DOE/CF-0063
Volume 7

Department of Energy
FY 2012 Congressional Budget Request

Nuclear Energy
Defense Nuclear Waste Disposal
Nuclear Waste Disposal

February 2011 Office of Chief Financial Officer Volume 7

Printed with soy ink on recycled paper

Defense Nuclear Waste Disposal/Nuclear Waste Disposal

[redacted]

Nuclear Energy

[redacted]

Defense Nuclear Waste Disposal/Nuclear Waste Disposal

Volume 7

Table of Contents

The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

DEPARTMENT OF ENERGY
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2010 Current Approp.	FY 2011 Cong. Request	FY 2011 Annualized CR	FY 2012 Congressional Request	FY 2012 vs. FY 2010 $	FY 2012 vs. FY 2010 %
Discretionary Summary By Appropriation						
Energy And Water Development, And Related Agencies						
Appropriation Summary:						
Energy Programs						
Energy efficiency and renewable energy	2,216,392	2,355,473	2,242,500	3,200,053	+983,661	+44.4%
Electricity delivery and energy reliability	168,484	185,930	171,982	237,717	+69,233	+41.1%
Nuclear energy	774,578	824,052	786,637	754,028	-20,546	-2.7%
Fossil energy programs						
Fossil energy research and development	659,770	586,583	672,383	452,975	-206,795	-31.3%
Naval petroleum and oil shale reserves	23,627	23,614	23,627	14,909	-8,718	-36.9%
Strategic petroleum reserve	243,823	138,861	243,823	121,704	-122,119	-50.1%
Northeast home heating oil reserve	11,300	11,300	11,300	10,119	-1,181	-10.5%
Northeast home heating oil reserve oil sale	0	0	0	-79,000	-79,000	N/A
Total, Fossil energy programs	938,520	760,358	951,133	520,707	-417,813	-44.5%
Uranium enrichment D&D fund	573,850	730,498	573,850	504,169	-69,681	-12.1%
Energy information administration	110,595	128,833	110,595	123,957	+13,362	+12.1%
Non-Defense environmental cleanup	254,673	225,163	244,673	219,121	-35,552	-14.0%
Science	4,963,887	5,121,437	4,903,710	5,416,114	+452,227	+9.1%
Energy transformation acceleration fund	0	299,966	0	550,011	+550,011	N/A
Nuclear waste disposal	98,400	----	98,400	0	-98,400	-100.0%
Departmental administration	168,944	169,132	168,944	128,740	-40,204	-23.8%
Inspector general	51,927	42,850	51,927	41,774	-10,153	-19.6%
Title 17 - Innovative technology loan guarantee program	0	500,000	-15,000	200,000	+200,000	N/A
Section 1705 temporary loan guarantee program	0	----	0	0	——	——
Advanced technology vehicles manufacturing loan	20,000	9,998	20,000	6,000	-14,000	-70.0%
Better building pilot loan guarantee initiative for Universities, Schools, and Hospitals	0	0	0	105,000	+105,000	N/A
Total, Energy Programs	10,340,250	11,353,690	10,309,351	12,007,391	+1,667,145	+16.1%
Atomic Energy Defense Activities						
National nuclear security administration:						
Weapons activities *	6,386,371	7,008,835	7,008,835	7,629,716	+620,881	+8.9%
Defense nuclear nonproliferation *	2,131,382	2,687,167	2,136,709	2,549,492	-137,675	-5.1%
Naval reactors *	945,133	1,070,486	945,133	1,153,662	+83,176	+7.8%
Office of the administrator *	410,754	448,267	410,754	450,060	+1,793	+0.4%
Total, National nuclear security administration	9,873,640	11,214,755	10,501,431	11,782,930	+568,175	+5.1%
Environmental and other defense activities:						
Defense environmental cleanup	5,640,371	5,588,039	5,642,331	5,406,781	-233,590	-4.1%
Other defense activities	847,468	878,209	847,468	859,952	+12,484	+1.5%
Defense nuclear waste disposal	98,400	0	98,400	0	-98,400	-100.0%
Total, Environmental & other defense activities	6,586,239	6,466,248	6,588,199	6,266,733	-319,506	-4.9%
Total, Atomic Energy Defense Activities	16,459,879	17,681,003	17,089,630	18,049,663	+248,669	+1.5%
Power marketing administrations:						
Southeastern power administration	0	0	0	0	——	——
Southwestern power administration	13,076	12,699	13,076	11,892	-1,184	-9.1%
Western area power administration	109,181	105,558	109,181	95,968	-13,213	-12.1%
Falcon & Amistad operating & maintenance fund	220	220	220	220	——	——
Colorado River Basins	-23,000	-23,000	-23,000	-23,000	——	——
Total, Power marketing administrations	99,477	95,477	99,477	85,080	-14,397	-14.5%
Federal energy regulatory commission	0	0	0	0	——	——
Subtotal, Energy And Water Development and Related Agencies	26,899,606	29,130,170	27,498,458	30,142,134	+1,901,417	+6.7%
Uranium enrichment D&D fund discretionary payments	-463,000	-696,700	-463,000	0	+463,000	+100.0%
Excess fees and recoveries, FERC	-10,933	-29,111	-28,886	-25,072	-14,139	-129.3%
Subtotal, Discretionary Funding	26,425,673	28,404,359	27,006,572	30,117,062	+2,350,278	+8.5%
Strategic petroleum reserve sale	0	0	0	-500,000	-500,000	N/A
Cancellation of prior year unobligated balances	0	0	0	-70,332	-70,332	N/A
Total, Discretionary Funding **	26,425,673	28,404,359	27,006,572	29,546,730	+3,121,057	+11.8%

NOTE: * FY12 is compared against the FY11 Request. This exception has been implemented for NNSA only.
** The Total, Discretionary Funding, FY12 vs FY10 "$" and "%" columns, reflects a comparison of FY12 Request vs. FY10 Current Approp for all programs including NNSA

Nuclear Energy

Nuclear Energy

Table of Contents

The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

Nuclear Energy

Non-Defense Activities

(including transfer of funds)

Proposed Appropriation Language

For Department of Energy expenses including the purchase, construction, and acquisition of plant and capital equipment, and other expenses necessary for nuclear energy activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, and the purchase of not more than 10 buses, all for replacement only, $754,028,000, to remain available until expended.

The Department of Energy is authorized to carry out the program provided for in section 638 of the Energy Policy Act of 2005 (42 U.S.C. 16014) in this and subsequent fiscal years, using funds received from non-Federal sources as provided for in section 638 (d)(4)(B).

Nuclear Energy
Office of Nuclear Energy

Overview

Appropriation Summary by Program

	FY 2010 Current Appropriation	FY 2011 CR	FY 2012 Request
Nuclear Energy Appropriation			
Integrated University Program	5,000	-	0
Nuclear Power 2010	101,960	-	0
Generation IV Nuclear Energy Systems	212,904	-	0
LWR SMR Licensing Technical Support	0	-	67,000
Reactor Concepts Research, Development and Demonstration	0	-	125,000
Fuel Cycle Research and Development	131,938	-	155,010
Nuclear Energy Enabling Technologies	0	-	97,364
Radiological Facilities Management	71,760	-	64,888
Idaho Facilities Management	172,716	-	150,000
Program Direction	73,000	-	93,133
International Nuclear Energy Cooperation	0	-	3,000
Congressionally Directed Projects	2,500	-	0
Subtotal, Nuclear Energy Appropriation	771,778	-	755,395
Transfer from State Department	2,800	-	0
Undistributed, NE	0	-	0
Use of Prior Year Balance	0	-	-1,367
Total, Nuclear Energy Appropriation	774,578[a]	786,637	754,028
Other Defense Activities (NE) Appropriation[b]			
Idaho Sitewide Safeguards and Security	83,358	-	98,500
Total, Other Defense Activities Appropriation	83,358	83,358	98,500
Total, Nuclear Energy and Other Defense Activities	857,936	869,995	852,528

[a] Includes a reduction of $4,886,596 for rescission (P.L. 111-226, FAA Transportation Modernization and Safety Improvement Act).
[b] Includes only the NE portion of the Other Defense Activities appropriation.

Preface

The Office of Nuclear Energy (NE) supports the diverse civilian nuclear energy programs of the U.S. Government, leading Federal efforts to research and develop nuclear energy technologies, including generation, safety, waste storage and management, and security technologies, to help meet energy and climate goals. NE's longer-term, science-based nuclear energy research and development (R&D) complements the near-term strategy to support the revitalization of the nuclear industry through loan guarantees provided by the Department of Energy's Loan Guarantee Program. In addition, NE proposes an expansion of cost-shared activities with industry in FY 2012 to accelerate deployment of light water reactor-based Small Modular Reactor (SMR) technology.

Within the Nuclear Energy Appropriation, NE funds: LWR SMR Licensing Technical Support, Reactor Concepts Research, Development and Demonstration (RD&D), Nuclear Energy Enabling Technologies (NEET), Fuel Cycle R&D, Radiological Facilities Management (RFM), Idaho Facilities Management (IFM), International Nuclear Energy Cooperation (INEC), and Program Direction. The Idaho Sitewide Safeguards and Security program is funded under the Other Defense Activities Appropriation.

Mission

NE advances nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance and security barriers through research, development, and demonstration as appropriate.

Benefits

Guided by the *Nuclear Energy Research & Development Roadmap*, issued in April 2010, NE is working to develop innovative and transformative technologies to improve the competitiveness, safety and proliferation resistance of nuclear energy to support its continued use in the United States and abroad. NE has established programmatic goals that reflect nuclear power's continuing role in satisfying the demand for clean energy. Those goals include exploring through RD&D: technology and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals; development of sustainable nuclear fuel cycles; and minimization of risks of nuclear proliferation and terrorism.

The suite of activities represented in this request are designed to support the development of advanced reactor designs and technologies, including reactors that could be capable of meeting electricity generation, co-generation of process heat, and performance demands beyond current base load nuclear power plants and advanced fuel cycle technologies. Additional activities in these programs will help address technical barriers to the long-term operation of nuclear plants as well as the technical, cost, safety, proliferation, and security issues associated with novel designs and innovative reactor concepts. A prominent influence on R&D direction is improving our understanding of proliferation risks as well as developing the technical means to mitigate them. NE's R&D programs are structured to effectively address these challenges, as described below.

NE will also implement a cost-shared LWR SMR Licensing Technical Support program that will support the commercialization of new light water reactor-based (LWR) SMR designs. The Department

will work with LWR SMR vendors and first-mover utilities on a cost-shared basis to help accelerate the deployment of this technology. The program will focus on engineering costs associated with design certification and licensing activities.

The Reactor Concepts RD&D program supports research, development and demonstration for a diverse set of advanced fission power systems capable of producing electricity (MWe) and, in the case of the Next Generation Nuclear Plant (NGNP), generating process heat (BTUs) sustainably and economically. Reactor concepts include advanced SMR concepts, the NGNP, and other advanced reactor concepts. R&D activities will also form the scientific basis for extending the life of the current fleet of nuclear plants. Development of each reactor concept will seek to improve performance, economics, fuel cycle options, and safety.

NE leads future nuclear waste management activities, including those associated with the on-going Blue Ribbon Commission on America's Nuclear Future, and oversees responsibilities under the Nuclear Waste Policy Act. Through its Fuel Cycle R&D program, NE will continue to perform results-oriented, science based R&D on fuel cycle approaches and technologies, including exploration of new and advanced fuel types – such as high burn-up and inert matrix fuels – that may lead to improved performance in today's reactor technologies. The program will examine a full range of technologies and develop waste management options critical to the long term management of used fuel.

Complementing the RD&D activities carried out by the Reactor Concepts RD&D and Fuel Cycle R&D programs, the NEET program develops crosscutting and transformative technologies that directly support and complement NE's development of new and advanced reactor concepts and fuel cycle technologies. Within this program, activities will be carried out through directed research projects as well as through investigator-initiated projects selected through open, competitive solicitations. In FY 2012, crosscutting activities include the consolidation of NE Advanced Modeling and Simulation activities focused on creating advanced modeling and simulation tools to aid in reactor and fuel cycle R&D. Complementing these activities, the Energy Innovation Hub for Modeling and Simulation which is focused on creating a virtual model of a Generation II nuclear reactor, represents the novel approach and products that will enhance many research areas within the NE R&D agenda. In addition, funding for the Advanced Test Reactor National Scientific User Facility (NSUF), previously requested under the IFM program, is included in NEET for FY 2012. The change reflects the contribution NSUF is expected to make toward the development of crosscutting and transformative technologies. Finally, the investigator-initiated, peer reviewed Transformative Nuclear Concepts R&D program is open to projects that relate to any aspect of nuclear energy generation—reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration.

Just as the scope of the NEET program is informed by key challenges associated with developing commercially-viable reactor and fuel cycle technologies, the outcomes of the R&D activities supported through the NEET program will yield important breakthroughs that may be applied to the specific technologies under development in the Reactor Concepts RD&D and Fuel Cycle R&D programs. This program structure helps advance current reactor designs and fuel cycle technologies, develops new reactor designs and technology, and encourages the identification and development of "outside the box" options in all aspects of the civilian nuclear energy program. All programs are tightly coordinated and complementary to avoid duplication and spur innovation.

To help ensure the safe and secure deployment of civilian nuclear power world-wide, the INEC program will work cooperatively to share research results, and to strengthen officially approved international agreements and other relevant U.S. international commitments in civilian nuclear energy matters. This program will coordinate with the National Nuclear Security Administration, DOE's Office of Policy and International Affairs, and other agencies as appropriate in executing its activities.

NE will continue to support nuclear energy R&D at universities by designating up to 20 percent of funds appropriated to its R&D programs for work that may be performed at university and research institutions, through open, competitive solicitations for investigator-led projects. The national laboratories are encouraged to partner with universities to conduct R&D.

NE's infrastructure programs, including the IFM and RFM programs, ensure that the Department's nuclear facilities used for advanced nuclear energy technology R&D and the co-funded production (with National Aeronautics and Space Administration (NASA)) of power systems for space and national security needs are operated and maintained to support national priorities. Key activities conducted under these programs include ensuring NE facilities meet essential safety and environmental requirements and are maintained at user-ready levels as well as ensuring the safe and secure management of all special nuclear materials contained in these facilities.

NE's Research Reactor Infrastructure program will continue to provide fresh reactor fuel to and remove used fuel from 26 operating university reactors that support nuclear energy R&D. In addition, the Department will initiate work to re-establish a domestic capability to produce plutonium-238 for use in radioisotope power systems to meet NASA projected demand, as well as support longer term NASA needs and potential future national security applications.

Indirect Costs and Other Items of Interest

Institutional General Plant Projects (IGPP)

Institutional General Plant Projects (IGPPs) are construction projects that are less than $10 million and cannot be allocated to a specific program. IGPPs fulfill multi-programmatic and/or inter-disciplinary needs and are funded through overhead.

	FY 2010 Current Approp	FY 2012 Request
Institutional General Plant Projects (IGPP)		
Idaho National Laboratory	0	20,789
Total, Indirect-Funded Maintenance and Repair	0	20,789

Facilities Maintenance and Repair

The Department's Facilities Maintenance and Repair activities are tied to its programmatic missions, goals, and objectives. Facilities Maintenance and Repair activities funded by this budget are displayed below.

Indirect-Funded Costs for Maintenance and Repair

	FY 2010 Current Approp	FY 2012 Request
Idaho National Laboratory	17,443	19,332
Total, Indirect-Funded Maintenance and Repair	17,443	19,332

Direct-Funded Costs for Maintenance and Repair

	FY 2010 Current Approp	FY 2012 Request
Idaho National Laboratory	18,378	13,171
Total, Direct-Funded Maintenance and Repair	18,378	13,171

Nuclear Energy
Office of Nuclear Energy

Funding by Site by Program

	FY 2010 Current Approp	FY 2012 Request
Argonne National Laboratory		
Fuel Cycle Research and Development	9,648	12,144
Generation IV Nuclear Energy Systems	15,494	0
International Nuclear Energy Cooperation	0	960
Nuclear Energy Enabling Technologies	0	3,726
Nuclear Power 2010	550	0
Reactor Concepts Research, Development and Demonstration	0	8,091
Total, Argonne National Laboratory	25,692	24,921
Brookhaven National Laboratory		
Fuel Cycle Research and Development	1,150	1,102
Generation IV Nuclear Energy Systems	125	0
International Nuclear Energy Cooperation	0	0
Nuclear Energy Enabling Technologies	0	0
Reactor Concepts Research, Development and Demonstration	0	150
Total, Brookhaven National Laboratory	1,275	1,252
Chicago Operations Office		
Generation IV Nuclear Energy Systems	45	0
Total, Chicago Operations Office	45	0
Idaho National Laboratory		
Fuel Cycle Research and Development	53,876	32,785
Generation IV Nuclear Energy Systems	142,002	0
Idaho Facilities Management	159,488	142,200
International Nuclear Energy Cooperation	0	250
Nuclear Energy Enabling Technologies	0	15,586
Nuclear Power 2010	350	0
Radiological Facilities Management	9,840	9,840

	FY 2010 Current Approp	FY 2012 Request
Reactor Concepts Research, Development and Demonstration	0	74,792
Total, Idaho National Laboratory	365,556	275,453
Idaho Operations Office		
Congressionally Directed Projects	2,500	0
Fuel Cycle Research and Development	12,068	33,394
Generation IV Nuclear Energy Systems	12,437	0
Idaho Facilities Management	12,243	6,300
Integrated University Program	5,000	0
International Nuclear Energy Cooperation	0	0
LWR SMR Licensing Technical Support	0	67,000
Nuclear Energy Enabling Technologies	0	25,112
Nuclear Power 2010	100,110	0
Program Direction	31,937	34,106
Radiological Facilities Management	10,500	4,986
Reactor Concepts Research, Development and Demonstration	0	1,947
Total, Idaho Operations Office	186,795	172,845
Kansas City Site Office		
Idaho Facilities Management	500	0
Total, Kansas City Site Office	500	0
Lawrence Berkeley National Laboratory		
Fuel Cycle Research and Development	1,345	2,254
Generation IV Nuclear Energy Systems	200	0
Nuclear Energy Enabling Technologies	0	543
Reactor Concepts Research, Development and Demonstration	0	0
Total, Lawrence Berkeley National Laboratory	1,545	2,797
Lawrence Livermore National Laboratory		
Fuel Cycle Research and Development	4,573	2,693
Generation IV Nuclear Energy Systems	358	0
International Nuclear Energy Cooperation	0	250

	FY 2010 Current Approp	FY 2012 Request
Nuclear Energy Enabling Technologies	0	2,116
Reactor Concepts Research, Development and Demonstration	0	415
Total, Lawrence Livermore National Laboratory	4,931	5,474
Los Alamos National Laboratory		
Fuel Cycle Research and Development	17,457	13,693
Generation IV Nuclear Energy Systems	364	0
International Nuclear Energy Cooperation	0	500
Nuclear Energy Enabling Technologies	0	5,264
Radiological Facilities Management	32,030	27,000
Reactor Concepts Research, Development and Demonstration	0	1,540
Total, Los Alamos National Laboratory	49,851	47,997
Nevada Site Office		
Program Direction	0	4,235
Total, Nevada Site Office	0	4,235
Oak Ridge National Laboratory		
Fuel Cycle Research and Development	10,605	13,677
Generation IV Nuclear Energy Systems	31,210	0
International Nuclear Energy Cooperation	0	100
Nuclear Energy Enabling Technologies	0	32,131
Nuclear Power 2010	300	0
Radiological Facilities Management	15,160	5,160
Reactor Concepts Research, Development and Demonstration	0	17,592
Total, Oak Ridge National Laboratory	57,275	68,660
Oak Ridge Operations Office		
Generation IV Nuclear Energy Systems	1,500	0
Program Direction	1,353	1,650
Total, Oak Ridge Operations Office	2,853	1,650

	FY 2010 Current Approp	FY 2012 Request
Pacific Northwest National Laboratory		
Fuel Cycle Research and Development	6,618	7,382
Generation IV Nuclear Energy Systems Initiative	500	0
Nuclear Energy Enabling Technologies	0	2,315
Reactor Concepts Research, Development and Demonstration	0	1,720
Total, Pacific Northwest National Laboratory	7,118	11,417
Radiological and Environmental Sciences Laboratory		
Program Direction	5,163	5,606
Total, Radiological and Environmental Sciences Laboratory	5,163	5,606
Sandia National Laboratories		
Fuel Cycle Research and Development	8,353	11,893
Generation IV Nuclear Energy Systems	1,752	0
International Nuclear Energy Cooperation	0	250
Nuclear Energy Enabling Technologies	0	3,038
Radiological Facilities Management	1,300	0
Reactor Concepts Research, Development and Demonstration	0	4,595
Total, Sandia National Laboratories	11,405	19,776
Savannah River National Laboratory		
Fuel Cycle Research and Development	4,115	5,653
Generation IV Nuclear Energy Systems	160	0
Nuclear Energy Enabling Technologies	0	207
Total, Savannah River National Laboratory	4,275	5,860
Washington Headquarters		
Fuel Cycle Research and Development	2,130	18,340
Generation IV Nuclear Energy Systems	6,757	0
Idaho Facilities Management	485	1,500
International Nuclear Energy Cooperation	0	690
Nuclear Energy Enabling Technologies	0	7,326
Nuclear Power 2010	650	0

	FY 2010 Current Approp	FY 2012 Request
Program Direction	34,547	47,536
Radiological Facilities Management	2,930	17,902
Reactor Concepts Research, Development and Demonstration	0	14,158
Total, Washington Headquarters	47,499	107,452
Total, Nuclear Energy	771,778	755,395

Site Description

Argonne National Laboratory

Introduction

Argonne National Laboratory (ANL) is one of the Department of Energy's (DOE) scientific research laboratories and is the Nation's first national laboratory, chartered in 1946. ANL, which occupies 1,500 acres, is located approximately 25 miles southwest of Chicago.

Fuel Cycle Research and Development

ANL supports electrochemical separations and waste form development activities. ANL has the lead for key systems analysis activities and contributes to used nuclear fuel disposition research and development (R&D).

Generation IV Nuclear Energy Systems

In FY 2010, ANL continued to play an important role in conducting key R&D in support of the Generation IV Nuclear Energy Systems (Gen IV) program. ANL participated in system design and evaluation activities for the Gen IV systems, makes important contributions to Gen IV fuels and materials efforts, and lead or participated in joint projects with France, Korea, Canada, Euratom, and Japan. ANL was responsible for staffing one of two U.S. experts for the Generation IV International Forum (GIF) Experts Group. ANL also supported the Idaho National Laboratory (INL) on the Next Generation Nuclear Plant (NGNP) in the area of reactor cavity cooling system modeling.

International Nuclear Energy Cooperation

ANL provides technical assistance in the development of the Department's international nuclear technology strategies. ANL will also assist in the development of workshops to engage industry and foreign governments as well as provide technical support for key international R&D and nuclear energy activities in areas of mutual interest, leveraging U.S. funding, and exchanging technical information related to innovative reactor concepts, fuel cycle technologies, and other nuclear technologies.

Nuclear Energy Enabling Technologies

ANL provides technical support to various cross-cutting reactor technologies including fast reactor safety, system and components testing, and innovative materials development. ANL evaluates innovative reactor concepts and assesses integrated system performance, including the development of integrated performance and safety codes to support modeling and simulation.

Reactor Concepts Research, Development and Demonstration
ANL provides integrating program management support for the Advanced Reactor Concepts (ARC) program, and essential technical support in the areas of advanced reactor system technology development and evaluation of the potential benefits and feasibility of transformational reactor concepts. ANL makes important contributions in energy conversion, modeling and simulation, advanced structural materials, and safety and operations, including performance of small-scale validation experiments. ANL leads or participates in international collaborative projects, and is responsible for staffing one of two U.S. experts for the GIF Experts Group. ANL also supports the INL on the NGNP in the area of reactor cavity cooling system modeling and provides capabilities supporting fuels, materials and instrumentation and control research and development for advanced Small Modular Reactor (SMR) concepts.

Brookhaven National Laboratory
Introduction
The Brookhaven National Laboratory (BNL) is a multi-program laboratory located in Upton, New York. DOE's BNL conducts research in the physical, biomedical, and environmental sciences as well as in energy technologies. Brookhaven builds and operates major facilities available to university, industrial, and government scientists. BNL also performs a prospective benefits analysis of DOE's nuclear energy R&D portfolio.

Fuel Cycle Research and Development
BNL will provide support to systems analysis, material protection, and advanced fuels R&D.

Generation IV Nuclear Energy Systems
In FY 2010, BNL provided support to the Proliferation Resistance and Physical Protection Working Group under the Generation IV International Forum.

Nuclear Energy Enabling Technologies
BNL will provide support to the proliferation risk assessment activities.

Reactor Concepts Research, Development and Demonstration
BNL will provide support to ARC by participating in expert groups on proliferation resistance.

Chicago Operations Office
Introduction
The Chicago Operations Office provides procurement, contract, cooperative agreement, and grant support.

Generation IV Nuclear Energy Systems
In FY 2010, the Chicago Operations Office supported distribution of certain Gen IV funding.

Idaho National Laboratory
Introduction
The INL is an extensive research and engineering complex that has been the center of nuclear energy research since 1949. It occupies 890 square miles in southeastern Idaho along the western edge of the Snake River Plain, 42 miles northwest of Idaho Falls, Idaho. The INL consists of three main

engineering and research campuses: (1) the Reactor Technology Complex at the site, (2) the Materials and Fuels Complex (MFC) at the site, and (3) the Research and Education Campus in Idaho Falls. As the INL Landlord, the Office of Nuclear Energy (NE) also operates the Central Facilities Area at the site that provides support to all the compounds and campuses at the site. NE has Lead Program Secretarial Office responsibility for the Idaho Operations Office (ID). INL is the center for NE's strategic nuclear energy R&D enterprise. INL has a central role in reactor concepts research, development and demonstration (RD&D) development, fuel cycle R&D, Light Water Reactor Sustainability (LWR-S), and space nuclear power and propulsion applications. While focused on its role as the center for nuclear R&D, as a multi-program national laboratory, INL also continues to pursue national security, and homeland security activities. INL Center for Advanced Energy Study administers the Nuclear Energy University Program.

Fuel Cycle Research and Development
INL leads the Fuel Cycle R&D Technical Integration Office. INL has assembled a unique set of expertise across all technical areas important to fuel cycle programs. This expertise enables INL to fully integrate the range of information necessary to set requirements for all elements of the program. INL will be a key contributor in the development of a detailed program plan for the Department's fuel cycle R&D effort. INL has developed the VISION code and coordinated development of related databases used to analyze various fuel cycle scenarios, supports R&D on transmutation fuel and electrochemical separations techniques, and can perform the irradiations of transmutation fuels. Related facilities are concentrated at the MFC and at the Advanced Test Reactor, and include a complete suite of glove boxes, hot cells, and dedicated equipment.

Generation IV Nuclear Energy Systems
In FY 2010, INL was the lead laboratory for the NGNP program and conducted the program's technical integration activities, as well as integration activities for all Gen IV R&D activities. INL, together with Oak Ridge National Laboratory (ORNL), is the principal laboratory responsible for the development of advanced gas reactor fuel and materials R&D. INL was responsible for staffing the Technical Secretariat for the GIF. FY 2012 NGNP activities are discussed under Reactor Concepts RD&D

Idaho Facilities Management
INL is a multi-program national laboratory that employs R&D assets to pursue a wide range of nuclear power R&D and other national energy security activities. The purpose of the Idaho Facilities Management (IFM) program is to operate and maintain the INL infrastructure required to support mission needs and priorities in a manner that is in compliance with environment, safety and health rules and regulations. NE is responsible for 890 square miles of land west of Idaho Falls (the site) and numerous laboratory and administrative facilities located in the town of Idaho Falls. NE operates and maintains buildings, nuclear and radiological facilities, and associated support structures; a full complement of site wide utilities, including power, communications and data transmission systems; 800 miles of paved and unpaved roads; 61 miles of high voltage electrical transmission lines; and 14 miles of railroad track.

International Nuclear Energy Cooperation
INL will support the development of the Department's international nuclear technologies strategies and international engagement with foreign countries. INL will also assist in coordinating government-to-government international bilateral and multilateral activities. In support of International Nuclear Energy Cooperation's (INEC) International R&D and Technical Coordination activities, INL will provide

technical support to key international R&D and nuclear energy activities in areas of mutual interest, leveraging U.S. funding, and exchanging technical information related to innovative reactor concepts, fuel cycle technologies, and other nuclear technologies.

Nuclear Energy Enabling Technologies
INL provides technical support for cross-cutting technologies including advanced fuels, fabrication and construction methods, advanced sensors and instrumentation, and proliferation risk assessment. INL has the lead on the development of advanced instruments and sensors for the existing light water reactor fleet. INL is a key contributor to advances in modeling and simulation in the areas of verification and validation and in reactor fuels.

Radiological Facilities Management
INL is responsible for maintaining facilities and equipment for the assembly, testing, and delivery of radioisotope power systems. This capability focuses on the assembly of the encapsulated Plutonium 238 (Pu-238) into heat sources, insertion of heat sources into generators, testing of the assembled generators, and delivery of the generators to customers. Activities also include the transfer of neptunium-237 inventory from the Savannah River Site (SRS) to the INL for use in the future for Pu-238 production. In FY 2012, INL will continue to provide fuel for university research reactors including fuel for conversions from highly enriched uranium to low enriched uranium, and shipped spent fuel from university reactors to DOE's SRS.

Reactor Concepts Research, Development and Demonstration
INL is the lead laboratory for the NGNP program and conducts the program's technical integration activities, as well as integration activities for the LWR-S program. INL, together with ORNL, is the principal laboratory responsible for the development of advanced gas reactor fuel and materials R&D. INL is responsible for staffing the Technical Secretariat for the GIF. INL will also provide support for the SMR research and development program, providing capabilities in the areas of materials, fuels, and instrumentation and control, as well as modeling and simulation of SMR safety and performance. INL provides support to the ARC program in the areas of nuclear data and advanced alloy development and testing. INL also serves as the lead laboratory for R&D related to Risk-Informed Safety Margin Characterization, Advanced Instrumentation and Controls, and Advanced Light Water Reactor Fuels Development.

Idaho Operations Office
Introduction
The ID provides procurement, contract, cooperative agreement, and grant support. In FY 2010, this office provided support for contractor security investigations conducted by the Federal Bureau of Investigation and the OPM for DOE Federal employees and contractors. ID provides procurement and management support for NE university funding activities. A portion of the funds allocated to ID will be competitively awarded for support of both mission-specific and mission-related activities. Recipients may include industry, national laboratories, universities, research institutions.

Fuel Cycle Research and Development
ID provides procurement support for the Fuel Cycle R&D program.

Generation IV Nuclear Energy Systems
In FY 2010, ID provided procurement support for the NGNP program. ID was responsible for executing partnership agreements with industry to complete the conceptual design of the NGNP in FY 2010.

Idaho Facilities Management
ID provides procurement and management support for various community regulatory support to meet obligations defined in the following cross-cutting agreements: S.M. Stoller, Payment in Lieu of Taxes, Shoshone-Bannock Tribes, and the National Oceanic and Atmospheric Administration.

Integrated University Program
ID awards competitively solicited scholarships and fellowships to graduate, post graduate, minority, and minority-serving institutions.

LWR SMR Licensing Technical Support
ID provides procurement support for this program and administers industry cost-sharing arrangements with industry partners.

Nuclear Energy Enabling Technologies
ID provides procurement support and assists in developing competitive solicitations and cost-sharing arrangements to support cross-cutting reactor technologies. ID will provide procurement support to Headquarters (HQ) for a competitively-awarded Energy Innovation Hub for Modeling and Simulation that will support validated advanced modeling and simulation tools through the virtual modeling of an existing, operating reactor.

Nuclear Power 2010
In FY 2010, ID provided procurement, contract, cooperative agreement and grant support for the Nuclear Power 2010 program.

Radiological Facilities Management
ID provides procurement, contract, cooperative agreement and grant support for the Research Reactor Infrastructure program.

Reactor Concepts Research, Development and Demonstration
ID provides procurement support for the R&D activities within this program and administers industry cost-sharing arrangements with industry partners.

Kansas City Site Office
Introduction
Kansas City Site Office was established in 1949 and comprises the largest portion of the Bannister Federal Complex in south Kansas City, MO. As one of the nation's most diverse low-volume, high-reliability production facilities, the Kansas City Plant is at the heart of the National Nuclear Security Administration organization.

Idaho Facilities Management
In FY 2010, the site office provided support for the Roof Assessment Management Program Data Collection and inventory and design activities.

Lawrence Berkeley National Laboratory

Introduction

Lawrence Berkeley National Laboratory (LBNL) has been a leader in science and engineering research for more then 70 years. Located on a 200 acre site in the hills above the University of California's Berkeley campus, adjacent to the San Francisco Bay, Berkeley Lab holds the distinction of being the oldest of the U.S. DOE's National Laboratories.

Fuel Cycle Research and Development

LBNL provides key support to waste forms modeling and simulation as well as generic repository performance due to the unique qualification of the laboratory's staff.

Generation IV Nuclear Energy Systems

In FY 2010, LBNL supported the development of Gen IV reactor concepts.

Nuclear Energy Enabling Technologies

LBNL provides key support to waste forms modeling and simulation.

Lawrence Livermore National Laboratory

Introduction

Lawrence Livermore National Laboratory (LLNL) is a multi-disciplinary R&D laboratory focused on national defense, which has two noncontiguous geographic locations in northern California. LLNL is approximately one square mile and is located 40 miles east of San Francisco. LLNL conducts research in advanced defense technologies, energy, environment, biosciences, and basic science.

Fuel Cycle Research and Development

LLNL provides expertise on the impact of separation technologies on the geologic repository and advanced computer simulations and modeling efforts.

Generation IV Nuclear Energy Systems

In FY 2010, LLNL supported the development of Gen IV reactor concepts.

International Nuclear Energy Cooperation

LLNL will provide technical expertise in support of INEC activities and assist in coordinating international bilateral and multilateral activities. Activities include technical assistance in the development of the Department's strategies and international engagement with foreign countries.

Nuclear Energy Enabling Technologies

LLNL provides support to the proliferation risk assessment activities.

Reactor Concepts Research, Development and Demonstration

LLNL supports the development of advanced reactor concepts in the areas of nuclear data measurements and GIF lead-cooled fast reactor activities.

Los Alamos National Laboratory

Introduction

Los Alamos National Laboratory (LANL) is a multi-disciplinary research facility located on approximately 28,000 acres near the town of Los Alamos in northern New Mexico. LANL is engaged in a variety of programs for DOE and other government agencies. LANL's primary mission is to engage in research and technical activities supporting the Nation's defense. LANL also supports DOE missions related to arms control, non-proliferation, nuclear material disposition, energy research, science and technology, and environmental management. R&D in the basic sciences, mathematics, and computing have a broad range of applications, including: national security, non-nuclear defense, nuclear and non-nuclear energy, atmospheric and space research, geoscience, bioscience, biotechnology, and the environment.

Fuel Cycle Research and Development

LANL is leading safeguards activities, and provides major support as the lead organization for oxide fuel research. LANL has unique facilities to measure and evaluate the nuclear data that are critical for the analyses of nuclear systems. LANL also provides expertise in the areas of advanced fuels, materials and accelerator-driven systems.

Generation IV Nuclear Energy Systems

In FY 2010, LANL provided technical support in the modeling of various aspects of advanced reactor concepts.

International Nuclear Energy Cooperation

LANL provides technical expertise in support of INEC activities and assist in coordinating international bilateral and multilateral activities. Activities include technical assistance in the development of the Department's strategies and international engagement with foreign countries.

Nuclear Energy Enabling Technologies

LANL leads activities associated with developing new tools and techniques to assess proliferation risks. LANL also provides technical support to several cross-cutting technologies to be developed under this program, including transformational fuels and materials development. LANL provides advanced computer simulations and modeling in support of separation technologies.

Radiological Facilities Management

At LANL, the facilities at Technical Areas (TA) -3, -35, -48 and -55 provide unique national actinide capabilities in the areas of analytical chemistry, materials characterization, chemical diagnostics, radiochemistry, and applied spectroscopy. A portion of the Plutonium Facility-4 at the TA-55 is dedicated to Pu-238 activities and is used to purify and encapsulate Pu-238 used in radioisotope power sources for the National Aeronautics and Space Administration (NASA) space exploration missions and national security applications. LANL capabilities were expanded to include establishing a Pu-238 scrap recovery capability to recycle Pu-238 scrap for use in future missions.

Reactor Concepts Research, Development and Demonstration

LANL provides technical support in the precision measurement of nuclear data to support advanced reactor concepts, and the development of small lead-bismuth-cooled reactor concepts.

Oak Ridge National Laboratory

Introduction

The ORNL is a DOE scientific research laboratory located in Oak Ridge, Tennessee. Major missions of ORNL include: (a) neutron scattering research, (b) high-performance computational modeling and simulation, (c) nuclear science and technology research, (d) materials science research, and (e) biological and life sciences research. The broad science agenda is supported by 19 major DOE user facilities, which are available to the international research community. ORNL also maintains the DOE computer code system, software, and documentation at the Radiation Safety Information Computational Center (RSICC) and serves as a repository for DOE computational research activities, including computer software that is developed by the Nuclear Engineering Education Research (NEER) projects.

Fuel Cycle Research and Development

ORNL provides key support for fuels, separations and waste form R&D as well as safeguards and nuclear data research. ORNL also supports systems analysis and engineering assessments, including uranium resource studies, and provides materials R&D expertise.

Generation IV Nuclear Energy Systems

In FY 2010, ORNL and INL were the principal laboratories responsible for the R&D of advanced gas reactor fuel suitable for NGNP. ORNL also lead the development of the Gen IV Materials handbook efforts, conducts much of the materials testing in support of the Gen IV, and chaired the Project Management Board for the Very-High Temperature Reactor (VHTR) Materials Project Arrangement under GIF. In addition, the Energy Innovation Hub for Modeling and Simulation (HUB) was started.

International Nuclear Energy Cooperation

ORNL will provide technical support for key international R&D and nuclear energy activities in areas of mutual interest, leveraging U.S. funding, and exchanging technical information related to innovative reactor concepts, small modular reactors, fuel cycle technologies, and other nuclear technologies. ORNL will also assist in the implementation of the INEC bilateral and multilateral R&D and policy engagement in the area of reactor technical evaluations and support.

Nuclear Energy Enabling Technologies

ORNL leads the advanced materials development activities and provides crosscutting technical support in the areas of advanced fuels, sensors and measurement sciences, proliferation risk assessment and advanced methods for fabrication and construction. The Hub is being run by ORNL. ORNL also contributes to advanced modeling and simulation for nuclear energy systems.

Radiological Facilities Management

The Radiochemical Engineering Development Center (REDC) at the ORNL is the Department's production, storage, and distribution center for the heavy-element research activities with advanced hot cell capabilities. REDC along with the Irradiated Fuels Examination Laboratory and Irradiated Fuels Examination and Testing Facility provide experimental capability in support of advanced fuel and structural material examination and testing and advanced aqueous flow sheet development and testing activities for advanced reactor research. ORNL provides the unique capabilities for fabricating carbon insulator and iridium heat source components for radioisotope power sources used for NASA space exploration missions. These sophisticated heat source components are necessary for the safe operation of these power systems during normal operation and during launch, re-entry or other deployment accidents. ORNL, in cooperation with INL, is playing a key role in establishing the domestic capability

to produce Pu-238 for use in NASA and national security missions. Facilities at ORNL could potentially be used to support the production effort.

Reactor Concepts Research, Development and Demonstration
ORNL and INL are the principal laboratories responsible for the R&D of advanced gas reactor fuel suitable for the NGNP and LWR-S R&D related to Nuclear Materials Aging and Degradation. ORNL provides integrating program management support for research and development capabilities for advanced SMR-related materials, fabrication, modeling and simulation, regulatory structure, and instrumentation and control. ORNL supports the ARC program in the areas of advanced materials and liquid-salt-cooled high-temperature reactor concepts and technology. ORNL also leads the development of the Materials Handbook efforts and chairs the Project Management Board for the VHTR Materials Project Arrangement under GIF.

Oak Ridge Operations Office
Introduction
The Oak Ridge Operations Office (ORO) supports the Small Business Innovation Research and Small Business Technology Transfer program.

Generation IV Nuclear Energy Systems
In FY 2010, ORO supported distribution of funding for the Department's FY 2010 Phase III Xlerator Program.

Pacific Northwest Laboratory
Introduction
Pacific Northwest Laboratory (PNL) is a multi-program laboratory located on approximately 640 acres of the Department's Hanford site. PNL also monitors a marine science lab in Sequim, Washington.

Fuel Cycle Research and Development
PNL has a key role in waste form activities by leveraging its history and expertise. PNL provides technical support in the areas of advanced separations, fuels, materials, safeguards and nonproliferation analysis, and systems analysis.

Generation IV Nuclear Energy Systems
In FY 2010, PNL supported the development of Gen IV reactor concepts.

Nuclear Energy Enabling Technologies
PNL provides support for advanced modeling and simulation and to the proliferation risk assessment activities. PNL also provide support for advanced sensors and instrumentation.

Reactor Concepts Research, Development and Demonstration
PNL supports the development of advanced reactor concepts in the areas of nuclear data measurements and ultrasonic viewing technology.

Sandia National Laboratories
Introduction
Sandia National Laboratories (SNL) is a research and development facility located on approximately 18,000 acres on the Kirtland Air Force Base reservation near Albuquerque, New Mexico and has

smaller facilities in Livermore, California and Tonopah, Nevada. The mission of SNL is to meet national needs in the nuclear weapons and related defense systems, energy security, and environmental integrity.

Fuel Cycle Research and Development
SNL supports the used nuclear fuel (UNF) disposition technical area. SNL was the lead laboratory that coordinated and organized scientific work for the repository program. It will now provide that technical expertise to support UNF disposition. It also supports systems analysis and separations and waste forms.

SNL also provides systems analysis support, particularly in the area of transportation analysis. SNL also has the lead for certain nuclear safeguards and security activities.

The laboratory has also developed widely used computer codes and models to analyze reactor safety. These codes have been validated and verified, and have been integrated into the nuclear industry's regulatory infrastructure. In this context, extensive databases have been developed to support probabilistic risk assessment modeling and analyses.

Generation IV Nuclear Energy Systems
In FY 2010, SNL R&D was focused on development of advanced gas turbo-machinery with helium or supercritical carbon dioxide as the working fluids.

International Nuclear Energy Cooperation
SNL will provide technical expertise in support of INEC activities and assist in coordinating international bilateral and multilateral activities. Activities include technical assistance in the development of the Department's strategies and international engagement with foreign countries.

Nuclear Energy Enabling Technologies
SNL provides support to advanced modeling and simulation and to the proliferation risk assessment activities.

Radiological Facilities Management
In FY 2010, SNL maintained the nuclear system safety basis and develop risk assessment tools in support of DOE responsibilities for public safety under the Atomic Energy Act and in fulfillment of DOE's role in the Presidential Launch Approval Process under Presidential Directive National Security Council Memorandum 25 (PD/NSC-25).

Reactor Concepts Research, Development and Demonstration
SNL provides support to advanced reactor concepts in the areas of gas turbo-machinery (development and operational performance testing of high efficiency Brayton cycle energy conversion technology), reactor safety, and proliferation resistance. SNL also supports advanced SMR research and development efforts in the areas of safeguards and security, codes and standards, and regulatory development.

Savannah River National Laboratory
Introduction
The Savannah River National Laboratory (SRNL) is an extensive material production and engineering

complex that has been a nuclear site since 1951 when construction began supporting the U.S. strategic weapons program. The SRS is now a multi-program operational site covering 310 square mile site near Aiken, South Carolina. Because of its Cold War nuclear legacy, there is a significant level of environmental management cleanup work being performed at the site. In addition to supporting NE programs, the SRS workforce continues to support NNSA's weapons disposition program. SRNL is a multi-program laboratory located on approximately 34 acres within the SRS.

Fuel Cycle Research and Development
SRNL conducts research on advanced aqueous separations, systems analysis, advanced safeguards, and waste form development. SRS provides systems engineering support as well.

Generation IV Nuclear Energy Systems
In FY 2010, SRNL was provided limited funding to archive valuable equipment and data related to non-electric applications of nuclear energy.

Nuclear Energy Enabling Technologies
SRNL provides support to the proliferation risk assessment activities.

Washington Headquarters
Introduction
FY 2010 and FY 2012 include funding for SBIR and other small business initiatives. A portion of the funds allocated to HQ will be competitively awarded for support of both mission-specific and mission-related activities. Recipients may include industry, national laboratories, universities, research institutions.

Fuel Cycle Research and Development
HQ provides management of certain research activities and competitive solicitations.

Generation IV Nuclear Energy Systems
In FY 2010, HQ provided overall oversight and management of R&D activities and served as the interface with the NRC.

Idaho Facilities Management
HQ funds cross-cutting departmental activities such as DCAA audits, NRC certificates and fees, and NE's share of DOE corporate infrastructure management systems. Funding also supports NE-owned material storage fees at BWXT and waste generator fees at the Nevada Test Site.

International Nuclear Energy Cooperation
HQ provides INEC activities that include technical expertise in support of international bilateral and multilateral engagement and civil nuclear energy R&D with countries that are established as significant participants in the commercial nuclear sector; energy supply, nonproliferation and fuel cycle assessments; and reviewing the legal and financial liability implications of proposed strategies and options. Work may also include the creation of workshops to engage industry and foreign governments.

Nuclear Energy Enabling Technologies
HQ provides oversight of a competitively-awarded modeling and simulation Hub for the development of

validated advanced modeling and simulation tools through their application to an existing, operating reactor.

Nuclear Power 2010
In FY 2010, HQ provided funding for close out activities on the NuStart combined Construction and Operating License demonstration project.

Radiological Facilities Management
HQ provides funds to initiate a project to restart the production of Pu-238 for the Space and Defense program.

Reactor Concepts Research, Development and Demonstration
HQ provides overall management of reactor research and development activities and serves as the primary interface with the NRC. HQ develops competitive solicitations and industry cost-sharing arrangements to support SMRs, NGNP, and other reactor concepts.

Integrated University Program

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Integrated University Program	5,000	0

Public Law Authorizations:
P.L. 111-85, Appropriations Act (2010)
P.L 111-226, FAA Air Transportation Modernization and Safety Improvement Act (FY2010)

Mission

The mission of the Integrated University Program is to provide scholarship and fellowship grants to support training of engineers and scientists in nuclear engineering, nonproliferation, nuclear forensics, and nuclear safeguards missions through support of nuclear science and engineering study and research.

Benefits

In FY 2010, the Integrated University Program provided approximately 30 three-year fellowships and 88 one-year scholarships. 100 percent of funding for multi-year awards is included within the FY 2010 appropriation.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The Integrated University Program has used various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department implemented the following means:
- Provide scholarships and fellowships as directed by statutory requirements.

The Department implemented the following strategies:
- Issue scholarship and fellowship grants according to statutory requirements in a manner that ensures awards are fully funded within available funds.
- Determine university needs and best categories of university grant investments to support nuclear science and engineering education.

These strategies contributed to the efficient and effective management of the program and productive use of the taxpayers' dollars.

In carrying out its mission, the program performs the following collaborative activities:

- Coordinate with the NRC and the National Nuclear Security Administration's Office of Defense Nuclear Nonproliferation to support nuclear science and engineering education without duplication.
- Coordinate with other training and education efforts within the DOE.

Integrated University Program

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Integrated University Program	5,000	0

Benefits

In FY 2010, the Integrated University Program provided approximetly 30 three-year fellowships and 85 one-year scholarships and 32 research fellowships. 100 percent of funding for the mulit-year awards is included within the FY 2010 appropriation.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Integrated University Program	**5,000**	**0**
In FY 2010, the Integrated University Program scope was focused entirely on supporting nuclear education by funding 85 one-year scholarships and 32 research fellowships of up to three-year's duration for students enrolled in nuclear energy-related fields of study or disciplines at U.S. universities and two-year colleges. One hundred percent of funding for multi-year awards is included within the FY 2010 appropriation.		
Total, Integrated University Program	**5,000**	**0**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Integrated University Program	
The decrease reflects the Administration's confidence that the nuclear industry, as it expands, will create incentives for students to enter nuclear-related programs.	-$5,000
Total Funding Change, Integrated University Program	**-$5,000**

Nuclear Power 2010

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Nuclear Power 2010	101,960[a]	0

Public Law Authorizations:
P.L. 111-85, Appropriation Act (2010)
P.L. 111-226, FAA Air Transportation Modernization and Safety Improvement Act (2010)

Mission

The Nuclear Power 2010 (NP 2010) program was a joint government/industry cost-shared effort established in FY 2002 to demonstrate untested NRC regulatory and licensing processes. The program was completed and brought to closure at the end of FY 2010.

Benefits

The NP 2010 program provided funding to industry to achieve notable milestones including the issuance of three NRC-approved Early Site Permits, which establish that a site is suitable for possible future construction and operation of a nuclear power plant, and the submission to and review by the NRC of two construction and operating license (COL) applications for two reactor designs.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The Department has implemented the following means:
- Close out joint government/industry cost-shared effort to support the combined COL demonstration project.

The Department has implemented the following strategies:
- Partnered with the private sector, national laboratories, and universities to support advanced Light Water Reactor (LWR) technologies and demonstrate current licensing processes.

[a] Includes a reduction of $3,040,000 for rescission.

These strategies and other efforts contributed to the efficient and effective management of the program, thus putting the taxpayer's dollars to more productive use.

The following external factors affected the program's ability to achieve its strategic goal:

- Ultimately, the decision to build new nuclear power plants rests with industry alone. This decision depends in part on power demand, economic and other technical factors beyond the scope of the Department's research and development programs.

Nuclear Power 2010

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Nuclear Power 2010		
Cost-shared Program with Industry	101,960	0
Standby Support Program	0[a]	0
Total, Nuclear Power 2010	101,960[b]	0

Benefits

The NP 2010 program achieved its objectives to demonstrate new regulatory processes. The program promoted industry interest in the deployment of the first new nuclear plants in 30 years and enabled industry to make decisions to build plants in 2010.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Cost-shared Program with Industry	**101,960**	**0**

As part of the program's cost-shared efforts, NP 2010 supported engineering and design for Generation III+ advanced LWRs. In FY 2005 the Department established competitively selected, cost-shared cooperative agreements with industry teams. The agreements originally included design certification activities for Westinghouse's AP 1000 and General Electric Hitachi's Economic Simplified Boiling Water Reactor (ESBWR).

By the end of FY 2010, all cost-shared design certification and COL project activities were completed. The program fully achieved its goals; and industry has more than sufficient information and incentive to proceed on its own.

In FY 2010, the Department:

- Completed cost-share funded activities for the design certification and design finalization of the AP 1000 and ESBWR technologies,
- Completed cost-share funded activities for the two COL reference application demonstration projects including industry interactions with NRC.

[a] Standby Support Program funding moved to the program direction account in FY 2010.
[b] Includes a reduction of $3,040,000 for rescission.

	(dollars in thousands)	
	FY 2010 Current Approp	FY 2012 Request
At the end of FY 2010, sufficient momentum had been created by the cost-shared programs that all partners have adequate incentive to complete any additional work through private funding and sufficient work will have been completed to demonstrate the new NRC design-centered licensing approach.		
Total, Nuclear Power 2010	**101,960**[a]	**0**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Cost-shared Program with Industry	
The decrease results from conclusion of the program.	-101,960
Total Funding Change, Nuclear Power 2010	-101,960

[a] Includes a reduction of $3,040,000 for rescission.

Generation IV Nuclear Energy Systems

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Generation IV Nuclear Energy Systems	212,904[a]	0

Public Law Authorizations:
P.L. 111-85, Appropriation Act (2010)
P.L. 111-226, FAA Air Transportation Modernization and Safety Improvement Act (2010)

Mission

The mission of the Generation IV Nuclear Energy Systems (Gen IV) program was to address critical unanswered questions about advanced nuclear reactor technologies through research and development (R&D) to help meet tomorrow's needs for reliable electricity production and non-traditional applications of nuclear energy. In FY 2012, Gen IV program activities will be carried out under the Reactor Concepts Research, Development, and Demonstration (RD&D) and Nuclear Energy Enabling Technologies (NEET) programs.

Benefits

Through scientific R&D and international collaboration, Gen IV supported the R&D of next-generation nuclear reactor technologies that could result in improved performance in sustainability, safety, economics, security, and proliferation resistance.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The Gen IV program used various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors impacted the ability to achieve these goals. The program also performed collaborative activities to help meet its goals.

The Department implemented the following means:

- Continued R&D on advanced, next-generation reactor systems that offered the most sustainable, cost-competitive, reliable, and secure means of generating electricity including participation by the national laboratories, industry, and university research communities, as well as the international research community represented by the Generation IV International Forum (GIF).

[a] Includes a reduction of $1,068,566 for rescission.

- International cost-sharing was put in place for the R&D on Gen IV technologies under the GIF reactor technologies and industry cost-sharing was pursued for the Next Generation Nuclear Plant (NGNP).

The Department implemented the following strategies:
- Nuclear Energy's (NE) R&D programs partnered with the private sector, national laboratories, universities, and international partners to develop advanced nuclear technologies.
- Programs engaged the international community in pursuit of advanced nuclear technology that benefited the United States with enhanced safety, improved economics, and reduced production of wastes.

These strategies contributed to efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could have affected the program's ability to achieve its strategic goal:
- Deploying new nuclear power is ultimately an industry decision. Whether new nuclear plant technology is deployed depends on power demand and economic and environmental factors beyond the scope of Department of Energy R&D programs. In the near term, it depends on complex economic decisions made by industrial partners.
- Industry is inclined to focus on near-term deployment using proven technologies. Industry may not immediately support or be supportive of longer-term development of better technologies.
- Gen IV research relies heavily on data produced through collaborations with foreign nations. Should vital data from foreign partners prove unavailable, U.S. efforts would need to be re-evaluated.

In carrying out the program's mission, the program performed the following collaborative activities:
- The program supported ongoing international collaboration on reactor technologies, to include fuel and material development.
- The Department coordinated with the NRC to assure that their R&D activities are complementary, cost effective, and not duplicative.
- The program is received broad international cooperation and support, consistent with the objectives of the program. The GIF, composed of representatives from 12 governments and the European Union, provided guidance for executing R&D activities focused on these next-generation nuclear energy systems.

Generation IV Nuclear Energy Systems

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Generation IV Nuclear Energy Systems		
Generation IV R&D	28,321	0
Next Generation Nuclear Plant R&D	163,199	0
Energy Innovation Hub for Modeling and Simulation	21,384	0
SBIR/STTR	0	0
Total, Generation IV Nuclear Energy Systems	212,904[a]	0

Benefits

Gen IV program activities will continue under the Reactor Concepts RD&D and Nuclear Energy Enabling Technologies programs. These programs consolidate reactor related R&D to improve information sharing, minimize duplication, and increase transparency. In FY 2010, Gen IV activities provided technical advancements and anticipated benefits including creating an international network of user facilities for nuclear R&D, and reducing the technical uncertainties to support the deployment of new nuclear reactor technologies.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Generation IV R&D	**28,321**	**0**

In FY 2010, the Gen IV R&D activities focused on reactors that could dramatically improve performance in sustainability, safety, economics, security, and proliferation resistance. This work included scientific R&D at national laboratories and universities, as well as through collaborations with international partners. Some research activities were coordinated with foreign researchers through the GIF, as well as other bilateral and multilateral agreements. Gen IV provided support for international policy and experts groups of the GIF, including working groups for common evaluation methodologies of reactor economics, safety, and proliferation resistance and physical protection. Also in FY 2010, Congress appropriated $10,000,000 for R&D activities to support Light Water Reactor (LWR) life extension activities.

In FY 2010, the Department:

- Developed an integrated fast reactor concept based on advanced reactor core and energy conversion studies, and innovations in system, structure, and component technologies, such as

[a] Includes a reduction of $1,068,566 for rescission.

advanced fuel handling systems, pumps, heat exchanger, and instrumentation and controls.
- Completed report on SHARP thermal hydraulics code development and associated verification and validation tests for Sodium Fast Reactors.
- Prepared the functions and requirements for a small-scale fast irradiation test reactor to support the science-based R&D of advanced fuels, materials, and transformational technologies.
- Analyzed control strategies and component performance for a supercritical carbon dioxide (S-CO_2) Brayton Cycle energy conversion system, and designed a small-scale demonstration project for providing experimental data for model validation, an independent review and assessment of the S-CO_2 project and products was performed.
- Conducted testing of advanced structural materials for use in Gen IV reactors and prepared reports on liquid metals compatibility testing, corrosion performance, creep fatigue, fracture toughness and impact testing, and thermal aging.
- Completed the Experimental Breeder Reactor-II shutdown heat removal test analysis International Atomic Energy Agency benchmark specification.
- Completed initial development and testing of linear array ultrasonic imaging system and waveguide transducer for in-service inspection of liquid metal reactor vessel internals.
- Continued participation in GIF committees and multilateral projects (e.g., participated in Monju restart activities).
- Completed the architectural and algorithmic requirements for a next-generation safety analysis code.
- Commenced analyses and testing (at Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory, and the University of Michigan) to define mechanisms and degradation modes for metals subject to irradiation-assisted stress corrosion cracking and concrete.
- Initiated irradiation tests of silicon carbide (SiC) clad fuel pins at the High Flux Isotope Reactor.
- Initiated a cooperative activity with Constellation (Ginna and Nine Mile Point 1) for obtaining information on materials subject to long-term reactor operating environments.

Next Generation Nuclear Plant R&D	**163,199**	**0**

The Department's NGNP program collaborates with industry and other governmental organizations to conduct activities necessary to demonstrate high temperature, gas-cooled reactor technology in the United States. This includes development of a licensing strategy with the NRC, design, and R&D sufficient to support a licensing application submittal to the NRC. This project covers a range of activities from R&D to construction that are subject to cost-sharing requirements outlined in section 988 of EPAct 2005. Near-term emphasis is on results that will support key decisions by the Secretary of Energy on the future of the program. Important considerations include the availability of a licensable fuel for the reactor, qualification of nuclear grade graphite, design of high project-risk components, such as steam-generators and heat exchangers, the form and content requirements for a gas-cooled reactor licensing application, and other factors.

In FY 2010, the Department cost-shared with industry to initiate the conceptual design of the NGNP. The Department continued to work with the U.S. private sector to identify industrial end-user requirements, and produced trade studies reviewing the potential for integrating NGNP into various industrial applications. Similarly, the Department's collaboration with the NRC resulted in progress

toward the development of a framework for licensing gas-cooled reactors in the United States.

Key issues included the establishment of gas-cooled reactor specific requirements for emergency planning zones, containment design, and the quantification of potential radioactive releases. Finally, the Department worked with universities, national laboratories, and the international community to develop analytical tools and conducted tests on fuel, metals and graphite to support the data needs of the reactor designers, regulators, and end-users. The Idaho National Laboratory (INL) coordinated NGNP R&D on behalf of the Department.

In FY 2010, the Department:

- Cost-shared with industry to initiate the conceptual design of a gas-cooled reactor concept for the NGNP. In addition to conceptual design, industry partners updated project cost and schedule estimates and developed business plans for financing and managing the final design, licensing, and construction of the NGNP.
- Continued advanced modeling techniques utilizing the Department's high-speed, parallel computers for the development of close-coupled neutronic and thermofluid codes.
- Maintained the *Generation IV Materials Handbook* and arranged for other international partner organizations to share existing data and add new materials data.
- Commenced irradiation in the INL Advanced Test Reactor (ATR) of the first Very-High Temperature Reactor fuel produced in commercial scale production equipment (Advanced Gas Reactor (AGR-2)).
- Prepared for and performed post-irradiation examination of the AGR-1 fuel removed from the ATR.
- Began irradiation of the first Advanced Graphite Creep (AGC-1) test experiment to provide data for nuclear graphite qualification.
- Continued mechanical and chemical property characterization of high-temperature metals.
- Developed an Appendix B Quality Assurance Program Description (QAPD) that incorporates the newest ASME NQA-1 Standard endorsed by the NRC and submitted QAPD for NRC approval.
- Continued development of national and international consensus codes and standards, including the qualification of high-temperature materials and the development of analytical methods.
- Prepared documentation on the technical and economic benefits and challenges of co-generation energy systems.
- Collaborated with NRC on scale reactor tests to be performed at Oregon State University and at Argonne National Laboratory to benchmark thermal-fluid reactor system modeling tools.
- Submitted several white papers to the NRC on key licensing topics and responded to their review comments, on topics including "Defense in Depth," "High Temperature Materials," "Fuel Qualification," and "Mechanistic Source Term."

Energy Innovation Hub for Modeling and Simulation **21,384** **0**

The Energy Innovation Hub for Modeling and Simulation (Hub) is creating a virtual reactor model of actual Tennessee Valley Authority-owned Westinghouse-designed operating pressurized water reactors that will be able to simulate reactor behavior. Engineers will be able to use this virtual model to improve the economics and safety of reactor operations by simulating proposed solutions to reactor

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request

power production increases and reactor life and license extensions. The combination of data gained from the virtual model and the physical reactor will be used to resolve technology issues confronting nuclear energy development.

The Hub will also serve to educate today's reactor engineers in the use of advanced modeling and simulation through direct engagement in Hub activities. The ORNL is leading the Consortium for Advanced Simulation of Light Water Reactors (CASL) of national laboratories, universities, and industry partners to manage Hub execution. CASL began operations in late June 2010.

In FY 2010, the Department:

- Executed a rapid startup toward steady-state operations: letting subcontracts; hiring key staff; created Intellectual Property Management Plans, established an export control policy, and implemented Nondisclosure Agreements.
- Deployed the CASL software repository, populated it with initial software components, which included validated legacy codes from industry partners.
- Performed initial set of CASL simulations on Department of Energy leadership-class platforms (e.g., the Jaguar Cray XT5 system at ORNL) in order to ascertain the base Virtual Reactor capability.

SBIR/STTR	**0**	**0**
In FY 2010, $5,515,905 and $647,931 were transferred to the SBIR/STTR programs respectively.		
Total, Generation IV Nuclear Energy Systems	**212,904**	**0**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Generation IV Nuclear Energy Systems	
The decrease reflects the transfer of activities to the Reactor Concepts RD&D and Nuclear Energy Enabling Technologies programs.	-212,904
Total Funding Change, Generation IV Nuclear Energy Systems	**-212,904**

LWR SMR Licensing Technical Support

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
LWR SMR Licensing Technical Support	0	67,000

Mission

The mission of the Light Water Reactor (LWR) Small Modular Reactor (SMR) Licensing Technical Support program is to support design certification and licensing activities for two LWR-based SMR designs through cost-shared arrangements with industry partners in order to promote accelerated deployment of SMRs. If industry chooses to deploy these technologies, they could help meet energy security and climate change goals. The acceleration of the deployment of clean energy technologies has been identified as a priority of the Administration.

Benefits

The LWR SMR Licensing Technical Support program will focus on engineering support for LWR SMR licensing to help improve the timeline for the commercialization and deployment of these relatively mature technologies. These SMRs may help to improve the affordability of nuclear power because of the potential to reduce costs of licensing and constructing one or multiple units, ultimately making nuclear more appealing to owners and investors. Other key benefits could include:

- Improving cost, schedule and quality through the modularization of components by replication in a factory setting.
- Providing power for applications where large plants are not needed or where infrastructure to support a large reactor units is lacking.
- Providing a carbon-free option for repowering aging fossil power plants or process heat for industrial applications.
- Providing potential nonproliferation benefits to the U.S. and the wider international community.

One additional benefit of the program may be the reestablishment of the U.S. as a technological leader in an emerging international market, leveling the playing field with growing foreign competition.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The LWR SMR Licensing Technical Support program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- The program will solicit, competitively select, and award financial assistance for vendor and utility partnerships to design and deploy innovative nuclear plant designs through cooperative agreements.
- The program will leverage innovative, crosscutting research and development (R&D), codes and standards, and regulatory activities carried out by the SMR R&D component of the Reactor Concepts Research, Development and Demonstration (RD&D) program and NEET program to help to resolve generic industry certification and licensing issues impacting the program goals.

The Department will implement the following strategy:

- The LWR SMR Licensing Technical Support program will be a cost-shared program to encourage industry to take risks on deploying potentially high-return SMR technologies while ensuring adequate industry incentives.

This strategy will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Whether new nuclear plant technology will be deployed depends on power demand and economic and environmental factors beyond the scope of DOE programs. It depends on complex economic decisions made by industry partners.
- The certification and licensing of plants is the responsibility of the NRC and the timing of review and approval processes is entirely independent of DOE influence.

In carrying out the program's mission, the program performs the following collaborative activities:

- The Department will work with the NRC in program planning to assure that its activities are complementary, cost effective, and not duplicative.
- The Department will work with industry and consensus standards developing organizations to identify requirements for updated codes and standards to address developing technology needs.

LWR SMR Licensing Technical Support

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
LWR SMR Licensing Technical Support	0	67,000
Total, LWR SMR Licensing Technical Support	0	67,000

Benefits

The primary mission of NE is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, and security issues, through RD&D. The LWR SMR Licensing Technical Support program supports design certification and licensing activities in a cost-shared arrangement with industry partners.

SMRs have significant potential advantages over larger plants by providing an owner more flexibility in financing, siting, sizing, and end-use applications. SMRs can potentially reduce an owner's initial capital outlay or investment due to the lower plant capital cost. Modular components and factory fabrication can potentially reduce construction costs and schedule duration. Additional modules can be added incrementally as demand for power increases with revenue provided by existing performing modules. SMRs can potentially provide power for applications where large plants are not needed, or may be able to replace aging and carbon-emitting fossil plants, or could be located at sites that may not have the necessary infrastructure to support a large unit such as smaller electrical markets, isolated areas, smaller grids, or restricted water or acreage sites.

SMRs are also expected to be an attractive clean power option for the wider international community and U.S. industry is well positioned to compete for these markets. The LWR SMR Licensing Technical Support program could help to improve U.S. competitiveness in the global marketplace. The program could also improve domestic energy security and provide another affordable clean energy source.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY2012 Request
LWR SMR Licensing Technical Support	**0**	**67,000**

The LWR SMR Licensing Technical Support program will support the commercialization of new LWR-based SMR designs. The objective of the program will be an industry cost-share with LWR SMR vendors and first-mover utilities with a focus on first-of-a-kind engineering costs associated with design certification and licensing activities that will accelerate the construction and operation of these plants. The acceleration provided by the cost-shared funding is expected to improve U.S. global

(dollars in thousands)

FY 2010 Current Approp	FY2012 Request

competitiveness, enhance domestic energy security and contribute to meeting greenhouse gas reduction goals. Related activities were included in the Department's FY 2011 Congressional budget request within the Reactor Concepts RD&D program.

The program will conduct a competitive process to select LWR SMR vendor and utility partnerships for financial cost-share assistance with a minimum of 50% industry contribution to support the design and licensing of two LWR SMR designs. The program intends to support licensing applications to expedite the construction and operation of the first-mover LWR SMR units. The solicitation process should result in the award of cooperative agreements to relatively mature SMR designs that will result in the acceleration of the domestic deployment of SMR technologies and the opening of export markets for these technologies, as well as advancements in nonproliferation, safety, and domestic energy security. The program will help to demonstrate the potential of the nascent SMR technology and encourage new competition in the marketplace. Within the merit review process, higher industry cost-share (i.e., fund greater than 50%) will be a rating criterion in evaluating program solicitations. Through cooperative agreements, the Department would provide support for:

- Two specific reactor technology vendors for the design, engineering, testing, analysis, and NRC approval of a design certification document (DCD) for their reactor system.
- Two specific utilities or consortia for the development of Combined Operating License Applications (COLAs) specific to the chosen sites

Site permitting activities may be included; the 10 CFR 50 licensing framework may be considered, if appropriate. The establishment of these cooperative agreements is expected to lead to an expedited schedule for the certification and licensing, encouraging industry toward eventual deployment of LWR SMR technology. DOE will establish clear deliverables and milestones that will appropriately gauge the progress of selected projects, with a goal of accelerating deployments. DOE will continuously manage the cooperative agreements to ensure resources are applied to emerging issues affecting project progress. The cost of this SMR licensing effort is $452 million over five years.

In FY 2012, DOE will:

- Manage cooperative agreements with SMR vendor and utility partners for cost-shared design certification and licensing activities.
- Continue to work with NRC and industry in addressing regulatory issues that are vital to the licensing of SMR designs.

Subtotal, LWR SMR Licensing Technical Support	**0**	**67,000**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
LWR SMR Licensing Technical Support	
The increase reflects the investment required to support design certification and licensing projects for two LWR-based SMR designs. This acceleration provides a means of improving the commercialization and international marketability of NRC-approved SMR designs.	+67,000
Total Funding Change, LWR SMR Licensing Technical Support	**+67,000**

Reactor Concepts Research, Development and Demonstration

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Reactor Concepts Research, Development and Demonstration	0	125,000

Public Law Authorizations:
P.L. 111-85, Appropriations Act (2010)

Mission

The mission of the Reactor Concepts Research, Development and Demonstration (RD&D) program is to develop new and advanced reactor designs and technologies that advance the state of reactor technology to broaden its applicability, improve its affordability and competitiveness, and ensure its lasting contribution in meeting our nation's energy and environmental challenges. RD&D activities carried out by the program are designed to address technical, cost, safety, and security issues associated with reactor concepts, including Small Modular Reactors (SMRs), gas-cooled reactor technology through the Next Generation Nuclear Plant (NGNP), and Advanced Reactor Concepts (ARC) programs. In addition, the program will develop improved understanding of age-related mechanisms that may support extending the life of existing Light Water Reactors (LWR). Nuclear Energy (NE) will leverage innovative, crosscutting research and development (R&D) activities carried out by the Nuclear Energy Enabling Technologies (NEET) program, complementing the RD&D carried out in this program. This program is guided by the *Nuclear Energy Research and Development Roadmap* (April 2010) in Objectives 1 and 2, which focus on extending the safe operating life of existing nuclear plants and improving the affordability of new reactors to help meet the Administration's energy security and climate change goals. Activities in the Reactor Concepts program are also closely coordinated with Objectives 3 and 4 that focus on developing sustainable nuclear fuel cycles and minimizing the risks of nuclear proliferation and terrorism. By advancing technologies through R&D, NE can help develop the technical basis for keeping existing nuclear plants operating longer than current license periods, support development of advanced concepts for the medium term, and promote design of revolutionary systems for the long term.

Benefits

Through scientific research at pre-eminent national laboratories, collaboration with universities and international research agencies, and competitive cost-shared RD&D with industry, nuclear power can expand both domestically and internationally, providing a clean, safe, secure, affordable and abundant source of energy. However, to maximize the benefits of nuclear power, work must be done to address technical, cost, safety, and security challenges.

These challenges include:

- Improving the affordability of nuclear energy;
- Addressing the management of nuclear waste; and
- Minimizing proliferation risks of nuclear materials.

The four elements within the Reactor Concepts RD&D program will help address these challenges. SMR R&D can improve the affordability of nuclear power making it more appealing to owners and investors because of the potential to reduce capital costs of licensing and constructing one or multiple

units. The NGNP is designed to demonstrate the technical viability of gas-cooled nuclear reactor technology to provide more efficient carbon-free electricity and high-temperature process heat for a variety of industrial uses. The Light Water Reactor-Sustainability (LWRS) research will help provide a technical basis for the long-term safety and reliability of the current nuclear power fleet beyond 60 years. Without life extension, existing LWR plants will begin to retire in 2029. Replacing these plants will be extremely expensive, as would be replacing the baseload power with other clean energy sources. The ARC program conducts research into other advanced reactor concepts may improve the sustainability of nuclear energy in a variety of ways, including improving the nuclear fuel cycle and nuclear waste management. Innovative reactor concepts offer the potential to further reduce capital and operating costs, improve performance, enhance safety, and minimize the risk of proliferation. These activities will enable nuclear power to continue to be a key component of our energy portfolio and help to achieve the energy security and greenhouse gas (GHG) emission reduction objectives of the United States.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The Reactor Concepts RD&D program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Advanced, next-generation reactor systems that offer the most sustainable, cost-competitive, reliable, and secure means of generating electricity and high-temperature process heat are being developed by the Reactor Concepts RD&D program. The program includes participation by the national laboratories, industry, and university research communities, as well as the international research community, with collaborations through the Generation IV International Forum (GIF).
- International cost-sharing is in place for the R&D on some intermediate- and long-term reactor technologies.
- The program will implement joint government/industry cost-shared R&D activities to understand and resolve material aging and degradation and establish the technical and licensing basis to extend the safe and economical operation of the existing nuclear plants to beyond 60 years. Laboratory R&D will be conducted to research, develop, and test high-performance LWR reactor fuel and clad materials to extend the operating cycles and enhance safety and productivity of existing nuclear plants and will be conducted with universities, industry, and national laboratories.
- The program will conduct R&D activities supporting innovative small modular reactor plant designs capable of achieving generation and performance demands currently not serviceable by large base load nuclear power plants.
- The program will leverage innovative, crosscutting R&D activities carried out by the NEET program, complementing the RD&D carried out in this program.
- The program will leverage capabilities developed by National Nuclear Security Administration and the Department of Energy's (DOE) Office of Science in modeling and simulation.

The Department will implement the following strategies:

- NE's R&D programs will partner with the private sector, national laboratories, universities, and international partners to develop advanced nuclear technologies.
- NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects.
- Programs will also engage the international community in pursuit of advanced nuclear technologies that will benefit the United States with enhanced safety, improved economics, and reduced production of wastes.
- NE will implement cost-sharing on projects according to Section 988 of the 2005 Energy Policy Act. This will encourage industry to take risks on potentially high-return technologies while ensuring adequate industry incentives. International cost-sharing is in place for the R&D on some intermediate- and long-term reactor technologies.

These strategies will contribute to the efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Whether new nuclear plant technology will be deployed depends on power demand and economic and environmental factors beyond the scope of DOE R&D programs. It depends on complex economic decisions made by industrial partners.
- Industry is inclined to focus on near-term deployment using proven technologies. Industry may not readily support or be supportive of longer-term development of advanced technologies.
- This nuclear energy research program relies in part on data produced through collaborations with foreign nations. Should vital data from foreign partners prove unavailable, an increased U.S. effort in technology development would be required.

In carrying out the program's mission, the program performs the following collaborative activities:

- The Reactor Concepts RD&D program will collaborate with NE's Fuel Cycle R&D and NEET programs to ensure related activities are complementary and not duplicative, and to encourage innovation across programmatic areas.
- Reactor Concepts RD&D will support international collaboration on various reactor concepts and coolants to include fuel and material development, systems, and components.
- The Department will work with the NRC in program planning to assure that their R&D activities are complementary, cost effective, and not duplicative.
- The Department will work with industry and consensus standards developing organizations to identify requirements for updated codes and standards to address developing technology needs.
- The Reactor Concepts RD&D program is receiving broad international cooperation and support, consistent with the objectives of the program. These R&D activities are integrated, where possible, into GIF activities in order to better leverage U.S. funding.

Reactor Concepts Research, Development and Demonstration

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Reactor Concepts Research, Development and Demonstration		
Small Modular Reactors Advanced Concepts R&D	0	28,674
Next Generation Nuclear Plant Demonstration Project	0	49,572
Light Water Reactor Sustainability	0	21,384
Advanced Reactor Concepts (formerly Generation IV Nuclear Energy Systems R&D)	0	21,870
SBIR/STTR	0	3,500
Total, Reactor Concepts Research, Development and Demonstration	0	125,000

Benefits

The primary mission of NE is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, and security issues, through RD&D. The Reactor Concepts RD&D program consolidates and integrates a variety of nuclear reactor technology initiatives to support this mission.

The Reactor Concepts RD&D program includes the following program elements:

- Small Modular Reactors Advanced Concepts R&D
- Next Generation Nuclear Plant Demonstration Project
- Light Water Reactor Sustainability
- Advanced Reactor Concepts

These reactor technologies will support a diverse set of fission power systems capable of producing electricity (MWe) and, in the case of NGNP, generating process heat (BTUs) in a socially acceptable, environmentally sustainable, and economically attractive manner. Development of each reactor concept will seek to improve performance, economics, safety, waste minimization, and reduce proliferation risks. Some reactor technologies in the long term may support sustainable fuel cycle options without increasing nuclear proliferation and security risks.

Advanced SMR designs have significant potential advantages over larger plants and over LWR-based SMR designs ready today. They are expected to provide potential nonproliferation, safety, efficiency, and other benefits. The emphasis of the program will be on advanced reactor technologies that offer simplified operation and maintenance for distributed power applications and increased proliferation resistance and security. We anticipate that most SMRs would be located below-grade to enhance safety and security. Some advanced SMRs designs could be able to operate for decades without refueling.

In FY 2012, the NGNP program supports continued R&D. The Secretarial decision on the future of this project is planned for the fourth quarter of FY 2011 and will consider technical, financial,

performance, and other issues in determining the appropriate next steps, including whether to proceed further on the project.

As currently envisioned, the project would demonstrate a gas-cooled reactor technology in the United States. The NGNP would be a small-to-medium sized reactor capable of high-temperature operation in excess of 700°C. Plants of this type should have a good combination of size, heat-output, and passive safety features to make them favorable candidates for use in industrial settings. The NGNP program is a collaborative enterprise with participation by the Department's national laboratories, U.S. universities, the nuclear industry, and the NRC, and includes work on a regulatory framework for licensing gas-cooled reactors, plant design, and R&D. Near-term emphasis is on developing information that will support key decisions by the Secretary of Energy on the future of the program. Important considerations include the availability of a licensable fuel for the reactor, qualification of nuclear grade graphite, and the development of form and content requirements needed to submit a license application for an advanced gas-cooled reactor.

The LWRS program conducts research to ensure a technical basis for the long-term safety and reliability of currently operating LWR nuclear power plants from the currently expected 60 years to perhaps 80 years or longer. The LWRS program focuses on developing the scientific basis to understand, predict, and measure changes in materials, systems, structures, and components as they age in environments associated with continued long-term operations. The program will then apply this knowledge to develop methods and technologies that support safe and economical long-term operation of existing reactors. In addition, the program will research new technologies to address enhanced plant performance, economics, and safety.

The ARC program (formerly Generation IV Nuclear Energy Systems Research and Development (Gen IV)) provides technical, economical, and environmental benefits for clean and sustainable energy produced by the nuclear energy option. NE will pursue these technical advancements through R&D activities with national laboratories, universities, industry, and other domestic and international governmental partners. These activities include conducting traditional R&D needed to advance the technologies; leveraging the use of advanced modeling and simulation tools developed under the NEET program; supporting international collaborative work to use available facilities for nuclear R&D; and reducing the technical uncertainties for deploying new nuclear reactor technologies. The program will research innovative nuclear energy technologies that can compete economically with other technologies for the production of electricity, provide clean (low-carbon) energy resources, and minimize environmental impacts. Activities carried out under ARC will develop advanced systems, components and materials for use with various coolants that face high-radiation, high-temperature environments. This program will also use advanced modeling and simulation activities, in coordination with the Advanced Modeling and Simulation program element under NEET, to directly support reactor related activities in order to extrapolate and predict behaviors beyond tested states as well as improve experiments by predicting areas of interest and validating expected experimental results.

NE programs allocate R&D funding to those entities (e.g., industry, laboratories, and universities) that are best qualified to carry out the work in support of NE's mission. Consistent with NE's commitment to supporting R&D activities at university and educational research institutions, NE programs competitively award funds that support both mission-specific and mission-related activities. NE designates up to 20 percent of funds appropriated to its R&D programs for work performed at university and research institutions, through open, competitive solicitations for investigator-led projects. The national laboratories are encouraged to partner with universities to conduct R&D.

Reactor Concepts RD&D technical advancements and anticipated benefits include supporting an international network of user facilities for nuclear R&D, and reducing the technical uncertainties surrounding new nuclear reactor technologies. These advancements will allow nuclear energy to compete economically with other clean energy technologies.

The energy sector must supply increasing amounts of electricity safely, dependably, economically, and in an environmentally advantageous manner with reduced CO_2 emissions. The 60-year licenses for the current nuclear power plants will begin to expire in 2029. Utilities are beginning to initiate planning for baseload replacement power and the technology options developed under the Reactor Concepts RD&D program can help ensure that nuclear energy remains a key part of the U.S. energy portfolio. These concepts may also help enable the United States to regain technical leadership and economic competitiveness in the global marketplace.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY2012 Request
Small Modular Reactors Advanced Concepts R&D	**0**	**28,674**

The SMR Advanced Concepts R&D program would support laboratory/university and industry projects to conduct nuclear technology R&D, including the development of codes and standards, novel sensors, control systems for multiple units, probabilistic risk assessments, advanced SMR concepts, and other technologies that are unique and would be useful to support development of advanced SMR concepts for use in the mid-to long-term.

The SMR R&D portfolio for 2012 timeframe was informed by a technical workshop conducted by NE in late June 2010. The workshop assembled experts in a number of technical disciplines to identify and prioritize a work scope. Based on this input, NE will be supporting R&D activities for advanced SMR designs such as high-temperature designs as well as fast spectrum neutron designs that offer added functionality and affordability. For these advanced SMR concepts with lower levels of technical maturity, the Department will first seek to establish the laboratory/university RD&D activities necessary to prove and advance innovative reactor technologies and concepts. Emphasis is on advanced reactor technologies that offer simplified operation and maintenance for distributed power applications and increased proliferation resistance and security. These program activities will be coordinated with other NE programs to avoid overlaps in technology development and assure synergies. These R&D projects will be cost-shared as well. Areas of R&D could include: basic physics and materials research and testing; state-of-the-art computer modeling and simulation of reactor systems and components; probabilistic risk analyses of innovative safety designs and features.

Additionally, DOE plans to assess advanced SMR concepts, examining the viability and performance assessment of select advanced SMR concepts with a focus on co-generation and load-following capabilities.

(dollars in thousands)

FY 2010 Current Approp	FY2012 Request

In FY 2012, DOE will:

- Conduct advanced SMR technology R&D activities, such as physics and materials research and testing; state of the art manufacturing and fabrication capabilities for reactor systems and components; improved instrumentation and control, and resolution of human-machine interface issues; and probabilistic risk analyses of innovative SMR safety designs and features.
- Support efforts in revising and establishing nuclear codes and standards to support SMR designs in conjunction with the Standards Developing Organizations (ANS, ASME, IEEE, ASTM, etc.).
- Conduct viability assessments of advanced SMR designs.

Next Generation Nuclear Plant Demonstration Project **0** **49,572**

This program sponsors a collaborative effort with universities, industry, and the NRC to conduct the design, licensing, and R&D necessary to demonstrate a new generation of gas-cooled reactors in the United States.

In FY 2010, the Department engaged with industry to initiate a cost-shared conceptual design for the NGNP, which was completed at the end of 2010. The NEAC commenced review of the conceptual design reports along with the state of NGNP R&D and licensing activities and plans to make a recommendation on whether or not to proceed into Phase 2 of the project during the third quarter of FY 2011. The Secretary will make a decision about the future of this project during the fourth quarter of FY 2011. The Secretarial decision will consider technical, financial, performance, and other issues in determining the appropriate next steps, including whether to proceed further on the project. The FY 2012 request for this program supports continued critical path R&D activities and work with industry.

The Department continues to work with the U.S. private sector to establish industrial end-user requirements, produce trade studies integrating NGNP into various industrial applications, and develop cost-sharing strategies to support industry in their efforts to commercialize gas-cooled reactor technologies. Similarly, the Department's collaboration with the NRC is speeding the development of a framework for licensing gas-cooled reactors in the United States. Key issues include the establishment of gas-cooled reactor-specific requirements for emergency planning zones, containment design, and the quantification of potential radioactive releases. Finally, the Department is working with universities, national laboratories, and the international community to develop analytical tools, identify additional R&D needs, and conduct tests on fuel, metals, and graphite to support the data needs of the reactor designers, regulators, and end-users. The Idaho National Laboratory (INL) coordinates NGNP R&D on behalf of the Department.

FY 2010 activities are discussed under the Gen IV budget element.

In FY 2012, the Department will:

- Continue the irradiation in the INL ATR of the first NGNP fuel produced in commercial scale production equipment (AGR-2), and make preparations to commence post-irradiation examination activities.
- Complete post-irradiation examination and simulated accident testing of the first NGNP fuel tested in the ATR (AGR-1).

(dollars in thousands)

FY 2010 Current Approp	FY2012 Request

- Initiate irradiation in ATR of NGNP fuels containing designed-to-fail fuel particles to provide data on fission product release and transport for use in development of improved models (AGR-3/4).
- Continue design of the AGR-5/6 experiment to demonstrate compliance with fuel performance requirements under normal operation and accident conditions.
- Conduct post-irradiation examination of the first graphite samples tested in the ATR to understand the influence of irradiation, temperature, and dose on the properties of nuclear graphite (AGC-1).
- Complete the irradiation of the AGC-2 test experiment and commence post-irradiation examination to provide data for nuclear graphite qualification.
- Continue to characterize graphite samples for use in additional AGC experiments, baselining the "as received" material properties to establish accurate physical, thermal, and mechanical response data.
- Continue property measurement and characterization of candidate high temperature materials for use in heat exchangers and reactor pressure vessels to support code-case data package development and qualification.
- Continue methods development and experimental validation to determine the capability of the passive system to remove decay heat and to validate state-of-the-art thermal-fluid models models for the unique geometry of the NGNP reactor cavity cooling system.
- Complete shakedown and testing of the OSU HTTF and conduct initial experiments studying High Temperature Gas Reactor Depressurized Conduction Cooldown scenarios.
- Continue validation of current analytical methods in reactor and plant simulation against benchmarks and experimental data, including benchmarking against NRC tools, and develop and test new methods to investigate performance and safety significant phenomena, if needed.
- Continue research on process heat applications, including resolution of component longevity issues, system interface requirements, and materials compatibility issues.
- Continue modeling and analysis studies of coupling gas reactor technology to various non-electric end-user applications.
- Continue working with the NRC to develop the process for licensing gas-cooled reactors.

Light Water Reactor Sustainability **0** **21,384**

This program will conduct R&D to explore extending the operating lifetime of current plants beyond 60 years and, where possible, enable further improvement in their productivity. The program will partner with industry and the NRC to conduct the long-term research needed to inform major component refurbishment and replacement strategies, performance enhancements, plant license extensions, and NRC's age-related regulatory oversight decisions. The research will focus on aging phenomena and issues that require long-term research that affect the existing fleet of both boiling and pressurized water reactors. Because industry has a significant financial incentive to extend the life of existing plants, the Department will work to ensure that activities are cost-shared to the maximum degree possible.

Planned activities are divided into five areas:

(1) Materials Aging and Degradation Assessment will develop a science-based fundamental understanding of materials aging and degradation to reduce the uncertainty in analytical predictions and provide insights for developing components with longer lifetimes. A mechanistic understanding of key materials aging and degradation phenomena will support longer-term operation of existing reactors, support licensing basis for extended operations, and support component life predictions for critical structures, systems, and components.

(2) Safety Margin Characterization will develop improved modeling and analysis methods including uncertainty quantification to enhance industry's ability to accurately predict safety margins, address aging effects to understand how safety margins change with aging plants, support power up-rates, and combine risk-informed, performance-based methodologies with fundamental scientific understanding of critical phenomenological conditions and deterministic predictions of nuclear plant performance.

(3) Efficiency Improvements will address the potential for additional power up-rates and capacity factor improvements, as well as reducing the impact to reactor operations due to inadequate cooling water. Drought conditions and competition with other users have created situations that are of immediate concern.

(4) Instrumentation and Controls will develop new systems and human/machine interface capabilities including advanced plant monitoring capabilities, facilitating centralized monitoring of nuclear status and performance, and developing advanced condition monitoring and prognostics technologies to understand and measure the aging of systems, structures, and components of nuclear power plants.

(5) Advanced LWR Fuel will develop new long-life fuel designs using advanced materials for fuel and cladding to achieve substantial increases in safety margins and performance, eliminate fuel failures, and achieve higher fuel burn-ups. Goals include improving the fundamental understanding of nuclear fuel and cladding behavior under extended burn-up conditions and developing a predictive analysis tool for advanced nuclear fuel performance.

FY 2010 activities are discussed under the Gen IV budget element.

In FY 2012, the Department will:

- Investigate mechanisms of irradiation-assisted stress corrosion cracking (IASCC), crack initiation in nickel-based alloys, high-fluence effects on stainless steels, IASCC of alloy X-750, reduction in toughness of reactor pressure vessel steels, swelling effects and phase transformations in high-fluence core internals.
- Assess degradation of concrete in unique reactor environments (radiation, high temperature, moisture) and develop nondestructive examination techniques.
- Continue existing pilot projects at the Ginna and Nine Mile Point 1 plants to obtain information on materials that supports development of guidance on inspection of containments and reactor

internals.
- Continue the development of the next generation safety analysis code, and extend it from small-scale demonstration of algorithmic features to plant-scale evaluations, focusing on case studies coordinated with industry.
- Develop a strategy, methods, and execute cost-shared pilot projects to demonstrate first-of-a-kind instrumentation and control technologies that enable the modernization of existing nuclear power plant instrumentation and control systems.
- Develop centralized on-line monitoring and information integration systems applicable to existing LWRs to enable early detection of material degradation.
- Continue the development of new long-life fuel designs with advanced fuel and cladding materials.
- Continue development of a model for fuel cracking at the mesoscale level with sufficient understanding to develop a predictive model for fission gas release.
- Continue development of alternative and new cooling technologies that can be applied in the near term to reactors impacted by insufficient cooling water supplies.
- Develop innovative technologies that lessen the environmental impacts of removing large volumes of cooling water from naturally occurring sources.
- Assess degradation of cables in unique reactor environments (radiation, high temperature, moisture) and develop tools & methods to measure degradation and predict failures.
- Identify technical gaps and limitations on extended power uprates greater than 20%.

Advanced Reactor Concepts (formerly Generation IV Nuclear Energy Systems Research and Development) **0** **21,870**

This program was previously referred to as the Gen IV R&D program. It will continue the Gen IV R&D work but has been modified to encompass reactor technologies beyond Generation IV. The program will focus on reactors that could dramatically improve performance in sustainability, safety, economics, security, and proliferation resistance. This work includes scientific R&D at national laboratories and universities, as well as through collaboration with international partners.

Both advanced thermal and fast reactor systems will be considered within the ARC program. Fast reactors could be employed to consume long-lived, high-activity elements found in used LWR fuels as part of a long term waste management approach if economic, technical, safety, and proliferation challenges are addressed.

Advanced reactors using a variety of coolants will be considered. Some research activities are coordinated with foreign researchers through the GIF as well as other bilateral and multilateral agreements. R&D to support near term deployment of a domestic commercial Sodium Fast Reactor (SFR) has been discontinued. Long-term R&D on Gen IV reactor concepts, including the SFR, with international GIF partners will continue. This element includes an examination of supercritical carbon dioxide ($S\text{-}CO_2$) as working fluid for a more efficient method of converting reactor energy to produce electricity. Support is also included for the international policy and experts groups of the GIF, including working groups for common evaluation methodologies of reactor economics, safety,

and proliferation resistance and physical protection. General technical support associated with international R&D collaborations that is not technology-specific is provided by the International Nuclear Energy Cooperation program.

In order to be effective, innovative reactor design concepts must consider the overall system performance, e.g., fuel and reactor performance and economics, material utilization and waste disposition, and non-proliferation considerations. Integrated reactor concepts will employ a diverse range of innovative ideas. It is important to both confirm the feasibility and assess the importance of technology innovations. R&D on innovative concepts will be guided by a clear assessment of potential performance and economic improvements. The existing knowledge base and the pursuit of new ideas will generate innovative concepts to focus R&D, with the goal of developing transformational technologies. The ARC and SMR R&D programs will closely coordinate any support from the respective programs for research and development activities on the various non-LWR small modular reactor concepts and technologies.

FY 2010 activities are discussed under the Gen IV budget element.

In FY 2012, the Department will:

- Further investigate, develop, and reduce long-term technical barriers to advanced reactor technologies through analysis, modeling, and small-scale experiments (including liquid metal plugging, inspection technology, and heat exchange experiments).
- Further the development of promising advanced reactor priority concepts identified from an expert team assessment, and investigate promising transformational concepts.
- Continue Brayton Cycle advanced energy conversion system development, including working fluid research for increased efficiency and applicability to multiple reactor designs.
- Perform advanced reactor system integration studies to determine optimal reactor system designs that combine advanced structural, system, and component level R&D products and innovations for improved safety and operational performance (including longer core life), confirm feasibility and benefits, and identify areas requiring additional R&D.
- Significantly increase R&D work on the Fluoride-cooled High Temperature Reactor (FHR), including safety and integrated systems modeling tasks and trade-off studies that compare and analyze design options.
- Initiate a small-scale test of a FHR Direct Reactor Auxiliary Cooling System at prototypic temperatures.
- Analyze FHR in-core dynamic motion of fuel pebbles and investigate on-line refueling process techniques (pebble and plate fuel).
- Continue work in the area of advanced reactor structural materials:
    - Complete fast reactor structural alloy optimization and develop ASME code qualification methodology for candidate materials.
    - R&D of FHR high strength and corrosion-resistant materials.
- Continue work in the area of advanced reactor safety research, including completing the EBR-II inherent safety International Atomic Energy Agency benchmarks, validating liquid metal cooled fast reactor safety codes and analysis methods, and addressing high priority items from the Regulatory Licensing Safety Gap Analysis.

(dollars in thousands)

FY 2010 Current Approp	FY2012 Request

- Continue work in the areas of nuclear data, GIF activity support, and international collaborations that support advanced reactor concept development and maturation.

SBIR/STTR	**0**	**3,500**

The FY 2012 amount shown is the estimated requirement for the continuation of the SBIR and STTR program.

Subtotal, Reactor Concepts Research, Development and Demonstration	**0**	**125,000**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Small Modular Reactors Advanced Concepts R&D	
The increase reflects funding for advanced SMR technology R&D activities.	+28,674
Next Generation Nuclear Plant Demonstration Project	
The increase reflects the funding necessary to continue needed fuels and materials R&D activities. In FY 2010, this activity was funded as part of the Gen IV program.	+49,572
Light Water Reactor Sustainability	
The increase reflects support for expanding the LWR Sustainability experimental suite across all research pathways, including materials and advanced fuels. In FY 2010, this activity was funded as part of the Gen IV program.	+21,384
Advanced Reactor Concepts (formerly Generation IV Nuclear Energy Systems Research and Development)	
The increase reflects support for the evaluation of innovative reactor systems to identify promising areas for further R&D. In FY 2010, this activity was funded as part of the Gen IV program.	+21,870
SBIR/STTR	
The increase reflects the estimated requirements for the continuation of R&D funding subject to SBIR/STTR.	+3,500
Total Funding Change, Reactor Concepts Research, Development and Demonstration	**+125,000**

Fuel Cycle Research and Development

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Fuel Cycle Research and Development	131,938[a]	155,010

Public Law Authorizations:
P.L. 111-85, Appropriation Act (2010)
P.L. 111-226, FAA Air Transportation Modernization and Safety Improvement Act (2010)

Mission

The mission of the Fuel Cycle Research and Development (R&D) program is to implement the R&D approach to help achieve the objective to develop sustainable fuel cycles as described in the *Nuclear Energy Research and Development Roadmap* (Roadmap). Specifically, the program will research and develop a suite of technology options that will enable future decision-makers to make informed decisions about how best to manage nuclear waste and used fuel from reactors. A long-term, science-based approach is employed to foster innovative, transformational technology solutions to achieve the mission.

The program also supports the other objectives described in the Roadmap regarding current reactors, new reactors, and minimizing the risk of nuclear proliferation and terrorism. The Office of Nuclear Energy (NE) will also oversee ongoing responsibilities under the Nuclear Waste Policy Act.

Benefits

The Fuel Cycle R&D program supports long-term technology development activities and will:

- Develop high burn-up and other fuels for use in reactors that could help reduce the amount of used fuel for direct disposal for each megawatt-hour of electricity produced (once-through fuel cycles);
- Investigate fuel forms, reactors and fuel/waste management approaches that could dramatically increase utilization, if economically competitive, of fuel resources and reduce the quantity of long-lived radiotoxic elements in the used fuel to be disposed (per megawatt-hour) (modified open fuel cycles). Technologies will be considered that require at most limited separation steps and minimize proliferation risks; and
- Develop techniques that will enable long-lived actinide elements to be repeatedly recycled (fully closed fuel cycles). The ultimate goal is to develop a cost-effective and low-proliferation-risk approach that would significantly decrease the long-term challenges posed by the waste and reduce uncertainties associated with its disposal.

The goal is to perform R&D within each of the three tracks above to advance fuel cycle technologies and waste management strategies to inform decision-making.

[a] Includes a reduction of $3,808k for SBIR/STTR and a reduction of $254k for rescission.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The Fuel Cycle R&D program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Conduct long-term science-based R&D through small-scale experiments, theory development, modeling and simulation, validation experiments, and development of transformational technologies that have the potential to produce beneficial changes in the way the nuclear fuel cycle, and particularly nuclear waste, is managed.
- Conduct R&D needed for the Department to provide input into the Administration's development of a national nuclear waste management strategy and to support the Blue Ribbon Commission on America's Nuclear Future.
- Leverage transformative and crosscutting R&D activities carried out by the Nuclear Energy Enabling Technologies (NEET) program, complementing the R&D carried out in this program.

The Department will implement the following strategies:

- NE's R&D programs will partner with the private sector, national laboratories, universities, and international partners to develop advanced nuclear technologies.
- NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects.
- NE programs competitively award funds through open, competitive solicitations for investigator-led projects. The national laboratories are encouraged to partner with universities in conducting R&D.
- Programs will also engage the international community in pursuit of advanced nuclear technology that will benefit the United States in terms of enhanced safety, improved economics, and reduced production of wastes.
- Pursue cost-sharing as required under Section 988 of the 2005 Energy Policy Act.

These strategies will contribute to the efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Nuclear energy research programs rely on data produced through collaborations with foreign nations. Should vital data from foreign partners prove unavailable, U.S. efforts would need to be re-evaluated.

In carrying out the program's mission, the program performs the following collaborative activities:

- The Fuel Cycle R&D program is undertaking long-term R&D on fuel cycle technologies to provide the U.S. government with information on and options for the long-term disposition of used nuclear fuel. Interdependencies with the Office of Environmental Management include collaboration on used fuel treatment technologies and waste forms to avoid duplication of effort.
- Interdependencies with National Nuclear Security Administration (NNSA) include coordination of advanced material control and accountability monitoring technology development, and safeguards and security aspects of advanced fuel cycle technologies.
- Interdependencies with the Office of Science (SC) include providing the basic science tools that can be used to close technology gaps that currently impede the implementation of fuel cycle technologies. Interfaces in basic energy sciences including actinide chemistry and materials, nuclear physics, and development of advanced simulation and modeling tools are coordinated between NE and SC.
- The Department will coordinate with the NRC to assure that R&D activities are complementary, cost effective, and not duplicative.
- The Department seeks input from the U.S. nuclear industry, utilities and the Electric Power Research Institute in providing advice to the Fuel Cycle R&D program to ensure that technology options meet industry requirements and needs.
- Participation in international experiments related to the development of advanced fuel cycle technologies is being performed in support of Fuel Cycle R&D program objectives.
- The Fuel Cycle R&D program will collaborate with NE's Reactor Concepts Research, Development and Demonstration (RD&D) and NEET programs to ensure related activities are complementary and not duplicative, and to encourage innovation across programmatic areas.
- The Fuel Cycle R&D program collaborates, where appropriate, with international partners from countries with advanced fuel cycles to leverage U.S. research investments and to pursue common goals toward advanced fuel cycles. The program provides technical support to NE's international mission via participation in international technical cooperation agreements. The program also pursues new international cooperation activities that provide access to facilities not available in the United States, such as fast spectrum test reactors for advanced fuel testing.

Fuel Cycle Research and Development

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Fuel Cycle Research and Development		
Separations and Waste Forms	41,257	36,893
Advanced Fuels	29,651	40,443
Transmutation Research and Development	4,288	3,109
Modeling and Simulation	26,009	0
Systems Analysis and Integration	14,783	20,466
Materials Protection, Accounting, and Control Technology	6,826	7,864
Used Nuclear Fuel Disposition	9,124	37,249
Fuel Resources	0	4,646
SBIR/STTR	0	4,340
Total, Fuel Cycle Research and Development	131,938[a]	155,010

Benefits

The Fuel Cycle R&D program in FY 2012 will advance the R&D approach described in the *Nuclear Energy Research and Development Roadmap* (Roadmap). Beginning in FY 2010, the program shifted from a near-term technology development and deployment program to a long-term, science-based R&D program which has the potential to produce beneficial changes to the way the fuel cycle, and particularly used fuel, is managed. The program is examining three fuel cycle strategies: once-through fuel cycle, modified open fuel cycle, and full fuel recycle. Examination of this full range of approaches is critical to provide future decision-makers with information needed to make decisions.

The technical activities proposed for FY 2012 will advance the solution-driven, goal-oriented, science-based approach described in the Roadmap. Within each of its technical areas, the program embodies the elements of the science-based approach: experiments, theory, and modeling and simulation. The program also employs a dual path: first, to research technologies needed to define and develop advanced fuel cycles with sufficient clarity that program milestones can be reasonably anticipated and planned; second, to pursue long-term high-risk, high-payoff research. In addition, up to 20 percent of appropriated program funds are allocated for universities and research institutions that contribute to the program mission and benefit university programs.

In FY 2012, the proposed technical activities advance the program within its current discovery phase where research is conducted to identify the feasibility of technology options in each of the three fuel cycle strategies: once-through, modified open, and full recycle.

[a] Includes a reduction of $3,808k for SBIR/STTR and a reduction of $254k for rescission.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Separations and Waste Forms	**41,257**	**36,893**

The mission of the Separations and Waste Forms technical area is to develop the next generation of used fuel separations and waste management technologies that enable a sustainable fuel cycle with minimal processing, waste generation, and potential for material diversion. Challenges in separations and waste forms include: 1) develop separations technologies and systems with reduced proliferation risk, very low process losses, and minimal undesirable waste streams; and 2) develop waste forms with predictable, long-term behavior and enhanced resistance to long-term degradation suitable for a variety of potential storage or geologic repository environments.

Separations and waste forms R&D activities will be determined by fuel requirements that have not yet been fully developed. At this time, separations and waste forms activities for the modified open cycle (MOC) fuel cycle strategy include volatilization methods for several MOC concepts, investigation of melt refine methods, and immobilization of volatile waste streams. Many of these activities would also support fully closed fuel cycle options as well.

In FY 2010, the Department:

- Formed a "sigma team" to research innovative methods for the separation of americium or americium/curium in a single process step. Sigma teams are multi-laboratory, multi-discipline technical experts organized to address grand challenges in the program.
- Formed a second sigma team to research innovative methods to capture off-gasses such as iodine and krypton from the head end processes and immobilize the captured gasses.
- Developed advanced concepts for electrochemical processing to recycle salt for waste minimization, advanced methods for transuranic recovery, and novel product consolidation methods.
- Used a competitive, peer reviewed process to select and initiate several transformational separations science-based projects to explore potentially "game-changing" concepts.
- Developed alternative waste forms that are tailored to specific radionuclides and potential geologic media.
- Characterized waste forms and assessed their performance in a variety of potential geologic media.
- Investigated new waste forms for electrochemical process inactive metals and spent salt streams.
- Developed, in conjunction with the Materials Protection, Accounting and Controls Technology (MPACT) technical area, advanced fuel cycle instrumentation that will provide for online/at-line, near real-time, active and passive nondestructive monitoring of electrochemical and aqueous processes.
- Developed, in conjunction with the MPACT technical area, advanced safeguards approaches, including formalization of requirements, for advanced separations processes and waste forms.
- Developed modeling and simulation approaches to support radiation transport and detection,

materials behavior in harsh environments, development of radiation and non-radiation based signatures, performance assessments/optimization, virtual inspector presence, and data visualization.

In FY 2012, the Department will:

- Conduct R&D of advanced electrochemical and aqueous separations technologies.
- Investigate minor actinide separation and off-gas capture and immobilization using the sigma teams.
- Develop fundamental science and methods related to separation processes that are associated with chemistry, thermodynamics, and kinetics.
- Investigate some separations processes designed specifically for modified open fuel cycle strategies.
- Conduct R&D of alternative waste forms including electrochemical waste forms and zirconium recycle.
- Characterize waste forms for both metal and oxide wastes.
- Conduct R&D and modeling to understand waste form behavior at atomistic and continuum levels.
- Investigate some waste forms and processes associated with modified open fuel cycle strategies including the immobilization of volatile waste streams.
- Fund university-based radiochemistry R&D in support of technical activities associated with separations and waste form science and to encourage research programs at the universities.
- Begin an investigation of the specialized waste forms associated with the disposal of spent fuel from high temperature gas-cooled reactors.

Advanced Fuels **29,651** **40,443**

The mission of the Advanced Fuels technical area is to perform R&D on nuclear fuel systems and fabrication processes to achieve multi-fold improvements in fuel and fabrication process performance. This will be in direct support to NE's imperatives of extending plant lifetimes, enabling new reactor builds, and developing sustainable fuel cycles through advanced transmutation fuels. An associated challenge to the mission is to develop long-term high-risk, high potential nuclear fuels and/or targets for thermal and fast reactors with major increases in performance over previous generation fuels.

This program also recognizes the importance of improving long-term waste management technology R&D investigated by the Fuel Cycle R&D program. Within this long-term context, the program supports the research and development of advanced fuels that could ultimately be utilized in advanced fast and thermal reactors as well as in support of reactor concepts being developed in other parts of NE.

In FY 2010, in addition to its traditional transmutation fuels development focus, the Advanced Fuels program expanded its R&D responsibility to include collaboration on long-term, high-risk, and potentially high-payoff (i.e. transformational) development in support of the Light Water Reactor Sustainability (LWRS) program.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

In FY 2012, all advanced fuels R&D activities associated with the MOC are conducted within the Advanced Fuels program. These MOC related activities include deep-burn fuels with high performance potential. Some of the fuels under development for modified open fuel cycle options could be applicable to fully closed fuel cycle options as well. FY 2012 will also be a year of enhanced irradiation preparation and support of various long-term, high-risk, high-payoff advanced fuels concepts as well as provide support for advanced fuel development needs of reactor programs in NE.

In FY 2010, the Department:

- Explored innovative fuel designs including transmutation fuels with long-term high performance payback such as composite dispersion fuels with micro-structural properties targeted for specific characteristics.
- Continued to develop advanced fabrication techniques that provide the desired control on fuel microstructure with the inclusion of strategic additives if needed.
- Performed analyses to investigate potential transformational advances in advanced fuels development.
- Initiated small-scale experiments needed to verify specific features of modeling development needs.
- Continued post-irradiation examination of irradiated experiments from the Fast Flux Test Facility (FFTF) and Advanced Test Reactor (ATR), as required for input to fuel performance code and modeling development and initiated plans for the return of the U.S. material irradiated in the Phénix fast spectrum test reactor in France.
- Developed initial plans for the development of advanced Light Water Reactor (LWR) fuels and claddings in coordination with the LWRS activity within the Reactor Concepts RD&D program, industry, and universities.
- Continued irradiation experiments at ATR for the development of advanced oxide and metal transmutation fuels and initiated plans for future separative effects testing to support advanced model development.

In FY 2012, the Department will:

Modeling and Simulation Support:

- Continue to support fuel cycle-specific performance code and modeling development via small-scale experiments to investigate important separate effects. This data will be used to enhance modeling and simulation (M&S) tools under development within the NEET program.

Post-Irradiation Examination:

- Receive irradiated U.S.-origin fuels and materials from the French Phénix fast spectrum reactor, and initiate applicable non-destructive post irradiation examinations.
- Continue activities to develop needs and options for transient test capabilities, which may be needed for licensing-related testing of any new fuel to be used in a nuclear power reactor in the United States.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

Fabrication:

- Continue fabrication and characterization development of metal fuels, with the capability to transmute large quantities of minor actinide bearing fuel so its technology readiness level is raised to that of oxide-based mixed oxide fuel. Fabrication process modeling will be continued in support of this activity and also to support ceramic fuel and clad development as needed.
- Continue to develop advanced fabrication techniques that provide the desired control on fuel microstructure with the inclusion of strategic additives if needed.

Other Fuel Activities:

- Continue development of innovative fuel systems that possibly support alternative fuel cycles to the current uranium oxide once-through fuel cycle with the potential for dramatic increased performance and waste minimization potential.
- Continue development of advanced high performance particle based fuel systems including the thermal deep burn concept and initiate potential fast reactor related deep burn development.
- Continue pursuit of fuel cladding material development for both thermal and fast reactor use to achieve major increase in radiation tolerance characteristics, thereby supporting deep burn concepts.
- Continue development of novel characterization and in-pile measurement instrumentation to support the fundamental understanding of the fuel behavior.
- Collaborate with the Advanced Reactor Concepts program to support their advanced fuel development needs.
- Continue coordination of transmutation fuels development with separations and waste forms R&D and systems analysis technical teams.
- Conduct joint studies under existing international arrangements with China and Russia to plan future irradiation experiments for reactor fuels and materials. The studies would include shipping arrangements, safety studies, diagnostic instrumentation requirements, and post irradiation planning.

Transmutation Research and Development **4,288** **3,109**

The mission of the Transmutation R&D technical area is to convert long-lived radioactive isotopes into shorter-lived elements. Transmutation can lower the long-term radiotoxicity of used nuclear fuel to below that of mined uranium ore by reducing the time for decay from hundreds of millennia to as little as centuries.

In the context of long-term waste management technology R&D, this activity supports research on advanced instruments and measures as well as analyses of highly accurate nuclear data such as neutron fission and capture cross-sections for elements of interest to the Fuel Cycle R&D program. Improved accuracy of nuclear data is important to a variety of activities including transmutation performance analysis, safeguards instrumentation design, high-burnup fuel development, waste package performance, and development of advanced models and simulation codes. Nuclear data

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

research is performed in collaboration with the SC.

In FY 2010, the Department:
- Continued R&D activities on high precision measurements of nuclear data, sensitivity analyses to reduce uncertainty, and development of advanced measurement techniques.
- Updated nuclear data libraries to include reduced uncertainties based on new data in the fast neutron region of the spectrum.

In FY 2012, the Department will:
- Continue to reduce nuclear data uncertainties by producing adjusted nuclear data and co-variances that include the sensitivities calculated from the representative integral experiments.
- Continue to deliver nuclear data evaluations and covariance production.
- Continue to measure nuclear data with unprecedented precision with the time projection chamber that was developed by the program.
- Continue to explore more advanced nuclear measurement techniques.
- Investigate systems which may be able to play a role in the reduction of highly radioactive waste by transmutation or other means such as subcritical accelerator driven systems and hybrids.
- Seek novel methods to help minimize the heat and radiation load from fission products in separated, processed waste. Such methods could include techniques other than traditional neutron irradiation.

Modeling and Simulation **26,009** **0**

The mission of Modeling and Simulation within NE is to create and deploy science-based, verified and validated modeling and simulation capabilities essential for the design, implementation, and operation of all aspects of nuclear energy systems and their nuclear fuel cycles to improve U.S. energy security. Program activities encompass the micro-behavior level of fuels and materials in Fuel Cycle R&D, to the macro-behavior level of reactor systems (e.g., LWRs and advanced reactors in Reactor Concepts RD&D) and their fuel cycles.

In FY 2012, modeling and simulation activities that support Fuel Cycle R&D are consolidated within the Advanced Modeling and Simulation sub-activity within the Crosscutting Technology Development activity under the NEET program.

In FY 2010, the Department:
- Delivered the first generation of integrated performance and safety codes to provide a limited science-based understanding of the performance of nuclear fuels and reactor core and safety systems.
- Established projects with universities, industry, and laboratories to deliver fundamental material performance models to the integrated code activities.
- Completed surveys of existing verification, validation, and uncertainty quantification methodologies and began to implement the most appropriate ones.
- Created a prototype application that provides a systematic approach to meeting security requirements by integrating the safeguard systems and separations process.

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request

- Developed an initial three-dimensional, high-resolution, integrated system application to understand and predict the performance of nuclear waste forms in repository environments.

Systems Analysis and Integration **14,783** **20,466**

The mission of the Systems Analysis technical area is to perform systems engineering and integrating analyses of nuclear energy and fuel cycle systems to inform fuel cycle R&D, programmatic decisions, strategy formulation, and policy development.

The technical integration program element provides support in the areas of technical integration, project controls, quality assurance, document management, knowledge management, and communications. This function ensures the technical consistency of the program, integrated product development, and planning and monitoring of work activities.

In FY 2010, the Department:

- Performed systems analyses, optimization studies, and trade studies. Defined sensitivity coefficients with respect to system level assumptions to guide the R&D prioritization effort.
- Provided strategic and program planning support in developing technology roadmaps, integrated schedules, and other planning documents.
- Developed and maintained a set of tiered models to be used for policy level decision making.
- Expanded knowledge management to include historical fuels data and geologic repository data and reports.
- Developed specifications and requirements for a fuel cycle simulator that can synthesize and visually present multi-variable attributes of potential fuel cycles.
- Used a systems engineering approach to develop a strategy for cataloging fuel cycle system options and identifying evaluation tools and metrics to aid in a screening process that will help focus the long-term fuel cycle R&D efforts.

In FY 2012, the Department will:

- Develop systems analyses, optimization, and trade-off studies regarding fuel cycle strategies and technologies.
- Develop and maintain a set of analysis and communication tools and associated data for analysis of fuel cycle systems, including development of a fuel cycle simulator.
- Use a systems engineering approach to identify technology options and develop screening criteria to eventually down select options for further development.
- Coordinate R&D throughout the laboratory complex including generating schedules, costs, and milestones as well as aggregating the programs monthly performance data, information management, and communications.
- Support a student awards program to facilitate innovation and the creation of new ideas as well as support higher education in fuel-cycle-relevant disciplines.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

Materials Protection, Accounting, and Controls Technology **6,826** **7,864**

The mission of the MPACT technical area is to develop technologies and analysis tools to enable next generation nuclear materials management for future U.S. nuclear fuel cycles to prevent diversion or misuse, thereby minimizing proliferation risks and enhancing confidence and acceptance of nuclear energy. One challenge on which MPACT will focus is to develop online, real-time, continuous, accountability instruments and techniques that permit at least an order of magnitude improvement in the ability to inventory fissile materials in domestic fuel cycle systems in order to detect diversion and prevent misuse.

Work within this technical area will be closely coordinated with work described in the NEET program but will focus specifically on informing future fuel cycle and safeguards R&D. Work will continue to be closely coordinated with NNSA programs.

In FY 2010, the Department:

- Identified gaps and areas for improving proliferation risk assessments of nuclear fuel cycles and drafted a roadmap outlining the path forward.
- Evaluated current methodologies for assessing proliferation risk and developed a plan for integrating new and existing concepts into analytical tools for evaluating proliferation risks associated with fuel cycle concepts. Probabilistic risk assessment approaches were included in the evaluation.
- Initiated the development of technologies to provide online, real-time measurement systems, including process-monitoring capabilities for improving material accountancy and reduced proliferation risk associated with advanced fuel cycle systems.
- Initiated the development of methodologies to incorporate safeguards and security systems into advanced fuel cycle systems to reduce proliferation risk, optimize performance, and reduce costs.

In FY 2012, the Department will:

- Conduct "safeguards and security by design" activities that consider proliferation and terrorism risks from the very earliest stages of development.
- Continue to develop innovative real-time active and passive methods for measuring and monitoring nuclear materials in advanced nuclear energy systems.
- Continue to develop advanced concepts for innovative real-time information analysis enabling early detection of, and response to, any significant diversion, theft or loss of nuclear material.
- Continue to incorporate university-based R&D in support of technical activities associated with MPACT and to encourage research programs at the universities.

Used Nuclear Fuel Disposition **9,124** **37,249**

The mission of the Used Nuclear Fuel Disposition technical area is to identify alternatives and conduct scientific research and technology development to enable storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles. The

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

challenge for Used Nuclear Fuel Disposition is the development of storage, transportation, and disposal systems resulting in near-zero radionuclide releases. Work in this program element supports all three fuel cycle approaches; once-through fuel cycle, modified open fuel cycle, and full fuel recycle. NE oversees responsibilities under the Nuclear Waste Policy Act. Within the Fuel Cycle R&D program, these include activities associated with nuclear waste management.

In FY 2010, the Department:

- Developed capabilities for analyses and trade studies to evaluate all aspects of storage and disposition scenarios and to provide rapid response capability as needed.
- Developed the technical bases and lessons learned for used nuclear fuel disposition.
- Developed modeling tools and initiated systems modeling for engineered and natural barrier systems and generic disposal concepts in multiple environments.
- Initiated a modeling and simulation experiment and testing program.
- Completed the transition of technical information and selected research science and engineering expertise from the Office of Civilian Radioactive Waste Management to NE.

In FY 2012, the Department will:

- Continue to support activities of the Blue Ribbon Commission.
- Continue R&D associated with the disposal of all classifications of radioactive waste including:
  - features, events, and processes database
  - generic disposal system-level modeling
  - generic engineered barrier system evaluations
  - generic natural system evaluation
  - inventory projections of radioactive waste
  - legal and regulatory framework analyses
  - low level waste disposition
  - technical bases from past waste management strategies
- Continue R&D associated with the storage and transportation of waste and by-product materials that are generated from current and future fuel cycles in the United States including:
  - security assessments
  - R&D opportunities to identify technical gaps
  - the technical bases needed to be developed for licensing the transport of materials

Fuel Resources **0** **4,646**

As outlined in the Nuclear Energy R&D Roadmap, the availability of fuel resources has important implications for any potential fuel cycle and reactor deployment scenario and therefore must be understood. The Fuel Resources technical area will conduct targeted research on "game-changing" approaches on resource extraction such as recovering uranium from seawater as well as conducting resource estimation and R&D for exploration. This effort will not emphasize existing commercial uranium mining technologies because the nuclear fuel industry has sufficient incentives to undertake activities necessary to advance such technologies. Instead, the research activities will focus on high-risk, high-reward R&D focusing initially on recovering unconventional resources such as extraction

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

of uranium from seawater environment.

In FY 2012, the Department will:

- Improve cost models of the current recovery technology for uranium in seawater to increase the understanding of the cost drivers.
- Develop nanoporous sorbent materials using modern ligand design tools to enhance uranium sorption capacity and selectivity from seawater.
- Develop innovative materials to strengthen mechanical stability of sorbent materials in seawater environment.
- Develop novel synthesis methods to significantly increase grafting efficiency.
- Complete an analysis to characterize long-term uranium resources including economic considerations and technical barriers. This study will include an evaluation of the utilization of low-grade resources (e.g., phosphates, seawater).
- Initiate laboratory scale testing of candidate sorbent materials using natural seawater.

SBIR/STTR	**0**	**4,340**

In FY 2010, $3,704,000 was transferred to the SBIR and STTR programs. The amount shown for FY 2012 is an estimated requirement for the continuation of the SBIR and STTR program.

Total, Fuel Cycle Research and Development	**131,938**	**155,010**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Separations and Waste Forms	
The decrease reflects the transfer of (1) Experimental Breeder Reactor-II used nuclear fuel treatment to the Idaho Facilities Management program and (2) activities related to the Materials Protection, Accounting, and Control Technologies program. This is partially offset by an increase in scope to explore technologies related to the modified open fuel cycle strategy.	-4,364
Advanced Fuels	
The increase reflects an increase in scope to (1) expand R&D from primarily transmutation fuels to a multitude of fuel types and (2) explore technologies related to the modified open fuel cycle strategy.	+10,792

	FY 2012 vs. FY 2010 Current Approp ($000)
Transmutation Research and Development The decrease reflects the transfer of transmutation-related activities associated with fast spectrum reactor technologies to the Reactor Concepts RD&D program.	-1,179
Modeling and Simulation The decrease reflects the consolidation of advanced modeling and simulation activities within the NEET program.	-26,009
Systems Analysis and Integration The increase reflects increasing scope to (1) conduct more comparative analyses of technologies associated with the three fuel cycle strategies and (2) introduce a systems engineering approach to manage technology options and prepare for down selection.	+5,683
Materials Protection, Accounting, and Control Technology The increase reflects a ramping up of activities related to the development of measurement systems and M&S tools**.**	+1,038
Used Nuclear Fuel Disposition The increase reflects an increase in scope to conduct R&D associated with storage, transportation and disposal of used nuclear fuel and radioactive waste under all three fuel cycle strategies and under a multitude of natural and engineered systems.	+28,125
Fuel Resources The increase reflects the introduction of a new technical area that focuses fuel resource analysis and evaluating "game-changing" approaches on resource extraction.	+4,646
SBIR/STTR The increase reflects the amount for FY 2012 that is an estimated requirement for the continuation of the SBIR and STTR program. In FY 2010, $3,704,000 was transferred to the SBIR and STTR programs.	+4,340
Total Funding Change, Fuel Cycle Research and Development	**+23,072**

Nuclear Energy Enabling Technologies

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Nuclear Energy Enabling Technologies	0	97,364

Mission

The mission of the Nuclear Energy Enabling Technologies (NEET) program is to conduct research, develop and provide crosscutting technologies that directly support and enable the Office of Nuclear Energy's (NE) broad research and development portfolio, and encourage the development of transformative, "outside-the-box" innovations in nuclear energy science and engineering.

Benefits

Pursuing crosscutting and transformative nuclear technologies and capabilities for incorporation into advanced reactor and fuel cycle concepts offers the promise of revolutionary improvements in safety, performance, reliability, economics, and proliferation risk reduction; and promotes creative solutions to the broad array of nuclear energy challenges related to reactor and fuel cycle development. The activities undertaken in this program complement those within the Reactor Concepts Research Development & Demonstration (RD&D) and Fuel Cycle R&D programs by providing a mechanism for pursuing broadly applicable R&D in areas that may ultimately benefit specific reactor and nuclear fuel concepts. Leveraging the knowledge generated through activities in the NEET program will provide useful information for program and strategic planning and will allow NE to address key challenges affecting nuclear reactor deployment (e.g., capital cost, technology risks, and proliferation concerns).

The Energy Innovation Hub for Modeling & Simulation (Hub) will provide crosscutting support to facilitate future improvement of nuclear technologies. As the President remarked in the State of the Union Address, "At Oak Ridge National Laboratory, they're using supercomputers to get a lot more power out of our nuclear facilities." The Hub is a focused collaboration of industry, national laboratories, and universities to apply advanced modeling and simulation to nuclear energy in order to get a lot more safe, clean and reliable energy from operating nuclear power plants. The Hub will also provide an opportunity for the next generation of nuclear scientist and engineers to train on the latest generation of advanced, supercomputing modeling and simulation tools.

Through the National Scientific User Facility (NSUF), universities and industry involved in testing and experimentation to further nuclear science and engineering research goals are able to access unique research facilities and equipment that would otherwise be unavailable.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The NEET program will use various means and strategies to achieve its GPRA Unit Program Goal; however, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Conduct long-term, science-based research and develop crosscutting, transformative technologies that directly support and complement NE's development of new and advanced reactor concepts and fuel cycle technologies.
- Evaluate improvements in other industrial sectors (aerospace, shipbuilding, etc.) to identify potential transformational technology ideas to be applied to the research, development, and deployment of nuclear energy technologies.

The Department will implement the following strategies:

- The Hub will inform the way in which the United States develops, implements, and licenses nuclear energy technologies through the application of state-of-the-art computer modeling and simulation of all processes from the sub-atomic to the system-integration level.
- Partner with the private sector, national laboratories, universities, and international partners to develop crosscutting advanced nuclear technologies and pursue cost-sharing as required under Section 988 of the 2005 Energy Policy Act.
- Programs will also engage the international research community in pursuit of advanced nuclear technology through various multilateral and bilateral international agreements.
- R&D will use a ~~"s~~cience-based" approach that involves the close coupling of experiments, theory, and advanced modeling and simulation to create new levels of understanding about the performance and safety of complex physical systems.
- Open competition for new ideas through broad solicitation of novel and transformative concepts for any technology or system that might contribute to nuclear power.
- Consolidate modeling and simulation work that was previously spread across the R&D portfolio into a coordinated program in order to share common developments and drive efficiency.
- NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects.
- NE will employ a certified peer review process for the evaluation and selection of NEET projects through open, competitive processes, as well as through direct funded R&D activities, to help ensure the appropriate allocation of resources and to support the discovery of new capabilities and encourage innovation among the research community.

These strategies will contribute to the efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goals:

- The decision to build new commercial nuclear power plants rests with the private sector alone. This decision depends in part on power demand and economic and environmental factors beyond the scope of the Department's programs. In the near term, it depends on complex economic decisions made by industrial partners.

In carrying out the program's mission, the program performs the following collaborative activities:

- NE will coordinate NEET program research and the Hub activities with the Office of Science (SC), and the National Nuclear Security Administration (NNSA).
- The NEET program will collaborate with NE's Reactor Concepts RD&D and Fuel Cycle R&D programs to ensure related activities are complementary and not duplicative, and to encourage innovation across programmatic areas.
- The Department will consult with the NRC on program planning to ensure that their R&D activities are complementary, cost effective, and not duplicative.
- The program will work to establish broad international cooperation and support consistent with the objectives of the program.
- Through the NSUF, NE carries out a variety of experiment design, fabrication, irradiation, and post-irradiation work in support of the NNSA, Naval Reactors, universities, and industry organizations. NSUF will partner with other national laboratory and universities to make available other unique irradiation and experimental facilities to nuclear researchers.

Nuclear Energy Enabling Technologies
Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Nuclear Energy Enabling Technologies		
Crosscutting Technology Development	0	41,178
Transformative Nuclear Concepts R&D	0	14,580
Energy Innovation Hub for Modeling and Simulation[a]	0	24,300
National Science User Facility	0	14,580
SBIR/STTR	0	2,726
Total, Nuclear Energy Enabling Technologies	0	97,364

Benefits

The NEET program includes four budget elements that contribute to a wide variety of existing and developing reactor and fuel cycle technologies. Collectively, these R&D activities support the technology development efforts of the Reactor Concepts RD&D and Fuel Cycle R&D programs by addressing challenges that are common to multiple reactor and/or fuel cycle technologies, such as reactor materials and advanced modeling and simulation tools. The transformative element provides a mechanism for fostering new ideas across the full spectrum of nuclear energy technology issues, ensuring that good ideas are researched even if they are not within the defined plans of existing programs and giving the existing programs creative outside-the-box solutions. Crosscutting activities previously carried out in other NE R&D programs are centrally managed in this program to improve efficiency and avoid duplication of effort.

The Crosscutting Technology Development activity provides R&D support to various reactor and fuel cycle technologies, both existing and under development. These include several areas that crosscut multiple nuclear technologies, including reactor materials and materials in extreme environments, innovative nuclear manufacturing methods, new instrumentation and sensor technologies for monitoring material and equipment conditions in existing reactors and creative approaches to further reduce proliferation risks. Beginning in FY 2012, Advanced Modeling and Simulation activities are also consolidated within the Crosscutting Technology Development activity, developing advanced modeling and simulation tools and methods that focus on the next generation of nuclear technologies. These activities will modernize the tool sets available to today's nuclear professionals with benefit to NE's R&D programs and to the commercial industry. Crosscutting Technology Development research is coordinated with the NRC and industry organizations (e.g. Nuclear Energy Institute, Electric Power Research Institute). The Transformative Nuclear Concepts R&D activity supports, via an open, competitive solicitation process, investigator-initiated projects that relate to any aspect of nuclear energy

[a] In FY 2010, funding for the Energy Innovation Hub for Modeling and Simulation was included in the Generation IV Nuclear Energy Systems program.

generation—reactor and power conversion technologies, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration. The Hub applies existing modeling and simulation capabilities to create a "virtual" reactor user environment for engineers to simulate a currently operating reactor. This approach provides a detailed, validated reactor performance predictive capability for use by engineers to address performance and safety issues related to power "uprates" and life extensions for current reactors.

Through the NSUF, university and industry researchers are able to access unique nuclear research facilities and equipment to conduct tests and experiments in order to further nuclear science and technology research goals. The Idaho National Laboratories (INL) Advanced Test Reactor (ATR) and post-irradiation examination facilities of the Material and Fuels Complex (MFC) are available as user facilities. In addition, research reactors at Massachusetts Institute of Technology (MIT) and North Carolina State University and examination facilities at the Universities of Wisconsin, Michigan and Nevada-Las Vegas are partnered with the NSUF bringing additional user facilities to the research community. Beginning in FY 2012, funding for NSUF will move from the Idaho Facilities Management (IFM) Budget to the NEET budget.

A balanced science-based R&D approach includes both performance enhancement of evolutionary concepts and investigation of novel concepts. These elements will further promote the generation of new ideas and foster exploration of new and original technology options. The research on transformative nuclear concepts will pursue non-traditional nuclear energy ideas that offer the potential for improved system performance and may radically alter nuclear system configuration and development needs. This could include the development of specialized nuclear fuels, revolutionary materials, tailored coolants, new techniques for energy conversion, or other innovations. Some examples of radical changes could be utilization of non-solid fuel forms or replacement of the conventional steam cycle. Including these transformational technologies into integrated system concepts is vital for the stimulation of refined concepts and systematic comparison of long-term options.

Incorporating these technologies and capabilities as part of an integrated system offers the promise of revolutionary improvement in safety, performance, reliability, economics, and proliferation risk reduction. Advances in these enabling technologies could reduce capital and operating costs, increase plant efficiency and reliability and improve the overall economics of nuclear energy. Better understanding and quantification of proliferation risks will improve the technical and policy choices associated with the nuclear fuel cycle. Improved material performance has the potential to enable greater reactor temperatures, new reactor designs, and/or new reactor missions. New classes of alloys and materials, not yet considered for reactor performance, may enable transformational reactor performance. Improving the accuracy of nuclear data and the use of advanced modeling and simulation tools and capabilities will contribute to improved safety and improved design processes without unneeded conservatism.

NE programs allocate R&D funding to those entities (e.g., industry, laboratories, and universities) that are best qualified to carry out the work in support of NE's mission. Consistent with NE's commitment to supporting R&D activities at university and educational research institutions, NE programs competitively award funds that support both mission-specific and mission-related activities. NE designates up to 20 percent of funds appropriated to its R&D programs for work performed at university and research institutions, through open, competitive solicitations for investigator-led projects. The national laboratories are encouraged to partner with universities to conduct R&D. In addition, the Transformative Nuclear Concepts R&D activity makes funds available for investigator-initiated projects

through open and competitive solicitations designed to encourage broad participation across national laboratories, universities, research institutions, and industry.

Detailed Justification

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

Crosscutting Technology Development **0** **41,178**

Crosscutting Technology Development provide either crosscutting or enabling technologies to support multiple reactor concepts in the areas including reactor materials, advanced methods for manufacturing, new sensor technologies for monitoring material and equipment conditions in existing reactors, creative approaches to further reduce proliferation risks, and advanced modeling and simulation tools.

Reactor Materials – New classes of alloys and materials, not yet considered for reactor performance may enable transformational reactor performance. The custom design of innovative steels using modern materials science techniques, industrial knowledge, and previous experience may be able to improve performance over traditional materials by a factor of five to ten, increasing the maximum operating temperature by 200 degrees Celsius for a period of at least 80 years. Concepts to be evaluated include optimized alloy composition, engineered microstructures, age-tempered microstructures, or combinations thereof. Other, more radical concepts that may be explored to enable even greater performance include bi-metallic layers, metal/ceramic composites, ion-beam or surface-modified alloys. A wide range of operating conditions will be considered with the general goal of improved strength and radiation resistance.

Beginning in FY 2012, research will be initiated on materials in extreme environments to understand the complex interactions of radiation-induced defects with microstructure, and their effects on the functionalities of materials under extreme conditions that exist in current and future generation nuclear reactor environments. The research will focus on understanding and modeling microstructures, and enhancing the radiation resistance of materials that maintain all of the required physical properties after prolonged exposure. In situ experiments will be closely integrated with theoretical/computational efforts to develop a fundamental understanding of degradation mechanisms and kinetics in order to predict long-term behavior. This research will be coordinated among NE, SC, and NNSA.

In FY 2012, the Department will:

- Issue a solicitation and fund up to six proposals to develop innovative materials in current and/or future reactors.
- Develop collaborations with industry, universities, and/or domestic and international agencies using competitive processes and cost-sharing arrangements as appropriate.
- Coordinate and integrate materials development activities with modeling and simulation and reactor component and system development to optimize the performance with the service requirements.
- Utilize experimental and modeling and simulation capabilities and initiate research to identify dominant physical mechanisms limiting behavior in materials in use in current and future nuclear reactors.

Proliferation Risk Assessment – The program is developing new tools and approaches for understanding, limiting, and managing the risks of proliferation and physical security for fuel cycle options. NE, in

collaboration with NNSA, is focusing on assessments required to inform domestic fuel cycle technology and system option development and partnering with other organizations to share results of assessments. These analytical/predictive tools for comprehensive proliferation risk assessments provide important information for discussions and decisions regarding fuel cycle options. These activities will be closely coordinated and integrated with activities conducted within the Fuel Cycle R&D budget to ensure there is no duplication. These assessments:

- Exploit science-based approaches for analyzing difficult-to-quantify proliferation risk factors or indicators (e.g., capabilities, motivations and intentions); address issues identified in several NAS studies related to risk assessment; and leverage current state-of-the-art academic research in this field.
- Evaluate the diverse decision factors (including economics, public health and safety, public perceptions, environmental benefits and proliferation and terrorism risk reduction) for different fuel cycle options to understand the tradeoffs and potential synergies between these decision criteria.
- Apply these tools to study nuclear energy system options and display the results in a useful format for decision makers.

In FY 2012, the Department will:

- Initiate R&D projects on improved proliferation and security risk assessment methods. The first project will focus on adversary modeling; the second, the vulnerability project, will further develop tools and methods for determining postulated probabilities that adversary actions will succeed in defeating counter methods.
- Apply improved proliferation and security risk assessment methods to high-priority nuclear energy options under the framework of the Generation IV International Forum to build and sustain international consensus on proliferation assessment methods and applications.
- Perform an independent review of proliferation risk assessment methods, tools, and applications, to develop recommendations on priority research.

Advanced Methods for Manufacturing – This program will conduct advanced manufacturing R&D. Advanced manufacturing technologies have the potential to significantly reduce the cost and duration of nuclear facility construction and improve manufacturing and fabrication quality of equipment, components and modules; thus improving the overall economics of new nuclear power. This effort will draw upon successful practices in the oil, aircraft, and shipbuilding industries, as appropriate, and employ the modeling and simulation capabilities of the national laboratories to validate and optimize new technologies. The technologies and techniques researched will be independent of reactor type and broadly applicable to industry.

In FY 2012, the Department will:

- Initiate a competitive selection effort for R&D activities based on the results of the July 2010 NEET workshop and other relevant information. R&D activities will likely focus on hybrid gas metal arc and laser welding; Automated Non-Destructive Examination techniques such as digital radiography and phased array ultrasonic; steel concrete composite structures; and prefabricated

modular rebar assemblies, among others.

Advanced Sensors and Instrumentation – This task will conduct necessary R&D to address the unique sensor, instrumentation, and related technology needs to monitor and control new advanced reactors and fuel cycle facilities. The unique operating conditions and fluids, upset and accident conditions, and degradation and aging phenomena (e.g. multiple units, very high temperature, and liquid metal) that are inherent to new nuclear energy systems will require advancements in these areas to measure key process parameters, control the thermal hydraulic behavior of systems, and achieve the needed reliability required of these systems. Some of the development work is expected to prove valuable for measuring, sensing, and accounting for materials in waste management and fuel cycle arenas as well.

In FY 2012, the Department will:

- Conduct research to develop advanced sensors to improve physical measurement accuracy and reduce uncertainty. This includes novel measurement techniques for in situ and ex-vessel measurements, materials research and testing to develop robustness for harsh environmental conditions, improved sensor functionality, uncertainty quantification, and advanced standards development.
- Conduct research on adaptive digital monitoring and control technology to develop needed advances in control system performance and self-calibration capability. This includes development and testing of resilient control strategies for highly autonomous and passive control system architectures, multi-unit and multi-process control and coordination, and monitoring and prognostic technologies to maintain a high degree of availability and reliability.
- Conduct research on fiber optic and wireless digital instrument communication systems including development and testing of communications architectures to enable orders of magnitude increase in data transmission and throughput in advanced control systems, and accompanying research on data integrity and security.
- Conduct research on highly integrated control system architectures with special emphasis on advanced automation and information technologies to enable highly efficient oversight and control of nuclear systems and integration of plant operations in fleet-wide deployment scenarios.

Advanced Modeling and Simulation - The code and methods development work previously spread throughout the NE R&D portfolio are consolidated in this program, which is directed to modernizing the design tools available to nuclear engineers and scientists in government, academia, and in industry. To accomplish this, the Department engages the national laboratories, U.S. universities and the commercial industry to ensure meaningful advances in modeling and simulation, with user-friendly environments, are made available within the next few years, and that fully realized computational tools that are able to *predict* behavior are completed within ten years. The vision is to support the NE's R&D objectives by creating the next generation of advanced nuclear modeling and simulation tools that meet both the needs of the user and the complexity of the problem. To that end, we are developing Advanced Modeling and Simulation capabilities for advanced reactors, innovative nuclear fuel forms, future safeguarded separations systems, and long term waste repositories. This is coordinated with the ongoing work of the

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

Hub aimed at currently operating reactors and fuel forms. Wherever possible the activities of the two independent efforts are being shared to leverage the efforts of both. Examples include sharing elements of an integrated performance code for fuels, materials models, and verification, validation, and uncertainty quantification methodologies.

This program is developing four Integrated Performance and Safety Codes (IPSC) in the major NE R&D areas of fuels, reactors, separations, and waste. These codes will provide modern predictive simulation capability to engineers and researchers working in the area of nuclear energy. The Fuel IPSC will utilize a high-performance computational software environment designed for high fidelity and predictive fuel pin and fuel element modeling with quantified uncertainties. The Reactor IPSC will provide high-fidelity modeling of the reactor core, primary system, and balance of plant, capable of predicting the neutronic, depletion, and thermo-fluid behavior for a prioritized set of advanced Liquid Metal and High Temperature Reactors. The Reactor IPSC also will provide adaptation of legacy production codes to model various small modular reactor concepts of interest and, where possible and useful, advanced codes for higher-fidelity simulations. Concepts of interest include reactors cooled by water, liquid salt, gas, and liquid metal. Behaviors of interest include core neutronic and thermal-fluid behavior, fuel depletion, transient system behavior, and seismic response. The Separations IPSC will support the development and design of fuel treatment/separations processes, equipment and facilities. The Waste Forms IPSC will accelerate design, performance assessment, and certification of selected new waste forms and disposal options. Early emphasis is on simulation of borosilicate glass waste form and the mechanics of waste migration. In addition, there are common supporting elements to all four IPSCs. These are Verification, Validation and Uncertainty Quantification providing methods for assuring the accuracy of the code calculations, Fundamental Methods and Models providing critical models of chemical and physical behavior needed to create a predictive capability, Enabling Computational Technologies providing quality assurance and tool sets to code developers, and Capability Transfer providing an interface with stakeholders.

FY 2010 activities associated with advanced modeling and simulation are discussed within the Generation IV, and Fuel Cycle R&D program budget requests.

In FY 2012, the Department will:

- Release version 2 of the Fuels IPSC. Version 2 will be capable of full 3D treatment of pellet-clad mechanical interaction and incorporate improved treatment of thermal, mechanical, and fission-gas-behavior models.
- Continue improving fundamental fuel and clad materials properties models to make the model more predictive and capable of modeling additional fuel types.
- Continue model validation and software quality assurance.
- Release version 1 of the SHARP high-fidelity reactor safety analysis code for advanced reactor primary loop simulations.
- Complete SHARP reactor core thermo-structural analysis module.
- Develop and demonstrate 3D, high-resolution, coupled thermal-hydraulic-neutronics simulation of a single LWR fuel assembly using SHARP.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

- Complete and implement mechanistically derived constitutive model for borosilicate glass degradation developed by up-scaling sub-continuum modeling results.
- Develop mechanism-based capabilities that predict aging behavior and performance of nuclear reactor components in support of advanced fuels, advanced reactors, and waste form IPSCs.
- Develop microscale-to-mesoscale upscaling models to predict chemistry microstructural evolution phenomena in support of fuels, waste forms, and safeguards and separations IPSCs.
- Implement the Predictive Maturity Index capability into a tool set allowing the code teams to develop model or experimental strategies to reduce key uncertainties.
- Focus on advanced needs for computational mesh generation and visualization tools, particularly on large-scale parallel computers, including complex geometry and multi-physics applications.
- Provide tools that will help ensure compliance with best practices for software quality assurance (SQA) according to quality rigor levels outlined in the SQA plan.

Transformative Nuclear Concepts Research **0** **14,580**

This program supports, via an open, competitive solicitation process, investigator-initiated transformative projects that are high-risk, high-reward concepts with the potential for making significant leaps forward in advanced nuclear technology development. The primary goal of this program is to encourage the identification and development of "outside-the-box" options in all aspects of the civilian nuclear energy program; ensuring that good ideas have sufficient outlet for exploration. The scope covers the full range of nuclear energy technology and is not specific to any on-going mission activities. However, information and results obtained through this program will be used to inform planning decisions in ongoing NE R&D programs. This program is a key mechanism in NE's R&D portfolio to further encourage transformative thinking and promote creative solutions to the universe of nuclear energy challenges and questions. This program is not focused on bringing nuclear concepts to the prototype stage.

In FY 2012, the Department will:

- Issue an open and competitive solicitation designed to encourage broad participation across national laboratories, universities, research institutions, and industry.
- Monitor progress, utilize results to inform and adjust its program and activity planning and strategy development, and ultimately consider the outcomes of funded activities within the context of its mission-specific activities.
- Peer-review applications by a body of internal and external experts to help select promising concepts, and to ensure that activities are not duplicative of any existing R&D activities.
- Award two to three year projects, depending upon project scope.

Energy Innovation Hub for Modeling and Simulation **0** **24,300**

The Hub is creating a virtual reactor model of actual Tennessee Valley Authority-owned, Westinghouse-designed, operating pressurized water reactors (PWRs) that will be able to simulate reactor behavior. Engineers will be able to use this virtual model to improve the economics and safety of reactor operations by simulating proposed solutions to reactor power production increases and reactor life and license extensions. The combination of data gained from the virtual model and the physical reactor will

be used to resolve technology issues confronting nuclear energy development. The Hub will also serve to educate today's reactor engineers in the use of advanced modeling and simulation through direct engagement in Hub activities. The Oak Ridge National Laboratory is leading a consortium (CASL – Consortium for Advanced Simulation of Light Water Reactors) of national labs, universities, and industry partners to manage Hub execution. CASL began operations in late June 2010. In FY 2010, the Hub was funded under the Generation IV budget line.

In FY 2012, the Department will:

- Apply virtual reactor simulation code (VERA) to the following problems: prediction of departure from nucleate boiling, calculation of radionuclide source terms, prediction of deposits on fuel, and calculation of Grid-to-Rod Fretting (fuel rod vibration).
- Compare the virtual reactor analysis with the Physical Reactor – the physical reactor model development will be completed and an initial qualification of results of VERA analysis with operational data from the physical reactor.
- Release the second generation of the CASL VERA to CASL partners and the broader nuclear energy community. Capabilities delivered in VERA include higher-fidelity versions of the initial physics capabilities (transport, thermal hydraulics, mechanics, fuel performance, coolant chemistry), but with improved predictability afforded by the addition of new science-based models for fuel and structural material performance and response (fuel/clad microstructure, corrosion chemistry, foreign material deposition and growth, and brittle failure).
- Deliver capability for coupling sensitivity results from each VERA component for full system response sensitivities and broadened UQ support within VERA to address epistemic and modeling bias uncertainties.
- Add advanced fluid modeling capabilities to VERA including computational fluid dynamics and incompressible, single-phase flow with sub-cooled boiling flow capability.

National Science User Facility **0** **14,580**

NSUF promotes the use of unique nuclear research facilities for science-based experiments to encourage active university, industry, and laboratory collaboration in relevant nuclear scientific research. The NSUF provides a mechanism for research organizations to collaborate, conduct experiments, and conduct post-experiment analysis at facilities not normally accessible. In this manner, researchers are introduced to new techniques, equipment, and personnel such that their research benefits from new technologies and experimental capabilities. The INL ATR and post-irradiation examination facilities of the MFC are available as user facilities. In addition, research reactors at the MIT and North Carolina State University and examination facilities at the Universities of Wisconsin, Michigan and Nevada-Las Vegas are partnered with the NSUF bringing additional user facilities to the research community.

In FY 2012, the Department will:

- Support up to five university partnerships;
- Award up to six university experiments using ATR, the ATR Hydraulic Shuttle Irradiation System (~~r~~abbit"), and other laboratory research facilities and multiple smaller-scale experiments using previously irradiated samples at partnership locations;

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

- Conduct an industry experiment in the reactivated PWR loop in ATR
- Explore NSUF partnership with other laboratory nuclear facilities (e.g. High Flux Isotope Reactor or Advanced Photon Source)
- Conduct NSUF user's week to educate new users of NSUF research facilities

SBIR/STTR	**0**	**2,726**

The FY 2012 amount shown is an estimated requirement for the continuation of the SBIR and STTR program.

Total, Nuclear Energy Enabling Technologies	**0**	**97,364**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Crosscutting Technology Development The increase supports the development of crosscutting technologies capable of supporting various reactor and fuel cycle technologies, including consolidation of advanced modeling and simulation activities and support for the Department-wide crosscut activity focused on materials in extreme environments.	+41,178
Transformative Nuclear Concepts Research and Development The increase supports the pursuit of novel and transformative, investigator-initiated concepts across the full spectrum of nuclear areas to help enable significant leaps forward in advanced nuclear technology development.	+14,580
Energy Innovation Hub for Modeling and Simulation The increase reflects the transfer of the Hub from the Gen IV budget to the NEET budget and supports on-going activities following from creation of the Hub in FY 2010.	+24,300
National Scientific User Facility The increase reflects the transfer of the NSUF from the Idaho Facilities Management budget to the NEET budget and supports national scientific user facility program in advancing nuclear science and engineering within the U.S. university and laboratory communities. In the IFM budget, NSUF activities were funded within the NSUF and INL Nuclear Reactor Research Facility Operations and Maintenance activities.	+14,580
SBIR/STTR The increase reflects an increase in R&D expenditures subject to SBIR and STTR.	+2,726
Total Funding Change, Nuclear Energy Enabling Technologies	**+97,364**

Radiological Facilities Management

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Radiological Facilities Management		
Space and Defense Infrastructure	41,760[a]	49,902
Research Reactor Infrastructure	10,000	4,986
Oak Ridge Nuclear Infrastructure	10,000	0
Los Alamos Nuclear Infrastructure	10,000	0
Pu-238 Production Restart Project	0	10,000
Total, Radiological Facilities Management	71,760	64,888

Public Law Authorizations:
P.L. 111-85, Appropriation Act (2010)
P.L. 11-226, FAA Air Transportation Modernization and Safety Improvement Act (2010)

Mission

The Radiological Facilities Management (RFM) program maintains Office of Nuclear Energy (NE) managed nuclear facilities at the Idaho National Laboratory and provides support to nuclear and associated support facilities at Oak Ridge National Laboratory (ORNL) and Los Alamos National Laboratory (LANL). Facilities related to the manufacture of radioisotope power systems for national security and space exploration missions are supported through the Space and Defense Infrastructure subprogram. The Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA) will initiate a project to restart the production of plutonium-238 (Pu-238) for future NASA missions and potential national security applications. NE's Research Reactor Infrastructure subprogram will continue to provide fresh reactor fuel services to operating university reactors that support nuclear energy research and development (R&D).

Benefits

The RFM program ensures that the Department's supporting radioisotope power systems production capabilities are maintained and operated in a safe, environmentally-compliant, and cost-effective manner. Key activities include the management and disposition of all special nuclear materials under NE ownership contained in these facilities and initiating the Pu-238 Production Restart Project. This Pu-238 Production Restart Project will be co-funded by DOE and NASA and will re-establish a domestic capability to produce Pu-238 to enable future space exploration missions and potential national security applications that require radioisotope power systems. Existing supplies of Pu-238 are limited; domestic production will help ensure that Pu-238 is available beyond the next decade to meet NASA and national security users' long-term demand.

[a] Includes a reduction of $240K for rescission.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY 2012 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Maintain the unique infrastructure and capability to deliver radioisotope power systems for space exploration and national security missions.
- Aggressively implement contracting reforms, including fixed price competitive bidding, earned value management, capital planning processes in accordance with DOE Order 413.3B, independent external evaluations, etc., to ensure that the infrastructure program is operating effectively and efficiently to meet the Department's highest priority program needs.

The Department will implement the following strategies:

- Partner with the private sector, national laboratories, universities, and international partners to develop and deploy advanced nuclear technologies to increase the use of nuclear energy in the United States.
- Re-establish domestic Pu-238 production capability to address anticipated future supply shortages.

These strategies will contribute to the efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Program infrastructure activities are interrelated with customer-defined (i.e., NASA and national security agencies) requirements for the development of radioisotope power systems. Changes in long-term projected demands for radioisotope power systems would impact NE's provision of infrastructure and development support, including activities associated with restarting domestic Pu-238 production.

In carrying out the program's mission, the program performs the following collaborative activities:

- Coordinates with national security agencies and NASA in developing radioisotope power systems for their use to ensure proposed systems and technologies satisfy the necessary technical requirements identified by customers for identified mission scenarios.

Space and Defense Infrastructure

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Space and Defense Infrastructure		
Idaho National Laboratory	9,840	9,840
Los Alamos National Laboratory	22,030	27,000
Oak Ridge National Laboratory	5,160	5,160
Other Activities	4,730	7,902
Total, Space and Defense Infrastructure	41,760[a]	49,902

Benefits

In 1961, the first Radioisotope Power Systems (RPS) was launched in support of the U.S. Navy satellite navigation system. Over the next five decades, the Department of Energy (DOE) and it predecessor agencies have remained the global leader in mission critical power supplies for unique, demanding missions. The Space and Defense Infrastructure program produces plutonium-238 (Pu-238) based RPS for National Aeronautics and Space Administration (NASA) missions and certain national security applications. The Department maintains capabilities at the Idaho, Oak Ridge, and Los Alamos National Laboratories needed to produce these systems.

The Pu-238 based RPS are needed for certain NASA and national security applications where other power sources, such as batteries, fuel cells, and solar technologies, are not economical or technologically viable. They enable NASA deep space missions that lead to major space science discoveries and open greater possibilities and opportunities.

In addition to the funding requested by the Department of Energy, NASA provides project-specific reimbursable funding for radioisotope power systems, reactor design and demonstration, material purchases, and launch approval safety activities. The level of reimbursable funding varies from year to year based on build schedules required to support a specific NASA mission.

[a] Includes a reduction of $240K for rescission.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Idaho National Laboratory	**9,840**	**9,840**
▪ Radioisotope Power Systems Assembly Operations	9,340	9,340
Funding supports the facility manager, alternate facility management, operations and maintenance staff, materials control, quality control, quality inspection, documentation, radiation health physicist support, radiation engineering, nuclear safety support, facility Documented Safety Analysis, mechanical and electrical engineering support, crane operations and maintenance, tooling and engineer development technical and equipment support, and overall program management including: training, transportation coordination, project management, shipping container hardware fabrication and repair, and drawing support. Idaho National Laboratory will store and maintain the flight quality status of the RPS for the NASA Mars Science Laboratory mission.		
▪ Capital Equipment for Radioisotope Power System Assembly Operations	500	500
These funds support capital equipment used in RPS assembly activities.		
Los Alamos National Laboratory	**22,030**	**27,000**
▪ Pu-238 Encapsulation and Scrap Recovery Facilities	20,030	25,000
Funding supports maintenance and operation of dedicated Pu-238 processing, encapsulation, and scrap recovery facilities. The facilities include equipment and support capabilities to manufacture the fuel forms and weld them into fuel clads; chemically remove impurities from the fuel; support the required materials control, quality control, quality inspection and documentation, and overall program management which includes: training, transportation coordination, project management, and facility safety.		
▪ Capital Equipment for the Pu-238 Facilities	2,000	2,000
These funds support capital equipment related to the maintenance and operation of dedicated Pu-238 processing, encapsulation and scrap recovery facilities.		
Oak Ridge National Laboratory	**5,160**	**5,160**
▪ Iridium Fabrication Facilities for Radioisotope Power Systems	4,410	4,660
Funding maintains infrastructure and capabilities to fabricate iridium cladding and carbon insulators used to encapsulate and contain the fuel pellets necessary for the safe operation of RPS equipment and capabilities for the production of iridium clad vent sets used to encapsulate the fuel; equipment and capability for the production of thermal insulation sleeves used in the re-entry protection system; and materials control, quality control, quality inspection, and documentation. Overall program management includes training, iridium inventory management, project management, and facility safety.		

	(dollars in thousands) FY 2010 Current Approp	FY 2012 Request
▪ Capital Equipment for Iridium Fabrication Facilities These funds support capital equipment associated with the capabilities to fabricate iridium cladding and carbon insulators.	750	500
Other Activities	**4,730**	**7,902**
▪ Safety/Program Analysis and Testing Infrastructure Funding supports maintaining and strengthening of the required analytical and testing capabilities that enables the Department to analyze RPS performance and safety for various applications. These capabilities are required to meet the presidential launch approval process required under the Presidential Directive/National Security Counsel-25 (PD/NSC-25).	4,430	7,602
▪ Certification of Type "B" Shipping Containers Funding supports DOE certification of fuel and power system shipping containers.	300	300
Total, Space and Defense Infrastructure	**41,760**	**49,902**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Los Alamos National Laboratory	
▪ **Pu-238 Encapsulation and Scrap Recovery Facilities** The increase fully funds the $12,000,000 full-cost recovery charge (space charge) from the National Nuclear Security Administration that was only partially funded in FY 2010.	+4,970
Total, Los Alamos National Laboratory	**+4,970**
Oak Ridge National Laboratory	
▪ **Iridium Fabrication Facilities for Radioisotope Power Systems** The increase is due to increased labor costs of personnel required to maintain capability at the iridium fabrication facilities**.**	+250
▪ **Capital Equipment for Iridium Fabrication Facilities** The decrease is due to decreased capital needs in FY 2012**.**	-250
Total, Oak Ridge National Laboratory	**0**

	FY 2012 vs. FY 2010 Current Approp ($000)
Other Activities	
▪ **Safety/Program Analysis and Testing Infrastructure** The increase is due to DOE's need for an increased understanding of the safety of its evolving hardware under the changing and challenging conditions of new launch environments. Further, nuclear launch reviews are conducted at senior levels of the agencies and the Administration in accordance with the Presidential nuclear launch approval process (Predidential Directive/National Security Council-25 or PD/NSC-25). Without this funding, DOE's ability to prepare adequate nuclear safety analyses and respond appropriately to those reviews would be hampered. The funding allows DOE to execute its responsibility under the Atomic Energy Act and sustain its safety analysis independence from other agencies.	+3,172
Total, Other Activities	**+3,172**
Total, Space and Defense Infrastructure	**+8,142**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses

	FY 2010 Current Approp	FY 2012 Request
Capital Equipment	3,250	3,000
Total, Capital Operating Expenses	3,250	3,000

Research Reactor Infrastructure

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Research Reactor Infrastructure		
Idaho National Laboratory	10,000	4,986
Total, Research Reactor Infrastructure	10,000	4,986

Benefits

This program provides fresh reactor fuel to and removes used fuel from 26 operating university reactors. It supports the continued operation of university research reactors by providing test reactor capability to universities, coupled with research, development, and educational opportunities in support of U.S. nuclear energy initiatives.

The continued operation of university research reactors plays an important role in developing future scientists and engineers in the United States. This program sustains unique capabilities for research and development and educational opportunities supporting U.S. energy initiatives. Used fuel shipments support U.S. and Department of Energy non-proliferation and national security objectives.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Idaho National Laboratory	**10,000**	**4,986**
FY 2012 funds will provide universities with fresh fuel to support continued operation of their research reactors and the shipments of used fuel as needed. Funding also supports maintenance and repair of fuel fabricating equipment as required.		
Total, Research Reactor Infrastructure	**10,000**	**4,986**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Idaho National Laboratory	
The decrease is due to the completion of: 1) fabrication of spare fuel inventory to respond to unplanned U.S. university fuel needs; and 2) reactor equipment and instrumentation upgrades at U.S. universities.	-5,014
Total, Idaho National Laboratory	**-5,014**

Oak Ridge Nuclear Infrastructure

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Oak Ridge Nuclear Infrastructure		
Oak Ridge National Laboratory	10,000	0
Total, Oak Ridge Nuclear Infrastructure	10,000	0

Benefits

In FY 2010, this Congressionally directed funding was used for hot cell upgrades and maintenance at the Radiochemical Engineering Development Center (REDC) at the Oak Ridge National Laboratory, which is the Department's production, storage, and distribution center for heavy-element research activities.

Constructed in the mid-1960's, REDC contains hot cells in Building 7920 and 7930 and auxiliary facilities that support laboratory scale testing in the areas of aqueous separation research and development and irradiated target processing activities for the High Flux Isotope Reactor.

Detail Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Oak Ridge National Laboratory	**10,000**	**0**

This FY 2010 unrequested funding in the amount of $10,000,000 was used in the following areas:

- Additional corrective and other targeted maintenance on nuclear safety and facility support components and equipment within REDC building systems such as ventilation, electrical, instrumentation, air, steam, cooling water, hot cell windows, manipulators, building structure and hoists/cranes; and
- Roof refurbishment and off-gas upgrades to the high-efficiency particulate air systems.

No additional funding has been requested in FY 2012.

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Oak Ridge National Laboratory	
The decrease reflects the elimination of this Congressionally directed funding. No funding is requested in FY 2012 for these activities.	**-10,000**
Total Funding Change, Oak Ridge National Laboratory	**-10,000**

Los Alamos Nuclear Infrastructure

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Los Alamos Nuclear Infrastructure		
Los Alamos National Laboratory	10,000	0
Total, Los Alamos Nuclear Infrastructure	10,000	0

Benefits

In FY 2010, this Congressionally directed funding was used to support equipment and facility upgrades, maintenance, and management practices at Los Alamos National Laboratory (LANL).

The LANL radiological facilities provide unique national actinide capabilities in the areas of analytical chemistry, materials characterization, chemical diagnostics, radiochemistry, and applied spectroscopy.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Los Alamos National Laboratory	**10,000**	**0**

This unrequested FY 2010 funding in the amount of $10,000,000 was applied to the following areas:

- Building structures, systems and components that are credited to the facilities' operations and safety bases;
- Maintenance and end-of-life replacement of equipment and infrastructure;
- Facility management practices that meet current Departmental requirements, including preparing safety documentation and supporting technical safety analyses, managing nuclear material inventories, enhancing worker protection programs, and training staff; and
- Additional corrective and routine preventive maintenance on nuclear safety and facility support components and equipment within building systems.

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Los Alamos National Laboratory	
The decrease reflects the elimination of this Congressionally directed funding. No funding is requested in FY 2012.	-10,000
Total Funding Change, Los Alamos National Laboratory	**-10,000**

Pu-238 Production Restart Project

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Pu-238 Production Restart Project		
Pu-238 Production Project	0	10,000
Total, Pu-238 Production Restart Project	0	10,000

Benefits

The Plutonium-238 (Pu-238) Production Restart Project will re-establish a domestic capability to produce Pu-238 for use in radioisotope power systems (RPS) and radioisotope heater units required by certain National Aeronautics and Space Administration (NASA) space missions and national security applications. The Department of Energy (DOE) will conduct the project in accordance with the principles of DOE Order 413.3A, the Department's approved project management system for acquisition of capital assets. The project will establish the capability to fabricate neptunium-237 targets, to irradiate the targets in existing DOE nuclear reactors, and to recover Pu-238 from the irradiated targets. The Department has an ongoing program to produce RPSs that rely on Pu-238 as an energy source. The capabilities necessary for developing these systems are funded within the Office of Nuclear Energy's Space and Defense Infrastructure program.

Pu-238-based RPSs are needed for certain NASA and potential national security applications where other power sources, such as batteries, fuel cells, and solar technologies are not viable. In the past NASA has used Pu-238-based RPSs to power missions to the outer planets Jupiter and Saturn, which are too distant from the Sun to depend on solar arrays to power their instruments. Likewise, Pu-238-fueled RPSs are critical to Mars missions, such as the Viking landers of the 1970s and the Mars Science Laboratory to be launched in 2011; solar panels cannot operate reliably on the planet given its frequent dust storms and temperature extremes. NASA also has depended on Pu-238 to fuel heater units to keep critical systems warm on spacecraft sent to Mars and destinations throughout the solar system. Continued access to Pu-238 will enable the agency to explore a wide range of planets, moons, and asteroids.

Existing supplies of Pu-238 are limited. While NASA has been able to support planned missions with Pu-238 procured from Russia, that source is limited. National security applications are prohibited by agreement from using Russian-supplied Pu-238, and the remaining supply of domestically produced Pu-238, produced more than a decade ago, is dwindling. Additional Pu-238 will be needed within the next decade to meet NASA projected demand as well as support longer term NASA needs and potential national security applications. NASA has established Pu-238 requirements to meet the power and heating needs of planned missions to explore the outer planets and a range of other solar system destinations for the next two decades. While NASA will continue to refine the needs of specific

missions, particularly those anticipated in the more distant outyears, its requirement for Pu-238 is expected to remain constant. National security users' longer-term requirements are less certain.

To meet the full scope of projected user needs, DOE plans to establish a production capacity of up to two kilograms per year. This production rate will satisfy NASA's current projected mission requirements and allow some flexibility in addressing any new priorities for space exploration missions and potential national security applications. DOE can provide the capability to support this production rate by modifying existing facilities. Funds in FY 2012 will be used for target development and reactor optimization activities and initiate engineering design and long-lead equipment procurement.

Cost-Share with NASA

As the primary user of Pu-238, NASA will share with DOE, in equal amounts, the cost of re-establishing a production capability. The full amount required for this project in FY 2012 in order to produce Pu-238 on a timely basis for user needs is $20 million. The DOE request for $10 million complements a parallel NASA request, which NASA will provide to DOE, to accomplish the full scope of activities. This shared funding arrangement is described in the *Startup Plan for Plutonium-238 Production for Radioisotope Power System;* June 2010 that outlines how the project will be executed. This funding allocation reflects that Pu-238 production re-start is needed to support future requirements at user agencies and properly acknowledges the Department's mission to maintain a national capability for a range of Federal users and its responsibility to manage efforts related to the safe and secure production of special nuclear material.

Detailed Justification

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request
Pu-238 Production Restart Project	
▪ **Pu-238/Conceptual Design and NEPA Support** **0**	**3,000**
Complete conceptual design of target fabrication and irradiated target processing facilities, including project management and technical support. Complete documentation and obtain approvals for Critical Decision-1 (CD-1), Approve Alternative Selection and Cost Range[a]. This request assumes an additional $3,000,000 from NASA will be provided in FY 2012 to accomplish the full scope of this activity.	

[a] Critical Decision-1 is the stage in the DOE's project management framework that reaffirms the mission need for a proposed project, establishes the alternative selection, and forms the basis to proceed with the preliminary design. It also establishes the preliminary cost estimate and schedule ranges for the project.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request
▪ **Pu-238/Target Development and Reactor Optimization**	**0**	**2,500**

Evaluate Advanced Test Reactor (ATR) and High Flux Isotope Reactor (HFIR) internal core configurations for optimal neutronics to produce Pu-238. Finalize target design and fabrication using existing laboratory facilities and equipment. Obtain approvals for developmental and production target irradiations in ATR and HFIR. Initiate post-irradiation examination of prototype targets to evaluate fission gas release, Pu-238 production yield and Pu-236 content. This request assumes an additional $2,500,000 from NASA will be provided in FY 2012 to accomplish the full scope of this activity.

▪ **Pu-238/ Target Fabrication Line Final Design and Installation**	**0**	**1,750**

Complete final design for target fabrication and initiate equipment installation. Installation of the target fabrication line will be managed as a Major Item of Equipment activity. This request assumes an additional $1,750,000 from NASA will be provided in FY 2012 to accomplish the full scope of this activity.

▪ **Pu-238/Irradiated Target Processing Line Preliminary Design**	**0**	**2,750**

Initiate preliminary design for the irradiated target processing line to support Critical Decision-2 (CD-2), Approve Performance Baseline. Conduct flowsheet validation studies. This request assumes an additional $2,750,000 from NASA will be provided in FY 2012 to accomplish the full scope of this activity.

Subtotal, Pu-238 Production Restart Project	**0**	**10,000**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Pu-238/Conceptual Design and NEPA Support	
▪ The increase is for work on conceptual design of target fabrication and irradiated target processing facilities (additional $3,000,000 will be provided by NASA).	**+3,000**
Pu-238/Target Development and Reactor Optimization	
▪ The increase is for evaluation of ATR and HFIR internal core configurations (additional $2,500,000 will be provided by NASA).	**+2,500**

	FY 2012 vs. FY 2010 Current Approp ($000)
Pu-238/Target Fabrication Line Final Design and Installation	
▪ The increase is for work on final design for target fabrication and other activities (additional $1,750,000 will be provided by NASA).	**+1,750**
Pu-238/Irradiated Target Processing Line Preliminary Design	
▪ The increase is for preliminary design for the irradiated target processing line (additional $2,750,000 will be provided by NASA).	**+2,750**
Total Funding Change, Pu-238 Production Restart Project	**+10,000**

Idaho Facilities Management

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Idaho Facilities Management	172,716[a] 15	0,000

Public Law Authorizations:
P.L. 111-85, Appropriations Act (2010)
P.L. 111-226, FAA Air Transportation Modernization and Safety Improvement Act (2010)

Mission

The mission of the Idaho Facilities Management (IFM) program is to manage the planning, acquisition, operation, maintenance, and disposition of nuclear facilities and resources at the Idaho National Laboratory (INL). The IFM program maintains Department of Energy (DOE) mission-supporting facilities and resources at INL in a safe, compliant status to support the Department's nuclear energy research, testing of naval reactor fuels and reactor core components, and range of national security technology programs that support the National Nuclear Security Administration (NNSA) and other Federal agencies such as the Department of Homeland Security in the areas of critical infrastructure protection and nuclear nonproliferation.

Benefits

The IFM program enables long-term nuclear research and development (R&D) activities by providing the people, facilities, equipment, and nuclear materials necessary to conduct a wide array of experimental activities in a safe and compliant manner. The Advanced Test Reactor (ATR) provides unique irradiation capability to further nuclear fuel and reactor component research in support of advanced nuclear reactor design activities. The Materials and Fuels Complex (MFC) contains a comprehensive range of fuel and experiment fabrication, and pre- and post-irradiation examinations to assess material and fuel characteristics and performance in varying reactor environments.

In FY 2012, the National Scientific User Facility (NSUF) program is transferred to the Nuclear Energy Enabling Technologies (NEET) program, providing universities access to INL facilities and equipment to further nuclear science and engineering research goals.

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

[a] Includes a reduction of $284,000 for rescission.

Means and Strategies

The program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Aggressively implement contracting reforms, including fixed price competitive bidding, earned value management, capital planning processes in accordance with DOE Order 413.3B, independent external evaluations, etc., to ensure that the infrastructure program is operating effectively and efficiently to meet the Department's highest priority program needs.
- Ensure that mission essential systems, resources, and services are identified, maintained, and operated in compliance with DOE, Federal, and state safety and environmental requirements in a secure and cost-effective manner.

The Department will implement the following strategies:

- Identify IFM mission critical facilities and activities through various means, including review of the INL Ten-Year Site Plan and other relevant materials. Develop detailed work planning and funding requests accordingly.
- Continued maintenance improvement program to clarify priority facilities, implement a facility sustainment program and reduce deferred maintenance.

These strategies will contribute to the efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- As the IFM program seeks to improve the responsiveness and support provided to a wide range of R&D and national security programs, changes in nuclear energy R&D progress and priorities could impact priorities within the IFM program, but not necessarily impact its overall cost and long-term liabilities.

In carrying out the program's mission, the program performs the following collaborative activities:

- INL carries out a variety of experiment design, fabrication, irradiation, and post-irradiation work in support of the NNSA, Naval Reactors, universities, partnerships with international governments and industry organizations.

Idaho Facilities Management

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Idaho Facilities Management		
INL Nuclear Research Reactor Operations and Maintenance	58,537	63,809
INL Non-Reactor Nuclear Research Facility Operations and Maintenance	53,541 5	4,506
INL Engineering and Support Facility Operations and Maintenance	20,741 1	2,824
National Scientific User Facility	4,000 0	
INL Regulatory Compliance	7,388 1	4,821
INL Facility Infrastructure Revitalization Program	28,509 0	
Advanced Post-Irradiation Examination Capabilities	0 4,	040
Total, Idaho Facilities Management	**172,716[a] 15**	**0,000**

Benefits

The IFM program enables long-term nuclear R&D and national security activities by providing the people, facilities, equipment, and nuclear materials necessary to conduct a wide array of activities. The ATR provides unique irradiation capability to further nuclear fuel and reactor component research in support of advanced nuclear reactor designs activities. The MFC contains a comprehensive range of pre- and post-irradiation examinations to assess material and fuel characteristics and performance in varying reactor environments. The Research and Education Campus houses laboratories, machining and glass shops, and administration buildings that support R&D for multiple programs.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
INL Nuclear Research Reactor Operations and Maintenance	**58,537**	**63,809**

This category supports nuclear research reactor operations and maintenance at the ATR for the INL, including the associated support infrastructure, the ATR Critical Facility (ATRC), and the Neutron Radiography Reactor (NRAD). It also maintains the Transient Reactor Test (TREAT) facility in an inactive standby mode. NRAD and TREAT are located at MFC.

[a] Includes a reduction of $284,000 for rescission.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

The primary reactor at INL is the ATR. ATR supports the majority of NE R&D programs as well as NNSA programs, including Naval Reactors Program work in support of the U.S. Navy nuclear fleet and Global Threat Reduction Initiatives to support conversion of research and test reactors to low-enriched uranium fuel. The ATR also supports universities and industry users. Programmatic work is funded by the sponsoring programs. The cost to other users depends upon the demands on the reactor and the nature of the user in accordance with DOE regulations.

In FY 2010, key accomplishments include: conducted the analysis and down selection process for upgrading safety related ATR nuclear instrumentation, began modifications for ATR Loop 2A, completed six spent ATR fuel shipments to the Idaho Nuclear Technology and Engineering Center, completed more than 35 irradiation campaigns for universities and the NNSA's Offices of Naval Reactors and Defense Nuclear Nonproliferation, and produced Cobalt-60 for commercial use in industrial radiography sources.

In FY 2012, the following reactor activities will be supported:

- ATR operations includes funding for five reactor crews; operations management; new fuel, core components and supplies; critical facility operations; test sponsor engineering and safety; reactor systems engineering; project management; safety basis maintenance; training; quality assurance; safety and environmental programs and oversight; and personnel, materials and services required to maintain all of the 57 buildings and structures, utilities, and grounds within the perimeter of the ATR Complex. The request also supports over 45 irradiation campaigns as scheduled while maintaining an operating efficiency greater than 80%, and continued operation of ATR Loop 2A with enhanced instrumentation and fuel ramp capability to support advanced fuel and material testing experiments.
- Maintenance and repair of ATR and the surrounding complex includes the cost of personnel, materials and services required to maintain the buildings, equipment, structures, utilities, and grounds. ATR has extensive system surveillance and maintenance requirements that are dictated by component manufacturers, technical specifications and requirements and local procedures. The request also supports scheduled maintenance activities consistent with these established requirements.
- ATR life extension and safety margin improvement activities restore outdated systems and documentation essential to maintaining performance and reliability to extend operations at a small fraction of the reactor's replacement cost. Although over 40 years old, the ATR has the potential for an extremely long operating life due to its unique design that allows extensive replacement of neutron-damaged components on an approximately seven year cycle. The request also supports activities such as ATR safety related Plant Protective System and Surveillance and Testing System replacements required due to the age of the existing systems.
- NRAD, ATRC, and TREAT reactors operations and maintenance activities including preventative and corrective maintenance on reactor systems, maintaining safety basis documentation, and training and qualification activities for reactor operators. The request also supports planned operational and maintenance levels for NRAD and ATRC, consistent

with scheduled experiments.

- Activities to assess transient test capability needs and options. The domestic capability to conduct transient fuel testing, which was conducted at TREAT, was suspended in the 1990's due to a low demand for data. Given potential future demands for the performance evaluation of nuclear fuel under high speed (millisecond to second) dynamic operating conditions, the Department has determined it is prudent to gather information and explore future options at this time. Activities may include alternative analysis and ranking, safety documentation, and environmental studies. There is no commitment or plan to pursue any transient test capability projects beyond the analysis outlined here.

INL Non-Reactor Nuclear Research Facility Operations and Maintenance **53,541** **54,506**

This category funds operations, maintenance, and support for non-reactor nuclear and radiological research facilities. The non-reactor nuclear research facilities support programmatic activities such as nuclear fuel development, separations development, pre- and post-irradiation fuel examinations, and radiological chemical analysis. This category also funds the management of NE-owned special nuclear materials (SNM), including the characterization, packaging, and disposition of surplus SNM.

In FY 2010, key accomplishments include: completed documented safety analyses (DSA) upgrades for key MFC nuclear facilities such as the Zero Power Physics Reactor building to comply with Departmental requirements, completed the required DSA identified facility upgrades to the Fuel Conditioning Facility and Hot Fuel Examination Facility (HFEF), and completed off-site shipments of surplus SNM.

In FY 2012, the following activities will be supported:

- Provide trained operators and technicians; provide qualified criticality safety officers and material balance custodians; prioritize and support maintenance and modification activities; analyze and authorize adjustments to operating parameters and facility operations; coordinate programmatic work activities; conduct and participate in audits, assessments, and reviews; develop and coordinate action plans; develop and provide nuclear training, quality assurance, document management; systems and safety engineering; environment, safety and health; nuclear materials management and stewardship; and program integration to support effective execution of projects and programs within the nuclear facilities at the MFC.
- Nuclear maintenance and repair includes the cost of personnel, materials, and services required to maintain the buildings, equipment, structures, utilities, and grounds within the perimeter fence at the MFC site and other radiological facilities. This includes facility safety system and procedural upgrades as identified through revised DSAs in which the physical part of the upgrades began in FY 2011. Examples of these upgrades may include, but not be limited to, control system upgrades, heating, ventilating, and air conditioning modifications, seismic structural improvements, and operations and maintenance procedure improvements.

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

- SNM management activities for NE-owned programmatic and surplus SNM at INL, including characterization, stabilization, and disposal of surplus SNM. The request supports the maintenance and operation of glove boxes and supporting systems to condition and prepare NE-owned surplus plutonium and uranium for off-site disposition.

INL Engineering and Support Facility Operations and Maintenance **20,741** **12,824**

This category funds all activities that support the effective operation and management of the buildings, structures and systems that support the non-nuclear facilities at the INL consistent with Departmental orders and regulations. This category also funds general infrastructure and sustainability planning requirements as outlined in applicable DOE and Federal requirements.

In FY 2010 key accomplishments include: completed scheduled facility inspections to assess structural, roof, and systems conditions and prepared three surplus, non-radiological facilities for disposition.

In FY 2012, the following activities will be supported:

- Real property life-cycle asset management.
- Recapitalization activities structured to keep existing facilities modern and relevant in an environment of changing standards and missions, consistent with DOE Order 430.1B requirements.
- Life-cycle planning to identify essential capital alterations and additions; improvements to land, buildings, and utility systems necessary to maintain INL general purpose infrastructure; common/domestic services infrastructure; and multi-program infrastructure.
- Alternative analyses for accomplishing NE-sponsored activities. Develop comprehensive planning activities to support Executive Order 13514 *Federal Leadership in Environmental, Energy, and Economic Performance.*
- Continue implementation of a systematic real property asset building inspection program and operation and maintenance of the Department's Facility Information Management System and Condition Assessment Information System.

Additionally, support is provided for Federally-funded program activities and community regulatory support activities to meet obligations defined in crosscutting agreements and contracts such as: Shoshone-Bannock Tribes, Nevada National Security Site waste disposal fees, Defense Contract Audit Agency, site environmental monitoring, Payment in Lieu of Taxes, and the National Oceanic and Atmospheric Administration.

National Scientific User Facility **4,000** **0**

The NSUF provides a mechanism for partner organization to propose and conduct experiments that introduce new techniques, equipment, and personnel in order to keep INL capabilities current with new technologies. This work assures continuous improvements in experimental capabilities at the ATR.

In FY 2010 key accomplishments include: awarded six university experiments using the ATR and other

(dollars in thousands)

FY 2010 Current Approp	FY 2012 Request

INL research facilities; conducted the annual NSUF User Week workshops to bring together over 100 researchers representing academia, industry and national laboratories to foster collaboration on nuclear energy issues; and supported six university partnerships to increase available capabilities for NSUF experiments.

In FY 2012, NSUF will be transferred to the NEET program. Due to the transfer, no further funding will be requested under the IFM program.

INL Regulatory Compliance **7,388** **14,821**

This category supports compliance activities driven by state and Federal environmental and other regulations that are under the purview of NE owner responsibilities. This category also supports other project costs for the proposed Remote-Handled Low Level Waste (RHLLW) Disposal Project to meet long-term waste disposal needs for NE and Office of Naval Reactors, consistent with regulatory requirements.

In FY 2010, key accomplishments include: treated two cubic meters of sodium contaminated low-level waste backlog at MFC and completed Resource Conservation and Recovery Act Voluntary Consent Order commitments at ATR.

In FY 2012, the request supports: increased processing rates for the disposition of EBR-II sodium-bonded fuel, consistent with the 1995 Settlement Agreement with the State of Idaho; treatment of approximately two cubic meters of sodium-contaminated low-level waste backlog; and development of documentation to support Critical Decision 2 (Approve Performance Baseline) for the RHLLW Disposal Project.

INL Facility Infrastructure Revitalization Program (IFIRP) **28,509** **0**

This category restored, rebuilt, and revitalized the physical INL infrastructure by replacing aging facilities and larger equipment to address costly, beyond useful life maintenance.

In FY 2010, key accomplishments include: completed operational-funded projects and GPPs, including the ATR Radioanalytical Chemistry Laboratory and HFEF Argon Chiller System, and purchased priority equipment, including analytical laboratory remote manipulator, a 25-ton lift truck, and a heat exchanger replacement at ATR.

In FY 2012, no further funding will be requested for IFIRP, having successfully achieved its goal of resolving all urgently needed revitalization projects. As a result, the IFM program will move toward a sustainment model for addressing facilities and infrastructure system capital needs.

	(dollars in thousands)	
	FY 2010 Current Approp	FY 2012 Request
Advanced Post-Irradiation Examination Capabilities	**0**	**4,040**

In 2012, the Irradiated Material Characterization Laboratory (IMCL) will come on line which will provide modern, relatively small (nano- and atomic-scale), flexible post-irradiation examination (PIE) support capabilities utilizing shielded alcoves rather than hot cells. IMCL will provide the ability to meet modern electrical, data transmission, cleanliness, vibration isolation and radiological control requirements to support state-of-the-art inspection tools and equipment. In FY 2012, funds are requested to support studies to assess possible advanced PIE capability options. The Department has not made a determination that such advanced capabilities are necessary and appropriate and these studies do not indicate a commitment to establish any advanced PIE examination capability or any related facilities beyond the IMCL.

PIE capabilities require a location where extremely high hazard materials can be routinely examined in a safe and secure environment. Advanced PIE capabilities may be useful for advanced fuels and materials characterization as well as development of new processes, tools and instruments to further research. The results of these studies would be used to inform the Department's decision-making process; however, these activities do not commit to the creation of this capability.

Total, Idaho Facilities Management	**172,716**	**150,000**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Idaho Facilities Management	
▪ **INL Nuclear Reactor Research Facility Operations and Maintenance** The increase reflects long-lead preparations for Core Internals Changeout scheduled for 2014 and ATR Life Extension Program activities (one-time funding for the replacement of the Plant Protective System and Surveillance and Testing System), and transient test capability review and options analysis.	+5,272
▪ **INL Non-Reactor Nuclear Research Facility Operations and Maintenance** The increase reflects the net results of a reduction due to the completion the purchase and installation of glove boxes to prepare surplus special nuclear material for off-site shipment and increases due to the start of operations of the Irradiated Material Characterization Laboratory, planned SNM disposition activities.	+965

- **INL Engineering and Support Facility Operations and Maintenance**
  The decrease reflects the completion of one-time planning, preparation, and demolition activities to disposition surplus non-radiological facilities and a reduction for personnel security investigation activities that are now funded under the Idaho Site-wide Safeguards and Security program. -7,917

- **National Scientific User Facility**
  The decrease reflects the transfer of NSUF programmatic scope to the NEET program. -4,000

- **INL Regulatory Compliance**
  The increase reflects moving the processing of EBR-II spent nuclear fuel for off-site shipment from the Fuel Cycle R&D program to the IFM program and other project costs for the RHLLW Disposal Project. +7,433

- **Idaho Facility Infrastructure Revitalization Program**
  The decrease reflects the successful completion of IFIRP activities. -28,509

- **Advanced Post-Irradiation Examination Capabilities**
  The increase is due to funds requested to support studies to assess possible advanced PIE capability options. +4,040

Total Funding Change, Idaho Facilities Management **-22,716**

Capital Operating Expenses Summary

Capital Operating Expenses

	FY 2010 Current Approp	FY 2011 CR	FY 2012 Request
Idaho National Laboratory			
General Plant Projects (GPP)	15,884	17,225	0
Capital Equipment	3,377	3,026	6,460
Total, Capital Operating Expenses	19,261	20,251	6,460

Major Items of Equipment *(TEC $2 million or greater)*

	Total Project Cost (TPC)	Total Estimated Cost (TEC)	Prior-Year Appro-priations	FY 2010 Current Approp	FY 2011 CR	FY 2012 Request	Completion Date
Atom Probe	2,200	2,075	2,200	2,200	0,000	0,000	FY 2010
Total, Major Items of Equipment				2,200	0,000 0,	000	

Program Direction

Funding Profile by Category

	FY 2010 Current Approp	FY 2012 Request
Idaho Operations Office		
Salaries and Benefits	24,890	26,404
Travel	996	1,036
Support Services	1,015	1,045
Other Related Expenses	5,036	5,621
Total, Idaho Operations Office	31,937	34,106
Full Time Equivalents	184[a]	197
Radiological and Environmental Sciences Laboratory		
Salaries and Benefits	2,440	2,589
Travel	65	67
Support Services	258	266
Other Related Expenses	2,400	2,684
Total, Radiological and Environmental Sciences Laboratory	5,163	5,606
Full Time Equivalents	17 [a]	19
Oak Ridge Operations Office		
Salaries and Benefits	1,000	1,081
Travel	20	20
Support Services	51	255
Other Related Expenses	282	294
Total, Oak Ridge Operations Office	1,353	1,650
Full Time Equivalents	7 [a]	8
Nevada Site Office		
Salaries and Benefits	0	3,098
Travel	0	100
Support Services	0	500
Other Related Expenses	0	537
Total, Nevada	0	4,235
Full Time Equivalents	0	18

[a] Reflects actual FTE usage in FY 2010.

	FY 2010 Current Approp	FY 2012 Request
Headquarters		
Salaries and Benefits	23,618	32,855
Travel	1,200	1,661
Support Services	4,052	4,928
Other Related Expenses	5,677	8,092
Total, Headquarters	34,547	47,536
Full Time Equivalents	142[a]	184[b]
Total Program Direction		
Salaries and Benefits	51,948	66,027
Travel	2,281	2,884
Support Services	5,376	6,994
Other Related Expenses	13,395	17,228
Total, Program Direction	73,000	93,133
Total, Full Time Equivalents	350[b]	426[b]

Mission

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Office of Nuclear Energy (NE). Also included is funding for NE and General Counsel Federal personnel responsible for administrative and judicial litigation involving the termination of the Yucca Mountain Nuclear Waste Repository, legal issues related to the standard contract, and the Department's responsibilities regarding spent fuel and high level waste.

In addition to appropriated funds, NE also manages approximately $91 million dollars annually in work for others and reimbursable funding from the National Aeronautics and Space Administration and the Department of Defense for the development of advanced radioisotope power systems for space exploration and national security missions.

[a] Reflects FTE actual usage in FY 2010.
[b] Does not include certain FTEs in other Department of Energy offices associated with legacy Yucca Mountain Project related activities

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Salaries and Benefits	**51,948**	**66,027**
Total, Salaries and Benefits	**51,948**	**66,027**

This account provides funding to support the salaries and benefits of the personnel associated with NE programs. Currently, 25 percent of the workforce is eligible to retire and an additional five percent will be eligible by the end of FY 2012. Over the past several years, NE has been trying to address the issue of an aging workforce through the recruitment of entry-level engineering, scientific, and administrative positions. In FY 2012, NE plans to hire additional staff to fulfill its current Full Time Employee (FTE) allocation of 426. In addition to the Headquarters (HQ) staff (184), NE funds field employees at the Idaho Operation Office (197), the Radiological and Environmental Sciences Laboratory in Idaho (19), the Oak Ridge Operations Office (8), the Nevada Site Office (18), and three employees who support the U.S. Mission to the Organization for Economic Cooperation and Development in Paris (1), U.S. Mission to International Organizations in Vienna (1), and the Department of Energy Tokyo Office (1). The request includes funds for FTEs to oversee ongoing responsibilities under the Nuclear Waste Policy Act, including administration of the Nuclear Waste Fund and the standard contract.

Travel	**2,281**	**2,884**

Travel includes funding for transportation of HQ and Operations Office personnel associated with NE programs, their per diem allowances while in authorized travel status, and other expenses incidental to travel. Also included are travel funds to support FTE's necessary to oversee ongoing responsibilities under the Nuclear Waste Policy Act.

Support Services	**5,376**	**6,994**

Support services include funding for technical and management support services provided to NE HQ and the Operations Offices. The use of support services allows the Department to hire the best available industry experts to assist federal staff in managing the nuclear programs and complex activities. In addition to rapidly acquiring this expertise, using support services provides unlimited flexibility in team composition as the needs of NE evolve.

Other Related Expenses	**13,395**	**17,228**

Other Related Expenses provides NE's contribution to the Department's Working Capital Fund (WCF) for common administrative services at HQ, such as rent and building operations, telecommunications, network connectivity, supplies/equipment, printing/graphics, copying, mail, contract closeout, purchase card surveillance, and salary and benefit expenses for federal employees who administer the WCF business lines per the Department's new policy being implemented in FY 2012. In addition, WCF services assessed to and used by HQ, Office of Scientific and Technical Information, and the Field include online training, the Corporate Human Resource Information System, payroll processing, and the Project Management Career Development Program

Subtotal, Program Direction	**73,000**	**93,133**
Total, Program Direction	**73,000**	**93,133**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Salaries and Benefits	
The increase for requested funds is sufficient for promotions, awards, and within-grade salary increases, and to support staff at the Nevada Site Office and HQ responsible for overseeing ongoing responsibilities under the Nuclear Waste Policy Act.	+14,079
Travel	
The increase reflects additional funds for projected travel requirements in FY 2012 including support for ongoing responsibilities under the Nuclear Waste Policy Act carried out by the Office of the General Counsel.	+603
Support Services	
The increase is primarily due to support services required at HQ to support NE and legacy Yucca Mountain activities carried out by the Office of General Counsel, additional support required at Oak Ridge for Uranium Fuel Supply activities, and a minor increase at Idaho.	+1,618
Other Related Expenses	
The increase is primarily related to a change in the Department's policy in FY 2012 to budget salary and benefit expenses related to federal employees who administer the WCF business lines through the Department's Program Offices to enable full-cost recovery.	+3,833
Total Funding Change, Program Direction	**+20,133**

Support Services by Category

	FY 2010 Current Approp	FY 2012 Request
Technical Support		
Feasibility of Design Considerations	950	1,325
Development of Specifications	425	475
Economic and Environmental Analyses	345	450
Surveys Or Reviews of Technical Operations	590	750
Total, Technical Support	2,310	3,000

	FY 2010 Current Approp	FY 2012 Request
Management Support		
Automated Data Processing	1,500	1,825
Manpower Systems Analyses	220	425
Preparation of Program Plans	160	294
Training and Education	135	200
Reports and Analyses Management and General Administrative Services	1,051	1,250
Total, Management Support	3,066	3,994
Total, Support Services	5,376	6,994

Other Related Expenses by Category

	FY 2010 Current Approp	FY 2012 Request
Other Related Expenses		
Working Capital Fund	3,439	4,664
Advisory and Assistance Services	100	300
Operations and Maintenance of Equipment	2,517	2,791
Printing and Reproduction	54	161
Training	377	401
Rent and Utilities	64	66
Communications, Utilities, Misc.	1,230	1,358
Supplies and Materials	1,043	1,097
Other Services	4,571	6,390
Total, Other Related Expenses	13,395	17,228

International Nuclear Energy Cooperation
Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
International Nuclear Energy Cooperation	0	3,000

Public Law Authorizations:
P.L. 111-85, Appropriation Act (2010)
P.L. 111-226, FAA Air Transportation Modernization and Safety Improvement Act (2010)

Mission

International Nuclear Energy Cooperation (INEC) serves as overall lead for all Office of Nuclear Energy (NE) international activities, including effectively coordinating international cooperative research and development (R&D) activities that further NE's mission; leading international nuclear energy collaboration efforts through bilateral and multilateral forums; providing technical, policy, and administrative support to carry out the civilian nuclear energy aspects of officially approved international agreements and other relevant U.S. international commitments; providing advice and support to other Department of Energy (DOE) offices and Federal agencies that are planning and/or implementing new agreements and other U.S. commitments having civilian nuclear energy aspects; leading international nuclear fuel service matters and other related activities; and advising other DOE offices and Federal agencies on general issues related to the international use of civilian nuclear energy.

Benefits

INEC will provide NE the ability to meet growing demands for engagement with potential international partners on civil nuclear policy, R&D, and related issues. INEC engages both bilaterally and multilaterally to support broader U.S. policy and commercial goals related to nuclear energy globally and will allow more effective integration of NE international R&D and policy interests. INEC will also leverage NE efforts with the National Security Council, Department of State, Department of Commerce and the Nuclear Regulatory Commission to facilitate U.S. nuclear energy R&D, policy, and commercial interests internationally.

The requested funding also supports INEC's international discussions, negotiations, and related analyses on a range of international nuclear energy strategies. Through INEC, NE will coordinate work with international partners on developing the new framework for civil nuclear cooperation that President Obama called for in his April 2009 speech in Prague: "And we should build a new framework for civil nuclear cooperation…so that countries can access peaceful power without increasing the risks of proliferation. That must be the right of every nation that renounces nuclear weapons, especially developing countries embarking on peaceful programs."

Annual Performance Results and Targets

The Department is in the process of updating its strategic plan, and has been actively engaging stakeholders including Congress. The draft strategic plan is being released for public comment concurrent with this budget submission, with the expectation of official publication this spring. The draft plan and FY12 budget are consistent and aligned. Updated measures will be released at a later date and available at the following link http://www.mbe.doe.gov/budget/12budget/index.htm.

Means and Strategies

The program will use various means and strategies to achieve its goals. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- NE will provide technical expertise in support of international bilateral and multilateral engagement and civil nuclear energy R&D with countries that are established as significant participants in the nuclear sector.

The Department will implement the following strategies:

- NE will partner with the private sector, national laboratories, universities and international partners to support cooperative international R&D activities to support the international use of civilian nuclear power.
- NE will work with DOE's Office of Policy and International Affairs as well as other U.S. Government organizations, including the National Nuclear Security Administration, National Security Council, and Department of State, to support the international use of civilian nuclear power.

These strategies will contribute to the efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- The international use of civilian nuclear power depends on a number of economic, environmental, and national security factors beyond the scope of DOE's programs. The safe expansion of nuclear energy is contingent upon resolving key challenges associated with limiting proliferation risks associated with international nuclear power deployment.

International Nuclear Energy Cooperation

Funding Schedule by Activity

	FY 2010 Current Appropriation	FY 2012 Request
International Nuclear Energy Cooperation	0	3,000

Benefits

The requested funding would support INEC,,s role as overall lead for all NE international activities, including analysis, development, and implementation of international civil nuclear energy policy. These activities include supporting international bilateral and multilateral engagement and civil nuclear energy R&D activities with countries that are established as significant participants in the civilian nuclear power sector. This program could also include the creation of workshops to engage industry and foreign governments.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
International Nuclear Energy Cooperation	**0**	**3,000**

In FY 2012, funding will support international technical coordination activities, including U.S. participation in international organizations engaging in technical collaboration and global nuclear energy policy, such as the International Atomic Energy Agency, the Generation IV International Forum and the International Framework for Nuclear Energy Cooperation. It supports technical collaborations through bilateral Action Plans, Working Groups, and the International Nuclear Energy Research Initiative. Furthermore, the funding will provide for coordination of NE R&D Roadmap implementation activities to understand proliferation risks. Activities carried out within this program will be closely coordinated with international R&D activities carried out within the R&D programs to avoid duplication. NE's international collaborations aim to resolve challenges arising from the global expansion of nuclear power and reinforce U.S. nonproliferation, security, and safety policies.

Total, International Nuclear Energy Cooperation	**0**	**3,000**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
International Nuclear Energy Cooperation	
The increase is provided to ensure collaboration across NE programs on international issues.	+3,000
Total Funding Change, International Nuclear Energy Cooperation	**+3,000**

Congressionally Directed Projects

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Congressionally Directed Projects	2,500	0

Public Law Authorizations:
P.L. 111-85, Appropriation Act (2010)

Description

FY 2010 Appropriation Acts included two congressionally directed projects within the Office of Nuclear Energy. No funding is requested for these activities in FY 2012.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Congressionally Directed Projects		
▪ Nuclear Fabrication Consortium, Ohio	**2,000**	**0**
Funding was congressionally directed in FY 2010 for the Nuclear Fabrication Consortium to develop fabrication approaches and data related to welding, joining and non-destructive examination that support the U.S. nuclear manufacturing, fabrication, and construction industries.		
No funding is requested for FY 2012.		
▪ McClellan Nuclear Radiation Center, California	**500**	**0**
Funding was congressionally directed in FY 2010 for McClellan Nuclear Radiation Center to purchase equipment upgrades needed to resume the processing of medical and research radioisotopes such as Iodine-125.		
No funding is requested for FY 2012.		
Total, Congressionally Directed Projects	**2,500**	**0**

Explanation of Funding Changes

	FY 2012 vs. FY 2010 Current Approp ($000)
Congressionally Directed Projects	
The decrease is due to no funding being requested for these activities in FY 2012.	-2,500
Total, Congressionally Directed Projects	**-2,500**

Defense Nuclear Waste Disposal/Nuclear Waste Disposal

Defense Nuclear Waste Disposal/Nuclear Waste Disposal

Table of Contents

The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management

Overview

Appropriation Summary by Program

	FY 2010 Current Appropriation	FY 2011 CR	FY 2012 Request
Defense Nuclear Waste Disposal			
Repository Program	98,400	0	0
Total, Defense Nuclear Waste Disposal	98,400	0	0

The Administration has determined that developing a repository at Yucca Mountain, Nevada, is not a workable option. As a result, in FY 2010, the Department moved to withdraw its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain and established a Blue Ribbon Commission to inform the Administration as it develops a new strategy for nuclear waste management and disposal. The Yucca Mountain project and the Office of Civilian Radioactive Waste Management (RW) were shut down by the end of FY 2010. The Administration remains committed to fulfilling its obligations under the Nuclear Waste Policy Act. Ongoing responsibilities under the Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of the General Counsel and the Office of Nuclear Energy, which will lead future waste management activities. The Office of Legacy Management has assumed managing records, information systems including the Licensing Support Network, and contractor pensions and post-retirement benefits.

No funding is being requested for the Yucca Mountain project or for RW.

Nuclear Waste Disposal and Defense Nuclear Waste Disposal Office of Civilian Radioactive Waste Management

Overview

Appropriation Summary by Program

	FY 2010 Current Appropriation	FY 2011 CR	FY 2012 Request
Nuclear Waste Disposal			
Repository Program	17,700	0	0
Program Management & Integration	10,700 0		0
Program Direction	70,000 0		0
Total, Nuclear Waste Disposal	98,400 0		0
Defense Nuclear Waste Disposal Repository Program	98,400 0		0
Total, Defense Nuclear Waste Disposal Repository Program	98,400 0		0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	196,800 0		0

Preface

The Nuclear Waste Disposal Account was established as part of the Nuclear Waste Policy Act of 1982 (P.L. 97-425), as amended, to provide funding to implement Federal policy for disposal of commercial spent nuclear fuel and high-level radioactive waste by the Office of Civilian Radioactive waste Management. The Administration has determined that developing a repository at Yucca Mountain, Nevada, is not a workable option. As a result, in 2010, the Department moved to withdraw its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain and established a Blue Ribbon Commission to inform the Administration as it develops a new strategy for nuclear waste management and disposal. The Yucca Mountain project and the Office of Civilian Radioactive Waste Management were shut down by the end of FY 2010. The Administration remains committed to fulfilling its obligations under the Nuclear Waste Policy Act. Ongoing responsibilities under the Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of the General Counsel and the Office of Nuclear Energy, which will lead future waste management activities. The Office of Legacy Management has assumed managing records, information systems including the Licensing Support Network, and contractor pensions and post-retirement benefits.

Yucca Mountain Repository Project

In FY 2010, they Yucca Mountain project and the Office of Civilian Radioactive Waste Management were shut down. DOE moved to withdraw from consideration by the Nuclear Regulatory Commission the license application for construction of a geologic repository at Yucca Mountain, Nevada, in accordance with applicable regulatory requirements.

In FY 2010, the Office of Civilian Radioactive Waste Management prepared the Yucca Mountain site for stewardship and remediation. The Department will work closely with state and federal agencies to develop and implement a remediation plan for the site that adheres to all applicable statutes and regulations. The Office of

Environmental Management staff will support remediation planning for the Yucca Mountain repository site.

Per the Office of Nuclear Energy's FY 2012 budget request, that organization will develop and execute a research and development program that will address critical scientific and technical issues associated with the long-term management and disposal of spent nuclear fuel. The Office of Nuclear Energy will support the work of the Blue Ribbon Commission and the development of an integrated approach to waste management options.

Program Direction and Management

The Office of Civilian Radioactive Waste Management was shut down in FY 2010. Critical functions under the Nuclear Waste Policy Act, including management of the Standard Contract with utilities and administration of the Nuclear Waste Fund are the responsibility of the Office of the General Counsel. The Department is committed to preserving core scientific knowledge and expertise resident in government and national laboratory personnel and applying it to developing a different approach to used fuel management, which is supported by the Office of Nuclear Energy. The Department has made every effort to utilize the expertise and experience of current Office of Civilian Radioactive Waste Management personnel, consistent with federal statutes, regulations, and union agreements.

Facilities Maintenance and Repair

The FY 2012 maintenance and repair budget request reflects the shut down of the program.

Direct-Funded Costs for Maintenance and Repair

	FY 2010 Current Approp	FY 2012 Request
Repository Project	900 0	
Total, Direct-Funded Maintenance and Repair	900	0

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management

Funding by Site by Program

	FY 2010 Current Approp	FY 2012 Request
NNSA Service Center		
Program Direction	500	0
Total, NNSA Service Center	500	0
Oak Ridge National Laboratory		
Program Direction	500	0
Total, Oak Ridge National Laboratory	500	0
Sandia National Laboratory		
Repository Project	40,000	0
Total, Sandia National Laboratory	40,000	0
Washington Headquarters		
Program Direction	50,000	0
Program Management and Integration	4,500	0
Repository Project	10,200	0
Total, Washington Headquarters	64,700	0
Repository Project Office		
Program Direction	19,000	0
Program Management and Integration	6,200	0
Repository Project	65,900	0
Total, Repository Project Office	91,100	0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	196,800	0

Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management

Funding by Site by Program

	FY 2010 Current Approp	FY 2012 Request
Sandia National Laboratory		
Repository Project	40,000	0
Total, Sandia National Laboratory	40,000	0
Repository Project Office		
Repository Project	58,400	0
Total, Repository Project Office	58,400	0
Total, Defense Nuclear Waste Disposal	98,400	0

Site Description

Oak Ridge National Laboratory
In FY 2010, in support of the Yucca Mountain Project and the Office of Civilian Radioactive Waste Management (OCRWM) Program Direction budget element, the Oak Ridge Office administered disbursement of funds and contracts/agreements with the OCRWM Management and Operations contractor, support services contracts and all other financial/contract agreements associated directly with the OCRWM Program. No funds are requested in FY 2012.

Sandia National Laboratory
In FY 2010, the Sandia National Laboratories-New Mexico (SNL) site located in Albuquerque, New Mexico, was the lead laboratory supporting the Yucca Mountain Project. No funds are requested in FY 2012.

Repository Project Office in Nevada
No funding is being requested in FY 2012 for the Yucca Mountain Repository Project in Las Vegas, Nevada. All leases were cancelled by the end of FY 2010 with the exception of the Hillshire Building, which was transferred to the Office of Legacy Management for ongoing records management. It is planned that this lease will be cancelled by the end of FY 2011.

Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management

Funding by Site by Program

	FY 2010 Current Approp	FY 2012 Request
NNSA Service Center		
Program Direction	500	0
Total, NNSA Service Center	500	0
Oak Ridge National Laboratory		
Program Direction	500	0
Total, Oak Ridge National Laboratory	500	0
Washington Headquarters		
Program Direction	50,000	0
Program Management and Integration	4,500	0
Repository Project	10,200	0
Total, Washington Headquarters	64,700	0
Repository Project Office		
Program Direction	19,000	0
Program Management and Integration	6,200	0
Repository Project	7,500	0
Total, Repository Project Office	32,700	0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	98,400	0

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management

Repository Program Funding

Funding Profile by Subprogram

	FY 2010 Current Appropriation	FY 2012 Request
Repository Program		
Repository Project	116,100	0
Program Management and Integration	10,700	0
Subtotal, Repository Program	126,800	0
Program Direction	70,000	0
Total, Repository Program	196,800	0

Mission

The mission of the Office of Civilian Radioactive Waste Management (OCRWM) was to manage and dispose of Spent Nuclear Fuel and High Level Radioactive Waste in a manner that protects public health and safety and the environment; enhances national security; and merits public confidence. The office was shut down in FY 2010.

The Yucca Mountain site occupies part of the Nevada Test Site as well as lands managed by the Bureau of Land Management (BLM) and the United States Air Force. DOE will engage BLM, the Air Force, and the State of Nevada, which has regulatory authority over certain aspects of the site, to determine the appropriate level of remediation necessary at the site. The Office of Environmental Management will support remediation planning.

Benefits

The Yucca Mountain Project and OCRWM were shut down in FY 2010.

Repository Project

Funding Schedule by Activity

	FY 2010 Current Approp	FY 2012 Request
Repository Project		
License	86,500 0	
Balance of Plant Infrastructure	2,000	0
Project Support	27,600	0
Total, Repository Project	116,100	0

Benefits

The Yucca Mountain project and OCRWM were terminated in FY 2010.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Licensing Support	**86,500**	**0**
In FY 2010, the Department of Energy moved to withdraw from consideration by the Nuclear Regulatory Commission the license application for construction of a geologic repository at Yucca Mountain, Nevada, in accordance with applicable regulatory requirements. The Department conducted lease cancellation, contract termination, preservation and archiving of project records and any necessary personnel separation activities. No funding is requested in FY 2012.		
Balance of Plant Infrastructure	**2,000**	**0**
Design work associated with development of the geologic repository at Yucca Mountain was cancelled in 2010. No funding is requested in FY 2012.		
Project Support	**27,600**	**0**
The Department met its obligation for financial assistance in FY 2010. No funding is requested in FY 2012 due to termination of the Yucca Mountain Project.		
Total, Repository Project	**116,100**	**0**

Program Management and Integration
Funding Schedule by Activity

(dollars in thousands)

	FY 2010 Current Appropriation	FY 2012 Request
Program Management and Integration		
Quality Assurance	6,970	0
Program Management		
Program Management and Control	30	0
Human Resources and Education	500	0
Total, Program Management	530	0
Safeguards and Security	3,000	0
System Analysis and Strategy Development		
Fee Adequacy Assessment	200	0
Total, Program Management and Integration	10,700	0

Benefits

All Program Management and Integration activities have ceased due to the shut down of the Office of Civilian Radioactive Waste Management. Ongoing responsibilities under the Nuclear Waste Policy Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of the General Counsel and the Office of Nuclear Energy, which will lead future waste management activities. The Office of Legacy Management has assumed managing records, information systems including the Licensing Support Network, and contractor pensions and post-retirement benefits.

All of the contracts for goods and services with the OCRWM are expired, have been downscoped to reflect long-term contractor pension responsibilities (and transferred to other Departmental elements for administration), or have been transferred within the Department for ongoing contractual requirements. These contracts included the management and operations contract for the repository, quality assurance support services, management and technical support services, information technology services, document and records management, security services, administrative services, and legal services. Many of these contracts required advance notice of intent not to exercise options or termination. Two contracts that were tereminated did not require reimbursable costs. Further, as set forth under the contracts, DOE is responsible for the reimbursement of the costs associated with the management and operationing contractor's defined benefit pension plan; the Department will fulfill its responsibilities, and we expect that current and future retirees will receive their benefits in accordance with the plan.

Detailed Justification

(dollars in thousands)

	FY 2010 Current Approp	FY 2012 Request
Quality Assurance	**6,970**	**0**
No funding is requested due to the shut-down of the Yucca Mountain Project and the OCRWM.		
Program Management	**530**	**0**
No funding is requested for Program Management due to the closure of the Yucca Mountain Project, and the OCRWM.		
▪ **Program Management and Control**	**30**	**0**
▪ **Human Resources and Education**	**500**	**0**
Safeguards and Security	**3,000**	**0**
No funding has been requested for Safeguards and Security because the Yucca Mountain Project and the OCRWM were shut down in FY 2010.		
Systems Analysis and Strategy Development	**200**	**0**
▪ **Fee Adequacy Assessment**	**200**	**0**
The functions for the Fee Adequacy Assessment efforts will be transferred from the OCRWM to the Office of Nuclear Energy. No funding is requested in FY 2012.		
Total, Program Management and Integration	**10,700**	**0**

Program Direction

Funding Profile by Category

	FY 2010 Current Approp	FY 2012 Request
Office of Repository Development		
Salaries and Benefits	26,883	0
Travel	685	0
Information Technology	8,700	0
Support Services	3,500	0
Other Related Expenses	1,810	0
Total, Office of Repository Development	41,578	0
Full Time Equivalents	175	0
Service Center Support		
Salaries and Benefits	1,000	0
Total, Service Center Support	1,000	0
Full Time Equivalents	3	0
Headquarters		
Management and Operational Support		
Salaries and Benefits	14,617	0
Travel	300	0
Information Technology	3,800	0
Support Services	2,600	0
Other Related Expenses	190	0
Working Capital Fund	2,500	0
	24,007	0
Other Matrix Support		
Salaries and Benefits	3,400	0
Travel	15	0
Total, Headquarters	27,422	0
Full-Time Equivalents	118	0
Total, Program Direction	70,000	0
Full-time Equivalents	296	0

Mission

The Administration has determined that developing the Yucca Mountain repository is not a workable option and that the Nation needs a different solution for nuclear waste disposal. The Office of Civilian Radioactive Waste Management was shut down in FY 2010. The core functions and staff to support efforts under the Nuclear Waste Policy Act to meet the obligations of the Government will continue to be supported under the Office of the General Counsel and the Office of Nuclear Energy (NE). NE will lead all future waste management activities. Every effort has been made to utilize the expertise and experience of Office of Civilian Radioactive Waste Management personnel in other Departmental organizations or government agencies consistent with Title 5 of the United States Code, Civil Service Regulations, and union agreements.

Detailed Justification

(dollars in thousands)

		FY 2010 Current Approp	FY 2012 Request
Salaries and Benefits			
No funds have been requested in FY 2012.	**45,900**		**0**
Travel			
No funds have been requested in FY 2012.	**1,000**		**0**
Information Technology			
No funds have been requested in FY 2012.	**12,500**		**0**
Support Services			
No funds have been requested in FY 2012.	**6,100**		**0**
Other Related Expenses			
No funds have been requested in FY 2012**.**	**2,000**		**0**
Working Capital Fund			
No funds have been requested in FY 2012.	**2,500**		**0**
Subtotal, Program Direction		**70,000**	**0**
Total, Program Direction		**70,000**	**0**

Support Services by Category

	FY 2010 Current Approp	FY 2012 Request
Technical Support		
Repository Project		
Management and Technical Services	4,400	0
Administrative Services	1,395	0
Total, Technical Support	5,795	0
Management Support		
Program Management and Integration		
Quality Assurance	300	0
Program Management and Control		
Program Management, Planning and Control	5	0
Total, Program Management and Control	5	0
Total, Program Management and Integration	305	0
Total, Support Services	6,100	0

Other Related Expenses by Category

	FY 2010 Current Approp	FY 2012 Request
Other Related Expenses		
Repository Project		
Communication, Other Rent, and Utilities	1,660	0
Other Services	90	0
Human Resources and Administration	60	0
Total, Repository Project	1,810	0
Headquarters		
Other Services	40	0

	FY 2010 Current Approp	FY 2012 Request
Human Resources and Administration	30	0
Supplies and Materials	20	0
Services Performed by Other Agencies	100	0
Working Capital Fund	2,500	0
Total, Headquarters	2,690	0
Total, Other Related Expenses	4,500	0

GENERAL PROVISIONS

SEC. 301. The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. 302. None of the funds in this or any other Act for the Administrator of the Bonneville Power Administration may be used to enter into any agreement to perform energy efficiency services outside the legally defined Bonneville service territory, with the exception of services provided internationally, including services provided on a reimbursable basis, unless the Administrator certifies in advance that such services are not available from private sector businesses.

SEC. 303. When the Department of Energy makes a user facility available to universities or other potential users, or seeks input from universities or other potential users regarding significant characteristics or equipment in a user facility or a proposed user facility, the Department shall ensure broad public notice of such availability or such need for input to universities and other potential users. When the Department of Energy considers the participation of a university or other potential user as a formal partner in the establishment or operation of a user facility, the Department shall employ full and open competition in selecting such a partner. For purposes of this section, the term "user facility" includes, but is not limited to: (1) a user facility as described in section 2203(a)(2) of the Energy Policy Act of 1992 (42 U.S.C. 13503(a)(2)); (2) a National Nuclear Security Administration Defense Programs Technology Deployment Center/User Facility; and (3) any other Departmental facility designated by the Department as a user facility.

SEC. 304. Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 414) during fiscal year 2012 until the enactment of the Intelligence Authorization Act for fiscal year 2012.

SEC. 305. Not to exceed 5 per centum, or $100,000,000, of any appropriation, whichever is less, made available for Department of Energy activities funded in this Act or subsequent Energy and Water Development and Related Agencies Appropriation Acts may hereafter be transferred between such appropriations, but no appropriation, except as otherwise provided, shall be increased or decreased by more that 5 per centum by any such transfers, and any such proposed transfers shall be submitted to the Committee on Appropriations of the House and Senate.

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. To the extent practicable funds made available in this Act should be used to purchase light bulbs that are "Energy Star" qualified or have the "Federal Energy Management Program" designation.

Note.—A full-year 2011 appropriation for this account was not enacted at the time the budget was prepared; therefore, this account is operating under a continuing resolution (P.L. 111–242, as amended). The amounts included for 2011 reflect the annualized level provided by the continuing resolution.