001; no new international projects will be awarded.

Small Business Innovative Research and Small Business Technology Transfer Programs	**0**	**923**	**479**

The decrease of $444,000 in SBIR/STTR reflects the decrease in funding for research and development.

Total, Nuclear Energy Research Initiative	**21,709**	**34,826**	**18,079**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# **Nuclear Energy Research Initiative**	
• Decrease in funding of $16,303,000 is due to no new awards in FY 2002	-16,303
# **Small Business Innovative Research and Small Business Technology Transfer Programs**	
• The decrease of $444,000 in SBIR/STTR reflects the decrease in funding for research and development.	-444
Total Funding Change, Nuclear Energy Research Initiative	-16,747

Nuclear Energy Technologies

Mission Supporting Goals and Objectives

The United States, as well as other nations, is entering a period of unprecedented uncertainty with regard to its supply of electric energy. This uncertainty has resulted from the long period during which the U.S. utility industry was discouraged–in some cases by government regulation–from investing in new electric generating capacity. Some uncertainty was also created by deregulation of the electric power industry. Today, margins of electric capacity are at historic lows, too many utilities are dependent upon too few energy options, and rolling blackouts threaten the economic prospects of important areas of the country.

As a result, the United States is poised to enter a new wave of power plant construction.

The United States Government believes that nuclear energy must remain an integral part of the Nation's energy mix to meet present and future energy supply needs. To help achieve this goal, the Office of Nuclear Energy, Science, and Technology (NE) has encouraged a wide-ranging discussion on the development of next generation nuclear energy systems, known as "Generation IV," to engage governments, industry, and the research community worldwide. The goal of the Generation IV nuclear energy systems initiative is to work over the next three decades on an international basis to identify, assess, and develop nuclear energy technologies that can compete in all markets with the most cost-efficient technologies expected to be available while further enhancing nuclear safety, minimizing the generation of nuclear waste, and further reducing the risk of proliferation.

A first step in the Generation IV initiative is the development of a Technology Roadmap to guide Generation IV R&D. Roadmapping is a methodology used to manage and gain consensus for the planning and execution of large-scale R&D efforts. The Roadmap will evaluate all reasonable concepts for meeting these needs, including nuclear energy systems that produce non-electricity products such as process heat, hydrogen, and desalinated water.

In October 2000, NE initiated the Generation IV Technology Roadmap project. The purpose of the Roadmap is to identify nuclear energy system concepts and associated fuel cycles that offer the greatest potential for meeting the goals of the Generation IV initiative; and set forth a long-term research and development plan for those concepts and potential fuel cycles.

The Roadmap will (a) articulate a vision of nuclear energy in the future (2030 and beyond), (b) establish a set of goals for nuclear energy systems that support the vision, (c) evaluate current nuclear energy systems technology in relation to these goals, and (d) identify the R&D advances needed to achieve the stated goals in the proper context of regulatory and institutional constraints.

The Roadmap development process is expected to stimulate innovative and critical thinking on new nuclear energy system concepts and fuel cycles that could, in the long-term, offer substantial advances and

breakthroughs. Concurrent with the long-term-focused Roadmap effort, the current regulatory, technical, and institutional barriers affecting the deployment of new nuclear reactors in the U.S. will also be evaluated and issues identified for resolution. This review will be conducted by a Near-Term Deployment Group, and will be incorporated into the Roadmap report to give it both near and long-term vision.

In addition, the Department is conducting several studies and activities in FY 2001, looking at other nuclear plant design improvement and deployment options. These activities include: (1) an assessment to analyze and describe changes to existing Advanced Light Water Reactor (ALWR) designs in order for these designs to be considered economically viable in the U.S.; (2) a study to determine the feasibility of deploying small reactors in remote locations; and (3) planning and implementation activities necessary to develop a commercial version of the advanced gas reactor being developed for surplus weapons material disposition, including activities in fuel development and testing, licensing interaction with the Nuclear Regulatory Commission (NRC), plant cost evaluation, and waste assessment. The Department plans to continue the advanced gas reactor activities initiated in FY 2001 related to fuel manufacturing improvements and NRC licensing interaction. Specifically, the Department will continue the development of fuel inspection capability for the uranium-bonded fuel microspheres and continue to develop the gas reactor regulatory and licensing framework.

The objectives of the Nuclear Energy Technologies program are to:

Define comprehensive technology-independent goals for Generation IV nuclear energy systems;

Direct the preparation of a Generation IV Technology Roadmap that

  < identifies nuclear energy system concepts and associated fuel cycles that offer the greatest potential for meeting Generation IV goals; and

  < sets forth a long-term research, development and demonstration plan for those concepts and fuel cycles.

Obtain significant international participation in the preparation of the Roadmap and the subsequent long-term research and development activities for next-generation nuclear power systems.

Identify the regulatory, technical and institutional issues to support near-term deployment of new nuclear power plants in the United States, with primary focus on advanced light water reactors and available gas-cooled reactor systems.

Prepare report on the feasibility of and issues associated with the deployment of small modular reactors in remote locations.

Develop regulatory and licensing framework for advanced gas reactor technologies.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Nuclear Energy Technologies	0	7,483	4,500	-2,983	-39.9%
Total, Nuclear Energy Technologies	0	7,483	4,500	-2,983	-39.9%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Nuclear Energy Technologies	**0**	**7,483**	**4,500**
# Generation IV Technology Roadmap	**0**	**4,483**	**4,000**

In FY 2001, the Generation IV technology goals will be developed to articulate and support development of a Technology Roadmap to guide subsequent R&D (performance measure). NE will obtain endorsement of the Generation IV Roadmap approach from the Generation IV International Forum by integrating the international community into the Roadmap development activities.

In FY 2001, concurrent with the long-term-focus of the Roadmap, the regulatory, technical, and institutional issues that need to be addressed to support the near-term deployment of new nuclear reactors in the U.S. will also be identified and incorporated into the Roadmap report to give it both near- and long-term vision.

In FY 2002, complete the Near-Term Deployment section of the Generation IV Technology Roadmap identifying the technological and institutional gaps that must be closed to enable one or more orders for commercial nuclear power plants in the United States by 2005 for deployment by 2010.

In FY 2002, the draft Generation IV Technology Roadmap will be completed and undergoing review for submittal to Congress in March 2003. The Roadmap will establish the long-term research and development plan for nuclear energy system concepts and associated fuel cycles that offer the greatest potential for meeting the goals of the Generation IV initiative. The decrease of $483,000 is due to reduced workscope as the draft technology roadmap is prepared for issuance in FY 2002.

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
# **Advanced Reactor Development**	**0**	**3,000**	**500**

In FY 2001, the Department will complete several studies and activities, looking at issues associated with near-term deployment of new advanced nuclear power plants. These activities include:

- An assessment of existing ALWR designs and possible changes needed for these designs to be considered economically viable in the United States. The Department, in coordination with industry, will identify ALWR design, institutional and regulatory changes. In addition, the Department will conduct a study, cost shared with industry, to evaluate and report on the generic factors affecting selection of a site for new nuclear plant construction in the United States. The report will assist the Department and the Nuclear Regulatory Commission in the evaluation and resolution of generic issues affecting the Early Site Permit regulatory process. The decrease of $1,000,000 is due to the completion of the ALWR design assessment in FY 2001.

- A study to determine the feasibility of deploying small reactors in remote locations. In FY 2001, the Department will evaluate the technical, economic and regulatory aspects for the deployment of small reactors at locations where fossil fuel use is not economically and environmentally viable. A report will be issued to Congress in FY 2001. The decrease of $1,000,000 is due to the completion of the small reactor deployment feasibility study in FY 2001.

- Planning and implementation of activities to commercialize the advanced gas reactor being developed for surplus weapons material disposition. The Department will initiate activities in FY 2001 involving commercial fuel development and testing, preparation of a plant cost evaluation, an assessment of waste disposal acceptability, and interaction with the Nuclear Regulatory Commission to begin development of the regulatory and licensing framework for advanced gas reactors. The decrease of $500,000 is due to reduced workscope planned for the advanced gas reactor development activities.

- Once this work is completed in FY 2001, the Department plans to continue the development of the regulatory and licensing framework for advanced gas reactors in conjunction with the Nuclear Regulatory Commission and industry. In addition, as budget resources are made available in future years, the Department will continue the development of fuel inspection capability for the uranium fuel microspheres.

Total, Nuclear Energy Technologies	**0**	**7,483**	**4,500**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# **Generation IV Technology Roadmap**	
• The decrease of $483,000 is due to reduced workscope as the draft technology roadmap is prepared for issuance in FY 2002	-483
# **Advanced Reactor Development**	
• The decrease of $1,000,000 is due to the completion of the ALWR design assessment in FY 2001.	-1,000
• The decrease of $1,000,000 is due to the completion of the small reactor deployment feasibility study in FY 2001.	-1,000
• The decrease of $500,000 is due to reduced workscope planned for the advanced gas reactor development activities	-500
Total Funding Change, Nuclear Energy Technologies.	-2,983

Infrastructure

Program Mission

The Infrastructure program funds the management of the Department's vital resources and capabilities at NE-managed sites to ensure that the Department can meet its vital mission requirements and that the NE sites are maintained in a safe, secure, environmentally-compliant and cost-effective manner to ensure the protection of the workers, the public, and the environment. These NE-managed sites include the Argonne National Laboratory-West (ANL-W), the Fast Flux Test Facility (FFTF), and the nuclear science research infrastructure at the Idaho Test Reactor Area (TRA).

At ANL-W, the program also includes maintaining DOE NE facilities in a user ready status to provide support to carry out vital DOE missions and continuing stewardship of special nuclear materials and other important materials at ANL-W. The FFTF program provides for the safe and environmentally-compliant deactivation of that facility.

DOE Strategic Objective

Environmental Quality 3 - Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.

Program Goals

The infrastructure program shares common goals for the Test Reactor Area (TRA) and Argonne National Laboratory-West sites in Idaho, and the Fast Flux Test Facility 400 Area site in Hanford, Washington. These goals include:

- ensuring an adequate maintenance program is conducted to maintain the common facilities and utilities (e.g., sewer, potable water) in accordance with the Department of Energy (DOE), Federal and State environmental, safety and health (ES&H) standards and regulations, and to provide reliable support for tenant programs.

- ensuring an adequate upgrade construction program is conducted to maintain the site buildings and utilities to meet programmatic, reliability, and ES&H requirements. Many of the buildings and utility systems are more than 40 years old, and upgrades must occur to ensure continued reliable operations.

- ensuring environmental compliance for the site, including identification of legacy waste and mitigation in accordance with DOE and state regulations and legal agreements with the state.

FY 2002 Program Strategies

Test Reactor Area Landlord (TRA)

The mission of the Idaho TRA is currently projected to extend until well into the 21st Century and possibly beyond. A significant increase in TRA Landlord funding is needed to upgrade or replace the aging utility and support facilities infrastructure in a timely manner, address the growing backlog of routine maintenance, and clean up legacy waste. While working to make the most effective use of the current level of funding, the Department will seek to increase the annual investment in the Test Reactor Area to ensure both reliability of site landlord services for the long term and compliance with Federal, State of Idaho, and Department environment, safety, and health laws and regulations.

Fast Flux Test Facility

Activities will continue for the deactivation of FFTF systems in accordance with the deactivation Project Plan. This plan reflects the activities required to implement the Record of Decision (ROD) for the Nuclear Infrastructure Programmatic Environmental Impact Statement (PEIS), which directed the permanent deactivation of the FFTF.

ANL-West Operations

Through this programmatic activity, the Department will ensure that ANL-W sites are maintained in a user ready or standby condition as required to meet the Department's important missions and are operated in a safe, secure, environmentally-compliant and cost-effective manner to ensure the protection of the workers, public and environment.

DOE will ensure that all special nuclear materials at ANL-W are secure and safely stored on-site. DOE will also maintain the infrastructure at ANL-W so the facilities will be in a user ready condition or standby condition as required to meet the Department's priority missions. Facilities and infrastructure determined to be unneeded or surplus will be deactivated and placed into a radiologically and industrially safe and stable shutdown condition to reduce program costs and long-term surveillance and maintenance.

Program Goals

TRA Landlord

Manage DOE nuclear facilities in a safe, environmentally-sound, and cost effective manner and provide for the easy, cost-efficient use of relevant facilities by Government and private sector researchers.

Fast Flux Test Facility

The goal of the FFTF shutdown program is to safely and cost-effectively complete permanent deactivation, and establish minimal required surveillance and maintenance, in full compliance with all applicable state and federal safety and environmental regulations.

ANL-West Operations

Manage the resources and capabilities of the ANL-W site required to maintain DOE NE facilities in a user ready status and in a safe and cost-effective manner to meet the on-going DOE mission and to ensure protection of the public, workers, and the environment.

Program Objectives

TRA Landlord

Ensure that TRA common use facilities and the utility infrastructure are maintained and operated to meet the requirements of tenant programs and in accordance with Federal and state environment, safety and health laws and regulations.

Fast Flux Test Facility

To execute the FFTF Transition Project Plan within budget for the permanent deactivation of the facility.

ANL-West Operations

The objectives of the program reflect long-term goals which are achievable only through multi-year funding extending beyond the three year period covered in this plan.

Provide necessary operations, engineering and maintenance support and required site materials and services to maintain the nuclear, radiological, and other facilities and infrastructure at ANL-W in operational ready or standby conditions as required to support important DOE missions and comply with all applicable DOE requirements.

- Place unneeded facilities and infrastructure at the ANL-West site in a radiologically and industrially safe and stable shutdown condition for long-term, low-cost surveillance and maintenance.

- Manage ANL-West site safety, security, and safeguards infrastructure and ensure that all nuclear materials are stored and handled safely in a manner which protects workers, the public, and the environment.

- Meet DOE's waste management and environmental commitments.

Significant Accomplishments And Program Shifts

TRA Landlord

- Complete the architectural and engineering phase and continue the construction phase of the TRA Fire and Life Safety Upgrade construction project.

- Complete Title II design and begin the construction phase of the TRA Electrical Utility Upgrade construction project.

Fast Flux Test Facility

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

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

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

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

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

ANL-West Operations

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

- In FY 2000, preconceptual planning activities were conducted for the Remote Treatment Facility (RTF) for disposal of ANL-W remote-handled-mixed transuranic and alpha-mixed low-level wastes. Regulatory requirements for this facility are documented in the Site Treatment Plan (which complies with the Resource Conservation and Recovery Act and the Federal Facilities Compliance Act/Consent Order) and in the Federal court-ordered settlement agreement between the Department and the State of Idaho resolving *United States vs. Batt*, October 1995.

- In FY 2001, RTF conceptual design and National Environmental Policy Act (NEPA) review activities were initiated.

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

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

- In FY 2002, continue conceptual design activities needed to support a request for a future budget line for RTF design and construction in FY 2004. Construction of the RTF needs to begin in FY 2005 with RTF operations commencing in FY 2009 if all remotely handled transuranic radioactive waste is to be removed from the State of Idaho by the Court-Ordered Settlement Agreement required shipment date of 2015.

Funding Profile

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Comparable Appropriation	FY 2002 Request
TRA Landlord	6,905	9,000	-267	8,733	8,733
Fast Flux Test Facility (FFTF)	31,908	44,010	-5,571	38,439	38,439
ANL-West Operations	29,367	39,150	-7,943	31,207	34,107
Total, Infrastructure	68,180 [a]	92,160	-13,781 [b]	78,379	81,279

Funding by Site

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	3,300	1,500	0	-1,500	-100.0%
Total, Albuquerque Operations Office	3,300	1,500	0	-1,500	-100.0%
Chicago Operations Office					
Argonne National Laboratory	29,367	31,207	34,107	2,900	9.3%
Total Chicago Operations Office	29,367	31,207	34,107	2,900	9.3%
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory	6,905	8,733	8,733	0	0.0%
Total, Idaho Operations Office	6,905	8,733	8,733	0	0.0%
Richland Operations Office					
Fluor Daniel Hanford	28,508	36,939	38,439	1,500	4.1%
Pacific Northwest National Laboratory	13	0	0	0	0.0%
Total, Richland Operations Office	28,521	36,939	38,439	1,500	4.1%
Washington Headquarters	87	0	0	0	0.0%
All Other Sites	0	0	0	0	0.0%
Total, Infrastructure	68,180	78,379	81,279	2,900	3.7%

[a] Includes $9,000,000 reprogrammed into FFTF from other NE programs.

[b] Includes $173,000 for FY 2001 rescission and $13,608,000 comparability adjustment for transfer of safeguards and security.

Site Descriptions

Argonne National Laboratory

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

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), Experimental Breeder Reactor-II (EBR-II), Sodium Process Facility (SPF), Analytical Laboratory (AL), Electron Microscopy Laboratory (EML), and Radioactive Scrap and Waste Facility (RSWF). These facilities are supported by several other nuclear, radiological and industrial support and office facilities.

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 EBR-II using electrometallurgical treatment technology; and if authorized following completion of the NEPA review process, it will be 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 is being deactivated in accordance with Congressional direction.

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 SPF is being used to convert radioactive sodium into a chemically stable, low-level waste form. The sodium being converted includes legacy sodium from the Enrico Fermi Atomic Power Plant (Fermi-I) in Michigan, which is stored at ANL-West; the primary and secondary sodium coolant from the EBR-II; and legacy sodium from some DOE fast reactor physics experiments in the 1970s, which is currently stored at the Rensselaer Polytechnic Institute (RPI) near Troy, New York. 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 and the TREAT, while not currently operating, provide a number of reactor physics, core design, nuclear materials, and waste treatment testing capabilities.

In July 1999, the Department selected the ANL and the INEEL to serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories will 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.

Hanford Site

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

The design, operation, and maintenance of FFTF was conducted in accordance with the standards established by the Office of Reactor Development and Technology (RDT) and the American National Standards Institute (ANSI), and the codes established by the American Society of Mechanical Engineers (ASME). An independent safety review of the design and construction of FFTF was conducted by the U.S. Nuclear Regulatory Commission (NRC) at the request of the Energy Research and Development Administration. The objective of the safety review was "to provide an in-depth technical review of the design of the FFTF comparable to that of a licensed plant." The NRC safety review was directed at "evaluating the adequacy of the design to ensure safe operation of the plant" and resulted in the issuance of a Safety Evaluation Report in August 1978.

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

The FFTF includes facilities for receiving, conditioning, storing, installing and removing from the core all routinely replaced core components, and storing irradiated fuel. Post-irradiation examination and packaging capabilities are also available. Utilities and services at FFTF include onsite emergency generation of electrical

power, heating and ventilation, radiation monitoring, fire protection, auxiliary cooling systems for cell atmospheres and some components.

The FFTF is being maintained in a minimum-safe standby condition with the reactor completely defueled while the shutdown activities are conducted, such that the facility remains in compliance with federal and state safety and environmental regulations. The main heat transport system is being operated at approximately 400°F, with the sodium kept in a molten state to support eventual draining and storage. Essential systems, staffing, and support services will continue to be maintained at levels to support FFTF system closure and deactivation, as well as fuel transfer to dry storage and sodium draining. Standby surveillance and maintenance activities are being performed to ensure that there is: (1) no degradation of key plant systems; (2) retention of the authorization basis and configuration control; (3) maintenance of key staffing, qualifications, and training; and (4) compliance with Federal and state safety and environmental requirements.

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

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

In December 1998, the Secretary announced the decision to remove the FFTF from consideration as a tritium supply source but to further investigate the facility’s potential role in the Department’s national nuclear technology infrastructure. In May 1999, after careful consideration of the recommendations from the Nuclear Energy Research Advisory Committee (NERAC) and other analyses, the Secretary concluded that the facility could possibly serve a unique and valuable science and research role. As such, the Secretary asked that a program plan be developed that clearly defines the potential application of the facility and the roles and responsibilities of potential user communities.

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

Based on the results from the program scoping plan and the NERAC recommendations, the Secretary announced on August 18, 1999, that the Department would initiate a NEPA review of the environmental

impacts associated with the restart and operation of FFTF as a nuclear research and medical isotope production facility. The results from the NEPA review led to a Secretarial Record of Decision in January 2001, which resulted in the establishment of a FFTF Shutdown Project.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is an extensive research and engineering complex that has focused on some of the most advanced energy research in the world since 1949. In recent years, in addition to continued operation of complex nuclear and non-nuclear facilities, the INEEL has initiated technology development in applied environmental science and engineering. The Idaho Test Reactor Area (TRA) is located within the INEEL. Since the early 1950s, test reactors, laboratories, hot cells and supporting facilities have been built at TRA. The principal facility operating at TRA is the Advanced Test Reactor (ATR). The ATR is one of the world's largest and most advanced test reactors. It provides both vital irradiation testing for reactor fuels and core components and isotopes critically needed by medicine and industry. Other facilities currently operating on the site are: the ATR Critical Facility reactor, the TRA Hot Cells and the INEEL Applied Engineering and Development Laboratory. ATR operations and a wide variety of scientific research projects are planned to continue at TRA until well into the twenty-first century. The following facilities at TRA are shutdown in a surveillance and maintenance status awaiting decontamination and decommissioning: the Materials Test Reactor (MTR), the MTR Canal, the Engineering Test Reactor, the Coupled Fast Reactivity Measurement Facility, and the Advanced Reactivity Measurement Facility. TRA is operated for the Department by Bechtel BWTX Idaho, LLC. Responsibility for TRA Landlord resides with the Office of Nuclear Energy, Science and Technology. The TRA Landlord 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.

In July 1999, the Department selected the INEEL and the ANL to serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories will 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.

Capital Operating Expenses & Construction Summary
Capital Operating Expenses

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Capital Equipment	0	340	2,500	2,160	635.3%
General Plant Projects	0	1,600	1,365	-235	-14.7%
Total, Capital Operating Expenses	0	1,940	3,865	1,925	99.2%

Construction Projects

(dollars in thousands)

	Total Estimated Cost (TEC)	Prior Year Approp-riations	FY 2000 Approp.	FY 2001 Approp.	FY 2002 Approp.	Unapprop. Balance
95-E-20, TRA Fire and Life Safety Improvements, INEEL	15,446	11,446	1,474	457	500	1,569
99-E-200, TRA Electrical Utility Upgrade	7,709	341	396	877	950	5,145
Total, Construction		11,787	1,870	1,334	1,450	6,714

Argonne National Laboratory-West Operations

Mission Supporting Goals and Objectives

The Argonne National Laboratory-West (ANL-W) Operations portion of the Infrastructure program is an important component of the Department's energy supply and research missions, encompassing several major areas. Key areas include maintaining and operating essential facilities at ANL-West; safely and securely managing all special nuclear materials at ANL-W; and deactivating unneeded facilities.

The FY 2002 budget requests funding to manage the Department's vital resources and capabilities at ANL-W to ensure that DOE missions can be met in a safe, environmentally-compliant and cost effective manner. Additionally, the FY 2002 budget will be used to support placing unneeded facilities and infrastructure in an industrially safe, stable and environmentally compliant condition.

Additionally, the FY 2002 budget requests funding to conduct Remote Treatment Facility (RTF) conceptual design activities in preparation of a request for line item funding in FY 2004 for detailed design and construction of RTF. The RTF is needed to accept, segregate, characterize, treat, package and ship remote-handled wastes that were generated at ANL-West in the performance of past DOE missions. In order to meet the required completion date of 2015 for removal of all remotely handled transuranic radioactive waste from Idaho as specified in the Federal Court-Ordered Settlement Agreement between DOE and the State of Idaho, several intermediate project milestones must be met. These include initiation of line item funding for design and construction in FY 2004 and commencement of facility operations by FY 2009. FY 2001 activities consist of preparing the bid package for the conceptual design report and initiating National Environmental Policy Act (NEPA) activities to support the NEPA Determination by December 2001. FY 2002 activities consist of preparing the conceptual design report and performing other conceptual design activities necessary to support a formal DOE decision to proceed with RTF preliminary design by the end of FY 2003.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
ANL-W Operations	29,367	31,207	34,107	2,900	9.3%
Total, ANL-W Operations	29,367	31,207	34,107	2,900	9.3%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
ANL-W Operations	**29,367**	**31,207**	**34,107**

The infrastructure components, as described below, are required to satisfy safety and environmental requirements; maintain facilities in a user ready status and provide support functions for the ongoing program work. Each infrastructure component below also includes support for associated management and administrative activities. Performance will be measured by conducting ANL-W Infrastructure activities in a safe, secure and environmentally compliant manner within the authorized budget as delineated in the DOE approved ANL-W Infrastructure Program Implementation Plan.

#	**Nuclear Facility Support**	**15,700**	**16,826**	**17,657**

Engineering, technical, operator and technician support for maintaining the nuclear facilities at ANL-W in compliance with DOE Orders, environmental and industrial safety requirements and good management practice. Includes maintenance and calibration of radiation protection, detection and control systems; maintenance of heating, ventilation and air conditioning, filtration, emergency power, breathing air, instrument air and materials handling systems; calibration of facility instrumentation and control equipment; radiation monitoring; safety oversight; safety analysis; material control and accountability; waste management; procedures; and training. The FY 2002 increase of $831,000 is due to several factors including: increased effort for safety and quality oversight as required to correct deficiencies identified by self assessments and DOE-EH during a Price-Anderson Amendments Act (PAAA) assessment; and increased effort to comply with the revised DOE nuclear safety and quality requirements.

#	**Radiological Facility Support**	**3,700**	**3,847**	**4,072**

Engineering, technical, operator and technician support for maintaining the radiological facilities at ANL-W in compliance with DOE Orders, environmental and industrial safety requirements and good management practice. Includes maintenance and calibration of radiation protection, detection and control systems; maintenance of heating, ventilation and air conditioning, filtration, emergency power, breathing air, instrument air and materials handling systems; calibration of facility instrumentation and control equipment; radiation monitoring; safety oversight; safety analysis; waste management; procedures; and training. The FY 2002 increase of $225,000 is due to increased costs of resources, including materials and supplies.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
# **Balance-of-Plant Support**	**3,822**	**4,113**	**4,278**

Maintenance of non-nuclear and non-radiological facilities; utilities; roads; fences; grounds; electrical distribution, sanitary and wastewater systems; and steam production and distribution, fire detection and protection, and life safety communications systems to ensure safe operations, environmental compliance, and protection of Government investment. The FY 2002 increase of $165,000 is due to increased costs of resources, including materials and supplies.

# **Site Materials and Services**	**6,145**	**6,421**	**6,900**

Site materials and services provided by either ANL-W or the INEEL site services contractor. These items include electricity and power management, fuel oil, telecommunications, dosimetry, solid waste management, fire department, emergency management, transportation, and occupational medicine. The FY 2002 increase of $479,000 is due principally to the increased cost of electricity, power management, fuel oil, and diesel fuel for transportation.

# **General Plant Project (GPP) Funding**	**0**	**0**	**450**

Replacement/upgrade of systems to correct identified regulatory (e.g., DOE, OSHA, NFPA) deficiencies and to improve system performance in the areas of fire detection and suppression, life safety communication systems, control systems, electrical distribution, and plant utilities to ensure safe operations, environmental compliance, and protection of government investment. A DOE approved Infrastructure GPP plan will identify, based on a graded approach, the highest priority deficiencies and their schedules for correction. Currently, 13.2 kilovolt electrical switchgear and sections of the steam and condensate piping at the ANL-W site that are nearing the end of their useful life and prone to failure are among the highest priority systems in need of repair and replacement. The FY 2002 increase of $450,000 reflects additional GPP to begin repair and replacement of those aging infrastructure components and systems that require immediate restoration.

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
# **Remote Treatment Facility**	**0**	**0**	**750**

The FY 2002 funding level supports Remote Treatment Facility (RTF) conceptual design activities needed for the preparation of a request for a future budget line item for the detailed design and construction of this facility for disposal of mixed transuranic waste stored at ANL-W (performance measure). This facility is essential for the segregation, characterization, treatment, and repackaging of remotely handled mixed transuranic waste to assure that the conditions of INEEL Site Treatment Plan and the Federal Court-Ordered Settlement Agreement between DOE and the State of Idaho are satisfied. This legacy waste has accumulated in storage at ANL-W as a result of nuclear research and operations conducted at the ANL-W site over the last half century. Under this funding plan, RTF conceptual design and other critical project activities will continue to support a DOE decision in FY 2003 to proceed with RTF preliminary design. Construction would begin in FY 2005; the start of RTF operations would commence in FY 2009; and all remotely handled mixed transuranic waste at ANL-W would be removed from the State of Idaho by the required shipment date of 2015 as specified in the Federal Court-Ordered Settlement Agreement. The FY 2002 increase of $750,000 reflects the additional conceptual design activities needed to support authorization of a budget line item in FY 2004 for RTF project design and construction.

Total, ANL-W Operations	**29,367**	**31,207**	**34,107**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# **ANL-W Operations**	
C Nuclear Facility Support: The FY 2002 increase of $831,000 is due to several factors including; increased effort for safety and quality oversight as required to correct deficiencies identified by self assessments and DOE-EH during a PAAA assessment; and increased effort to comply with the revised DOE nuclear safety and quality requirements.	+831
C Radiological Facility Support: The FY 2002 increase of $225,000 is due to increased costs of resources, including materials and supplies.	+225
C Balance-of-Plant Support: The FY 2002 increase of $165,000 is due to increased costs of resources, including materials and supplies.	+165

	FY 2002 vs. FY 2001 ($000)
C Site Materials and Services: The FY 2002 increase of $479,000 is due principally to the increased cost of electricity, power management, fuel oil, and diesel fuel for transportation.	+479
C General Plant Project (GPP): The FY 2002 increase of $450,000 is needed to support the addition of General Plant Project funding to begin repair and replacement of aging facility and utility systems to correct identified regulatory deficiencies and to improve system performance	+450
C Remote Treatment Facility: The FY 2002 increase of $750,000 reflects the additional conceptual design activities needed to support a budget line item in FY 2004 for a facility to treat remotely handled mixed transuranic waste for disposal in accordance with the Court Ordered Settlement Agreement between the DOE and the State of Idaho	+750
Total Funding Change, ANL-W Operations	+2,900

Capital Operating Expenses & Construction Summary
Capital Operating Expenses

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
General Plant Projects (GPP)	0	0	450	450	100.0%
Total, Capital Operating Expenses	0	0	450	450	100.0%

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# Maintain and Shutdown Fast Flux Test Facility	
C Increase of $1,281,000 is due to increased electricity costs	+1,281
C Decrease of $1,705,000 is due to cessation of pre-ROD expanded surveillance and maintenance on operating and non-operating equipment to support FFTF shutdown	-1,705
C Decrease of $200,000 is for completion of reactor vessel drain pump procurement in FY 2002	-200
C Decrease of $1,259,000 is due to cessation of staff expansion and qualification in FY 2002 in order to direct resources to other deactivation activities	-1,259
C Increase of $533,000 is to modify and maintain fuel handling systems, solid waste transfer cask, and closed-loop ex-vessel machine to support shutdown	+533
C Increase of $350,000 is to initiate activities to prepare the Sodium Removal and Sodium Storage systems for use.	+350
C Increase of $2,500,000 to procure a heavy lift mobile crane for handling fuel storage casks	+2,500
Total, Maintain and Shutdown Fast Flux Test Facility	+1,500
# Complete National Environmental Policy Act Review	
C Decrease of $1,5000,000 is due to completion of final PEIS for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility in FY 2001.	-1,500
Total, Complete National Environmental Policy Act Review	-1,500
Total Funding Change, Fast Flux Text Facility	0

Test Reactor Area Landlord

Mission Supporting Goals and Objectives

The Idaho Test Reactor Area (TRA) is located within the Idaho National Engineering and Environmental Laboratory (INEEL). Since the early 1950s, test reactors, laboratories, hot cells and supporting facilities have been built and operated at this site. Currently operating on the site are: (1) the Advanced Test Reactor (ATR), which is the world's largest and most advanced test reactor, (2) the ATR Critical Facility reactor, (3) the Nuclear Materials Inspection and Storage Facility, which receives, inspects and stores new ATR fuel until needed, (4) the TRA Hot Cells where vital isotopes for medicine and industry that have been produced in the ATR have normally been processed and shipped (currently in standby while awaiting a potential privatization agreement for isotope production with a commercial entity), (5) the INEEL Applied Engineering and Development Laboratory, (6) Office of Science fusion energy research facilities, which are expanding, and (7) a major industrial machine shop facility that supports not only TRA facilities but also performs support work for all of INEEL. Vital nuclear reactor testing, isotope production, fusion energy research, and numerous other scientific research projects are planned to continue until well into the 21st century.

The major active facility at the TRA is the ATR. The ATR is the responsibility of and is operated by the Office of Nuclear Energy, Science and Technology and its operations are funded by its users. The principle user of the ATR is the Office of Naval Reactors within the Department's National Nuclear Security Administration. The ATR is vital to achieving the Department's strategic goal of providing the U.S. Navy with safe, militarily effective nuclear propulsion plants and ensuring their continued safe and reliable operation. ATR currently conducts virtually all irradiation testing of Navy reactor fuels and core components. The ATR depends on the TRA Landlord facilities and utilities to support its operations.

TRA Landlord Mission Supporting Goals and Objectives:

- Ensuring an adequate maintenance program is conducted to maintain the site common facilities and utility infrastructure in accordance with the Department of Energy (DOE), Federal and State of Idaho environmental, safety and health (ES&H) standards and regulations and to ensure reliable program support for tenant programs.

- Ensuring an adequate upgrade construction program is conducted to the site buildings and utility infrastructure to meet programmatic, reliability and ES&H requirements. Most of the TRA Landlord buildings and utility systems are more than 40 years old, and, given the projected indefinite continuing mission of the site, upgrades must be made to the buildings and especially to the utility infrastructure. These facilities and systems are at or near the end of their useful life or do not meet current ES&H requirements.

- Ensuring environmental compliance for the site including identification of legacy waste and mitigation in accordance with DOE, Federal and State of Idaho regulations and specific legal agreements entered into with the State of Idaho.

A significant increase in TRA Landlord funding is needed. The site is more than 40 years old, and the aging TRA facilities and utility infrastructure are urgently in need of upgrading in the very near term to ensure safety and reliability and to avoid violations under Federal and State of Idaho environmental and worker safety regulations. It is projected that the site will be in operation until well into the 21st century. If this goal is to be met, the Department needs to accelerate its investment in upgrading or replacing the TRA Landlord facilities and utility infrastructure.

The requested funding for TRA Landlord of $8,733,000 for FY 2002 is sufficient to meet the milestones for legacy waste cleanup in the Voluntary Consent Order between the State of Idaho and DOE, and to limit the growth in backlog of maintenance to no more than 10 percent. This increasing growth in backlog, coupled with Line Item Construction Projects that have been repeatedly deferred, will eventually result in system failures or ES&H issues that could cause major disruptions in operations at the site.

Planned FY 2002 TRA Landlord accomplishments within the requested funding include: (1) providing construction projects operating support, (2) conducting routine maintenance and repair on common site facilities and utility systems, (3) ensuring site environmental compliance including cleanup of legacy waste, and (4) conducting General Plant Projects (GPP) and Line Item Construction Projects (LICP).

The FY 2002 budget provides for continuation of the LICP to improve fire safety for the TRA site to meet current Federal, State and DOE fire safety standards. The principal Fire & Life Safety Improvements LICP accomplishments in FY 2002 will be continuing the process of upgrading fire doors, fire suppression systems, alarm systems, and smoke detectors in various site buildings. The requested FY 2002 budget also provides for continuation of the TRA Electrical Utility Upgrade LICP to reconfigure the 40 year old high voltage portion of the electrical utility system to meet current needs and to replace aged switchgear, control panels, instrumentation, cabling, and transformers for which maintenance parts are no longer available or which are at the end of useful life and beyond economical repair.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Operations and Maintenance	5,035	7,399	7,283	-116	-1.6%
Construction	1,870	1,334	1,450	116	8.7%
Total, Test Reactor Area Landlord	6,905	8,733	8,733	0	0.0%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Operations and Maintenance	**5,035**	**7,399**	**7,283**

Performance in FY 2002 will be measured by meeting the milestones for legacy waste cleanup at TRA in the Voluntary Consent Order between the State of Idaho and DOE and efficiently manage resources to limit growth in backlog of maintenance to no more than 10 percent.

#	**Construction Operating Support**	**1,260**	**1,103**	**958**

Provide engineering, planning, development, design, project validation and construction management for the Fire & Life Safety LICP, the Electrical Utility Upgrade LICP, and GPP projects. The decrease of $145,000 reflects deferral of planning activities associated with future line item projects.

#	**Maintenance and Repair**	**1,244**	**972**	**2,584**

Conduct surveillance, preventive maintenance, and routine repair activities on site. A $3,600,000 backlog of maintenance and repair has evolved. The increase of $1,612,000 will be used to reduce the growth of the maintenance backlog. These activities are essential in maintaining the reliability and longevity of the support systems critical in keeping the ATR, the TRA Hot Cells and other facilities operational.

#	**General Purpose Capital Equipment (GPCE)**	**0**	**340**	**0**

Procure GPCE to support TRA Landlord requirements. The decrease in funding reflects the deferral of planned purchases in FY 2002 such as a radiation portal monitor, in order to provide additional funding for maintenance and repair activities.

#	**General Plant Projects (GPP)**	**0**	**1,600**	**915**

In FY 2002 conduct such projects as: (1) complete the Radioactive Liquid Retention Basin Isolation Project to ensure that there can be no leak of radioactive liquid from the abandoned Retention Basin to the environment, and (2) complete the new potable water well and water system to meet new state and federal drinking water standards on-site. The FY 2002 decrease of $685,000 reflects deferral of the ventilation system upgrades for two TRA office buildings in order to provide additional funding for maintenance and repair activities.

#	**Environmental Compliance**	**2,531**	**3,384**	**2,826**

Continue environmental compliance measures for current waste streams and cleanup of legacy waste in accordance with DOE, Federal and State of Idaho regulations, and specific agreements with the State of Idaho. Such activities include: TRA Waste Tank Remediation; characterization and disposition of legacy wastes; and decontamination of site facilities as required. The $558,000 decrease is a result of legacy waste characterizations being less costly than originally anticipated.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Construction	**1,870**	**1,334**	**1,450**
# **TRA Fire & Life Safety Improvements**	**1,474**	**457**	**500**

In FY 2002, continue the TRA Fire & Life Safety LICP which corrects numerous significant violations of fire safety codes and regulations across the site. The FY 2002 increase of $43,000 is necessary for project completion in FY 2005.

# **TRA Electrical Utility Upgrade**	**396**	**877**	**950**

Continue the TRA Electrical Utility Upgrade LICP which replaces most of the obsolete site high voltage electrical distribution system which is inadequate for current tenant needs and becoming unreliable due to age and dwindling availability of spare parts. Any significant failures in this system now could not be quickly remedied and would have major impact on site operations, most importantly operations of the ATR. Types of components needing replacement or modification include switchgear, transformers, electrical panels, underground ductbanks, power cables, control wiring, and instrumentation and control equipment. The increase of $73,000 will allow for purchases of all electrical equipment planned for FY 2002 consistent with planned project completion in FY 2005.

Total, Test Reactor Area Landlord	**6,905**	**8,733**	**8,733**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Operations and Maintenance	
# Construction Operating Support: The decrease of $145,000 reflects deferral of planning activities associated with future line item projects.	-145
# Maintenance and Repair: The increase of $1,612,000 will be used to address the highest priority maintenance work, to reduce and , if possible, stop the growth of the maintenance backlog, and to maintain the TRA Hot Cells in a standby, but operational status.	+1,612
# General Purpose Capital Equipment (GPCE): The $340,000 decrease reflects the deferral of planned purchases in FY 2002 such as a radiation portal monitor, in order to provide additional funding for maintenance and repair activities.	-340
# General Plant Projects: The FY 2002 decrease of $685,000 reflects deferral of the ventilation system upgrades for two TRA office buildings in order to provide additional funding for maintenance and repair activities	-685
# Environmental Compliance: The $558,000 decrease is a result of legacy waste characterizations being less costly than originally anticipated.	-558
Total, Operations and Maintenance	-116
Construction	
# TRA Fire & Life Safety LICP: The increase of $43,000 is necessary for project completion in FY 2005.	+43
# TRA Electrical Utility Upgrade LICP: The increase of $73,000 will allow for purchases of all electrical equipment planned for FY 2002 consistent with planned project completion in FY 2005.	+73
Total, Construction.	+116
Total Funding Change, Test Reactor Area Landlord	0

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

(Changes from FY 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

| The project's TEC has increased $714K from $6,995K to $7,709K and project completion has been delayed one year as a result of less than planned funding. The work scope deferral has resulted in $275K in added escalation, management and contingency costs. Mandatory, more rigorous work control procedures implemented as part of the Department's new Integrated Safety Management System have added $415K in costs. The remaining $24K increase has been caused by an increase in design and construction costs associated with addressing Quality Level II equipment that was not identified during conceptual design. In addition to the $714K increase in TEC, a funding delay has caused the construction operating support costs for the project to increase by $205K resulting in the project's TPC increasing from $7,937K to $8,856K .

| In FY 2000, $908K was reprogrammed to other DOE activities. Also, a $48K rescission was applied to the FY 2001 appropriation. This has been added to FY 2005. Table 2., Financial Schedule, reflects these changes.

| The project physical construction start has been delayed from 4Q FY 2001 to at least 2Q FY 2002 because funding less than planned in FY 2000 and FY 2001 will not support a construction subcontract in FY 2001. All FY 2001 funds will be used to initiate hardware procurement.

| Adjustments have been made in Table 2. Financial Schedule, to reflect constraints imposed by projected funding being less than planned at the current request level.

| For reasons noted above, physical construction completion is changed from 4Q 2004 to 4Q 2005.

|

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 *(Current Baseline Estimate)*	2Q 1999	3Q 2001	2Q 2002	4Q 2005	7,709	8,856

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design/Construction			
1999	341	341	315
2000	396[a]	396	321
2001	877[b]	877	877
2002	950	950	950
2003	2,200	2,200	2,200
2004	1,246	1,246	1,246
2005	1,699	1,699	1,800

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 not unsafe, 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 system unreliability and significant personnel safety hazards.

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 accelerated funding. However, continuing fiscal constraints have not allowed for project acceleration.

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

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

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:

a. 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.
b. 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.
c. 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.
d. 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.
e. 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.

The requested FY 2002 funding will be used to start construction activities.

4. Details of Cost Estimate

(dollars in thousands)

	Current Estimate	Previous Estimate
Design Phase		
Preliminary and Final Design Costs (Design Drawings and Specifications)	662	600
Design Management Costs (0.3% of TEC)	20	17
Project Management Costs (1.3% of TEC)	97	114
Total, Design and Management Costs (10.1% of TEC)	779	731
Construction Phase		
Utilities	3,996	3,834
Inspection, Design and Project Liaison, Testing, Checkout and Acceptance	315	249
Construction management (9.4% of TEC)	721	426
Project management (8.8% of TEC)	679	566
Total, Construction Costs	5,711	5,075
Contingencies (15.8% of TEC)	1,219	1,189
Total, Line Item costs (TEC)	7,709	6,995

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 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Cost						
Design	315	321	114	0	0	750
Construction	0	0	763	950	5,246	6,959
Total, Line item TEC	315	321	877	950	5,246	7,709
Other project costs						
Conceptual design costs	132	0	0	0	0	132
NEPA documentation costs	4	0	0	0	0	4
Other project-related costs	137	71	118	300	385	1,011
Total other project costs	273	71	118	300	385	1,147
Total, Project Cost (TPC)	588	392	995	1,250	5,631	8,856

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

	Current Estimate	Previous Estimate
Total related annual funding	*	*

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

This project replaces existing equipment and cabling built to outdated standards and currently at the end of useful life. The replacement system will be built using current standards for design and materials and will correct numerous inefficiencies with the existing system. Routine maintenance and repairs for all TRA common use facilities and utilities, including this system, are funded through the annual TRA Landlord 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 2001 Congressional Budget Request are denoted with a vertical line [|] in the left margin.)

Significant Changes

| After the FY 2001 Congressional budget was submitted, a general reduction of $80K was applied to the FY 1999 appropriation for this project. Also, in FY 1999, delays were encountered in the construction of the one million gallon fire water tank resulting in some activities and their associated costs shifting into FY 2000. The funding required/used for the general reduction of $80K was added to FY 2005. In addition, a rescission of $43K was applied to the FY 2001 appropriation. This has been added to FY 2005. Table 2., Financial Schedule, reflects these changes.

| Due to the requested funding being less than appropriated; therefore, extending the project schedule, operating funds to support the project have increased by $998K to $2,918K, increasing the TPC from $17,366K to $18,364K. Increases are due to extended project management coverage, escalation in costs for radiological controls, additional systems engineering, and other TRA operations support required to manage the schedule changes and priority adjustments.

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 (Current Baseline Estimate)	2Q 1995	2Q 2001	3Q 1995	4Q 2005	15,446	18,364

2. Financial Schedule

(dollars in thousands)

Fiscal Year	Appropriations	Obligations	Costs
Design/Construction			
1995	1,696	1,696	1,180
1996	1,900	1,900	1,140
1997	1,000	1,000	1,819
1998	4,425	4,425	954
1999	2,345	2,345	3,471
2000	1,474	1,474	3,942
2001	457[a]	457	791
2002	500	500	500
2003	500	500	500
2004	500	500	500
2005	649	649	649

3. Project Description, Justification and Scope

Project Description

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

From this effort, 684 recommendations were developed for fire protection improvements to ensure compliance with current regulations and national codes. Improvements have been ranked in priority order commensurate with available funding in order to ensure that extending completion to FY 2005 will have minimum impact on fire and life safety.

This project provides the following:

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

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

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

- 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, identifies 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, but is not limited to, 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)	1,341	1,237
Design Management Costs (0.3% of TEC)	41	38
Project Management Costs (0.5% of TEC)	83	76
Total, Design and Management Costs (9.5% of TEC)	1,465	1,351
Construction Phase		
Improvements to Land	152	155
Buildings	6,122	6,235
Utilities	2,357	2,401
Standard Equipment	636	648
Inspection, design and project liaison, testing, checkout, and acceptance	783	797
Construction Management (9.8% of TEC)	1,514	1,291
Project management (8.8% of TEC)	1,366	656
Total, Construction Costs	12,930	12,183
Contingencies (6.8% of TEC)	1,051	1,912
Total, Line Item costs (TEC)	15,446	15,446

5. Method of Performance

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

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

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

6. Schedule of Project Funding

(dollars in thousands)

	Prior Years	FY 2000	FY 2001	FY 2002	Outyears	Total
Project Cost						
Facility Cost						
Design	1,198	214	53	0	0	1,465
Construction	7,366	3,728	738	500	1,649	13,981
Total, Line Item TEC	8,564	3,942	791	500	1,649	15,446
Other Project Costs						
Conceptual design costs	350	0	0	0	0	350
NEPA documentation costs	51	10	2	0	0	63
Other project-related costs	961	658	120	44	722	2,505
Total Other Project Costs	1,362	668	122	44	722	2,918
Total, Project Cost (TPC)	9,926	4,610	913	544	2,371	18,364

7. Related Annual Funding Requirements

(FY 2003 dollars in thousands)

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

Narrative Explanation of Related Annual Funding Requirements

The additional TRA Landlord 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.

Nuclear Facilities Management

Program Mission

The Nuclear Facilities Management program is a key component of the Department's energy supply and research mission and supports the DOE strategic goals and objectives as documented in the DOE Strategic Plan and the DOE Performance Plan. In the FY 2001 Energy and Water Appropriation, this program and the Argonne National Laboratory-West Operations portion of the Infrastructure program were formed from the previous "Termination Costs" program to more accurately represent the activities being performed at Argonne National Laboratory-West (ANL-W). The mission of this program includes the shutdown and deactivation of Experimental Breeder Reactor-II (EBR-II) at ANL-W and carrying out the long-term treatment and management of DOE's sodium-bonded spent nuclear fuel. Specifically, the key elements of this program are as follows:

- Prepare DOE sodium-bonded spent nuclear fuel for ultimate disposal as determined by National Environmental Policy Act (NEPA), National Research Council, and DOE reviews and subsequent Record of Decision (ROD) for treatment and management of sodium-bonded spent nuclear fuel.

- Further development of electrometallurgical treatment technology to help the Department meet long-term commitments in the management of its spent nuclear fuel.

- Safely and effectively manage and disposition the Department's material legacies associated with DOE's past nuclear energy activities.

- Place unneeded facilities in industrially safe, stable and environmentally compliant conditions for low-cost, long-term surveillance and maintenance. The current focus in this program element is the shutdown and deactivation of EBR-II at ANL-West. Key progress is being made in the treatment of sodium removed from EBR-II, which is required to fully deactivate the facility.

DOE Strategic Objective

Environmental Quality 3 - Manage the material and facility legacies associated with the Department's uranium enrichment and civilian nuclear power development activities.

FY 2002 Program Strategy

Through this programmatic activity, the Department will resolve spent nuclear fuel disposition problems and address other critical DOE missions. Also, the Department will complete deactivation of the EBR-II and apply electrometallurgical treatment in accordance with the NEPA reviews and ROD to the disposition of DOE sodium-bonded spent nuclear fuel. Finally, the Department will responsibly manage and disposition legacy materials generated from past DOE nuclear energy activities.

Program Goal

The program goals for the Nuclear Facility Management program are to responsibly and effectively carry out the long-term treatment of and management of DOE's sodium-bonded spent nuclear fuel, further develop electrometallurgical treatment technology to improve spent fuel treatment efficiency, shut down and deactivate the Experimental Breeder Reactor-II and other surplus facilities at ANL-W, and meet the Department's waste management and environmental commitments for this program.

Program Objectives

The objectives of the program reflect long-term goals which are achievable only through multi-year funding extending beyond the three year period covered in this plan.

- Prepare DOE sodium-bonded spent nuclear fuel for disposition using methods determined to be appropriate through NEPA, National Research Council, and DOE review; research potential other applications for the electrometallurgical technology; and develop advanced process equipment for waste volume reduction and process efficiency improvement.

- Place the EBR-II and other surplus facilities at the ANL-West site near Idaho Falls, Idaho in a radiologically and industrially safe and stable shutdown condition for long-term, low-cost surveillance and maintenance.

- Meet DOE's waste management and environmental commitments.

Significant Accomplishments And Program Shifts

- Demonstration of the electrometallurgical technology for treatment of sodium-bonded EBR-II fuel and blanket assemblies was initiated in June 1996.

- EBR-II defueling was completed in December 1996, three months ahead of schedule.

- In FY 1997, an Environmental Assessment and Finding of No Significant Impact were issued for the shutdown of the EBR-II, including the conversion of the sodium coolant to an environmentally acceptable form suitable for disposal.

- In FY 1998, modifications to the Sodium Process Facility were completed to enable processing of legacy sodium from the Enrico Fermi Atomic Power Plant (Fermi-I), and EBR-II primary and secondary sodium into a waste form suitable for disposal.

- In FY 1999, the electrometallurgical treatment technology demonstration project was successfully completed on schedule.

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

- In FY 2000, the National Research Council released a favorable report on the success of the electrometallurgical treatment technology (EMT) demonstration.

- In FY 2000, the draining, processing, and disposition of the 13,000 gallons of sodium coolant from the EBR-II secondary coolant system was completed.

- In FY 2000 after completion of the NEPA review and issuance of the Record of Decision (ROD), production activities on the treatment and management of DOE sodium-bonded spent nuclear fuel were initiated.

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

- In FY 2001 and FY 2002 consistent with the ROD, treat at least 0.5 MTHM per year of EBR-II spent nuclear fuel.

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

Funding Profile

(dollars in thousands)

	FY 2000 Comparable Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Current Appropriation	FY 2002 Request
Nuclear Facilities Management	42,100	34,850	-77	34,773	30,457
Total, Nuclear Facilities Management . .	42,100	34,850	-77 [a]	34,773	30,457

[a] FY 2001 rescission.

Funding by Site

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Chicago Operations Office					
Argonne National Laboratory	41,012	33,561	29,957	-3,604	-10.7%
Chicago Operations Office	95	0	0	0	0.0%
Total, Chicago Operations Office	41,107	33,561	29,957	-3,604	-10.7%
Albuquerque Operations Office	771	0	0	0	0.0%
Washington Headquarters	18	12	0	-12	0.0%
All Other Sites	204	1,200	500	-700	-58.3%
Total, Nuclear Facilities Management	42,100	34,773	30,457	-4,316	-12.4%

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.

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

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

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 EBR-II using electrometallurgical treatment technology, and is currently 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 is being deactivated in accordance with Congressional direction.

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 SPF is being used to convert radioactive sodium into a chemically stable, low-level waste form. The sodium being converted includes legacy sodium from the Enrico Fermi Atomic Power Plant (Fermi-I) in Michigan, which is stored at ANL-West; the primary and secondary sodium coolant from the EBR-II; and legacy sodium from some DOE fast reactor physics experiments in the 1970s, which is currently stored at the Rensselaer Polytechnic Institute (RPI) near Troy, New York. 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 and the TREAT, while not currently operating, provide a number of reactor physics, core design, nuclear materials, and waste treatment testing capabilities.

In July 1999, the Department selected the ANL and the INEEL to serve as the Nuclear Reactor Technology Lead Laboratories. These Lead Laboratories will 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.

Nuclear Facilities Management

Mission Supporting Goals and Objectives

The goals and objectives of the Nuclear Facility Management program is to close the Experimental Breeder Reactor-II and to treat its sodium-bonded spent nuclear fuel.

In addition, the Nuclear Facilities Management program supports the Department's mission to manage the approximately 2,700 metric tons of spent nuclear fuel currently in its inventory. These activities could reduce life-cycle costs by developing and deploying an innovative spent fuel treatment technology to solve currently intractable problems. The challenge of effectively managing the large inventory of DOE spent nuclear fuel is greatly complicated by the fact that it consists of about 150 different fuel types. Some of these spent fuels present special problems, (*e.g*., the presence of hazardous materials such as sodium). Other spent fuels are damaged, such as the core debris from Three Mile Island unit 2. Spent fuel with these characteristics may not be acceptable for disposal in current form in a geologic repository and therefore must be treated.

A prime example of this type of challenge is the EBR-II spent fuel at the ANL-West site. The EBR-II spent fuel is a metal fuel form containing elemental sodium as a bonding agent. Sodium metal is highly reactive, burns in air, and can explode when exposed to water. Because the sodium is partially absorbed by the uranium fuel elements, mechanical means are not fully effective in removing the sodium. The Department has analyzed whether to treat this fuel to remove as much of the sodium as possible to create a waste form acceptable for disposal. An accepted technology for removing the sodium from sodium-bonded spent fuel is the electrometallurgical treatment technology developed by ANL. In FY 1996, the Department completed an environmental assessment for the demonstration of electrometallurgical technology to treat EBR-II fuel and blanket assemblies. This ANL-West demonstration project, limited to 125 EBR-II driver and blanket assemblies, was completed in FY 1999.

A National Research Council (NRC) panel provided an ongoing independent evaluation of the development of electrometallurgical treatment (EMT) technology and the EMT demonstration project. Their interim reviews supported completion of the electrometallurgical technology demonstration project. The NRC completed their evaluation of the demonstration and issued their final assessment report with the conclusion that the electrometallurgical demonstration project successfully met all of established success criteria. The NRC panel also found that there were no technical barriers in the use of electrometallurgical technology to treat the EBR-II spent fuel, that this technology can be used to treat sodium-bonded spent nuclear fuel, and that EMT represents a potentially viable technology for other DOE spent fuel treatment. However, because of the quantities of these other spent fuels in the DOE inventory, including the other sodium-bonded spent fuels, and the larger amounts of waste that would be generated by the EMT process, additional waste form development and test activities necessary to gain acceptance qualification were recommended prior to initiating treatment of these other spent fuels.

Based in part on the above NRC reviews, an environmental impact statement was prepared for disposition of sodium-bonded fuel with application of this technology as the preferred alternative for treatment of the EBR-II spent fuel. In September, 2000, a Record of Decision based on the preferred alternative was issued for the treatment and management of the EBR-II spent fuel.

The FY 2002 budget requests funding to continue development and testing of waste stream treatment process equipment of a scale suitable for spent fuel inventory treatment, continue long-term tests to characterize performance of reference waste forms in accordance with established testing protocol, and develop waste form qualification plans and computer modeling to gain Nuclear Regulatory Commission approval for disposal of metal and ceramic waste forms in a geologic repository. The Department's path forward for managing its inventory of sodium-bonded nuclear fuel has been based, in part, on the success of the demonstration, the conclusions of the NRC review, as well as the NEPA review. The FY 2002 budget request provides funding to continue minimal spent fuel treatment for disposition of DOE's remaining inventory of sodium-bonded spent nuclear fuel.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Nuclear Facilities Management					
EBR-II Shutdown Activities	11,350	8,781	4,200	-4,581	-52.2%
Disposition of Spent Fuel and Legacy Materials Activities	19,050	16,164	16,267	103	0.6%
Disposition Technology Activities	11,700	9,828	9,990	162	1.6%
Total, Nuclear Facilities Management	42,100	34,773	30,457	-4,316	-12.4%

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
EBR-II Shutdown Activities	**11,350**	**8,781**	**4,200**

These are the costs to conduct the EBR-II Shutdown activities according to the stated program goals and objectives. Performance will be measured by meeting the agreed upon completion dates between DOE and ANL for draining the EBR-II primary system sodium in FY 2001, treating and dispositioning all EBR-II primary and secondary systems sodium and all Fermi reactor sodium coolant in storage at ANL-W in FY 2001, and deactivating EBR-II and all directly related surplus facilities in FY 2002.

#	**Sodium Processing**	**5,000**	**2,981**	**0**

Includes processing and disposition of EBR-II secondary and primary sodium and Fermi sodium. The FY 2002 decrease of $2,981,000 is due to all sodium processing activities being completed in FY 2001.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
# EBR-II Plant Deactivation	**6,350**	**5,800**	**4,200**

Includes engineering and technical effort for the deactivation of the EBR-II and directly related facilities. The FY 2002 decrease of $1,600,000 is due to all EBR-II plant deactivation activities being completed in mid FY 2002.

Disposition of Spent Fuel and Legacy Materials Activities	**19,050**	**16,164**	**16,267**

These are the costs to conduct the Disposition of Spent Fuel and Legacy Materials activities according to the stated program goals and objectives. Performance will be measured by successfully treating at least 0.5 MTHM of EBR-II spent fuel in FY 2001 and FY 2002.

# Disposition of Spent Fuel Activities	**18,350**	**14,964**	**15,767**

Operate Argonne facilities in accordance with Record of Decision (ROD) for treatment and management of stored sodium-bonded fuels. In FY 2000, this activity includes maintaining the Fuel Conditioning Facility and the Hot Fuel Examination Facility to allow for management of the DOE inventory of sodium-bonded spent fuel in accordance with the DOE ROD following completion of the National Environmental Policy Act (NEPA) review process and resuming treatment operations. FY 2001 funding supports completing deferred facility and process equipment maintenance and improvements and treating spent fuel at a minimal rate (0.5 MTHM per year). In FY 2002 and the years that follow, the spent fuel treatment rate would be maintained at only 0.5 MTHM per year until incremental funding is provided to support 24-hour operations and to implement process improvements. The FY 2002 increase of $803,000 is due to increased costs of resources, including materials and supplies.

# Disposition of Legacy Materials Activities	**700**	**1,200**	**500**

Repackage and remove DOE legacy spent fuel from a commercial facility. In FY 2001, begin design and safety analysis needed to support DOE legacy repackaging and removal activities. Funding in FY 2002 covers material storage costs at the commercial facility and minimal planning efforts. The $700,000 decrease is due to a reduced scope to cover materials storage costs at the commercial facility and minimal planning efforts for permanent disposal.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Disposition Technology Activities	**11,700**	**9,828**	**9,990**

Technical support for sodium-bonded spent nuclear fuel treatment includes research and development of treatment process refinements to ensure proper treatment of disrupted EBR-II fuel rods, a development and test effort on waste stream treatment process equipment of a scale suitable for inventory treatment, long-term waste characterization tests to support qualification activities and to gain Nuclear Regulatory Commission approval for emplacement of metal and ceramic waste forms in a geologic repository, and improvements to existing process equipment. This activity also supports the start of development of zeolite columns and other equipment refinements to reduce waste volume and improve process efficiency. The FY 2002 increase of $162,000 is due to increased costs of resources, including materials and supplies.

Total, Nuclear Facilities Management	**42,100**	**34,773**	**30,457**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# EBR-II Shutdown Activities: A net decrease of $4,581,000 reflects the completion of major program activities in FY 2001 and FY 2002.	
C A $2,981,000 decrease is due to all sodium processing activities being completed in FY 2001.	-2,981
C A $1,600,000 decrease is due to the completion of all EBR-II Shutdown activities in mid FY 2002.	-1,600
# Disposition of Spent Fuel and Legacy Material Activities: A net increase of $103,000 reflects a combination of increases and decreases in key program areas..	
C A $803,000 increase in the Disposition of Spent Fuel effort is due to increased costs of resources, including materials and supplies.	+803
C A $700,000 decrease in the Disposition of Legacy Materials effort is due to a reduced scope to cover materials storage costs at the commercial facility and minimal planning efforts for permanent disposal.	-700

	FY 2002 vs. FY 2001 ($000)
# Disposition Technology Activities	
C A $162,000 increase is due to increased costs of resources, including materials and supplies	+162
Total Funding Change, Nuclear Facilities Management.	-4,316

Program Direction

Mission Supporting Goals and Objectives

The Office of Nuclear Energy, Science and Technology (NE) Program Direction account funds expenses associated with the technical direction and administrative support of NE programs. The Department's Office of Nuclear Energy, Science and Technology (NE) represents the Federal Government's core expertise and capability in a wide range of civilian nuclear technologies. NE is one of the most diverse organizations in the Department. It is a research and development program that crosses many fields of application, all unified by its expertise and experience in the application of nuclear science and technology.

Program Direction has been grouped into four categories:

"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 the Office of Science funded energy research reactor operations (*e.g.*, the High Flux Isotope Reactor at the Oak Ridge National Laboratory), and activities funded by other Federal agencies. This category includes funding for other personnel compensation, such as, cash incentive awards and overtime pay. As part of the Department's objective to maintain a highly skilled workforce, NE must replenish critical technical expertise such as that required to assure the safe operation of the Department's various reactor facilities and to carry out new responsibilities such as the Nuclear Energy Research Initiative (NERI), and the Nuclear Energy Plant Optimization (NEPO) program.

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

"Support Services" includes funding for technical and management support services provided to NE Headquarters and Operations office employees. NE does not rely on expert contractors from the national laboratories to manage NE programs in place of Federal staff. NE only receives support from two M&O contractors assigned to the D.C. area. NE requires its senior technical managers to be Federal employees with significant experience necessary to accomplish program objectives. To reduce support services costs, NE has retrained and redeployed staff to reduce dependence on contractors while meeting growing needs in programs such as our University program and the Nuclear Energy Research Initiative. As an example, NE successfully retrained administrative staff to replace contractors providing graphics services. As a result, NE is far less dependent upon support service contractors than most other similar organizations.

"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 and Administration (MA) established a Working Capital Fund to provide funding for mandatory administrative costs, such as, rent and telephone services. Payments into this fund reflect usage of Fund services which are priced and charged to users in accordance with policies established by the Working Capital Fund Board.

The Department's reorganization, of March 1, 2000, established the National Nuclear Security Administration (NNSA). The Office of Naval Reactors (NR) transferred from NE to the NNSA. NR has agreed that the ten FTEs that support the operations of the Advanced Test Reactor and other Test Reactor Area facilities at the Idaho Operations Office, should remain in NE. Those FTEs are included in FY 2002 and, for comparability purposes, they have also been included in the FY 2000 and FY 2001 amounts.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Chicago					
Salaries and Benefits	1,364	1,406	1,474	68	4.8%
Travel	67	85	85	0	0.0%
Support Services	29	29	29	0	0.0%
Other Related Expenses	217	101	101	0	0.0%
Total, Chicago	1,677	1,621	1,689	68	4.2%
Full Time Equivalents	12	12	12	0	0.0%
Idaho					
Salaries and Benefits	1,049	1,049	1,093	44	4.2%
Travel	30	30	30	0	0.0%
Support Services	0	0	0	0	0.0%
Other Related Expenses	123	123	123	0	0.0%
Total, Idaho	1,202	1,202	1,246	44	3.7%
Full Time Equivalents [a]	11	11	11	0	0.0%
Oak Ridge					
Salaries and Benefits	763	817	832	15	1.8%
Travel	191	29	29	0	0.0%
Support Services	150	50	50	0	0.0%
Other Related Expenses	151	10	10	0	0.0%
Total, Oak Ridge	1,255	906	921	15	1.7%
Full Time Equivalents	8	7	8	1	14.3%
Oakland					
Salaries and Benefits	108	112	117	5	4.5%
Travel	14	10	10	0	0.0%
Support Services	0	0	0	0	0.0%
Other Related Expenses	23	23	23	0	0.0%
Total, Oakland	145	145	150	5	3.4%
Full Time Equivalents	1	1	1	0	0.0%

[a] Reflects transfer from NR of 10 FTEs at the Advanced Test Reactor Area in accordance with the NE/NNSA memorandum of agreement.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Richland					
Salaries and Benefits	472	565	649	84	14.9%
Travel	16	16	16	0	0.0%
Support Services	0	0	0	0	0.0%
Other Related Expenses	0	0	0	0	0.0%
Total, Richland	488	581	665	84	14.5%
Full Time Equivalents	5	6	6	0	0.0%
Ohio					
Salaries and Benefits	30	0	0	0	0.0%
Travel	0	0	0	0	0.0%
Support Services	0	0	0	0	0.0%
Other Related Expenses	0	0	0	0	0.0%
Total, Ohio	30	0	0	0	0.0%
Full Time Equivalents	0	0	0	0	0.0%
Headquarters					
Salaries and Benefits	10,527	11,464	13,118	1,654	14.4%
Travel	558	585	685	100	17.1%
Support Services	4,369	3,944	3,944	0	0.0%
Other Related Expenses	1,634	2,594	2,644	50	1.9%
Total, Headquarters	17,088	18,587	20,391	1,804	9.7%
Full Time Equivalents	102	114 [a]	110	-4	-3.5%
Total Nuclear Energy					
Salaries and Benefits	14,313	15,413	17,283	1,870	12.1%
Travel	876	755	855	100	13.2%
Support Services	4,548	4,023	4,023	0	0.0%
Other Related Expenses	2,148	2,851	2,901	50	1.8%
Total, Program Direction	21,885	23,042	25,062	2,020	8.8%
Full-Time Equivalents	139	151	148	-3	-2.0%

[a] FY 2001 appropriated funding level supports 98 current on-board HQS staff plus an additional 12 new/replacement positions expected to be filled during the year, bringing the total projected on-board staff to 110 at year-end. The expected FTE usage rate for FY 2001 is 104.

Detailed Program Justification

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Salaries and Benefits	**14,313**	**15,413**	**17,283**

NE Headquarters has streamlined its organizational structure from a multi-layered organization to a single-layered organization; downsized from 258 employees in 1993 to a current level of 98 employees; retrained and redeployed administrative staff to reduce dependence on contractors; and continuously redirected and realigned staff to accomplish program goals efficiently and effectively. As part of the Department's objective to maintain a highly skilled workforce, Nuclear Energy must hire approximately 12 additional staff to replenish critical technical expertise such as that required to assure the safe operation of the Department's various reactor facilities and to carry out new responsibilities such as the Nuclear Energy Research Initiative (NERI), the Nuclear Energy Plant Optimization (NEPO) programs. In addition, NE is faced with another issue concerning the aging workforce. The average age of NE employees is 49, and there are many employees who will soon be eligible to retire (25% by December 31, 2001). Over fifty percent of the current organization could turnover within just a few years. Staffing levels have now reached the point where some augmentation is necessary to be able to maintain a core staff of knowledgeable, competent, and experienced scientists and engineers to meet the growing responsibilities now being placed on the Office. NE is currently recruiting several entry-level engineering and scientific positions to replace senior, experienced technical staff expected to retire in the near future.

NE field employees paid from the NE KK Program Direction account includes Chicago Operations Office (12), Idaho Operations Office (11), Oakland Operations Office (1), Oak Ridge Operations Office (8), and the Richland Operations Office (6). Field staffing levels at ID reflect the transfer of 10 FTEs at the Advanced Test Reactor Area to NE from Naval Reactors in accordance with the memorandum of agreement between NE/NNSA. FY 2002 funding is based on these revised staffing levels plus the anticipated pay raise for FY 2002.

Travel	**876**	**755**	**855**

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

FY 2002 funding is based on increased international travel related to the new responsibilities, such as NERI, as well as travel to various foreign governments in support of U. S. Government policy and program initiatives.

(dollars in thousands)

	FY 2000	FY 2001	FY 2002
Support Services	**4,548**	**4,023**	**4,023**

In accordance with the Departmental initiative to reduce the level of support services contracting, NE has reduced Headquarters support services contracting from $10.6 million in support services contracts in FY 1995 to an estimated $4.0 million in FY 2002. NE has undertaken a special effort to minimize Advanced Radioisotope Power Systems Program support services.

Other Related Expenses	**2,148**	**2,851**	**2,901**

The single largest expenditure ($1.568 million in FY 2002) in the other related expenses category is earmarked for the Headquarters Working Capital Fund (WCF). The Department's Office of Management and Administration (MA) established a Working Capital Fund to provide funding for mandatory administrative costs, such as, rent and telephone services. Payments to this fund reflect usage of Fund services which are priced and charged to users in accordance with policies established by the Working Capital Fund Board. The Other Related Expense category also includes support for the Nuclear Energy Research Advisory Committee. Finally, this category includes expenses for Automated Data Processing (ADP) hardware and software support, training, periodicals and subscriptions, etc.

FY 2002 funding is based on escalation and increased administrative expenses to support new hires.

Total, Program Direction	**21,885**	**23,042**	**25,062**

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
# Salaries and Benefits	
C Salaries and benefits for 12 additional new hires to fill current vacancies, replenish critical technical expertise and to carry out new responsibilities, plus escalation in accordance with established guidelines	1,870
# Travel	
C Increased international travel related to the NERI program as well as travel to various foreign countries in support of other U. S. Government initiatives..	100
# Other Related Expenses	
C Increase attributable to escalation and administrative expenses in support of new hires.	50
Total, Program Direction	2,020

Support Services

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Technical Support Services	3,064	2,652	2,652	0	0.0%
Management Support Services	1,484	1,371	1,371	0	0.0%
Total, Support Services	4,548	4,023	4,023	0	0.0%

Other Related Expenses

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Working Capital Fund	1,311	1,518	1,568	50	3.3%
Nuclear Energy Research Advisory Committee	136	500	500	0	0.0%
ADP/TeleVideo Hardware and Software	310	323	355	32	9.9%
Subscriptions/Publications	18	20	20	0	0.0%
Training	35	45	45	0	0.0%
Other Miscellaneous	338	445	413	-32	-7.2%
Total, Other Related Expenses	2,148	2,851	2,901	50	1.8%

Advanced Accelerator Applications (AAA)

Program Mission

The Advanced Accelerator Applications (AAA) program is designed to make important advances for the Nation in areas of: energy security; national security; science and technology; and improving the U.S. education infrastructure.

The mission of the AAA program is to conduct scientific, engineering research, development and demonstration on (1) transmutation of spent nuclear fuel and waste; (2) accelerator production of tritium as a backup technology; (3) materials science; and (4) other advanced accelerator applications. Its major component is the development, design, and construction of a new facility to support U.S. advanced nuclear technology research in the 21st century.

Achievement of the AAA program mission will be accomplished through five major activities:

1. Develop, design, construct, and commission an Accelerator Driven Test Facility (ADTF) which is needed to address the depleted and aging U.S. nuclear research infrastructure;

2. Transmutation research and development to support experimental testing of non-fertile fuels, separations technology, materials testing, spallation targets design and testing leading to a transmutation proof-of-performance/practicality test;

3. Leverage and adopt the existing engineering development and design information, hardware, and resources of the Accelerator Production of Tritium (APT) program (particularly the Low Energy Demonstration Accelerator) to support AAA activities.

4. Establish a AAA Fellowship Program to support the development of new scientists and engineers and foster a new area of nuclear science and engineering for coupled accelerator / spallation-target / sub-critical systems. A science and engineering user community for the ADTF will be fostered through close cooperation with universities, laboratories, industry, and the Office of Science.

5. International Collaboration to support the research, design, and development of transmutation systems and the design and construction of the ADTF to ensure the ADTF will contribute to major advancements in nuclear science and engineering research.

Accelerator-Driven Test Facility (ADTF)

Recently, the Nuclear Energy Research Advisory Committee (NERAC) concluded that after a decade of neglect and decline, the U.S. nuclear research infrastructure can no longer support expansion of the Federal nuclear research and development program. Existing facilities can only support partial completion of the AAA Program objectives. A new, dedicated facility is required for fully reaching the goals of the AAA Program and

to support a future expansion of nuclear technology research in the United States. In particular, there exists no facility in the world capable of demonstrating the safe and efficient coupling of an accelerator, spallation target, and sub-critical reactor. The ADTF will be a highly flexible and unique user facility with which the Nation can assess technology options for the transmutation of spent nuclear fuel, provide a test bed for advanced nuclear technologies and applications, and demonstrate technologies pertinent to a robust tritium-backup capability. The ADTF would be comprised of two components: an advanced high energy accelerator that will provide protons to experimental facilities, and a sub-critical multiplier that includes a spallation target.

Transmutation Research and Development (R&D)

The Transmutation R&D program is based on a structured framework that defines performance requirements based on all elements of an integrated transmutation system leading to proof-of-performance testing and demonstration of waste transmutation. The Transmutation R&D activity will:

- Clearly define system performance objectives for transmutation and separations efficiency;
- Develop technology options to partition the components of used nuclear fuel for entry into a transmutation system;
- Develop approaches for transmuter fuel forms that do not produce plutonium during burn-up of nuclear waste;
- Research and develop technologies for a transmuter composed of a lead-bismuth eutectic or sodium-cooled tungsten target driving a sodium-cooled blanket. Also, assess performance and develop technologies as appropriate for gas-cooled and other advanced reactor concepts as part of a two-tiered strategy for long-lived nuclear materials use and management.

Accelerator Production of Tritium

The AAA program will provide the United States with a considerably more robust backup tritium production capability for national security. The program will adapt the Accelerator Production of Tritium (APT) design to develop an ADTF capable of demonstrating tritium production and be upgradeable to produce tritium in the future if needed. As part of the AAA Program, a range of vital technologies will be tested and demonstrated, including a coupled-cavity linac, superconducting structures, advanced diagnostics and control systems.

AAA Fellowship Program

Achieving AAA's goal of helping the revitalization of the domestic nuclear infrastructure means executing a vigorous program of university partnerships that support bringing new students into nuclear engineering and related disciplines. The AAA program will support 100 new students pursuing masters and Ph.D degrees in a range of nuclear science and technology uses during the course of the estimated ten-year program. In parallel, the University of Nevada will establish a major center aimed at materials, information systems, and other areas tied directly into AAA technical efforts which will also bring in new students to nuclear fields.

International Collaborations

A key objective of the AAA program is to put in place nuclear technologies and activities that will help rebuild U.S. technical leadership and credibility in international nuclear arenas. Close interaction and collaboration with similar international efforts is foreseen. Countries conducting efforts synergistic with the AAA program include:

- France: technical expertise in aqueous separations, fuels, and test facilities;
- Italy and Spain: energy amplifier program and development of nuclear designs and technologies;
- Germany: facilities and programs for developing and testing advanced liquid metal coolants;
- Switzerland: development and testing of neutron spallation targets using lead-bismuth;
- Russia: lead-bismuth technology, fabrication and testing of neutron targets, expertise in fuels and separations and advanced reactor development;
- Japan: nuclear fuels, research program for plutonium utilization, management of long-lived materials in nuclear waste, and planned construction of a basic and applied research facility; and
- South Korea: expertise in reactor and nuclear system design.

DOE Strategic Objective

Energy Resources 2 - Promote reliable, affordable, and clean transformation of fuel supplies into electricity and related products.

FY 2002 Program Strategies

For FY 2002, the Department has requested no new funds for the AAA Program. The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program.

Program Goals

- Contribute new, technically viable methods to assist in solving the long term civilian spent nuclear fuel problem;
- Develop a first-of-a-kind nuclear engineering research facility, available in 10 years, with user access to advance nuclear science and technology;

Provide demonstrable alternatives for the production of tritium and provide assurance of a backup supply of tritium required for national security;

Provide a strengthened academic nuclear infrastructure that educates new scientists and engineers for both energy and national security missions; and

Provide a new technology base (coupled Accelerator/spallation target/reactor) for advanced nuclear technology that will support U.S. research and development in the 21st century.

Program Objectives

Develop a pre-conceptual design of an Accelerator Driven Test Facility (ADTF), which could be designed and built within 10 years to demonstrate accelerator production of tritium, the technologies for the transmutation of spent nuclear fuels, and provide a test bed for advanced nuclear technologies and applications.

Conduct trade studies and R&D to develop the technology base for economical and environmentally sound transmutation of nuclear waste including the practicality and value of transmutation for long-term waste management.

Continue to develop the technology base for alternative tritium production. Document the status of APT preliminary design and engineering development, and demonstration activities, and provide capabilities for alternate tritium-production in the ADTF.

Establish an AAA University Fellowship Program with research partnerships to rebuild the national nuclear science technology base, re-establish the nuclear engineering and science infrastructure and enhance university curricula.

Contribute to the re-establishment of U.S. technology leadership by cooperating with international partners in nuclear technology development efforts in the AAA program through collaborations, utilizing existing facilities and sharing expertise.

Significant Accomplishments And Program Shifts

Civilian Research and Development (Accelerator Transmutation of Waste) (ATW)

In FY 2000, developed a six-year ATW program plan including a "Decision Framework" under which technology choices were examined and systematically evaluated.

In FY 2000, established a science and engineering based research program for ATW technology development; initiated systems studies to establish and evaluate technology options; and issued a program plan for the conduct and management of the ATW research program.

In FY 2001, merged the Nuclear Energy ATW program with Defense Programs APT project to establish the AAA program.

Accelerator Production of Tritium

In FY 1999, the Department formally announced that the Commercial Light Water Reactor (CLWR) was selected the primary technology for tritium production and APT was designated the backup technology.

In FY 1999, consistent with the Departments tritium technology selection, the approved scope of the APT project baseline changed from "develop, design, and build an APT plant" to "develop and perform preliminary design only for an APT plant."

In FY 1999, the APT Low Energy Demonstration Accelerator (LEDA) successfully demonstrated beam through the LEDA Radiofrequency Quadrupole (RFQ) at prototypic conditions, a key engineering development and demonstration milestone.

In FY 2001, merged the Defense Programs APT project with the Nuclear Energy ATW program to establish the AAA program.

Advanced Accelerator Applications Program

In FY 1999, the Offices of Nuclear Energy and Defense Programs conceived of a joint accelerator program that would combine the successful development of the APT program with NE's ATW program. The joint program would provide for a more robust backup tritium production capability, jump-start the nascent ATW program and create a user facility for nuclear engineering and science.

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

In FY 2001, a Report to Congress was submitted that outlines the AAA Program and a ten-year plan for R&D, design and construction of the ADTF.

Funding Profile

(dollars in thousands)

	FY 2000 Current Appropriation	FY 2001 Original Appropriation	FY 2001 Adjustments	FY 2001 Current Appropriation	FY 2002 Request
Advanced Accelerator Applications [a]					
Advanced Accelerator Applications	0	34,000	-75	33,925	0
Construction	0	0	0	0	0
Total, Advanced Accelerator Applications	0 [b]	34,000	-75 [c]	33,925	0

[a] Does not include funding for the APT budget which was funded by DP in FY 2000 ($88M) and FY 2001 ($34M)

[b] In FY 2000, funding in the amount of $8,220,000 was provided for Civilian Research and Development (ATW) program under Energy Supply.

[c] FY 2001 Rescission

Funding by Site

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Albuquerque Operations Office					
Albuquerque Operations Office	0	9,713	0	-9,713	-100.0%
Los Alamos National Laboratory	0	13,882	0	-13,882	-100.0%
Sandia National Laboratories	0	250	0	-250	-100.0%
Total, Albuquerque Operations Office	0	23,845	0	-23,845	-100.0%
Chicago Operations Office					
Chicago Operations Office	0	0	0	0	0.0%
Argonne National Laboratory	0	8,000	0	-8,000	-100.0%
Brookhaven National Laboratory	0	300	0	-300	-100.0%
Total, Chicago Operations Office	0	8,300	0	-8,300	-100.0%
Idaho Operations Office					
Idaho Operations Office	0	0	0	0	0.0%
Idaho National Engineering and Environmental Laboratory	0	0	0	0	0.0%
Total, Idaho Operations Office	0	0	0	0	0.0%
Oakland Operations Office					
Oakland Operations Office	0	0	0	0	0.0%
Lawrence Livermore National Laboratory	0	250	0	-250	-100.0%
Total, Oakland Operations Office	0	250	0	-250	-100.0%
Ohio Operations Office					
Ohio Operations Office	0	0	0	0	0.0%
Mound Plant	0	0	0	0	0.0%
Total, Ohio Operations Office	0	0	0	0	0.0%
Oak Ridge Operations Office					
Oak Ridge National Laboratory	0	200	0	-200	-100.0%
Oak Ridge Institute of Science and Education	0	0	0	0	0.0%
Total, Oak Ridge Operations Office	0	200	0	-200	-100.0%
Richland Operations Office					
Fluor Daniel Hanford	0	0	0	0	0.0%
Pacific Northwest National Laboratory	0	500	0	-500	-100.0%
Total, Richland Operations Office	0	500	0	-500	-100.0%
Savannah River Site	0	830	0	-830	-100.0%
Washington Headquarters	0	0	0	0	0.0%
All Other Sites	0	0	0	0	0.0%
Total, Advanced Accelerator Applications	0 [a]	33,925	0	-33,925	-100.0%

[a] In FY 2000, funding in the amount of $8,220,000 was provided for Civilian Research and Development (ATW) program under Energy Supply.

Site Descriptions

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. LANL serves as the lead laboratory for the Civilian Research and Development (ATW) program. LANL was the lead laboratory for the Accelerator Production of Tritium (APT) program and has the highest level of high energy linear accelerator expertise in the country. The Los Alamos Neutron Science Center (LANSCE) contains an 800 MeV linear proton accelerator and the Low Energy Demonstration Accelerator (LEDA), which will be used in the Civilian R&D program to develop and demonstrate the ATW accelerator technology.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a U.S. Department of Energy scientific research laboratory located in New Mexico. Sandia's work focused on the assessment of the proliferation aspects of the ATW System, with specific focus on the front end processing of the Light Water Reactor Oxide fuel to ATW metal fuel; coordination with the U.S. universities conducting research on these topic areas; and developing a draft report on the proliferation resistance of the ATW system.

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.

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 will 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.

ANL is a major contributor to the AAA program, with lead responsibilities in the development of fuel and separation technologies that will be explored for the transmutation of nuclear waste.

Brookhaven National Laboratory

The Brookhaven National Laboratory (BNL) is a multiprogram laboratory located in Upton, New York. BNL is supporting ATW target design technology in support of the ATW program.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) is a U.S. Department of Energy scientific research laboratory located in California. LLNL will focus on the evaluation of environmental impacts, waste stream management issues and impacts on the geologic repository. LLNL will develop the framework for evaluation and comparison of environmental impacts from system alternatives as information becomes available regarding effluents, wastes streams and impacts on the environment from construction, operation and decommissioning.

Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) is a U.S. Department of Energy multiprogram laboratory located in Oak Ridge, Tennessee. ORNL will support the neutronics code development; high energy photonuclear models; multiprocessing, and support other elements of AAA related fuels and material development.

Pacific Northwest National Laboratory

Pacific Northwest National Laboratory is a U.S. Department of Energy multiprogram laboratory located in Richland, Washington. PNNL will support the high temperature tensile tests in support of the AAA Program and support engineering related develops of the AAA program.

Advanced Accelerator Applications (AAA)

Mission Supporting Goals and Objectives

In late FY 1999, facing limited funding in FY 2001, Nuclear Energy (NE) and Defense Programs (DP) management proposed a joint accelerator program that would combine the successful development to date of the Accelerator Production of Tritium (APT) program with NE's Accelerator Transmutation of Waste (ATW) program. The proposed joint program would provide DP a more robust backup tritium production capability, jump-start NE's nascent ATW program, and create a user facility for nuclear engineering and science. The new joint effort was termed the Advanced Accelerator Applications (AAA) program.

The Energy and Water Development Appropriations Act for Fiscal Year 2001 provided $34,000,000 to the Department "to establish a new program for Advanced Accelerator Applications" and $34,000,000 to DP for preliminary design and engineering development in the APT Program. Total funding for the combined program in FY 2001 is $68,000,000.

The FY 2001 Appropriations Act also directed the Department of Energy to prepare a program plan for managing and executing the AAA program. The report provides an overview of a ten-year research and development (R&D) plan with programmatic element and a description of a construction project for a new Accelerator Driven Test Facility (ADTF). The ADTF would provide the capability to perform proof-of-performance experiments as well as form a foundation to support the U.S. scientific and nuclear engineer infrastructure, a critical element of this country's future.

For FY 2002, the Department has requested no new funds for the AAA Program. The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program.

The FY 2001 work scope includes the following elements:

Accelerator Driven Test Facility: The ADTF would be a unique and highly flexible test and user facility that will demonstrate technologies for the transmutation of spent nuclear fuel and waste, provide a test bed for advanced nuclear technologies and applications, and demonstrate accelerator technologies supporting a robust tritium backup capability.

Transmutation Research and Development (R&D): The Transmutation R&D program will investigate issues in the fundamental transmutation science and technology for target and nuclear system physics, special transmutation nuclear fuels and their behavior and performance, separations chemistry, and materials issues. The main areas of research include: systems, separations, waste forms, low level fission products, transmuter, and fuels. The ten-year program advances all portions of accelerator-driven transmutation research and development to a level where integrated proof-of-performance testing can be performed. During FY 2001, planned research and development activities will focus on the development and demonstration of technology for separations, fuels and materials.

Accelerator Production of Tritium: During FY 2001 the scope of the APT tritium backup effort includes completion of key Engineering Development and Demonstration (ED&D) efforts in accelerator, materials, and related areas. The program will identify options for tritium production using the ADTF. Summary and documentation of the preliminary design status of the original APT production plant will be concluded in FY 2001. The APT plant preliminary design efforts will be brought to an interim stage of completion during FY 2001, and those design elements unique to the APT Plant baseline design will be stopped at their current level of completion.

*AAA Fellowship Program:* In FY 2001 the AAA program began an effort to establish a University Program consisting of two key components. The first would support and foster development of Masters and Doctoral degree candidates in disciplines such as nuclear science, physics, chemistry, radiochemistry, chemical engineering, and nuclear engineering. This effort would provide real technical support for the AAA program that is integrated directly with program elements. A vigorous, academic based user group for the ADTF would be created. This program would be a peer-reviewed, competitive program that would have summer internships at the DOE Laboratories participating in the AAA program. The second component of the University Program involves the University of Nevada at Las Vegas (UNLV) for research and development of technologies for economic and environmentally sound refinement of spent nuclear fuel.

*International Collaboration:* In FY 2001 the AAA program sought international participation in transmutation science (fuels, et al.) and in participating in the review the conceptual design of the ADTF. These initial discussions have indicated that the U.S. is several years behind other countries in the science of transmutation, however there is strong interest by these parties to participate and share with the U.S. their research information.

Funding Schedule

(dollars in thousands)

	FY 2000	FY 2001	FY 2002	$ Change	% Change
Advanced Accelerator Applications [a]					
Advanced Accelerator Applications	0	33,925	0	-33,925	-100.00%
Construction	0	0	0	0	0.00%
Total, Advanced Accelerator Applications	0 [b]	33,925	0	-33,925	-100.00%

[a] Does not include funding for APT which was funded by DP in FY 2000 ($88M) and FY 2001 ($34M).

[b] In FY 2000, funding in the amount of $8,220,000 was provided for Civilian Research and Development (ATW) program under Energy Supply.

Detailed Program Justification

	(dollars in thousands)		
	FY 2000	FY 2001	FY 2002
Advanced Accelerator Applications Program, Operations [a]	**0**	**33,925**	**0**

This activity provides for engineering development and demonstration, pre-conceptual and conceptual design the ADTF; transmutation research and development activities; and establishment of programs for university participation and international collaborations. For FY 2002, the Department has requested no new funds for the AAA Program. The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program.

# **Accelerator Driven Test Facility . . . . . .**	**0**	**12,000**	**0**

This activity provides for engineering development and demonstration, pre-conceptual design, conceptual design, and NEPA for the ADTF. In FY 2002, performance will be measured by continue studies on the Advanced Accelerator Applications proof-of-performance and designs (using FY 2001 carryover funding). The Administration is reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program. The decrease of $12,000,000 reflects the Department's decision to not request funding for new initiatives until U.S. energy policy and related research priorities are identified.

# **Transmutation Research & Development . . . . . .**	**0** [b]	**18,425**	**0**

This activity provides for investigation in the fundamental transmutation science and technology for target and nuclear system physics, special transmutation nuclear fuels and their behavior and performance, separations chemistry, and materials issues. The decrease of $18,425,000 reflects the Department's decision to not request funding for new initiatives until U.S. energy policy and related research priorities are identified.

# **AAA University Fellowship Program . . . . . .**	**0**	**3,500**	**0**

This activity provides for a AAA fellowship program with the goal of funding 10 new graduate students in engineering and science each year beginning in FY 2001 (performance measure). In FY 2002, the AAA university fellowship program will be executed and will support 10 Masters Degree students in science and engineering related to nuclear technologies. The decrease of $3,500,000 reflects the Department's decision to not request funding for new initiatives until U.S. energy policy and related research priorities are identified.

Total, Advanced Accelerator Applications	**0** [b]	**33,925**	**0**

[a] Does not include funding for APT which was funded by DP in FY 2000 ($88M) and FY 2001 ($34M)

[b] In FY 2000, funding in the amount of $8,220,000 was provided for Civilian Research and Development (ATW) program under Energy Supply.

Explanation of Funding Changes from FY 2001 to FY 2002

	FY 2002 vs. FY 2001 ($000)
Advanced Accelerator Applications Program	
# The decrease of $33,925,000 is due to the Administration reviewing U.S. energy policy and related research priorities. Until these priorities are clearly identified, the Department will not request funding for major new energy initiatives. The Department has provided Congress a AAA Program Plan to facilitate discussion on the potential of a AAA program.	-33,925
Total, Advanced Accelerator Applications	-33,925