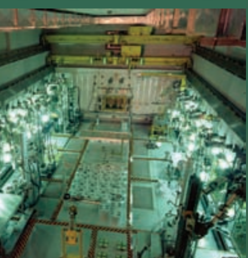
DOE/ID - 11449
Final

Idaho National Laboratory

2013-2022 TEN-YEAR SITE PLAN





DOE-NE's National Nuclear Capability—Developing and Maintaining the INL Infrastructure

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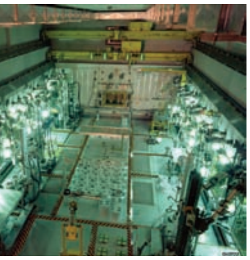



DOE-NE's National Nuclear Capability—Developing and Maintaining the INL Infrastructure

June 2011

Idaho National Laboratory

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MESSAGE FROM THE DEPUTY LABORATORY DIRECTOR

The Idaho National Laboratory (INL) Ten-Year Site Plan for Fiscal Year 2013 outlines a vision and strategy for delivering the world-leading capabilities that the Department of Energy Office of Nuclear Energy (DOE-NE) needs to accomplish its mission.

The result is an INL that is the core of the national nuclear research, development, and demonstration (RD&D) capability, with the flexibility and capacity to meet DOE-NE needs and serve as a "national user facility" accessible to researchers and experimentalists from universities, national laboratories, international research institutions, other federal agencies, and industry. The transition to the user-facility model began in 2007 when DOE designated the Advanced Test Reactor (ATR) as a scientific user facility, making it easier for other researchers and students to access INL's irradiation capabilities.

The INL's unique nuclear energy RD&D capabilities include a concentration of integrated reactor and fuel-cycle research facilities that have supported NE RD&D for decades. Nuclear energy RD&D methodology has since evolved, however, to an integrated science-based approach that builds on past scientific advances and links experimental capabilities with modeling and simulation. This approach makes it possible to explore a broader range of technology options in a much more cost-effective manner — a necessity for large-scale RD&D efforts such as those required to address the recommendations of the President's Blue Ribbon Commission on America's Nuclear Future. An infrastructure that can support research using fissile and highly radioactive materials and fuels is an important distinguishing feature of INL.

These distinctive resources center on the ATR — a highly flexible materials test reactor that has successfully served the fuel and materials irradiation testing needs of DOE-NE, Naval Reactors, National Nuclear Security Administration, and others for years — along with colocated experimental fuel fabrication and materials and fuels characterization, testing, and examination capabilities. INL also retains unique-in-the-world capabilities for transient testing, which are under consideration for future use to meet domestic and international nuclear testing needs that are currently unavailable anywhere in the world.

INL operates the only engineering-scale electrochemical separations research facility in the United States, using technology pioneered here. Second-generation aqueous processing laboratories operating at INL are flexible and reconfigurable at the laboratory and bench-scale. Facilities are also available to support DOE's desired progression to integrated, laboratory-scale aqueous separations capabilities, and, if needed in the future, an engineering-scale demonstration. A multipurpose laboratory, INL also operates engineering and testing capabilities for energy integration, environmental integrity, and national and homeland security.

Over the last 5 years, INL has made significant progress consolidating around three main complexes by acquiring new laboratory and office space, reducing aging infrastructure unrelated to modern missions, and upgrading core capabilities. The transition to an open campus environment is also conducive to a user-facility business model. This progress has been possible because of growth of DOE infrastructure funding and reinvestment of efficiency gains. While these areas will remain important, INL is beginning to focus on infrastructure planning for other areas related to the laboratory's multiprogram missions or that will be needed to support future DOE-NE mission accomplishment. The goal is to maintain, build upon, and maximize use of the existing infrastructure rather than to expend resources on new infrastructure or facility construction.

This document builds on last year's effort to institutionalize the TYSP as the infrastructure-planning basis for the laboratory, linking mission needs to infrastructure revitalization and capability enhancement requirements. INL has, or is completing, strategic plans for all the core capabilities of the laboratory, and the updated TYSP reflects these plans and progress in implementing them. While the vision remains unchanged, the details of implementation will continue to evolve as plans mature.

David Hill

Deputy Laboratory Director,
Science and Technology

CONTENTS

Figures

Tables

Appendices

ACRONYMS

AL	Analytical Laboratory
ATR	Advanced Test Reactor
ATR-C	Advanced Test Reactor Critical (facility)
CAES	Center for Advanced Energy Studies
CESB	Contaminated Equipment Storage Building
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
DOE-EM	Department of Energy Office of Environmental Management
DOE-ID	Department of Energy Idaho Operations Office
DOE-NE	Department of Energy Office of Nuclear Energy
EBR-II	Experimental Breeder Reactor II
EML	Electron Microscopy Laboratory
EPRI	Electric Power Research Institute
EROB	Engineering Research Office Building
ESL	Energy Systems Laboratory
FASB	Fuels and Applied Science Building
FCF	Fuel Conditioning Facility
FIB	focused ion beam
FMF	Fuel Manufacturing Facility
FY	fiscal year
GPS	global positioning
HEU	highly enriched uranium
HFEF	Hot Fuel Examination Facility
ICP	Idaho Cleanup Project
IFM	Idaho Facilities Management
IGPP	Institutional General Purpose Plant Project
IMCL	Irradiated Materials Characterization Laboratory
INL	Idaho National Laboratory
INSIGHTS	Independent Gamma, Hydraulics, and Temperature Separate-Effects
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INL Research Center
ISU	Idaho State University
LDRD	laboratory-directed research and development
LEU	low-enriched uranium
LICP	Line-Item Construction Project
LLW	low-level waste
LWR	light water reactor
M&O	management and operating
MaCS	Microscopy and Characterization Suite
MFC	Materials and Fuels Complex
MOA	Memorandum of Agreement
N&HS	National and Homeland Security
NASA	National Aeronautics and Space Administration
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NGNP	Next Generation Nuclear Plant
NNSA	National Nuclear Security Administration
NRAD	Neutron Radiography Reactor
NRC	Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NSUF	National Scientific User Facility
ORNL	Oak Ridge National Laboratory
PEP	Project Execution Plan
PIE	postirradiation examination
R&D	research and development
RAL	Remote Analytical Laboratory
RCL	Radiochemistry Laboratory
RD&D	research, development, and demonstration

RDD&D	research, development, demonstration, and deployment
REC	Research and Education Campus
REL	Research Education Laboratory
RERTR	Reduced Enrichment for Research and Test Reactor
RWMC	Radioactive Waste Management Complex
S&S	safeguards and security
SHaRE	Shared Equipment Program
SMC	Specific Manufacturing Capability
SNM	special nuclear material
SSP	Site Sustainability Plan
SSPSF	Space and Security Power Systems Facility
TAN	Test Area North
TREAT	Transient Reactor Experiment and Test Facility
TRIGA	Training, Research, Isotopes, General Atomics
TYSP	Ten-Year Site Plan
UNF	used nuclear fuel
WFO	work-for-others
WMD	weapons of mass destruction

1. INTRODUCTION

1.1 Overview

This Ten-Year Site Plan (TYSP) describes the strategy for accomplishing the long-term objective of transforming Idaho National Laboratory (INL) to meet Department of Energy (DOE) national nuclear research and development (R&D) goals, as outlined in DOE strategic plans. These plans are informed by the Nuclear Energy Research and Development Roadmap (DOE 2010a; DOE Office of Nuclear Energy [DOE-NE] Roadmap) and reports such as the Facilities for the Future of Nuclear Energy Research: A Twenty-Year Outlook (DOE-NE 2009). In addition, the TYSP is responsive to the 2008 recommendations of the National Academy of Sciences (NAS 2008), which recognized the need for DOE to invest in research capabilities and to develop a process for prioritizing, evaluating, and obtaining capabilities.

The goal of the INL TYSP is to clearly link R&D mission goals and INL core capabilities with infrastructure requirements (single- and multi-program), establish the 10-year end-state vision for INL facility complexes, and identify and prioritize infrastructure needs and capability gaps. The INL TYSP serves as the basis for documenting and justifying infrastructure investments proposed as part of the budget formulation process, including the development of budget documents such as the Integrated Facilities and Infrastructure Crosscut. The TYSP serves as the infrastructure-planning document for INL, and, though budget formulations documents have basis in the TYSP, it is not in itself a budget document.

Mission

INL is the preeminent nuclear energy laboratory with synergistic world-class multiprogram capabilities and partnerships.

Vision

Build an INL that serves the nation and is enduring – the National Nuclear Laboratory

- *Defining INL as the National Nuclear Capability with the following attributes:*
  - *Leading and integrating programs of national significance*
  - *Relevant connections to universities, labs, industry, and international research institutions*
  - *Research leading to deployable technologies*
  - *User facilities considered to be world-class*
  - *Overwhelming technical expertise*
- *Delivering world-leading capabilities that enable DOE-NE to accomplish its mission.*

1.1.1 National Nuclear Capabilities

As the DOE-NE national laboratory, INL serves a unique role in civilian nuclear energy research. With a 60-year history in reactor and fuel-cycle technology development, INL assists DOE-NE by leading, coordinating, and participating in R&D conducted by national laboratories, U.S. universities, and international research institutions, and by providing its nuclear energy research infrastructure as a shared resource for the entire nuclear energy enterprise.

INL maintains and operates the majority of DOE-NE's essential nuclear energy R&D capabilities, representing and retaining the core of the federal government's national nuclear energy R&D infrastructure. As one of a few national laboratories that will sustain the capability to handle Safeguards Category I materials and as the DOE-NE laboratory, it retains the unique ability to support research using fissile and highly radioactive fuels and materials. In addition, the recent interpretation by the State of Idaho concerning the 1995 Settlement Agreement between the State of Idaho, DOE, and the U.S. Navy (State of Idaho 1995) allows INL to receive research quantities of commercial used nuclear fuel (UNF). This enables INL to support the needs of industry and the DOE in development and qualification of new fuels, investigations regarding existing fuels, and development of novel fuels to support existing or advanced fuel cycle technologies.

To support this mission, INL operates core capabilities that are unique to nuclear energy R&D, including the following:

- Neutron irradiation
- Postirradiation examination (PIE) and characterization
- Experimental fuel development (fabrication process development)
- Separations and waste form development
- Other specialized testing capabilities (e.g., nuclear facilities, hot cells, and shielded enclosures dedicated to radioisotope power-source assembly, testing, and other specialized tests in highly radioactive environments).

Test reactors, hot cells, and shielded enclosures are at the top of this hierarchy of facilities in degree of complexity, offering the ability to handle highly radioactivity materials; they are followed by smaller scale radiological facilities, specialty engineering facilities, and nonradiological laboratories. Core capabilities are those that are unique to nuclear energy R&D, typically enable handling of highly radioactive materials, or are expensive to build/operate. Table 1-1 crosswalks capabilities to INL facilities and identifies whether the facility is operating, being modified/under construction, or is in cold standby. Section 3 provides additional discussion of these capabilities and plans to mature them.

The nuclear core capabilities are owned, retained, and/or operated by DOE-NE for its mission accomplishment. They complement specialized laboratories and glove-box lines in the DOE complex and at universities that are capable of handling relatively lower-hazard materials as well as supporting activities such as integral scale testing and severe accident, thermal hydraulics, and seismic analyses.

To support the DOE-NE mission, INL offers its facilities, not only to laboratories and to universities participating in DOE research but also as a user facility, to the broader nuclear energy research community. The specialized capabilities that qualify INL to conduct nuclear energy R&D are also available to help other federal agencies, industry, and regional partners meet their mission needs. These include core competencies in reactor technologies, fuel cycle development, and systems engineering as well as a remote location with the safeguards, security, and safety infrastructure to manage radiological and nuclear materials and testing under normal and abnormal conditions.

1.1.2 Nuclear Energy Roadmap

In the 2010 DOE-NE Roadmap (DOE 2010a), the DOE-NE established its principal mission as advancing nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs.

Table 1-1. Idaho National Laboratory nuclear energy research and development core capabilities - operational, in progress, or planned.

Core Capabilities/Functionality[a]	INL Facilities[b]	DOE-NE Objectives (1-4)				Other Users[c]			
		1	2	3	4	NNSA	Univ.	Other Fed.	Intl. Coop
Irradiation/Capabilities									
Thermal-spectrum irradiation	ATR/ATR-C	●	●	●		●	●	●	●
Out-of-pile testing	INSIGHTS (conceptual)	●	●	●			●	●	●
Fast-spectrum irradiation	None (limited international capabilities)		●	●				●	●
Transient irradiation	TREAT (cold standby)	●	●			●	●	●	●
Postirradiation Examination and Fresh Fuel Characterization Capabilities									
Receipt of irradiated fuels/materials	HFEF	●	●	●		●	●	●	●
Nondestructive examinations (physical dimensions, photography, gamma scanning, neutron radiography, eddy current evaluation, etc.)	HFEF	●	●	●		●	●	●	●
Destructive initial analysis (pin puncturing, gas pressure, fission gas sampling and analysis, void volume)	HFEF	●	●	●		●	●	●	●
Destructive examinations (cutting/ sectioning, sample mounting, grinding/polishing/etching, optical microscopy)	HFEF	●	●	●		●	●	●	●
Mechanical testing of highly radioactive materials (sample preparation/ machining/punching, high temperature mechanical properties; fatigue and crack growth; tensile, hardness, impact testing, etc.)	HFEF/FASB	●	●	●		●	●	●	●
Destructive analyses (chemical and isotopic analysis, material characterization, fuel density, fission gas retention, crack growth rate, electro-optical examination including SEM, TEM, FIB, EPMA, etc.)	HFEF/AL/EML/FASB/CAES/ IMCL (In progress)	●	●	●		●	●	●	●
Thermal testing and microanalysis and nanoanalysis	Planned	●	●	●		●	●	●	●
Experimental Fuel Fabrication Capabilities (Glovebox lines co-located with irradiation facilities)									
Fuel containing Pu and minor actinides that can be contact handled (ceramic, metal). Small rods and targets up to dose limits	FMF (modifications underway)	●	●	●		Material Storage[d]	●	●	●
Fuel that must be fabricated in a shielded facility, pin/rod scale	FCF/HFEF	●		●			●	●	●
HEU, LEU, thorium in small quantities (pin/plate), and characterization	FASB	●		●		●	●	●	●
LEU in larger quantities. Larger scale fabrication equipment such as extrusion presses and rolling mills	CESB (modifications planned)	●		●		●	●	●	●

Table 1-1. Idaho National Laboratory nuclear energy research and development core capabilities - operational, in progress, or planned.

Core Capabilities/Functionality[a]	INL Facilities[b]	DOE NE Objectives (1-4)				Other Users[c]			
		1	2	3	4	NNSA	Univ.	Other Fed.	Intl. Coop
Advanced Separations and Waste Forms (Hot cells and radiochemistry laboratories)									
Aqueous separations and pretreatment technologies	RAL[e], RCL, FASB, CFA, BCTC			●	●	●	●		●
Electrochemical separations and waste form (Eng. Scale)	FCF/HFEF			●	●	●	●		●
Specialized Laboratory Facilities									
Radioisotope power system assembly and test	SSPSF							●	

a. Section 1.3 provides more information about INL capabilities supporting DOE-NE's mission.
b. Facilities are operational and DOE-NE-owned unless otherwise identified.
c. Capabilities related to fuel fabrication, irradiation, fresh fuel characterization, and PIE are also available to support industry users.
d. RERTR Program uses FMF for storage of LEU fuel.
e. Request to Transfer RAL from DOE-EM to DOE-NE, Correspondence, Hill and Clark to DOE-ID Interim Manager Miotla, March 2, 2010.
AL = Analytical Laboratory
ATR = Advanced Test Reactor
ATR-C = Advanced Test Reactor Critical (facility)
BCTC = Bonneville County Technology Center
CAES = Center for Advanced Energy Studies
CESB = Contaminated Equipment Storage Building
CFA = Central Facilities Area
EML = Electron Microscopy Laboratory
EPMA = electron probe microanalyzer
FASB = Fuels and Applied Science Building
FCF = Fuel Conditioning Facility
FIB = focused ion beam
FMF = Fuel Manufacturing Facility
HEU = highly enriched uranium
HFEF = Hot Fuel Examination Facility
IMCL = Irradiated Materials Characterization Laboratory
LEU = low-enriched uranium
NNSA = National Nuclear Security Administration
RAL = Remote Analytical Laboratory
RCL = Radiochemistry Laboratory
RERTR = Reduced Enrichment Research and Test Reactors
SEM = scanning electron microscope
SSPSF = Space and Security Power Systems Facility
TEM = transmission electron microscope
TREAT = Transient Reactor Experiment and Test Facility

To accomplish this mission, DOE-NE identified four research objectives that it is pursuing:

1. Develop technologies and other solutions that can improve reliability, sustain the safety, and extend the life of current reactors
2. Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals
3. Develop sustainable nuclear fuel cycles
4. Understand and minimize the risks of nuclear proliferation and terrorism.

The DOE-NE Roadmap calls for increased coupling of theory with fundamental, phenomenological testing, and modeling and simulation to accomplish DOE research objectives. Having the capability to perform the experiments necessary to explore new technologies requires that DOE-NE have access to a broad range of capabilities, from small-scale laboratories up to, potentially, full prototype demonstrations. The DOE-NE Roadmap objectives are summarized in Section 1.3.

Table 1-1 depicts INL core capabilities that are operational, in progress, or planned, as well as the DOE-NE Roadmap objectives that would require these capabilities and current or potential other customers for these services. While national laboratories do not compete with industry, they retain unique capabilities that are generally complex and expensive to retain and operate. These capabilities are available for use by other federal agencies, international research organizations, and industry. Research conducted by other agencies and industry that require access to DOE national laboratory capabilities is generally of national importance and is conducted in cost-shared cooperation between DOE and an agency or DOE and industry (e.g., the radioisotope power system and the light water reactor [LWR] sustainability programs). INL also provides direct contracted technical support to industry. In this instance, the research results are often proprietary.

1.1.3 Multiprogram Capabilities

In addition to its role in nuclear energy research, INL is a multiprogram laboratory, delivering scientific and engineering solutions to meet national needs in energy integration, environmental integrity, and national and homeland security (N&HS).

INL serves the national needs of critical infrastructure protection and nuclear nonproliferation. Both areas are strategically aligned for accomplishment of INL's nuclear energy mission. Specifically, INL is addressing the following challenges:

- Assuring the protection of U.S. critical infrastructure (e.g., energy systems, nuclear reactors, chemical plants, transportation systems, etc.) through assessments of vulnerabilities from attacks, natural disasters, and aging infrastructure; and research, development, testing, evaluation and implementation of protective solutions that address prevention, intrusion detection, and system resiliency and event recovery.
- Advancing nonproliferation technologies (e.g., material detection, signatures, safeguards and security [S&S] approaches, and security system and facility design) that enhance the securing and safeguarding of national and international nuclear fuel cycle facilities and the protection, control, and accountability of radiological materials.
- Providing prevention, detection, mitigation, and response-readiness technologies to defeat chemical/biological/radiological/nuclear/explosives threats; enhance personnel and facility physical security; and protect against asymmetrical threats.
- Manufacturing armor packages for the U.S. Army's Abrams Main Battle Tank mission as well as supplying R&D and manufacturing capabilities for other national security needs.

INL also retains capabilities to support national needs in three additional areas: energy, environment, and fundamental technical capabilities for the broader laboratory. INL has expertise in five key capabilities: 1) process engineering and modeling; 2) geoscience; 3) chemical conversion and separations; 4) process characterization and monitoring; and 5) materials characterization and evaluation.

Nuclear nonproliferation and critical infrastructure protection missions take place throughout INL. Clean energy systems development and integration and synergistic environment research are concentrated at the Research and Education Campus (REC). With continuing investments to revitalize the existing infrastructure and fill mission-related capability gaps, INL can continue to provide a national nuclear energy capability and serve as a multiprogram laboratory for many years to come.

1.1.4 User-Facility Model

INL views its unique nuclear R&D capabilities and infrastructure as national assets to be available to universities, industry, national laboratories, international research organizations, and other federal agencies. DOE-NE seeks to involve the best experts from across the nuclear energy community in its research, including national and international partners from the government, as well as private and education sectors. INL seeks to offer its capabilities and related nuclear science and engineering infrastructure to these experts to advance DOE-NE research goals.

Through the National Scientific User Facility (NSUF), INL offers outstanding irradiation and PIE capabilities to help researchers explore and understand the complex behavior of fuels and materials. In 2007, DOE designated the Advanced Test Reactor (ATR) and associated PIE capabilities at the Materials and Fuels Complex (MFC) as user facilities, providing universities, national laboratories, industry, other federal agencies, and international research institutions with greater access to them. Beginning in Fiscal Year (FY) 2012, management and funding of the INL NSUF will transfer from the Idaho Facilities Management program to the DOE Nuclear Energy Enabling Technologies Program.

NSUF grants access to ATR, Advanced Test Reactor Critical (ATR-C) Facility, a sample library, and/or PIE capabilities to university-led scientific groups for major projects; access to any researcher for small-scale rapid turnaround projects; and competitive pricing for industry groups and other federal agencies. The program has expanded since the initial creation of the NSUF to offer irradiation and PIE instruments at partner universities. These include the Massachusetts Institute of Technology, North Carolina State University, University of Michigan, University of Wisconsin, University of Nevada at Las Vegas, University of California-Berkeley, and the Illinois Institute of Technology (which provides access to Argonne National Laboratory's Advanced Photon Source). More recently, the program has expanded to include partner irradiation and materials testing capabilities at Oak Ridge National Laboratory (ORNL). Since its creation, the NSUF has made links to other major user facilities, the Advanced Photon Source at Argonne National Laboratory, the Los Alamos Neutron Scattering Center, the Shared Equipment Program (SHaRE) at ORNL, and the National Institute of Standards Center for Neutron Research. The NSUF also includes educational initiatives aimed at preparing nuclear science and engineering students to conduct nuclear energy research and experimentation. As a program, it also encourages teaming among universities, industry, and national laboratories.

The research sponsored and funded by the NSUF links directly to DOE-NE mission accomplishments; there is also a link between the NSUF and the Nuclear Energy University Program, administered by the Center for Advanced Energy Studies (CAES). In addition, working through a Cooperative Research and Development Agreement with the Electric Power Research Institute (EPRI), the NSUF is enabling industry to use INL capabilities. The NSUF Program, located within the CAES building, is prototyping the laboratory of the future, serving as a gateway to INL and expanding opportunities for access to its broader capabilities.

To achieve this vision of a laboratory-wide user facility, INL proposes taking specific steps that will enhance the accessibility of INL capabilities to outside users. These changes include creating new laboratory space within the in-town Research Education Laboratory (REL), a leased facility planned for completion by 2013. This facility will enable visiting researchers to connect remotely to the MFC equipment, collaborate with research underway at MFC, and gain firsthand experience with advanced instruments using low-level radioactive research materials. Targeted enhancements will also build on existing capabilities to create world-leading nuclear energy R&D infrastructure. Additionally, the NSUF will study the possibility of continued expansion to include fuel cycle laboratories, computational capability, thermal hydraulic facilities, and material processing centers.

1.1.5 Program-Driven Ten-Year Site Planning Process

This INL TYSP links DOE-NE's R&D mission goals to INL core capabilities and infrastructure, evaluates their current condition, and identifies and prioritizes infrastructure needs and capability gaps, as well as the most efficient and economic approaches to closing those gaps. The TYSP proposes an infrastructure plan within projected funding levels, and builds on the existing infrastructure, where possible, before building new, stand-alone facilities and capabilities.

To meet this goal, the infrastructure strategy for INL for the next decade is focused on three key actions: 1) sustaining existing distinctive capabilities, 2) building on core and enabling capabilities to create world-leading capabilities and supplementing these capabilities through national and international partnerships, and 3) transitioning the laboratory to a user facility model and open campus environment.

1.1.6 Delivering the Ten-Year Vision

Over the next 10 years, INL proposes a timeline to build upon its core capabilities needed to meet its 10-year vision. The timeline illustrated in Figure 1-1 highlights the major infrastructure elements planned to achieve this vision and reflects the strategy described in this TYSP based on integrating capabilities, facilities, and infrastructure. This timeline is further depicted in Appendix B, Figure B-1.

1.2 Assumptions

INL has based its master planning effort on capabilities necessary to support the DOE-NE Roadmap to achieve the desired 10-year end-state. The following underlying assumptions also apply to this TYSP:

1. INL will continue to manage its infrastructure as a shared national resource and expand the user facility concept to encompass broader capabilities of the laboratory beyond fuels, materials, and irradiation test and examination services.
2. The number of uncleared, on-site visitors and collaborative partners will grow, increasing the need for unrestricted access to experimental capabilities and data visualization in an open campus environment as much as possible within the REC (e.g., CAES, a proposed new NSUF capability, the Energy Systems Laboratory [ESL], and the planned REL).
3. S&S requirements will continue to be more restrictive in some areas, with direct impact on management of special nuclear material (SNM). N&HS programs will require dedicated collateral secure space to support growing sensitive national security programs. These unclassified materials represent a significant national asset in support of critical national security programs.
4. The critical SNM asset inventory and associated S&S capabilities are unique assets that will attract other R&D organizations.
5. A better understanding of nuclear fuels and material performance in their nuclear environment, at the nanoscale and lower, is critical to the development of innovative fuels and materials required for tomorrow's nuclear energy technologies.

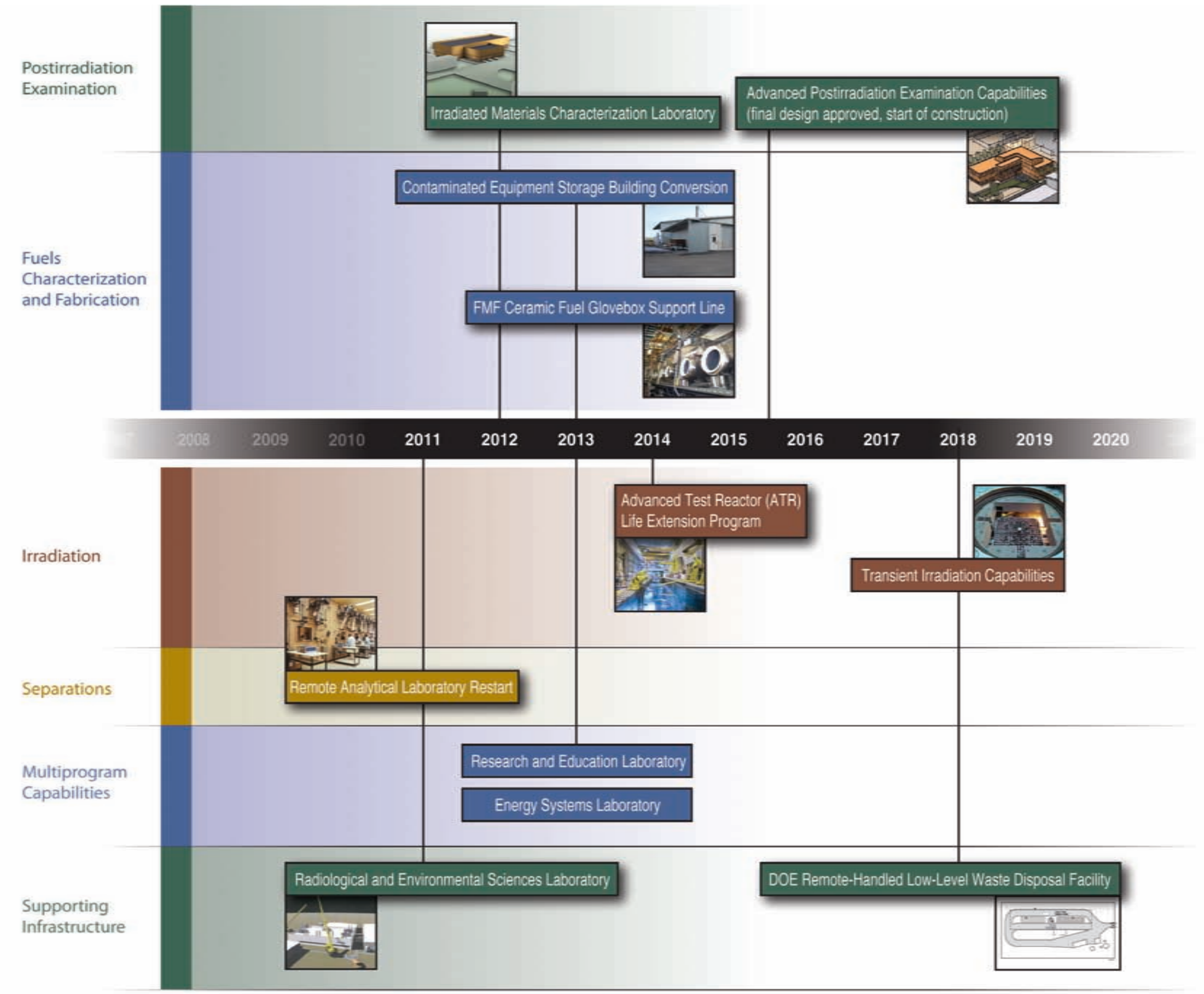

Figure 1-1. Proposed timeline for establishing the new end-state core capabilities.

6. INL is the repository for research samples of fuel and materials and is responsible for their movement to other laboratories and universities for collaborative R&D.
7. Expeditious completion of disposition of fast reactor fuel using electrochemical processing will enable INL to utilize the Fuel Conditioning Facility (FCF) and the Hot Fuel Examination Facility (HFEF) more fully for DOE-NE R&D.
8. INL plans to continue operating the Space and Security Power Systems Facility (SSPSF) for final assembly and testing of radioisotope power systems.
9. Multiprogram synergy and capabilities stewardship are keys to developing effective nuclear energy solutions. INL will develop R&D capabilities that serve multiple programs using direct or indirect funding. Program funding will develop and maintain program-specific capabilities.
10. The ongoing National Environmental Policy Act (NEPA) process will determine the future role of INL in Pu-238 production. INL will not advance-reserve facility capabilities for this purpose.
11. The Next Generation Nuclear Plant (NGNP) R&D program will continue at INL, and its infrastructure needs are considered in the TYSP. However, INL planning for the deployment of NGNP is pending a future DOE decision before proceeding with design, licensing, and construction.
12. INL will size and modernize workforce, facilities, and infrastructure, within budgetary constraints, to meet its nuclear energy, N&HS, and environment and energy mission and programmatic objectives. Focus will be on building capability and relationships that naturally bring the best talent to INL.

INL will align with the national strategies and alternative selections resulting from the following ongoing NEPA analyses:

- *Storage of low-enriched uranium and disposition product from the sodium-bonded fuel disposition campaign*
- *PIE capability*
- *Resumption of transient testing of nuclear fuels*
- *Assessment of plutonium-238 production alternatives*
- *Testing of other advanced separations technologies, with planning for engineering scale demonstration*
- *Continued engineering scale electrochemical separations and waste form development*
- *Optimized infrastructure to support resident and visiting researchers.*

13. The 2011 National Defense Authorization Act included legislative language on energy parks, authorizing the Energy Secretary to develop energy parks at former defense nuclear facilities. INL is pursuing the Energy Park concept through the Hybrid Energy Systems approach, in which reconfigurable testbeds are established as a means of reducing the risk of deployment of advanced energy systems.
14. INL embraces sustainability through the implementation of INL design and operating standards and the INL Site Sustainability Plan (SSP), through incorporation of the INL High Performance Building Strategy, and through participation from the INL workforce.

15. INL continues to provide an expansive site and facilities that support testing, evaluation, training, and exercises for many of the nation's weapons of mass destruction (WMD) response teams and critical government national security programs.

16. Accelerator-based technologies developed at INL enable the detection of illicit transportation of shielded nuclear materials, and are being developed to support new safeguards and treaty verification efforts that will be essential to enabling the safe and secure global growth of nuclear energy.

17. The budget resources specified in DOE-NE's 5-year budget guidance informs the TYSP. The funding projections do not include funding for large, program-specific capital projects such as the NGNP and a possible fast spectrum test reactor.

18. Federal program decisions such as resumption of transient testing, advanced PIE capabilities, and nuclear material consolidation will be evaluated in the NEPA process.

1.3 Mission Description

INL is furthering the DOE-NE mission to advance nuclear power as a resource capable of making major contributions in meeting the nation's needs for energy supply, emissions reduction, and energy security, as articulated in the four DOE-NE Roadmap objectives (see Section 1.1.2). These pressing challenges set the context for INL's strategy.

As a multiprogram national laboratory, INL also supports the needs of the National Nuclear Security Administration (NNSA); the DOE Offices of Environmental Management (DOE-EM); Energy Efficiency and Renewable Energy; Science; Electricity Delivery and Energy Reliability; and numerous work-for-others (WFO) customers, as described by its missions in N&HS and Energy and Environment. INL undertakes WFO for other federal agencies, including the National Aeronautics and Space Administration (NASA), the Department of Defense (DOD), Department of Homeland Security (DHS), the Nuclear Regulatory Commission (NRC), and the Interior Department. Infrastructure improvements or capability enhancements needed to provide unique support to non-DOE-NE customers are funded through direct investment from the customer or cost recovery. Included in these WFO missions is the Specific Manufacturing Capability (SMC) program conducted at the Test Area North (TAN) area of the INL Site. Additional information on INL missions is provided in the management and operating (M&O) contract (No. DE-AC07-05ID14517) with Battelle Energy Alliance, Inc.

INL seeks to meet the needs of DOE-NE cost effectively and efficiently, and to offer its capabilities to the national and international nuclear energy enterprise. Science-based research primarily supporting the DOE-NE mission is the focus of INL nuclear capabilities; however, these capabilities are also relevant to the other mission areas (i.e., N&HS and energy and environment). In addition, capabilities brought to INL from the other mission areas offer an even more robust R&D environment, enhancing the value of INL as a national resource. In many cases, well-chosen infrastructure additions or modernization will not only support DOE-NE missions, but will also position INL researchers to better support other mission areas.

1.3.1 Nuclear Energy

Building on its legacy responsibilities, infrastructure, and expertise, INL's nuclear energy mission is to perform science-based R&D focused on advanced nuclear technologies that address objectives of the DOE-NE Roadmap and promote revitalization of the nation's nuclear power industry. INL coordinates and/or participates with the DOE-NE, providing technical integration, building key capabilities, and leveraging capabilities across the national laboratory system and with universities.

1.3.1.1 Objective 1—Develop Technologies and Other Solutions That Can Improve the Reliability, Sustain the Safety, and Extend the Life of Current Reactors

This objective is accomplished by supporting and conducting the long-term research needed to inform component refurbishment and replacement strategies, performance enhancements, plant license extensions, and age-related regulatory oversight decisions. The R&D focus is on aging phenomena and issues that require long-term research and are generic to reactor type.

1.3.1.2 Objective 2—Develop Improvements in the Affordability of New Reactors to Enable Nuclear Energy to Help Meet Energy Security and Climate Change Goals

These improvements will address barriers associated with the deployment of new nuclear power plants, including advanced designs such as small modular reactors, fast spectrum, and high-temperature reactors with advanced technologies that could support electric and nonelectric applications of nuclear energy. This objective comprises R&D in fundamental nuclear phenomena and development of advanced fuels to improve the economic and safety performance of these reactors. In addition, it includes development of interfacing heat transport systems and tools that improve the understanding of the interaction between kinetics of various reactor systems and chemical plants or refineries, as well as the long-term performance of catalysts and solid-oxide cells at the atomistic level. This objective also includes crosscutting research on issues such as reactor materials, proliferation risk assessment, safety risk assessment, advanced sensors and instrumentation, and methods for manufacturing and construction.

The NGNP is a government-sponsored project (PL 109-58) focused on the development, early design, and licensing of an advanced high-temperature gas reactor, as well as associated advanced technologies, to transport high-temperature process heat. This provides the opportunity for nuclear energy to displace the use of fossil fuels in many industrial applications and provide a low-emission energy supply. In support of the commercialization of this technology, the federal government is sponsoring research to develop and qualify the fuel, high-temperature graphite and metals, and analytical methods for the high-temperature gas reactor. A component of this initiative is the demonstration of high-temperature steam electrolysis for nuclear assisted production of hydrogen. The program is currently focused on advanced cells that show better performance as opposed to scaled demonstrations necessary for commercialization.

1.3.1.3 Objective 3—Develop Sustainable Fuel Cycles

R&D focuses on domestic nuclear-fuel recycling and waste management technologies as well as optimized solutions to reduce proliferation risks. Long-term technology development activities include:

- Developing 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).
- Developing nuclear fuel that better utilizes the fuel resource and reduces the quantity of actinides in used fuel, as well as separations and fuel-processing technologies for used LWR fuel to extract more energy from the same mass of material (modified open fuel cycles).

- Developing technologies that recycle all of the actinides in thermal or fast-spectrum systems to reduce radiotoxicity of the waste, while more fully utilizing uranium resources (fully closed fuel cycles).
- Developing technologies and conducting the long-term research associated with packaging, storage, transportation, and disposal of UNF and HLW.

Because DOE-NE also has oversight of responsibilities under the Nuclear Waste Policy Act, it is pursuing research associated with disposal options and storage and transportation.

Unlike R&D Objectives 1 and 2, management of UNF and development of fuel cycle technologies are primarily the government's responsibilities because the government is legally responsible for UNF. Thus, the necessary R&D, if appropriate, is led primarily by the government. However, early and continuous industry collaboration is important because any technologies that are developed will ultimately be implemented by the commercial entities.

1.3.1.4 *Objective 4—Understand and Minimize Risk of Nuclear Proliferation and Terrorism*

This objective will assure that access to the benefits of nuclear energy can be enabled without increasing nuclear proliferation and security risks. It incorporates simultaneous development of nuclear fuel cycle technology, S&S approaches, technologies and systems, new proliferation risk assessment tools, and nonproliferation frameworks and protocols. While R&D associated with safeguards by design are led by the NNSA laboratories, INL fuel cycle facilities (i.e., the FCF) will support development of approaches and testing of process control instrumentation and new sampling systems that provide near real-time accountability.

1.3.2 National and Homeland Security Programs (Department of Defense, Department of Homeland Security, National Nuclear Security Administration)

INL provides unique capabilities, facilities, and expertise in N&HS that are synergistic with the laboratory's nuclear mission. The N&HS mission is aligned with Presidential priorities and is focused in two primary areas: (1) critical infrastructure protection and (2) nuclear nonproliferation, which includes the key areas of S&S and signatures, detection, and response.

1.3.2.1 *Critical Infrastructure Protection*

The Critical Infrastructure Protection mission focuses on reducing the cyber and physical security risks across the nation's 18 critical infrastructure sectors (NIPP 2009). INL has established unique capabilities in industrial control systems cyber security, wireless communications, electric power, infrastructure modeling, and armor and explosives technologies. Each of these areas − and the control systems cyber security area in particular − is relevant to advancing nuclear power as a resource capable of meeting energy, environmental, and national security needs. The nuclear power industry is poised to take a significant technological step from legacy analog technology to resilient digital systems in both new reactors and retrofits to the existing fleet. This migration will require significant R&D to resolve technical barriers and provide high assurance that the digital technologies employed are adequately protected against cyber attacks. Building on its extensive experience working with the energy sector, INL is engaging the Nuclear Energy Institute (NEI) and the NRC in security issues related to nuclear plants. Critical infrastructure protection efforts at INL have had a direct impact on the nation's energy security and will become increasingly important in the future.

1.3.2.2 Nuclear Nonproliferation Safeguards and Security

Nuclear Nonproliferation S&S provides capabilities that support multiple U.S. government organizations, including DOE-NE and NNSA, with direct relevance to DOE-NE Roadmap Research Objective 4 (Understand and Minimize Proliferation Risk). INL capabilities support, or can support, R&D in a number of nonproliferation areas, such as:

- Fuels that reduce the proliferation risk
- Safeguard approaches and technologies using fuel cycle expertise and facilities such as FCF
- Risk management approaches to security that are of growing interest to NRC.

INL provides lead program assistance and nuclear fuels expertise in support of the Global Threat Reduction Initiative. This program involves the removal of nuclear materials from less secure locations in the former Soviet Union and the conversion of reactor fuels from highly enriched uranium (HEU) to low-enriched uranium (LEU). Fuel fabrication and postirradiation capabilities at MFC and the irradiation capabilities of the ATR have been central to the success of this initiative.

1.3.2.3 Signatures, Detection, and Response

Differentiating capabilities make INL a laboratory of choice for the DOD, the DHS, and NNSA in many facets of defense against WMD. INL has world-leading capabilities in detection of and response to threats involving chemicals, nuclear and radiological materials, and explosives. These capabilities include:

- Research quantities of nuclear and radiological materials that are increasingly difficult to access elsewhere in the nation
- Facilities and equipment that support nuclear and radiological forensics, such as the HFEF, Analytical Laboratory (AL), and the mass spectrometers capable of ultratrace detection
- A large-scale explosive test range
- An expansive site that supports testing, evaluation, training, and exercises for many of the nation's WMD response teams
- Accelerator-based technologies developed at INL that enable the detection of illicit transport of shielded nuclear materials, and that are being developed to support new safeguards and treaty verification efforts essential to enabling the safe and secure global growth of nuclear energy.

1.3.2.4 Specific Manufacturing Capability

The primary mission of the SMC is to provide facilities, equipment, and trained personnel to manufacture armor packages for the U.S. Army's Abrams Main Battle Tank. Current plans call for the program to continue this mission with the Army until FY 2016. Beyond FY 2016, the Army has expressed an interest in utilizing the specialized facilities and workforce expertise at SMC for their future survivability requirements.

Additional missions for the SMC Program could include R&D and manufacturing in support of DOD and N&HS requirements to protect personnel and equipment against specific threats. This would be accomplished through collaboration with Aberdeen Research Laboratory, the Heavy Brigade Combat Team, and the DOD. The use of INL's National Security Range to conduct materials and systems tests of both classified and unclassified designs is important to advancing mission accomplishment of the Program's various missions.

The SMC Program has an exceptional record of production excellence, security, customer satisfaction, and safety. Under its current alignment with

N&HS, SMC plays a key role in supporting the laboratory's mission to provide world-class N&HS solutions.

1.3.3 Energy and Environment

The energy and environment mission of the laboratory is derived from engineering and research capabilities in specific areas of energy supply (i.e., biomass assembly, testing of advanced vehicles, and development of catalysts) and in developing engineering solutions for the integration of energy systems. As affirmed in the 1995 Settlement Agreement between the State of Idaho, DOE, and the U.S. Navy (State of Idaho 1995), INL is the lead laboratory for the DOE's used (spent) nuclear fuel management . Under this role, INL conducts the research, development, and testing of treatment, shipment, and disposal technologies for all DOE-owned UNF. This role was later expanded to include DOE-produced high-level waste. In addition, the laboratory provides technical assistance in the area of water resource management to federal, state, and local governments.

1.3.3.1 Used Nuclear Fuel and High-Level Waste Leadership

As the DOE lead laboratory for UNF and high-level waste, INL works with commercial nuclear generating companies, cask vendors, the EPRI, M&O contractors at other DOE sites, other federal offices, and the international research community to solve technical issues associated with packaging, storage, transportation, and disposition of these materials. Activities performed include designing and assembling large-scale demonstrations of repository, waste processing, and storage systems. INL retains unique infrastructure and physical assets in these areas including instrumented casks for demonstrations involving storage of UNF. This includes research to establish the technical foundation for acceptance of materials at future repository or storage systems, developing disposition pathways for challenging materials, total system performance modeling for repository systems, materials testing, and nondestructive evaluation of cask and system performance.

From 2002-2009, INL designed and demonstrated a full-scale system to close the large waste packages for placement into the repository. INL served a key role in the recovery, transportation, and examination of the fuel from the TMI-2 reactor following the 1979 accident.

A current development system is the cold crucible melter that is unique and has some advantages compared to the current generation of joule-heated melters used for treating radioactive waste. A one-of-a-kind system, the technology is being used successfully to evaluate technologies for vitrifying high-level waste streams and low-activity waste streams produced at the Savannah River Site and the Hanford Reservation. This system may also be used in the future to evaluate vitrification of radioactive waste streams at INL.

This expertise and associated capabilities are also applicable to the technical focus area of used fuel management within the fuel-cycle research area (DOE-NE Roadmap Research Objective 3).

1.3.3.2 Biomass Feedstock Assembly

The goal of INL's Bioenergy Program is to overcome key technical barriers facing the U.S. bioenergy industry by systematically researching, characterizing, modeling, and demonstrating the physical and chemical characteristics of the nation's diverse lignocellulosic biomass resources to produce biofuels and other value-added products more cost effectively. Realizing national biofuel production goals requires development of feedstock supply systems that can provide biomass to biorefineries sustainably and cost effectively. INL's

Bioenergy Program developed an engineering design, analysis model, and conceptual strategy for a feedstock supply system that can sustainably provide uniform-format lignocellulosic biomass at a commodity scale within national cost targets. Four major INL research laboratories are employed to research, develop, and demonstrate the systems and technologies needed to meet DOE's biomass program requirements: (1) Biomaterials Deconstruction and Flowability, (2) Computational Engineering and Simulation, (3) Biomass Stabilizing and Upgrading, and (4) the Feedstock Process Demonstration Unit.

1.3.3.3 Energy Storage and Vehicles

INL is the lead DOE laboratory for field performance and life testing of advanced technology vehicles. The laboratory provides benchmark data for DOE technology modeling, simulations, and R&D, as well as to fleet managers and other vehicle purchasers for informed purchase, operations, and infrastructure decisions.

The transition to hybrid electrical and all-electric light-duty vehicles for personal transportation has the potential to shape the demand curve for electricity in the United States. However, realization of this advanced technology will require improvements in batteries, energy conversion, and electrical infrastructure — all of which are established areas of INL expertise. INL is coordinating plug-in demonstration projects with private companies and city, county, port, and environmental agencies. Onboard data-loggers, cellular modems, and global positioning system (GPS) units will transmit information from these vehicles to INL researchers for analysis. INL's integrated vehicle, energy storage, and grid demonstration and testing laboratory is a regional and national testing and demonstration resource for DOE, DOD, other federal agencies, and industry. The applied battery research and diagnostic testing includes thermodynamic life analysis of advanced battery chemistries under development and advanced physical and materials modeling. The program is also developing roadway and vehicle electrification systems and smart grid integration concepts.

1.3.3.4 Hybrid Energy Systems

Hybrid energy systems are those that integrate two or more primary energy and carbon sources to produce a suite of energy products in an optimal way. Hybrid energy systems can be envisioned as five major interconnected platforms: (1) feedstock extraction and processing; (2) energy transfer; (3) energy storage; (4) byproduct management; and (5) system integration, monitoring, and control. An emerging area of research within the laboratory, hybrid energy (including nuclear-assisted hybrid systems) is growing to meet the energy integration needs of the DOD and other federal, state, and international customers and partners. Examples of research underway in this area include:

- Developing methods to improve the efficiency of feedstock processing and reduce carbon emissions
- Conducting research to understand reaction phenomena and heat disposition requirements
- Exploring methods for converting surplus power to stored energy
- Conducting research to convert syngas and pyrolysis products into energy products
- Researching gas separation and management of by-products
- Supporting technology development for tar and oils upgrading
- Conducting research to optimize energy and material integration of hybrid energy systems
- Developing design criteria for monitoring and control systems for hybrid energy solutions.

1.3.3.5 Systems Integration of Natural Resource, Energy, and Ecosystem Utilization

Energy production and distribution require the development and use of multiple natural resources (e.g., water, land, minerals, and biomass) and often compete with other important resource uses such as food production, residential development, recreation, and other industrial applications. Ecosystem and regional-level analysis tools based on Geospatial Information Systems and system-dynamics modeling techniques are being developed to analyze energy and natural resource development and use. They also identify systems that address fluctuations in demand and availability of resources and energy in the short and long term. Finally, researchers are developing advanced environmental forensics capabilities to detect trace levels of specific chemicals and other small changes in the environment.

1.3.4 Idaho Cleanup Project

The Idaho Cleanup Project (ICP) ensures the safe, informed, and judicious use of the INL Site by multiple generations following remediation through decisions and actions that (1) protect human health and the environment from residual contamination, (2) conserve ecological and cultural resources, and (3) respond to regulatory, political, and technological changes.

The project involves the safe environmental cleanup of the INL Site, contaminated by conventional weapons testing, government-owned research and defense reactors, laboratory research, and defense missions at other DOE sites.

The 7-year, $2.9B cleanup project, funded through DOE-EM, focuses on (1) reducing risks to workers, the public, and the environment and (2) protecting the Snake River Plain Aquifer, the sole drinking water source for more than 300,000 residents of eastern Idaho. This project is discussed in detail in Appendix C.

2. TEN-YEAR END-STATE VISION

The proximity of the ATR and, potentially, the Transient Reactor Experiment and Test Facility (TREAT) to INL's PIE and characterization capabilities, co-located glovebox lines for experimental fuel development, and co-located separations research facilities provides the foundation for national nuclear energy research at INL. Along with facilities supporting (or capable of supporting) future needs for scale-up testing and demonstrations, these facilities, with targeted investments, should be able to meet the needs of DOE-NE and nuclear energy R&D in general for years to come.

Over the last 5 years, INL has advanced research capabilities at the laboratory, beginning with the ATR and continuing with the MFC. At MFC, there has been a major emphasis on the purchase of state-of-the-art PIE equipment and fresh fuel-characterization equipment, as well as modifications to the Fuel Manufacturing Facility (FMF) for ceramic fuel fabrication work. The resulting suite of capabilities will provide DOE, industry, national laboratories, universities, and other federal agencies with the tools required to expand the use of nuclear energy as a critical baseload power source and support N&HS needs.

2.1 Consolidation Around Three Main Campuses

Work associated with nuclear energy and other missions takes place at several locations at INL. Currently, nuclear energy R&D capabilities are consolidated around three main campuses: (1) the REC, (2) the ATR Complex, and (3) the MFC (Figure 2-1). Though located in separate areas of the INL Site, these campuses are connected by capability and function. A new road to improve ease of transport of experiments from ATR to MFC should be completed in 2011.

INL: The National Nuclear Laboratory Ten-Year End-State Vision

- *ATR meeting the neutron irradiation needs of the nation*
- *World-class fuel fabrication and characterization capabilities*
- *World-leading PIE capabilities*
- *Meeting transient testing needs of the United States and international research community*
- *Laboratory and integrated laboratory-scale testing of other advanced separations technologies, with planning for engineering scale demonstration*
- *Continued engineering-scale electrochemical separations and waste-form development*
- *Optimized infrastructure to support resident and visiting researchers.*

The strategic vision for INL builds on the current strength of each campus; investments to modernize each area are designed to create the form, aesthetics, and function of a campus environment that will attract and retain researchers and foster collaboration, communication, and connectivity both internally and with outside experts. A cooperative research environment in town will be facilitated by contemporary office space integrated with modeling and simulation capabilities, lower-hazard laboratory space acquired under lease arrangements, and data links between nuclear energy R&D capabilities in town and those at the MFC.

Figure 2-1. Idaho National Laboratory campuses.

2.1.1 Research and Education Campus

Since 2005, INL's in-town capabilities have been consolidated into the REC (Figure 2-2), which serves as the "front door" to INL and comprises diverse laboratories supporting research in nuclear energy, N&HS, and energy and environment. REC research often supports research underway in higher-hazard or larger-scale facilities at the other campuses as well as at U.S. universities and other national laboratories.

The REC is home to a range of research capabilities and facilities as well as INL administrative functions. The Engineering Research Office Building (EROB) is one of the main office buildings for INL staff. In the future, a new REL (148,000 ft^2) will be the NSUF high performance gateway to the laboratory. It will offer laboratory and office space for INL scientists and engineers, as well as an auditorium. REL, pursued under a third-party lease arrangement, is currently planned for occupancy and operation in the 2013 timeframe.

In addition, it may be possible for the NSUF to obtain dedicated space earlier than previously envisioned in a proposed stand alone facility by locating dedicated NSUF laboratory and office space within REL. A decision on whether to pursue a stand-alone NSUF facility has been deferred pending completion of the REL facility layout because it may be possible to locate these capabilities within REL. Expansion of the REC Office and Cafeteria, near EROB, is deferred as well.

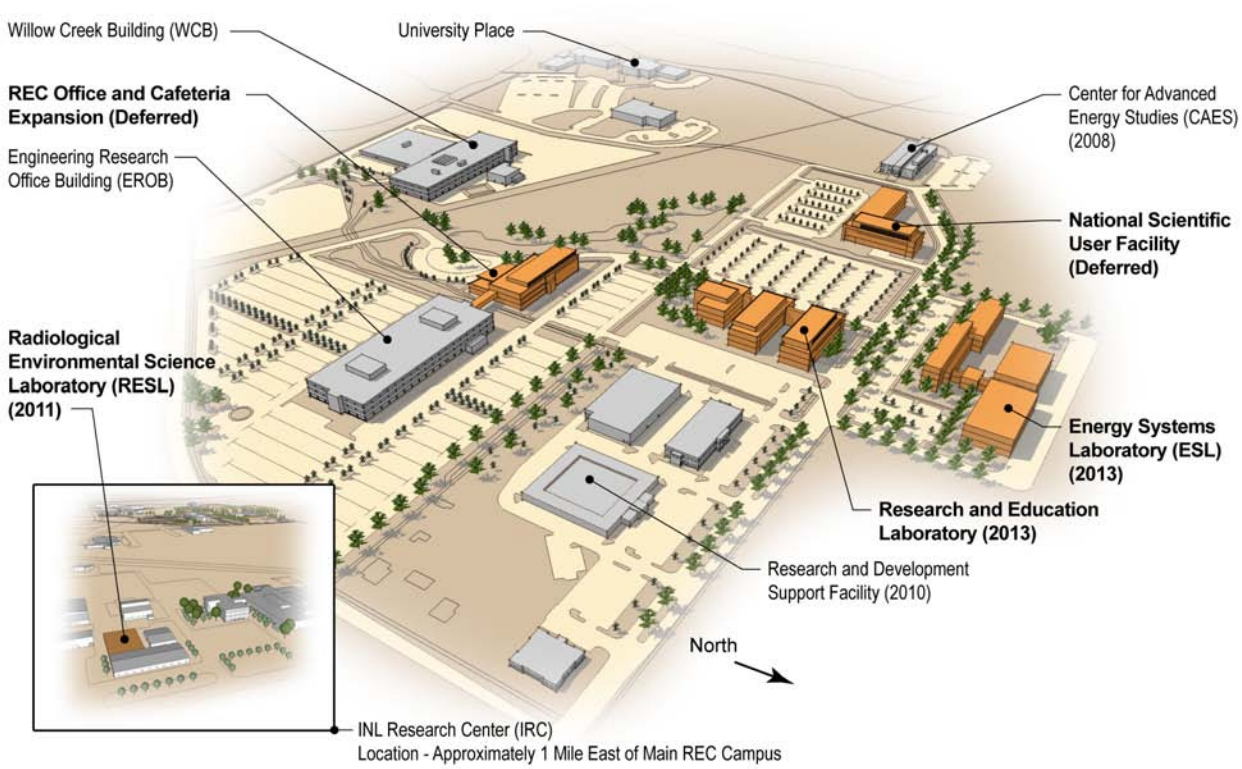

Figure 2-2. Research and Education Campus.

In addition to EROB and the proposed new REL, the REC includes the INL Research Center (IRC) (280,000 ft^2), a collection of laboratories that support advanced research, process development, and applied engineering in biology, chemistry, metallurgy, robotics, biology, materials characterization, modeling and computational science, physics, and high-temperature electrolysis production of hydrogen for nuclear and nonnuclear energy applications. Its large footprint, including high-bay areas for small scale pilot plant research, enables INL to advance basic research and bench scale concepts into viable, integrated systems (e.g., hybrid energy systems) for DOE-NE and other customers.

The 91,000-ft^2 ESL, a new combined laboratory and office facility currently under construction and slated for occupancy and operation in FY 2013, will complement and expand current capabilities at IRC. Being built under a third-party lease arrangement, this new facility, when completed, will be the largest new research facility since IRC was built in the mid-1980s. It will house expanded capabilities needed to support growth in bio-energy feedstock processing, advanced battery testing, and hybrid energy systems-integration research.

The CAES (55,000 ft^2), a $17M research facility partially funded by the State of Idaho, opened in 2008. A collaborative partnership between Idaho's public universities and INL, the CAES (along with the NSUF Program) serves as a gateway to research capabilities of INL and a center for cross-organizational and peer-to-peer technical collaboration. CAES houses both laboratory and office space, including state of-the-art materials science laboratories, imaging equipment featuring an Atom Probe, and a four wall computer-assisted

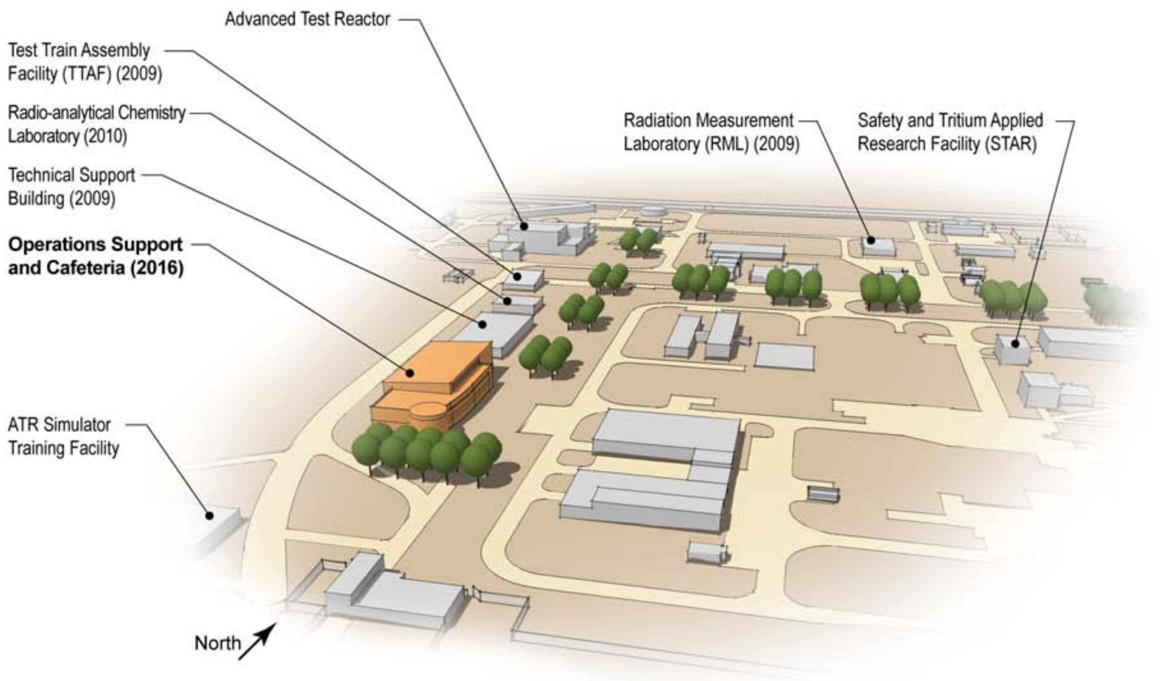

Figure 2-3. Advanced Test Reactor Complex.

virtual environment, which is an immersive virtual environment. In addition, other laboratories are dedicated to actinide sciences, analytical chemistry, and carbon management. These capabilities are made available to the CAES partners through collaborative research activities in nuclear science and engineering, bio-energy, carbon management, energy efficiency, and advanced materials.

The REC also includes three facilities dedicated to INL's N&HS mission, acquired since 2005 to house researchers and program capabilities requiring secure locations for machining, fabricating, assembly, and systems operations.

INL is also considering expanding its hybrid energy system-demonstration capabilities in about 2015 to emphasize nuclear power as part of a to-be-established, larger-scale component testing and integration capability. Equipment requirements associated with each stage of facility/technology development are currently being developed.

The DOE is also constructing a new Radiological and Environmental Science Laboratory, anticipated to be occupied and operational in FY 2011.

2.1.2 Advanced Test Reactor Complex

Located 45 miles west of Idaho Falls, the ATR is the world's most advanced materials test reactor (Figure 2-3). A low-temperature, pressurized water-cooled reactor for steady-state irradiation, the ATR is fully subscribed meeting the needs of DOE-NE, Naval Reactors, NNSA, and many other research users. Other facilities in the complex include the associated ATR-C, a test-train assembly facility, and a supporting radio-analytical laboratory completed and started up in FY 2010.

The ATR has historically supported fuel development for the Navy's nuclear propulsion program. Over the last decade, its use has expanded into other mission areas that include particle fuel development for the high-temperature gas reactor,

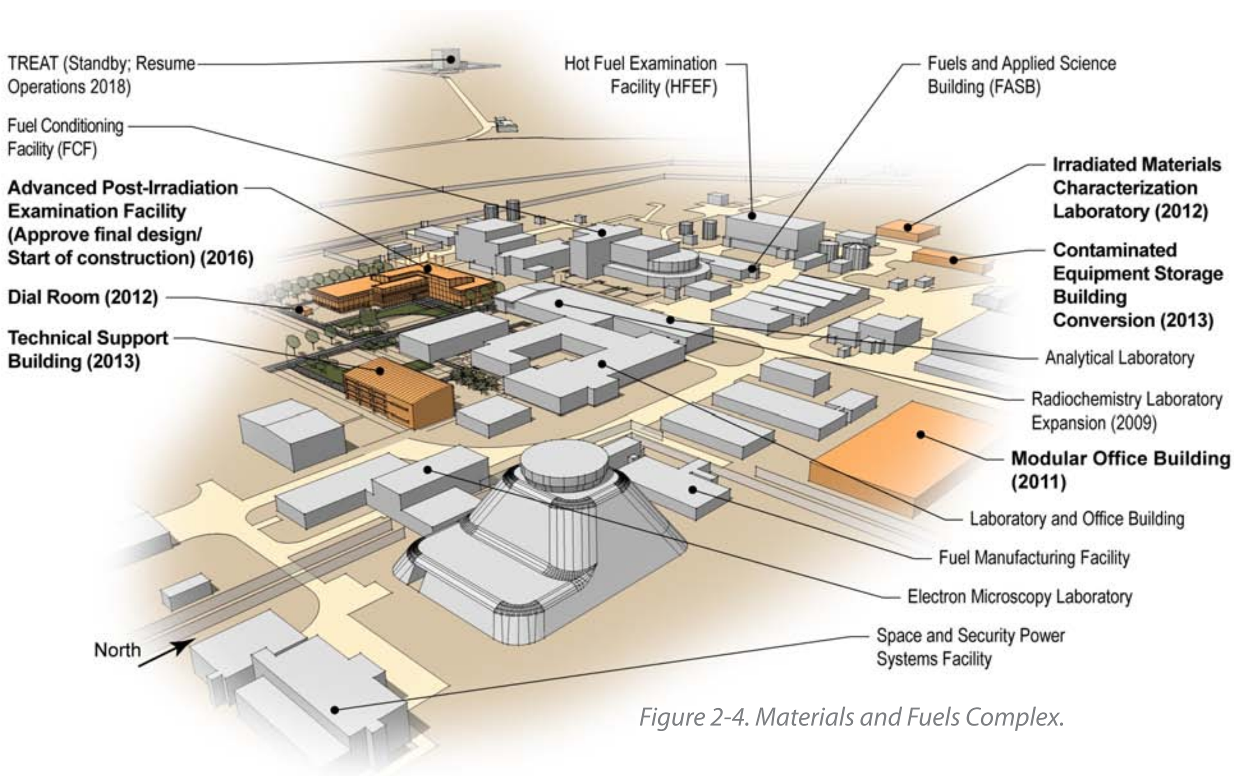

Figure 2-4. Materials and Fuels Complex.

minor actinide-bearing fuel development, and low-enriched fuel for NNSA's Reduced Enrichment for Research and Test Reactor (RERTR) Program, which is part of the Global Threat Reduction Initiative. The ATR is also one of two test reactors suitable for future production of Pu-238.

In 2006, INL chartered the ATR Life Extension Program with the purpose of improving the material condition and reliability of the ATR. It was established to ensure the ATR would remain viable for the nation's future nuclear energy research needs.

The decontamination and decommissioning of the Materials Test Reactor helped facilitate the transformation of the ATR Complex. With the shutdown reactor and ancillary facilities removed, INL completed the new Technical Support Building (16,400 ft^2) in 2009, which provides essential office space for ATR engineers and operators.

In addition, in 2009, INL completed both the Test Train Assembly Facility (4,483 ft^2) containing high precision equipment for experiment test train assembly and the Radiation Measurement Laboratory (6,929 ft^2). As indicated above, a new radiochemistry laboratory (4,600 ft^2) necessary to support ATR began operation in FY 2010. A second support facility is proposed for 2016.

2.1.3 Materials and Fuels Complex

The MFC, located 28 miles west of Idaho Falls, is the center of fuel fabrication, transient testing, and postirradiation testing at the laboratory (Figure 2-4). It is home to the TREAT facility (currently in cold standby); the Neutron Radiography Reactor (NRAD) Training, Research, Isotopes, General Atomics (TRIGA) reactor used for neutron radiography; and hot cell facilities used for PIE and advanced separations and waste form research such as HFEF, FCF, and the Fuels and Applied Science Building (FASB). MFC also houses analytical laboratories and an Electron Microscopy Laboratory (EML) for isotopic and chemical analyses and nanometer-scale analysis of material samples from its research facilities and colocated fuel fabrication glovebox lines (e.g., FMF and FASB). The MFC operates a facility for final assembly and testing of radioisotope power systems (SSPSF).

In 2009, INL completed construction of the new Radiochemistry Laboratory (8,200 ft^2) at MFC, and modifications are underway to convert an existing facility to provide additional radiological space for fuel development. MFC plans include construction of the Irradiated Materials Characterization Laboratory (IMCL) for fuels and materials characterization, a proposed new Advanced PIE Capability, ceramic fuel fabrication capability, and new office buildings for INL and visiting researchers.

Efforts are underway to establish a 13,000-ft^2 modular office space this year to provide interim space for employees while new office buildings are constructed over the next 5 to 10 years. The Technical Support Building is proposed for construction and operation by 2013, followed by future office space. New office space will provide the facility functionality needed to respond to the evolving needs of DOE-NE missions.

2.2 Balance of Site Capabilities

There are eight facility areas located on the INL Site, which occupies a 569,135-acre expanse of otherwise undeveloped, high-desert terrain. Buildings and structures are clustered within these areas, which are typically less than a few square miles in size and separated by miles of open land. The Central Facilities Area (CFA), located centrally on the INL Site, is the main services and support area for the two main DOE-NE R&D campuses located on the desert. The primary non-DOE-NE facility areas include the Idaho Nuclear Technology and Engineering Center (INTEC), Radioactive Waste Management Complex (RWMC), and Naval Reactors Facility (NRF). Other, smaller site areas include the Critical Infrastructure Test Range Complex (CITRC) and TAN.

INL currently depends on the DOE-EM owned and operated RWMC for disposal of remote-handled low-level waste (LLW) from continuing operations. This is expected to continue until the Subsurface Disposal Area facility at RWMC is full or until it must be closed in preparation for final remediation, approximately at the end of FY 2017. INL has proposed, and DOE has approved, mission need for construction of a replacement remote-handled LLW disposal facility, consisting of approximately 250 precast concrete vaults. Development of documentation to support Critical Decision 2 will be completed in FY 2012. Startup of this facility is currently planned for FY 2018. Contact-handled LLW is disposed of offsite.

2.2.1 Central Facilities Area

Site-wide area infrastructure consists primarily of roads, railroads, power distribution systems, communication systems, and utility systems that serve and connect facility areas. Support services provided from CFA include medical, fire suppression, transportation, security, communications, electrical power, craft support, warehousing, and instrument calibration (Figure 2-5). A small and steadily increasing amount of space at CFA is used for R&D to support N&HS work, housing wireless test-beds in four existing buildings.

While some work supporting the N&HS mission takes place at the REC, there are also capabilities at CFA and other locations on the INL Site where they can take advantage of its remoteness and desirable, quiet radiofrequency spectrum.

Figure 2-5. Central Facilities Area.

INL is developing a consolidation and revitalization plan for CFA that will include space to support NHS missions and space-management and land-use initiatives, and that will reduce cost by consolidating operations.

2.2.2 Critical Infrastructure Test Range Complex

The CITRC area supports N&HS missions of the laboratory, including program and project testing (i.e., critical infrastructure resilience and nonproliferation testing and demonstration). Wireless test-bed operations, power line and grid testing, unmanned aerial vehicle testing, accelerator testing, explosives detection, and radiological counterterrorism emergency-response training take place at the CITRC area. A future electric-grid test bed is planned at INL near the CFA/CITRC area, including a new reconfigurable test substation and several miles of transmission and distribution lines. An area north of TAN is being developed for a future accelerator experiment to detect illicit transport of shielded nuclear materials.

2.2.3 Specific Manufacturing Capability at Test Area North

Since 1984, SMC has been the lead manufacturer of armor packages for the U.S. Army's Abrams Main Battle Tank. Located at TAN on the laboratory's 890-square mile site, this 25-acre armor manufacturing complex boasts 320,000 ft^2 of secure floor space that is complete with state-of-the-art equipment and a knowledgeable and security-cleared workforce. Capabilities at the SMC complex include light and heavy metal rolling, metal fabrication equipment, in-house engineering and quality departments, a state-of-the-art metallurgical lab, and experienced manufacturing support crafts (e.g., electrical, mechanical, and landlord).

With these extensive resources, the SMC Program has the ability to provide independent technical evaluations and solutions to manufacturing, engineering, and material science challenges for a variety of programs and customers. The proven expertise of the workforce and an extensive infrastructure investment make SMC an essential manufacturing resource for the nation.

2.2.4 Idaho Nuclear Technology and Engineering Center

Currently owned and operated by DOE-EM, the INTEC operated until 1992 to recover HEU from UNF and convert liquid high-level waste from government reactors into a more stable, solid granular material suitable for long-term storage (Figure 2-6). During its 40-year production mission, INTEC recovered uranium from a diverse set of UNFs, including metals, aluminum, stainless steel, zirconium, Navy fuels, and graphite fuel. In the 1980s, second-generation facilities that housed advanced fuel storage and dissolution, remote maintenance capabilities, and sampling and analytical technologies replaced earlier buildings. Construction of a facility (CPP-691) to house second-generation chemical separation / uranium extraction capabilities was started but not completed. The facility is approximately 70% complete and is a candidate for potential reuse in the future. Today, with environmental cleanup of INTEC nearing completion, most of its facilities are or will be surplus to the ICP and the DOE-EM mission.

DOE-EM owns a suite of facilities at INTEC whose research, development, and demonstration (RD&D) capabilities would provide affordable, secure, and remotely located infrastructure to meet the DOE-NE revitalization mission for the next 20 years. These facilities are or will become surplus to DOE-EM's ICP mission and could be transitioned to DOE-NE in a phased manner, with low-risk facilities and those needed to meet strategic milestones transferred first. DOE-NE's acquisition of such facilities could advance nuclear fuels RD&D capabilities and position INL for an expanding role in managing UNF and leading the nuclear renaissance.

INL plans to use the Unirradiated Fuel Storage Building (CPP-651) and several surrounding buildings for relocation of LEU disposition product from the sodium-bonded spent nuclear fuel campaign.

Other INTEC facilities are under consideration for future use to support DOE-NE R&D or INL operations. For example, the UNF pool at the Fluorinel Dissolution Process and Fuel Storage (CPP-666) facility is necessary for storage of ATR used fuel. Along with the fuel storage capabilities of the Fluorinel Dissolution Process and Fuel Storage is the Fuel Dissolution Process cell, which provides shielded capabilities with manipulators that could be used in the future to investigate and test advanced separations technologies, conduct extended used fuel storage studies, and develop unique monitoring and inspection systems for used fuel storage. Finally, the CPP-603 facility and the 2707 Pad would allow capability to extract fuels, reseal casks, and store casks for extended storage studies.

Additionally, the Remote Analytical Laboratory (RAL) is a 13,000-ft^2 facility designed for a wide range of organic, inorganic, and radio-analytical capabilities and one of the most modern hot cells in the DOE complex. The RAL offers versatility to meet near-term and continuing needs for radiochemistry work and longer-term needs for laboratory and bench-scale testing of separations technologies. It previously served as a test bed for high-level waste centrifugal technology development. The RAL is a conventional chemical laboratory with an air atmosphere that contains an analytical hot cell with a waste load-out cell. The request to transfer RAL from DOE-EM to DOE-NE (Clark and Hill 2010) is currently under review by DOE-NE based on an INL-submitted Project Execution Plan (PEP). Facility turnover from DOE-EM to DOE-NE is expected by the end of the fiscal year, with start-up in FY 2012 following an INL readiness assessment.

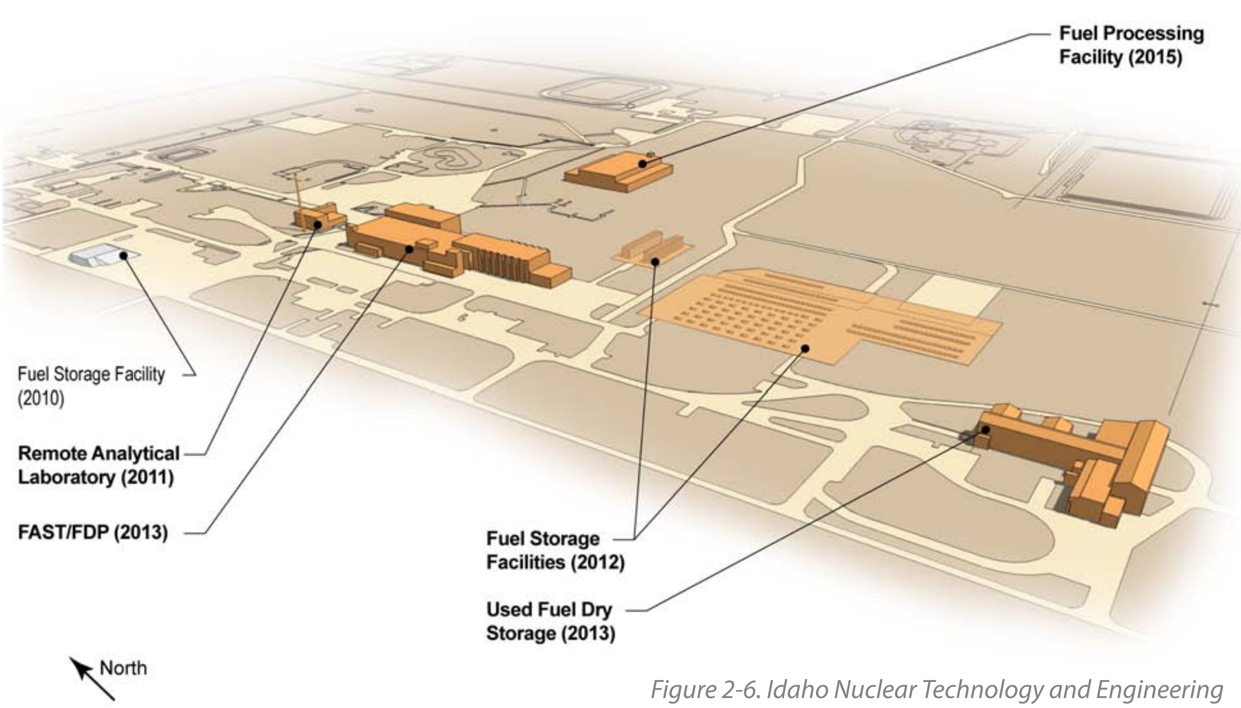

Figure 2-6. Idaho Nuclear Technology and Engineering Center.

DOE-NE and DOE-EM have recently signed a Memorandum of Agreement (MOA; DOE-NE/DOE-EM 2011) to support an orderly transfer of selected DOE-EM-managed facilities and operations at INL to DOE-NE and INL. DOE-EM has developed an ICP acceleration plan that would enable the majority of DOE-EM cleanup work at INL to be completed by 2015. The acceleration plan is compatible with the desired transfer of selected facilities and operations currently managed by DOE-EM to DOE-NE for mission-relevant activities at INL. These facility transfers would mutually support the successful implementation of the DOE-NE R&D Roadmap activities and the DOE-EM acceleration plan.

To support this MOA, DOE-NE and DOE-EM are working towards an orderly transfer of responsibilities and funding of select DOE-EM facilities and operations at INL. All transfers will be accomplished through a mutually agreed upon PEP. This PEP will outline a phased systematic transfer of facilities and stewardship responsibilities to DOE-NE through a target date of 2015. The phased transfers may include a period for surveillance by DOE-NE to validate their reasonableness (i.e., functionality and budget target). A DOE-NE-EM working group is being established at the Department of Energy Idaho Operations Office (DOE-ID) to develop, oversee, and direct the technical scope needed to execute the approved PEP successfully.

2.3 Land-Use and Campus Planning

INL has institutionalized a planning effort that has identified the needs for additional facilities in each of these campuses over the next 20 years. In some instances, activities to establish these capabilities are well underway, have been approved by DOE-NE, or are proposed within the 10-year window of this document. In other instances, a potential need for capabilities and facilities has been identified;

however, the data are not mature enough to include in the TYSP. All proposed projects are subject to NEPA documentation.

Sustainability concepts will be incorporated in all INL campus planning activities to the maximum extent practicable with the express purpose of meeting operational and mission needs with high performance sustainable buildings.

2.4 Idaho National Laboratory Sustainability and Energy Management Program

INL has institutionalized a program to implement sustainable practices in facility design and operation, procurement, and program operations that meet the requirements of Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*; DOE Order 430.2B, *Departmental Energy, Renewable Energy, and Transportation Management*; DOE Order 450.1A, *Environmental Protection Program; the Strategic Sustainability Performance Plan* (DOE 2010b); and the SSP (DOE-ID 2010).

The INL Sustainability Program seeks to achieve measurable and verifiable energy, water, and greenhouse gas reductions; responsible use and disposal of materials and resources; and cost-effective facilities, services, and program management. The goal of the INL Sustainability Program is to promote economic, environmental, and social sustainability for INL, helping to ensure its long-term success and viability as a premier DOE national laboratory.

INL has a detailed strategy and plan captured in the SSP. Developed in accordance with DOE Orders and the Strategic Sustainability Performance Plan, the SSP provides the roadmap and specific actions needed to meet the department's sustainability goals. The annual update to the SSP will be prepared in accordance with the new DOE Order 436.1, *Departmental Sustainability*. INL continues to mature its comprehensive leadership strategy to address the execution gaps identified in Appendix D, specifically to refine the planned investment strategy necessary to meet its goals.

The current sustainability strategy is focused on leadership to reduce greenhouse gas emissions by changing how and what resources are consumed (e.g., energy, water, fuel, electronics, and other consumables) and, thereby, achieve the department's sustainability goals for INL. The strategy focuses on:

- Changing behaviors as consumers
- Investing in internal research and development to deploy innovative solutions to sustainability
- Leveraging third-party investments to adopt new and/or proven sustainable technologies and to recapitalize infrastructure
- Partnering to demonstrate and deploy innovative sustainable practices
- Committing to sustainable technologies in purchasing and acquisition decisions.

A full description of the INL Sustainability and Energy Management Program and its associated goals, progress, and requirements, including additional details on how INL plans to implement the Sustainability Program are provided in Appendix D. INL will incorporate current and emerging leadership strategies in future Ten-Year Site Plans.

3. IDAHO NATIONAL LABORATORY CORE CAPABILITIES

INL retains core nuclear energy R&D capabilities in irradiation testing, PIE, fuel fabrication, advanced separations, waste form development, and final assembly and testing of radioisotope power systems. These capabilities require the use of reactors, hot cells, and other specialized laboratory facilities that are able to support research using highly radioactive materials; they are essential to DOE-NE research and accessible to the broader nuclear energy R&D community. Therefore, INL is proposing a strategy of incremental investments, building on the substantial sunk investment in research facilities with advanced tools and instruments that are unique to DOE-NE R&D and that distinguish INL as a national center for reactor and fuel cycle RD&D.

Part of this strategy is to retain capabilities at the CAES facility and in space within the new REL building to enable INL and visiting researchers to collaborate more effectively, with research taking place at the MFC. INL also retains capabilities in critical infrastructure protection; nuclear nonproliferation; energy, environment, and fundamental research; and engineering.

Table 5-1 in Section 5 summarizes the strategy described below for establishing world-leading capabilities at the laboratory and integrating them to support the development of fuel, reactor, and fuel cycle technologies.

3.1 Steady-State Irradiation

3.1.1 Thermal-Spectrum Irradiation

The ATR is a material test reactor with thermal neutron fluxes of 1×10^{15} neutron/cm^2-sec and maximum fast (E>0.1 MeV) neutron fluxes of 5×10^{14} neutrons/cm^2-sec. These fluxes, combined with its 77 irradiation positions, make the ATR a versatile and unique thermal irradiation facility.

The reactor accommodates static, sealed capsule tests with passive instrumentation, tests with active instrumentation for measurement and control of specific testing parameters, and pressurized water loops. A new hydraulic shuttle irradiation system installed in 2008 allows for short-duration irradiation tests, and a new Test Train Assembly Facility (4,200 ft^2) opened in 2009 to support the precision work associated with experiment assembly for insertion in the reactor.

The purpose of the ATR-C facility, located in an extension of the ATR canal, is to evaluate prototypical experiments before they take place so that researchers can understand the effects on ATR core reactivity. The ATR-C is a full-size, low-power, pool-type nuclear replica of the ATR. Its normal operating power level is approximately 100 W, with a maximum power rating of 5 kW.

Improving ATR capabilities and operational reliability has been an INL priority since the beginning of the current M&O contract. In addition, this year, in response to the Fukushima nuclear plant accident, DOE allocated additional funds to accelerate planned defense-in-depth retrofits related to the primary coolant system, heat exchanger supports, and modification of a wall in the control room and instrumentation for the fuel storage canal.

Establishing the ATR NSUF has brought a sustained focus on enabling high-quality experiments through improved experiment design, control, and instrumentation to achieve capabilities that compare to, if not exceed, top test reactors worldwide. Improved instrumentation is a key aspect of this capability, and the continual deployment of new sensors at ATR enables better experimental control and data acquisition from important scientific investigations, such as embrittlement behavior of pressure vessel steels, irradiation effects on the degradation of core structural materials, and demanding tests on fuel performance limits. INL is developing these new instrumentation capabilities in conjunction with new test capabilities (i.e., an additional pressurized water loop).

The current phase of in-core instrumentation work will conclude within 5 years, at which point instrumentation research will evolve to a more innovative program that considers advanced technologies for higher resolution data capable of detecting changes in microstructure during irradiation. A newly installed pressurized water loop (2A) will be ready to support light water reactor sustainability research in 2012. The outage for tie-in of the loop was extended to spring 2012 to minimize schedule impacts on other experiments in the ATR.

By the end of this decade, these capabilities should be in use by DOE-NE, universities, other national laboratories and federal agencies, and industry. In addition, by the end of the decade, the ATR Life Extension Program will be completed and reactor reliability and sustainability projects should be underway to support continued long-term availability of the ATR. INL is evaluating submission of a justification of mission need analysis for this effort in FY 2012. Because the ATR's internal components are periodically replaced, it remains a valuable research and test machine capable of decades of service.

3.1.2 Fast-Spectrum Irradiation

INL currently has no fast-spectrum irradiation capability except for boosting the fast-to-thermal neutron ratio in ATR tests using filters. There is no fast test reactor capability in the United States, and U.S. researchers must rely on foreign capabilities that are limited and difficult to access. Boosted tests such as these provide useful information; however, the thermal tail in the neutron spectrum makes the tests nonprototypical for a fast-spectrum system. Fast-spectrum irradiation testing is needed for fast reactor fuels and materials testing. The United States has no plans in the next 10 years to build a fast test reactor. However, if such plans were considered, INL would be a strong candidate site because of its already operating infrastructure and location.

3.1.3 Nuclear Data and Out-of-Pile Testing

INL serves a national leadership role in a science-based approach to nuclear fuels development. Revolutionary advancements in fuel cycle technologies require improvements in our basic understanding of microstructure behavior under irradiation. The DOE-NE Roadmap calls for development of predictive modeling tools that are informed and guided by small scale, phenomenon-specific experiments for evaluating a broad set of advanced fuel designs and concepts. These advanced tools must potentially incorporate all of the relevant physics and chemistry, spanning phenomena from the mesoscale to the microstructural level and over a large range of reactor variables such as heat, pressure, and radiation. A dedicated, accompanying validation effort is also required to guide the development of a predictive modeling capability. In a science-based approach to this problem, small-scale, separate-effects experiments could effectively provide foundational physical information about the early dynamics of fuel in an environment that can be very similar but much less complicated to model than a reactor core.

3.1.3.1 Existing Capabilities

INL, in collaboration with Idaho State University (ISU), is currently developing a separate-effects, out-of-pile testing capability. This capability, called the Intense Neutron Spectra with Independent Gamma, Hydraulics, and Temperature Separate-Effects (INSIGHTS), is planned for operation within the next 5 years. A strategic plan is under development this fiscal year to examine in more detail program needs, functional requirements, additional capabilities needed, acquisition, and funding strategies.

A 4.5-MV Tandem Pelletron accelerator has been acquired and installed at the Idaho Accelerator Center for developing a unique, beginning of life, fast-flux irradiation capability for separate-effects testing of fuel material at the microstructure level. This accelerator is capable of producing 200 microamps of protons or deuterons that can be used for charged particle irradiations, or can be used to produce a fast neutron flux with a secondary target. The initial modeling and design of this INSIGHTS line-of-sight irradiation capability has been performed to accommodate the Pelletron-produced neutron source.

In conjunction with separate-effects testing capabilities, an advanced materials fabrication capability is also needed to produce the engineered test samples for separate-effects testing. These capabilities are also under development in cooperation with ISU and are expected to be in place by FY 2013. A metal-organic chemical vapor deposition system can currently produce single crystal and bi-crystal samples of metallic and ceramic fuel materials of an unprecedented quality for the study of grain structure effects. This device can also produce novel fuel materials with precise control over grain structure, substrate layering, and defect placement for separate-effects testing.

3.1.3.2 Ten-Year End State Capabilities

Observing the grain structure of fuel before and after irradiation has been a part of fuel examination programs for a long time. However, there has never been a capability to examine the changes in the grain structure during the irradiation process. The 10-year end state capability would allow real time, grain structure imaging and monitoring of specifically engineered fuel materials under fast neutron irradiation with separable effects control. The INSIGHTS separate-effects capability with independent gamma delivery, hydraulic application, and temperature control is anticipated to be established over the next 5 years as a user facility and to be a partnership between INL and ISU.

The working model, closely tied with NSUF and CAES, provides a flexible experimental environment, control and access for detailed measurements on small fuel samples and configurations. The proposed capability would provide a number of direct line-of-sight experimental channels capable of delivering tailored neutron spectra with fast fluxes that approach 10^{15} $cm^{-2}s^{-1}$, with prompt gamma radiation highly suppressed by the lead scattering media. An electron linear accelerator would be used as an external gamma source, controlled independently of the neutron flux, to provide specific doses to any of the experimental channels. The inclusion of small-scale ovens and hydraulic presses in experimental volumes would provide the other independently controlled forces known to impact early fuel dynamics. The system would be designed with simplicity and flexibility in mind, to insure many unforeseen measurements can be accommodated and simulated.

The INSIGHTS separate-effects testing supports the development of advanced instrumentation and materials for in-core use without the added complexity of critical reactor safety concerns. In addition, the INSIGHTS accelerator would also be capable of supporting charged particle irradiations, serving as an “advanced aging” device to test irradiation performance of materials loaded with fission gases (e.g., xenon, krypton, hydrogen, and helium) without the associated radioactivity or requiring long-term irradiation.

3.2 Transient Irradiation

DOE-NE has approved the need to establish a transient testing capability in approximately 2018 to accomplish its mission by elucidating the understanding of fuel performance phenomenology at the millisecond-to-second time scales. Testing fuel behavior in prototypic, time-resolved conditions is essential to guiding the development and validation of time-resolved computer models of fuel and core behavior across atomistic, mesoscale, and integrated-behavior scales.

Transient testing capabilities also meet the need to screen advanced fuel concepts, allowing for early identification of the limits of fuel performance. Transient testing will help focus fuel development on a range of viable options, ultimately reducing the time and cost required to develop new fuels. Transient testing will support Research Objectives 1 through 3 of the DOE-NE Roadmap, which involve understanding and predicting LWR performance, developing innovative fuel designs for existing LWRs and advanced reactors, and developing advanced transuranic-bearing fuels for the Fuel Cycle R&D Program.

The United States has not performed transient testing for over a decade but has retained a capability to do so with the TREAT reactor, the only transient test facility in the world that can conduct tests on full-size fast reactor fuel and 36-in. segments of LWR fuel. During prior missions, TREAT performed 6,604 startups and 2,885 transient irradiations. The capabilities of TREAT and colocation of PIE capabilities at INL make restart of TREAT an attractive option for meeting U.S. transient testing needs. In addition to domestic users from national laboratories, international entities and U.S. universities and industry have expressed interest in using TREAT to meet their transient-testing needs.

Full-capability transient testing and analysis, advanced instrumentation, and PIE of experimental fuels are essential to completing the suite of examinations needed to improve the science-based understanding of the behavior of nuclear fuels and materials. Many of the PIE facilities and capabilities needed to perform this work are located and operated at MFC. INL is pursuing enhancements to these capabilities.

DOE-ID, through the NEPA process, will assess the potential impacts of resuming transient testing in the United States. Should DOE decide to refurbish and restart TREAT for this purpose, INL will be able to provide integral safety testing capability.

Resumption of the TREAT facility and transient testing operations would be a multiyear process comprising refurbishment and restart of the TREAT reactor as well as the reestablishment of transient testing support infrastructure. Experiments will require preparation for testing, handling following transient testing, and PIE. Some of the equipment used in HFEF for preparing transient tests exists (using already irradiated fuels); however, it has not been used in some time. The integrated effort to resume domestic transient testing includes inspecting and refurbishing selected equipment and systems; updating the operating and safety policies and procedures; revising the existing safety bases documents; staffing realignments; and training of the operational workforce, all of which would be performed with operating funds.

This effort also includes refurbishment and replacement of the operating control and data collection systems and retrofits to the high-efficiency particulate air filtration systems, which would be operationally funded for functional like-for-like replacements and/or capital asset subprojects.

INL estimates TREAT restart to support U.S. and international research is possible in 3 to 5 years. DOE NE has proposed funding in FY 2012 for continued surveillance and preservation of its essential systems.

Given the slower nature of transients in gas reactors, transient testing of gas reactor fuel began in 2010 using furnaces installed in the HFEF and in a furnace at ORNL.

3.3 Fresh Fuel Characterization and Postirradiation Examination

3.3.1 Existing Capabilities

Current characterization and PIE capabilities at the MFC include equipment in the HFEF, the AL, the EML, and the FASB. In addition, the CAES Microscopy and Characterization Suite (MaCS) is an NRC-licensed facility that focuses on nano- and atomic-level characterization where exams can be completed using microgram or nanogram quantities of irradiated material specimens downsized and prepared at MFC. MaCS is fully operational, and its equipment includes a local electrode atom probe, a focused ion beam, a transmission electron microscope, and atomic force microscope, as well as a scanning electron microscope. The NSUF has established a portal for national and international research teams to perform research in the MaCS.

These capabilities are adequate to serve basic needs for fuel examination, material handling, and waste disposal and provide the foundation for establishing world-leading PIE capabilities.

Handling large quantities of irradiated fuel at the assembly scale presents a significant radiological hazard. This work must be carefully controlled and conducted in heavily shielded hot cell facilities on a protected site, which is the case with capabilities in place and proposed for the MFC. On the other end of the spectrum, it can be beneficial to conduct basic studies on small, low-hazard radiological specimens in a radiological laboratory environment rather than in a nuclear facility. Results allow for prediction of fuel performance based on sound scientific principles, and collaboration with visiting scientists is more productive in terms of discovery. The most effective research capabilities couple heavily shielded nuclear facilities with radiological characterization laboratories that contain high-end research equipment. Thus, INL proposes to equip the CAES facility and planned NSUF capability (located at the REC) with high end research equipment for use on radiological materials. As identified in Section 1.1.4, INL is proposing a new, leased REL to house this additional equipment.

Sustaining world-leading capabilities for the next 40 to 60 years will require full utilization and life extension of current facilities and construction of two new facilities. The following sections describe current PIE resources at MFC, planned equipment purchases and receipts, and construction of two new facilities. Over the last several years, more than $20M has been spent on new, state-of-the-art fresh fuel characterization and PIE equipment, some of which will be relocated and/or installed in the IMCL.

3.3.1.1 Hot Fuel Examination Facility

The HFEF is a heavily shielded nuclear facility designed to be the front-end of the PIE capability. It has the ability to receive and handle kilograms to hundreds of kilograms of nuclear fuel and material in almost any type of cask, including full-size commercial LWR fuel. The mission of HFEF is to receive material, conduct nondestructive and destructive examinations, and prepare material specimens for transfer to characterization laboratories for detailed analysis. HFEF also houses limited mechanical testing equipment, as well as the NRAD 250-kW TRIGA reactor for neutron radiography and bench-scale electrochemical separations testing capabilities and engineering-scale waste-form development capabilities to support operations in FCF.

Examples of material preparation for further examination include sectioning fuel rods to produce cross-section specimens on the pellet scale; preparing cladding sections for mechanical testing and micro-structural analysis; sorting, packaging, and cataloging hundreds to thousands of material test specimens from test reactor irradiations; and machining large pieces of in-core structural materials mined from decommissioned power reactors into test specimens.

Upgrades to current HFEF characterization equipment will support continued nondestructive and destructive examination of a variety of fuel specimens required for DOE-NE, NNSA, and industry programs. In addition, INL will pursue specialized capabilities (i.e., a consolidated fuel-examination machine and a fuel-rod refabrication rig) for ongoing DOE-NE research.

3.3.1.2 Electron Microscopy Laboratory

The EML houses a transmission electron microscope, a dual-beam focused-ion beam (FIB) fitted with electron backscatter diffraction and microchemical analysis capabilities, and a state-of-the-art Scanning Electron Microscope fitted with a Wavelength Dispersive Spectrometer with software that allows semi-quantitative analysis of heavy actinides. The EML will continue to function in this capacity until the IMCL and a new imaging suite – a microscopy laboratory recently installed at the CAES – are fully functional. The EML will then transition to providing needed general-purpose radiological laboratory space.

3.3.1.3 Analytical Laboratory

The AL focuses on chemical and isotopic characterization of unirradiated and irradiated fuels and materials. It receives small quantities of irradiated material from the HFEF, performing dissolution and dilution in a series of analytical hot cells, followed by analysis of the diluted materials using instrumentation equipped with hoods or gloveboxes for radiological control. The AL houses many advanced instruments, including an Inductively Coupled Plasma Mass Spectrometer, two Thermal Ionization Mass Spectrometers, and instruments for determining the fundamental thermodynamic properties of actinide-bearing materials. The AL will continue its current mission with regular upgrades.

3.3.1.4 Fuels and Applied Science Building

The FASB has three missions: (1) fuel development, (2) materials characterization, and (3) irradiated materials testing. Its east wing has been redeveloped as a low-level, thermophysical properties laboratory, outfitted with equipment for sample preparation, optical microscopy, electron microscopy, and thermodynamic properties determination. A laboratory in the west wing is being equipped with a suite of lead-shielded gamma cells to conduct environmental crack-growth-rate and fracture-toughness testing on irradiated materials. Some of the fuel development equipment will be moved to the Contaminated Equipment Storage Building (CESB) to enable more PIE work at FASB.

3.3.2 Ten-Year End-State Capabilities

As articulated in the INL Strategic Plan for World-Leading PIE Capabilities (INL 2009), INL will establish two modern facilities, each of which will be unique in the world with respect to comprehensive characterization and analysis of nuclear fuels and materials – more specifically, nuclear fuels and high-dose (highly activated) nonfuel materials such as cladding. These facilities will provide operational flexibility and streamlined workflow processes that can be reconfigured to meet evolving mission requirements. Facility design will incorporate modularization to facilitate equipment-specific shielding and flexibility for future equipment development, configuration alteration, and ease of replacement.

3.3.2.1 *Irradiated Materials Characterization Laboratory*

The IMCL will be the first facility of its type in the United States designed specifically for advanced instrumentation and equipment. Nonreactor nuclear facilities in the United States were state-of-the-art when they were constructed; however, these facilities were not designed to accommodate advanced microstructural characterization equipment, rendering them obsolete for this purpose. The IMCL will contain space for installation of instruments and equipment within shielding structures that can be redesigned and refitted whenever necessary. The IMCL will have mechanical systems that tightly control temperature, electrical and magnetic noise, and vibration to the standards required for advanced analytical equipment.

Designed as a multipurpose facility suitable for many different missions over its projected 40-year life, the IMCL will first house modern, state-of-the-art PIE instrumentation. The IMCL will routinely handle and perform microscale and nanoscale characterization of material specimens and irradiated fuel samples in the mass range of tens of grams down to micrograms. Its capabilities will include an Electron Probe Micro Analyzer, micro-x-ray diffraction, dual beam FIB, field-emission-gun scanning-transmission electron microscopy, scanning electron microscopy, scanning laser thermal diffusivity, limited mechanical testing capability, and sample preparation capability. The facility design will allow easy routine maintenance of the instruments.

Coupled with the CAES, and new capability to be added to the REL, this suite of instruments will provide DOE-NE with some of the powerful, state of-the-art characterization tools used successfully to overcome material performance limitations in other branches of materials science. The IMCL will also serve as a test-bed for developing the infrastructure and protocols required for remote operation of advanced research equipment by INL and its research partners, in preparation for constructing and operating a line item PIE facility, which will further expand U.S. nuclear energy research capabilities.

The IMCL is a General Plant Project that is expected to begin operation in 2012; DOE-ID approved Critical Decision-0 in August 2009 (PLN-3128).

3.3.2.2 *Advanced Postirradiation Examination Capability*

Although the IMCL represents a significant advance over current U.S. nuclear energy research and development capability, the transition to a full-spectrum nuclear research capability will require further expansion into a new multiprogram line-item facility capable of handling much larger samples. As the project matures and the capability is built over the next 6 to 10 years, some of the capability demonstrated in the IMCL may transition to the new facility. This would be consistent with the useful lifetime of such research equipment and would provide the newer facility with state-of-the-art instrumentation. The line item facility will be a third-generation, PIE analytical laboratory that will further consolidate and expand capabilities that function on the micro, nano, and atomic scale. Options for locating this facility within MFC are currently under review. DOE-NE approved the

Justification of Mission Need, Critical Decision-0 for the Advanced PIE Capability in January 2011[1] with Critical Decision-1 activities to be underway in FY 2012.

The facility will be designed with cooperative R&D at the core of its mission, with information technology infrastructure that allows remote operation and monitoring of equipment from in-town and off-site locations. A workshop with U.S. national laboratories, universities, and industry held in March 2011 to discuss research community needs for PIE is helping to inform the detailed design features of the capability. A similar workshop was held in the summer of 2011 with the international research community. As IMCL microstructural characterization capabilities transition to the new facility, INL will use the IMCL to consolidate mechanical testing capabilities from the FASB, HFEF, and IMCL into one location.

In addition, optimum use of MFC radiological facilities requires modifications to their missions. The pilot-scale fabrication capabilities currently in the FASB will be moved to the CESB in FY 2011 through FY 2012. Before the move, the CESB must undergo electrical power and other utility upgrades. During FY 2011 through FY 2013, the mission of FASB will continue to transition to radiological characterization and mechanical testing. Remaining capabilities in the EML will transition to FASB, and the EML will be used as a general-purpose radiological facility.

3.3.2.3 National Scientific User Facility

As the national hub for nuclear energy research, INL relies heavily on the intellectual capacity of the entire nation and the world to make breakthroughs in nuclear energy technology. Therefore, INL must invest in the development of an operational strategy that allows outside customers to access the national capability present at INL routinely and effectively. This strategy must encompass facility access, material transfers, equipment operation by visitors and INL users, release of data, visitor office space, visitor computer networking, access for non-U.S. visitors, remote operation of equipment, and research equipment staffing.

In conjunction with the current CAES building, the proposed new, leased REL would house additional high-end PIE instruments that parallel capabilities at the MFC for use by visiting researchers, enabling them to collaborate in DOE-NE research programs.

By design, the CAES research facility operates in the same manner as universities do; in the case of low risk radiological research, this approach provides a cost-effective, innovative, and productive environment for exploring fundamental science questions and executing basic research complementary to research at INL facilities. The NRC license that the CAES holds through ISU has material quantity limits sufficient for handling low-activity specimens. These factors make the CAES an ideal location for state-of-the-art research equipment. These research tools will be of sufficient quality to position CAES as a major regional center for materials characterization that can support innovative material science studies related to many technical areas − including, but not limited to, nuclear energy.

Capabilities in CAES and NSUF at REL will focus on nanoscale and atomic-level characterization, where examinations can be completed using micrograms or nanograms of irradiated specimens prepared at the MFC. The combined available NSUF analytical capabilities at REC will include an atom probe (Local Electron Atom Probe), aberration-corrected Field Emission Gun Scanning Transmission Electron Microscope, dual-beam

[1] Letter from Peter B. Lyons to NE-32, *Advanced Post Irradiation Examination (PIE) Capability Project Approval of Critical Decision (CD-0), Approve Mission Need,* Jan 31, 2011.

FIB, and scanning electron microscopy, as well as a Nano Secondary Ion Mass Spectrometer and a chemical characterization tool with parts-per-billion detection limits and 30-nanometer spatial resolution. Other capabilities will include small-sample testing, nanoindentation, Raman spectroscopy, Auger Electron Spectroscopy, and atomic force microscopy. As noted, a data link between the CAES and NSUF capabilities in REL will be needed. As new capabilities are created by the scientific community, the CAES and NSUF will be the entry point for bringing new analysis technologies to INL. Providing access through the NSUF to advanced computational capability through the Center for Advanced Modeling and Simulation will allow national research teams to supplement their irradiation experimentation and analysis with modern calculation capability. Finally, the addition of this suite of modern instrumentation will better support INL researchers in their ability to engage in fundamental research through the Office of Science.

3.4 Experimental Fuel Fabrication and Process Development

INL has extensive metallic-fuel fabrication expertise, and the laboratory is completing the capabilities needed for basic ceramic-fuel development. Additional capacity is needed to produce larger batch sizes of experimental ceramic fuel and develop ceramic fuel fabrication processes that use various combinations of uranium, plutonium, neptunium, americium, and, potentially, thorium.

Much of the existing MFC equipment and supporting infrastructure for metal fuel development is applicable and is used for fabricating and characterizing ceramic fuels, including glove box lines at the FMF, AL, and EML. Building on existing infrastructure to establish a fabrication capability for multiple fuel forms creates the best synergy with current characterization capabilities and eliminates increased duplication cost.

Implementing complete capabilities for ceramic fuel fabrication involves three independent but coordinated projects: (1) a one-to-one replacement of a glove box and fume hood to support near-term activities; (2) installation of a new glovebox line for powder processing, pellet pressing, sintering, and pellet encapsulation and welding into fuel pins; and (3) installation of a glovebox support line. The support line will allow multifunction and multiprogram research through flexible “plug-and-play architecture” that can be readily changed out, replaced, and reused, which will also make it possible to extend the fabrication process to composite fuels.

In addition, INL operates uranium glovebox lines in the FASB, primarily to develop new fuel types that will be used to convert research and test reactors from HEU to LEU fuel. The facility also supports development of fuel for other programs like prototyping of transmutation fuel fabrication processes for fuel cycle R&D. The FASB houses unique uranium fabrication capabilities such as a hot isostatic press, friction stir welding systems, rolling mills, annealing furnaces, inert welding, and uranium machining capabilities. The FASB also has a suite of instrumentation and testing equipment dedicated to characterization of fresh uranium fuel.

Because the FASB is at capacity, some of its bench-scale fuel fabrication capabilities will be moved to the CESB to allow installation of stress corrosion-cracking testing capabilities. Prior to the move, CESB must undergo electrical power and other utility upgrades.

3.5 Separations and Waste Form Research

The DOE-NE approach to science-based research incorporates theory, small-scale experimentation, and modeling and simulation. Fuel cycle research focuses on addressing the challenges associated with three fuel cycle strategies – an open, modified-open, or fully closed fuel cycle.

Implementation of two of these fuel cycle strategies – modified open and fully closed – would incorporate fuel management activities ranging from some fuel conditioning to extensive separations. This could range from conditioning of high burn-up fuel after discharge to removing fertile materials and deep burn of nonfertile materials to a fully closed fuel cycle using advanced separations technologies.

Over the last decade, DOE sponsored research on two broad categories of technologies for group separation of actinides – advanced aqueous processes and molten salt electrochemical techniques. For aqueous processes, a suite of advanced flow sheets was demonstrated at the laboratory and bench scale. Electrochemical processing is currently used to disposition fast reactor fuels and conduct research on group separation of actinides. Waste form R&D is also conducted in close coordination with the separations processes at bench and laboratory-scale, and in the case of electrochemical processing, at the engineering scale.

Some separations research will explore technologies that offer the potential for high payoff in terms of economics or performance; however, much of it will focus on developing a science-based understanding of separations technologies. This will be accomplished through tools and models developed over the next few years and validated with small-scale experiments. The specific suite of technologies explored will depend on, and will have to be integrated with, fuel development as well as an understanding of potential waste form requirements.

After 2020, DOE-NE expects to focus on continued development of specific technologies, including conceptual design for engineering-scale testing of operations and integrated processes – an essential step toward full-scale industrialization.

3.5.1 Existing Capabilities for Aqueous and Electrochemical Separations

INL has extensive research and operations experience with processing technologies at all scales. In the 1980s, INL built and operated the only U.S. second-generation aqueous reprocessing plant, and the laboratory has broad experience processing various UNF types, including aluminum, zirconium, stainless steel, and graphite fuels. INL operates engineering-scale electrochemical separations and conducts related R&D, with the following existing capabilities.

3.5.1.1 Aqueous Separations

Cold laboratory-scale testing for aqueous systems takes place at the IRC. Engineering/pilot-scale, cold surrogate testing for aqueous systems is conducted in Idaho Falls at the Bonneville County Technical Center contractor laboratory. Warm (radiotracers and glove box work) laboratory/bench-scale testing and analytical capabilities exist at CFA and MFC's AL and Radiochemistry Laboratory (RCL). Additionally, a state-of-the-art Co-60 gamma irradiator with a radiolysis/hydrolysis test loop is located at MFC FASB. The DOE's progression to integrated laboratory-scale testing will require a larger hot cell facility, waste management support systems, and enhanced S&S measures. The RAL at INTEC is one of the newest hot cells in the nation and retains the design features needed to house these transitioning, early development programs. It is suitable in the near term to provide radiochemistry capabilities to support laboratory-scale hot testing and prepare for future integrated laboratory-scale testing of advanced aqueous processes. The RAL could also serve a role in receiving experiments from ATR and passing out samples to NSUF customers.

3.5.1.2 Electrochemical Capabilities

The electrochemical separations process was originally designed to recycle short-cooled, high-fissile content fuel in a compact, remotely operated facility adjacent to reactors in a tightly coupled system, thereby avoiding extensive storage and off-site transportation. The process, often described as pyro-processing, uses electrochemical and metallurgical techniques at elevated temperature in the absence of water and other neutron-moderators, enabling processing of highly fissile materials without extreme dilution. The intent is recovery of uranium and group actinides and conditioning of the fission products into stable waste forms.

Used sodium-bonded Experimental Breeder Reactor II (EBR-II) and Fast Flux Test Facility fuel is currently being prepared for processing and disposition in engineering-scale equipment installed in the FCF at the MFC, with additional waste form equipment planned for installation in the HFEF.

Three small cells are available in inert atmosphere glove boxes for experiments with a range of materials: one in a nonradiological laboratory for investigations with surrogate materials, one in FASB for experiments with low-activity materials (i.e., depleted uranium or thorium), and a third in the HFEF for electrochemical experiments with irradiated materials. Capabilities for research beyond simple gram-scale electrochemistry (i.e., other process operations in electrochemical recycling) are not available. Improving and adapting this process requires more than simple, stand-alone electrochemical experiments at the gram scale.

3.5.2 Ten-Year End-State Capabilities

3.5.2.1 Aqueous Separations

To advance technologies and capabilities in the area of aqueous separations, INL must have integrated, shielded, wet-chemistry capabilities at both laboratory and engineering scales as well as warm engineering-scale capabilities to allow for testing with natural/depleted uranium and/or radiotracers. The RAL at INTEC is currently being prepared for transfer from DOE-EM to DOE-NE to support INL nuclear energy research missions. INL has requested that DOE-NE ask DOE-EM to remove the facility from the decontamination and decommissioning list (Clark and Hill 2010). Transfer to DOE-NE is expected by the end of FY 2011. A readiness review is planned for early FY 2012 to support separations, experiment disassembly, and several other projects for non-DOE-NE customers. DOE retains other capabilities at INTEC that could be utilized if the department chooses to pursue engineering-scale demonstration of advanced aqueous processes.

The Fuel Cycle R&D Separations program will be one of the first programs to move into the facility. This facility would be used to conduct laboratory/bench-scale testing with surrogate radioactive materials and, eventually, actual fuel. A 24-stage, 2-cm centrifugal contactor setup currently exists in the RAL hot cell that has been used in the past to support flow sheet development activities with actual waste solutions. These contactors, after refurbishment, would be available for future use to support the DOE's desired progression to integrated, laboratory-scale capabilities at INL and could transition to a reconfigurable facility for separations experiments. Bringing RAL on line and establishing warm and hot, bench-scale R&D capabilities for aqueous separations is a critical, near-term milestone (FY 2011-FY 2015) and enabler to realizing the DOE/INL vision and key objectives.

The REL facility in Idaho Falls is the target future facility for developing warm (depleted uranium and/or radiotracer) aqueous capabilities at lab-scale and then engineering-scale. This facility is expected to be operational by 2013. The Aqueous Separations and Radiochemistry Department will have a significant amount of laboratory space in this facility, which will include space for engineering-scale centrifugal contactor testing. In addition, the facility will be able to use small amounts of radioactive material.

Future processing programs will be designed to treat waste as it is made by minimizing liquid waste requiring a tank farm storage system, thereby reducing cost and environmental risk. Thus, it follows that engineering scale system tests will incorporate waste treatment to demonstrate a fully integrated operation. The Fuel Dissolution Process and Fuel Processing Facility (CPP-691) facility at INTEC have been identified as facilities that could support engineering-scale, aqueous separations demonstration and materials disposition capability in the future. Such demonstrations are critical to creating sustainable fuel cycles and achieving proliferation resistance. In addition, these capabilities could support the consolidation and treatment of a wide variety of legacy, complex-wide DOE nuclear material.

3.5.2.2 *Electrochemical Separations*

Strategic to the future success of electrochemical separations technology is an ability to investigate processes and phenomena at laboratory-scale, both individually and as an integrated process, first with unirradiated materials and then with irradiated materials. This capability exists internationally but does not currently exist in the DOE complex. It is somewhat unusual that INL possesses an operating engineering-scale facility, with significant operations and infrastructure costs, but not the laboratory-scale support structure to develop improvements. The result is that process improvements can only be investigated in the larger scale facility and are, thus, expensive and implemented only in minor increments to limit risk to operations.

A world-leading research capability in electrochemical recycling requires the capability to test the range of fundamental and applied science associated with the entire process, as well as the ability to validate the development of fundamental and integrated process models. This suite of tools would include laboratory scale versions of the set of process operations in beginning-to-end integrated process testing with uranium and small quantities of transuranics. It would also include a parallel, laboratory-scale capability in a hot cell, allowing research and demonstration with used fuel and irradiated materials.

These capabilities are necessary to improve the knowledge of individual process steps and to understand the coupled, dependent effects between process operations, which are generally the dominant technical limitations. These capabilities are necessary to develop and demonstrate an adaptation to the process for aluminum-clad fuels and to develop the process modifications to recycle uranium product to the commercial market. Preconceptual design studies will begin within the next fiscal year to evaluate options for modifying an existing radiological-capable location (i.e., available rooms on the main floor of the FCF, the third floor of the HFEF, or other locations) to house these capabilities.

3.6 Used Fuel Storage and Transportation Research, Development, and Demonstration

The withdrawal of the license application for the proposed geologic high-level waste repository at Yucca Mountain, Nevada, presents challenges and opportunities for management of UNF. As it considers new, advanced approaches to management of used fuel, DOE can take advantage of advancements in technology and approaches to innovation that have occurred in the years since the Nuclear Waste Policy Act was enacted in 1982.

In FY 2011, a Presidential Blue Ribbon Commission on America's Nuclear Future will complete a comprehensive review of the back end of the fuel cycle and make draft recommendations for a path forward. Whatever the outcome, the withdrawal of the Yucca Mountain Geologic Repository license application means that used civilian nuclear fuel inventories will continue to increase, requiring potentially larger used fuel storage pools, or increased dependency on dry storage technologies. Most likely, the U.S. civilian fleet of nuclear power plants will increase its dependency on dry storage of used fuels as the United States considers alternatives for permanent disposition.

It is anticipated that used fuel may need to reside in dry storage for 100 years or longer, pending implementation of a final disposition pathway. Presently, the U.S. NRC licenses dry storage for only 60 years, based upon a very limited set of data for fuel of moderate burn-up. More recently, industry has transitioned to higher burn-up fuels, which stress the fuel and cladding to greater levels than in the past 50 years. While the NRC allows dry storage of high-burn-up fuel to occur, additional data are needed to inform future studies of dry storage of high burn-up fuels.

Established in 2009, the DOE UNF technical focus area under the Fuel Cycle R&D program seeks to address the technical, safety, and security issues related to long-term UNF dry storage. This focus area is in the early stages of determining the type of data needed and how those data might be obtained to develop the case for long-term dry storage. At this point, it is envisioned that testing on UNF will be performed, storage technologies will be evaluated and tested, and an overall integrated system will need to be defined. Its performance will be verified and validated, and predictive models will be needed to demonstrate that the integrated system is safe for 100+ years. The material will need to be transported for final disposition at the end of that storage period. INL is the only DOE laboratory that has sufficient infrastructure to perform this mission and that is currently able to bring UNF to its research campuses for RD&D purposes.

3.6.1 Existing Capabilities for Used Fuel Storage and Transportation RD&D

This focus area has two proposed approaches to gathering the data needed to demonstrate the safety case for used fuel storage and transportation. One approach is to gather specific fuel types and conduct assembly-level tests. These tests would be conducted on both pressurized water loop and boiling water reactor fuel within a large hot cell. The assemblies would be placed within controlled atmosphere test heaters to simulate dry storage cask environments. Monitoring would be conducted in-cell and samples would be routinely taken to determine if changes were occurring. Conducting the tests within a hot cell would mean that PIE, mechanical properties testing, and analytical chemistry functions would be conveniently located nearby. INL would conduct these tests in the HFEF hot cells using existing MFC capabilities.

Another possible approach would be to assemble tests in full-sized storage casks using many metric tons of used fuel, place those casks on a storage pad, and sample/examine those casks every few years to determine changes in the fuel and cask materials. INL believes that conducting tests of this type, performed in place at vendor/utility sites, would be most appropriate for confirmatory purposes. However, should preliminary testing indicate the need to transition to large-scale tests that could be conducted at a vendor/utility site, INL is the only DOE site with an NRC-licensed storage facility and pad, located at the INTEC site (Buildings 603 and 666). These facilities and storage pad areas would be ideally suited to support full-scale cask tests.

In addition to used fuel storage RD&D capabilities, INL has a long history of analysis capabilities and technology development for many types of radioactive wastes and UNF. INL has extensive working relationships with commercial nuclear companies, cask vendors, EPRI, other DOE national laboratories, and the international research community to solve technical issues associated with packaging, storage, transportation, and disposition of these materials. Activities performed include designing and constructing large-scale demonstrations of repository, waste processing, and storage systems. This includes research to establish the technical foundation for acceptance of materials at future repositories or storage systems, developing disposition pathways for challenging materials, total system performance modeling for repository systems, materials testing, and nondestructive evaluation of cask and system performance. INL maintains a strong role in evaluating waste streams, waste forms, and processing technologies that apply to advanced reprocessing flowsheets for purposes of waste disposition. In addition, INL has a unique demonstration-scale, cold crucible melter and an off-gas treatment system that allow waste form development. With decades of experience supporting transportation of radioactive materials, INL is a key participant in the Transportation Emergency Preparedness Program and shipment and disposal of UNF and other nuclear materials.

3.6.2 Ten-Year End-State Capabilities

It is expected that INL will be conducting valuable tests on new higher burnup UNFs within 10 years, which will allow the DOE to complete the technical basis for dry storage of used fuel for 100 years or more. This work will contribute to increased R&D capabilities within the HFEF, continued development of the AL, utilization of the IMCL and advanced PIE future capabilities, and development of mechanical properties testing capabilities for highly radioactive materials. The work will support development of advanced modeling and simulation codes that will describe the way used fuel ages over time (e.g., multiphysics modeling and simulation and uncertain quotient modeling).

During the next 10 years, INL will evolve its overall capabilities with respect to used fuel disposition to meet the emerging needs of next-generation fuel cycles. This will include establishing the technical foundation for accepting materials at future repositories or storage systems, developing disposition pathways for challenging materials, total system performance modeling for repository systems, materials testing, and nondestructive evaluation of cask and system performance. Innovative treatment options for nuclear materials will place an emphasis on waste minimization, and proliferation resistance will be developed and demonstrated. Existing models for melt dynamics and melter and off-gas control for cold crucible induction melting systems will be designed and demonstrated to facilitate the production of advanced ceramic/glass waste forms systems at commercial scale to support next generation fuel cycles.

3.7 Radioisotope Power Systems

The SSPSF was commissioned in 2004 by the DOE-NE for final assembly and testing of radioisotope power systems. Existing equipment pertaining to fueling and testing was transferred from the shutdown Mound Site in Ohio to INL. With regular upgrades, the SSPSF can continue to support this mission. Additional program-funded capabilities are anticipated over the next 10 years to enable the SSPSF to apply planetary protection protocols to radioisotope power-system units and to store larger numbers of units to meet NASA needs. The DOE-NE is currently evaluating how Pu-238 production can be reestablished, and INL is among the sites under consideration.

3.8 Multiprogram Capabilities

3.8.1 Critical Infrastructure Protection

N&HS research, development, demonstration, and deployment (RDD&D) of critical infrastructure systems aligns with all 18 critical infrastructure sectors specified in the National Infrastructure Protection Plan with an emphasis on electrical power. N&HS supports government customers in partnership with utilities, industry, academia, and private organizations. N&HS RDD&D programs are aligned to enhance the security, efficiency, and resiliency of infrastructure. N&HS primarily develops and applies capabilities related to cyber security, control system security, wireless communications security, electrical power systems protection, explosives detection, and blast effects testing. Protective solutions are developed and verified through vulnerability assessments, modeling and simulation, research, engineering prototyping, full-scale testing and evaluation, and training.

Critical Infrastructure Protection RDD&D utilizes offices, including secured space, within the REC, CFA, and CITRC. Programmatic RDD&D occurs in laboratories and test facilities within dedicated labs in N&HS REC and CFA facilities, the INL Site field-testing areas for the Next Generation Wireless Test Bed, the Unmanned Arial Vehicle runway, and the National Security Test Range. Critical Infrastructure Protection electrical power grid testing routinely uses part of INL operating power grid for full scale testing. Other field-testing activities use facilities and areas across the INL Site as available at CFA, MFC, TAN, and INTEC.

3.8.2 Nuclear Nonproliferation

In alignment with the U.S. Global Threat Reduction Initiative, N&HS nuclear nonproliferation programs focus on the overall security and protection of nuclear and radiological activities and materials. These include 1) processes and materials declared as part of national and international activities, and 2) processes and materials undeclared for proliferant activities including other WMD. N&HS develops solutions addressing nonproliferation and counter-proliferation challenges inherent to the nuclear fuel cycle and future nuclear energy facilities. These solutions include providing national level capabilities for the detection and characterization of proliferant WMD signatures and observables, and capabilities to prepare our national emergency responders for incident response and recovery.

Nonproliferation RDD&D utilizes offices, including secured space, within the REC and MFC. Programmatic RDD&D occurs in laboratories and test facilities within dedicated labs in N&HS REC facilities, shared field testing areas at CITRC and CFA, and in collaboration with nuclear facilities at MFC and ATR.

3.8.3 N&HS Infrastructure

As INL provides solutions to many significant national security issues (e.g., Global Threat Reduction Initiative, National Infrastructure Protection Plan), N&HS will continue to use and enhance laboratory expertise, facilities and equipment to accomplish laboratory missions. N&HS current and future capabilities reside in unclassified and secured offices and laboratories and include broad use of Site facilities, test ranges, and the full-scale infrastructure of INL for technology RDD&D (Table 5-1). Technology capabilities focus on electric power grid, infrastructure modeling and simulation, control systems, cyber security, wireless communications, nonproliferation safeguards, nuclear and radiological emergency response, WMD detection systems, and explosives testing and mitigation. Unclassified and classified RDD&D will occur in facilities equipped with communication and network connectivity for on-site and remote command and control, computer modeling and simulation, and real-time testing and demonstration. All facility and equipment investments are utilized in developing and enhancing specific INL capabilities consistent with the nonproliferation and critical infrastructure protection mission.

3.8.4 SMC Technical Capabilities

Developed and maintained by the U.S. Army at the INL Site, SMC is a state-of-the-art facility with extensive capabilities in unique material fabrication and processing. Capabilities that the SMC Program contributes to laboratory-wide expertise include a full range of product development and manufacturing skills specific to survivability systems and threat defeat mechanisms. These include material process development, classified computer networks, prototype manufacturing, mechanical testing and evaluation, and full-scale fabrication of heavy and light armor systems. In partnership with other laboratory-wide resources, SMC has developed a broad range of expertise in the modeling and simulation of ballistic events. Using state-of-the-art software and a number of high-performance computers located throughout the complex, INL and SMC design engineers can predict, with a significant degree of accuracy, the performance of a wide range of materials. The SMC Program also has a full complement of trained and security-cleared technical support personnel that evaluate problems and develop solutions specific to threat defeat research, armor development, and production. Given SMC's vast RDD&D experience, the Program is a valuable national resource in providing a sounding board for independent technical evaluations and solutions to manufacturing, engineering, and material science challenges for a variety of programs and customers.

3.8.5 Process Engineering and Modeling Capabilities

Process engineering and modeling are central to developing next-generation energy and environmental systems. INL has developed a powerful set of tools by coupling modeling, experimental validation, and mathematical verification expertise for design and analysis of processes involving kinetics and heat and mass transfer. Recent analyses include Steam Assisted Gravity Separation for recovery of oil sands, coal-to-liquids processing to generate liquid transportation fuels from coal, and biomass to biofuels using high-temperature steam electrolysis as a carbon-free hydrogen source. At a broader scale, system-dynamics modeling techniques are being developed to analyze energy and natural resource development and use; they identify systems that address fluctuations in demand and availability of resources and energy in the short and long term. Over the last 10 years, INL has applied system-dynamics techniques to increasingly complex systems and diverse areas including nuclear fuel systems, energy feedstock systems, and regional water management.

In the next 10 years, INL will expand and refine capabilities in process engineering and modeling as use of virtual computer-aided engineering expands. Expected enhancements and extensions include the ability to perform "whole plant" analysis, including fully dynamically coupled systems simulation, which will advance complex systems process control, monitoring, and operation. For example, using this capability, INL will develop sophisticated operator-training tools to use as a virtual plant to better train plant engineers and operators. These tools will increase the speed that new technologies are transferred to the private sector. Finally, INL will apply this technology to develop even more advanced Hybrid Energy Systems that reduce carbon emissions, extend plant life, and reduce operating and maintenance costs.

3.8.6 Geoscience Capabilities

Geoscience research at INL over several decades has established capabilities that can support research to address a variety of subsurface energy and environmental challenges that the United States faces. These include DOE missions related to the environmental cleanup of cold war legacy waste, geologic hazard assessments for siting and monitoring of nuclear reactors, geothermal exploration, and developing unconventional strategic fuels in an environmentally responsible and carbon-sensitive manner to ensure U.S. energy security.

Integration of computation and experimental testing at the laboratory and field scale is currently being applied to solve challenging environmental problems, and to a more limited extent, to energy recovery. Understanding of large aquifer behavior, amendment addition for environmental protection, and remote sensing are distinguishing characteristics of INL's geoscience capabilities. In particular, INL has been working on the simulation of the coupling between fluid generation, deformation, fracturing, fluid flow, and heat transport processes in the subsurface. The advanced numerical methods and computational frameworks, developed by INL scientists to solve tightly coupled nonlinear equations for nuclear fuels applications, provide INL with cutting-edge capabilities that are being combined with innovative models for the deformation and fracture of geomaterials. Because of the need to validate and verify these rapidly evolving computer codes, INL has developed capabilities for conducting highly monitored, specialized experiments. Feedback between experiments and modeling created by the close integration of computation, laboratory testing, and fieldwork has put INL at a distinct competitive advantage relative to organizations that focus solely on simulations or experiments.

Computer simulations made by INL scientists have become progressively more sophisticated with the rapid growth of computational capabilities. Innovations in creating physically based numerical codes of tightly coupled subsurface processes have placed INL at the forefront of this research area. Within the next 10 years, advanced high-performance computing capabilities will enable researchers to simulate physical, chemical, and biological coupled processes accurately. At the same time, advancing experimental capabilities will provide information and data for calibrating the models. These advancements in computational and experimental capabilities will make it possible to address a full range of energy and environmental challenges that are not currently understood. Important applications for this new capability include in situ recovery of unconventional fossil fuels, engineering enhanced geothermal energy systems, and geologic sequestration of carbon dioxide.

3.8.7 Chemical Conversion and Separations Capabilities

Technologies now under development will enable the next generation of chemical conversion processes, which will be able to create value-added fuels and chemicals from readily available materials such as nonfood biomass and captured carbon. These include environmentally advantageous processes that minimize energy use and waste generation while increasing efficiency. INL's applied and exploratory battery research laboratory is developing advanced electrolyte and electrode technologies. Critical technologies that support this objective include steady-state catalysis, thermal and nonthermal plasma processing, extremophilic organisms capable of performing chemistries in harsh environments, super critical fluid chemistry, and targeted chemical separations. INL is currently leveraging existing technologies associated with steady-state catalysis, control systems, and thermal plasma processing to provide advanced materials.

Laboratory-directed research and development (LDRD)-funded research is building and solidifying capabilities associated with extremophile biotechnology, supercritical chemistry, and electrochemistry.

Next-generation chemical synthesis harnesses the functionality of advanced solid catalysts and high performance extremophilic organisms to perform chemical conversions. Examples include the reduction and activation of surplus carbon dioxide into target fuels and chemicals, utilization of lignocellulosic materials for ethanol production, and the reaction of unwanted organic materials, such as aromatics, into fuels by low-temperature plasma processing. Enabling chemical conversion technologies are advanced nanoscale catalyst regeneration processes using supercritical fluids and chemical separations using novel synthetic membranes that operate in thermal and chemically demanding environments.

During the next 10 years, INL's existing expertise will be expanded in several areas, including the following:

- Advanced, nanosized catalytic materials produced by supercritical chemistry
- Alternate catalytic materials to replace catalysts based on platinum and rare earth elements
- Development of advanced, high-temperature polymer and membrane materials to replace energy-intensive separations and perform selective separations in harsh environments
- Electrocatalyst research for beneficial uses of carbon dioxide and low-waste production of unique chemical compounds
- Separation strategies for recycling and recovery of rare earths and other strategic and critical materials
- Advanced electrolyte and electrode technologies.

3.8.8 Process Characterization and Monitoring Capabilities

Improving the efficiency of feedstock and energy utilization requires better understanding and control of chemical processing and energy delivery systems. INL's focus is on non-steady-state and cyclic systems and integration of energy sources to produce energy and products in a cost- and energy-efficient manner.

INL's integrated vehicle and grid-energy storage demonstration and testing laboratory is a regional and national RD&D resource for DOE, DOD, other federal agencies, and industry. The exploratory and applied battery research and diagnostic testing conducted at this laboratory includes thermodynamic life analysis as well as advanced physical and materials modeling. INL is coordinating electric-drive vehicle demonstration and testing projects with private companies and city, county, port, and environmental agencies. Onboard data-loggers, cellular modems, and GPS units will transmit information from these vehicles to INL researchers for analysis and reporting to stakeholders.

The Hybrid ESL conducts design, analysis, and experimental testing of integrated systems that produce both energy and chemical products and are capable of rapidly adjusting the production rates of either to meet daily fluctuations in energy services production and demand. INL's focus is on understanding the heat, mass transfer, and kinetics and providing intelligent monitoring and control for these non-steady-state systems.

Biomass feedstock research is developing an engineering design, analysis model, and conceptual strategy for a feedstock supply system that can sustainably provide uniform-format lignocellulosic biomass at a commodity scale within national cost targets. This work requires developing processes that address the complex chemical and physical properties of biological feedstocks. The current focus is on residues from agriculture and silvaculture. INL's substantial experience in the decontamination of DOE facilities has been harnessed for infrastructure decontamination. INL is recognized for its engineering-scale evaluation and monitoring of innovative decontamination techniques.

During the next 10 years, INL will expand its process characterization and monitoring capabilities. The vehicle and grid-energy storage demonstration work will include testing and monitoring of Smart Grid concepts for vehicles and develop improved models for characterization and prediction of battery health. The Hybrid ESL will develop demand-matched integrated production of energy and chemical products and real-time monitoring and control of complex integrated non-steady-state industrial systems. The biomass feedstock research will expand the range of biomass types processed (e.g., algae), improve the economics of production through enhanced process control, and enhance the deployability and reliability of the systems. INL's infrastructure decontamination expertise will be expanded to address water security threats; this work will include modeling and sensor development to meet the water security needs identified by the Environmental Protection Agency for water supply and sewer systems.

3.8.9 Materials Characterization and Evaluation Capabilities

Materials characterization and evaluation research includes understanding the behavior of materials and evolution of material properties in a variety of environments with emphasis on materials for present and future-generation energy systems. A comprehensive suite of tools has been developed to evaluate metals and lightweight materials under relevant high-temperature, chemically corrosive, high-radiation, high-stress environments to understand creep, creep-fatigue, stress corrosion cracking in metals, and mechanical and thermal properties in both metals and carbon-based materials. The capabilities are also applicable to a broad set of materials.

INL research is focused on developing the next generation of sensors for noncontacting inspection of energy-production-systems materials operating in harsh environments, including radiation environments. The methods include laser-based measurements of thermal, acoustic, and mechanical properties of materials in a range of local spatial scales from nanometers to bulk properties. Development includes systems that measure fundamental properties for use in validating modeling results and applied techniques that will be used on materials under real-world conditions.

Much of this capability has related to the development of advanced nuclear reactors. In 10 years, materials characterization and monitoring will cover a much broader range of energy-relevant materials and processes. There will be growth in materials characterization for both nuclear and nonnuclear energy systems. Work developing new materials to replace those that become scarce, difficult, or prohibitively expensive to produce will require an understanding of lightweight materials for transportation efficiency, as well as understanding and developing new materials for a variety of modern devices and materials associated with energy production.

INL will adapt and develop capabilities to characterize materials on smaller-length scales and in more challenging environments, and will focus measurement technologies on nanoscale thermal transport (for nuclear fuels and thermoelectric applications), ultrafast thin film metrology, and in-pile characterization of nuclear material, including application of new nondestructive evaluation capability for online monitoring.

3.9 Supporting Capabilities

Advances in scientific computing over the last 40 years have made it possible to simulate scientific systems at a scale from smallest to largest, and to a much greater degree of fidelity than previously possible. Modeling and simulation is a powerful tool that can be combined with experimental data to reduce design and testing time, uncertainties associated with models, and the burden on infrastructure.

U.S. capabilities in high-performance computing are evolving rapidly, and numerous computers are available within the laboratory to support modeling and simulation. INL would seek access to additional, leading-edge capabilities, as needed.

INL's strategy is to continue to apply and invest in trailing-edge scientific computing capabilities (i.e., computers that are among the top 100 in the world in computational speed for modeling, simulation, and visualization). For example, INL's high performance computing center currently supports INL fuel development and other reactor development needs, including those of other national laboratories and users.

INL also provides access to a variety of used fuel types, both commercial and DOE-owned, as well as both NRC-licensed and DOE-regulated storage configurations/systems. These capabilities make it possible to support the broad range of nuclear energy RD&D on used fuels and materials, including advanced separations RD&D and evaluations of storage systems and fuel conditions after storage, which contribute to the technical bases necessary for extended storage. The January 2011 MOA between the State of Idaho and DOE is also a critical supporting capability for nuclear energy RD&D at INL (State of Idaho/DOE 2011). Setting the conditions under which INL can receive research quantities of commercial used fuel for examination, testing, and storage allows INL to retain library storage of the used fuel for future research uses, and is a necessary step in transforming the laboratory to a user-facility environment.

4. IDAHO NATIONAL LABORATORY ENABLING CAPABILITIES

INL maintains two enabling capabilities that support mission-driven core capabilities and allow them to function most effectively and maintain their mission-related focus: (1) utilities and supporting infrastructure and (2) nuclear-materials management.

4.1 Utilities and Supporting Infrastructure Capabilities

Supporting infrastructure consists primarily of real property assets (i.e., buildings) that support the laboratory's core R&D capabilities and mission critical facilities. INL real property infrastructure includes 531 DOE-NE-owned and operating real property assets. These assets include 291 operating buildings[2] totaling 2.3 million ft^2 with a total resource property value of $1.19B, and 240 OSFs that have a total replacement property value of $940M. OSFs include real property assets that are 1) not buildings (i.e., bridges, communications towers, roads, railroads, etc.) and 2) site utility systems that collect or distribute utility services (i.e., steam, electricity, compressed gases, liquid waste streams, natural gas, and water).

As part of the 10-year vision for sustainment, INL is committed to implementing a proactive, mission driven, and risk-based approach to sustain INL infrastructure in a manner that ensures mission-supporting infrastructure is in a mission-ready state. The INL sustainment strategy focuses on (1) maximizing asset service life, (2) revitalizing assets at the optimum time in their life cycle, and (3) upgrading assets to support the mission needs of the R&D programs.

[2] *The term "Operating Buildings" includes all operating buildings and trailers that have a Facility Information Management System status of operating (status codes 1, 2, and 6).*

The following are key elements of INL's strategy for sustaining INL utilities and supporting infrastructure:

- Effective management of the capabilities provided by enduring assets
- Investment in new supporting infrastructure to continue to reliably support current missions and make new mission capabilities possible
- Implementation of sustainability concepts into enduring and new infrastructure assets to enhance energy and water efficiency and improve employee health and productivity
- Efficient and timely disposition of nonenduring assets.

4.1.1 Management of Enduring Assets

Enduring assets are mainly support buildings and utilities that serve the long-term needs of INL missions. INL applies a risk-based approach to evaluate and prioritize investments based on the role and importance of each asset in achieving INL missions. Also critical to successful and efficient implementation of this approach is the application of engineering and facility management principles toward assuring a full understanding and mitigation of the risk that an unplanned equipment failure could have on worker safety, environmental protection, and mission accomplishment. The strategy for managing enduring assets is as follows:

- **Sustain** assets in good working order by performing condition monitoring, condition assessment surveys, proactive replacement of aging equipment at the optimum time, incorporation of sustainable design principles, and timely repair if an unexpected failure occurs
- **Revitalize** assets so that they remain relevant to mission needs and are reliable, modern, sustainable, and cost-effective to operate and sustain throughout their life cycle

- **Enhance** existing assets to incorporate sustainability principles, support expansion of existing capabilities, and development of new sustainable capabilities to support changing missions. Appendix D describes the INL strategy for achieving DOE's goals for enhancing the sustainability of INL utilities and supporting infrastructure.

4.1.2 Disposition of Nonenduring Assets

Nonenduring assets are primarily buildings that are no longer needed, no longer capable of performing their intended function, or no longer economically justifiable to support current and/or future INL mission needs. The strategy for managing nonenduring assets is to minimize long-term cost liabilities, optimize space utilization, identify and control legacy hazards to worker safety and the environment, and reduce the overall INL footprint. The process for disposition of these buildings is as follows:

- Declaring nonenduring assets as excess real property
- Vacating the asset, stabilizing hazards and hazardous materials, and taking steps to minimize the risk and cost of long-term stewardship activities
- Controlling access and monitoring the asset for degradation and/or changing hazardous conditions
- Demolishing nonradioactively contaminated buildings
- Transferring radioactively contaminated buildings to DOE-EM for final disposition.

Appendix B, Section B-3, describes INL's plans for disposition of nonenduring assets.

4.1.3 Investment in New Supporting Infrastructure

This TYSP identifies the capabilities needed to accomplish INL's 10-year vision and the supporting infrastructure resources required to enable the new capabilities. For example, establishing world-leading PIE capabilities at INL will require revitalization and expansion of the underlying utilities (e.g., electrical supply, sewage collection, and data transmission) and support facilities (e.g., office and relevant laboratory space) at MFC. Appendix B, *Prioritized Resource Needs*, lists the specific infrastructure investments needed to achieve the vision identified in the TYSP.

Appendix A contains additional details on how INL plans to manage real property assets effectively, including:

- A description of the maintenance strategy to achieve long-term, efficient operation of all new infrastructure assets
- A capability assessment that evaluates the current conditions of the supporting infrastructure and utilities at INL complexes and defines investment and implementation strategies
- Plans for managing enduring assets, nonenduring assets, and new supporting assets.

4.2 Nuclear Material Management Capability

The INL mission requires access to a variety of SNM. Responsible management of these materials is fundamental to assuring the availability of nuclear material needed. This requires appropriate facilities and the S&S capabilities to store and handle Safeguards Category I quantities of SNM. These facilities and capabilities are unique assets that not only enable INL to perform its missions but also to attract other R&D organizations that need to use them.

INL's overall nuclear material management strategy is to obtain/retain and make accessible materials needed to support R&D, dispose of unneeded materials to reduce liabilities, and ensure the safe and efficient handling and storage of nuclear materials. The following facilities and capabilities are key elements of this strategy.

4.2.1 Fuel Manufacturing Facility Special Nuclear Material Glovebox

INL is currently developing capabilities (e.g., gloveboxes and process equipment) to treat a significant portion of its surplus of unirradiated enriched uranium materials, including sodium-containing materials, for reuse or recycle. Installation of the new SNM Glovebox in the FMF began in May 2011, with initiation of readiness activities to begin in September 2011.

4.2.2 Unirradiated Fuel Storage Building Reactivation

Efforts are also underway to establish storage at INTEC for LEU currently stored at MFC that resulted from the sodium-bonded fuel disposition campaign. The near-term driver for this effort is for storage of the LEU product in support of cleaning out the TREAT warehouse for TREAT restart activities. The plan is to refurbish the 4,600 ft^2 Unirradiated Fuel Storage Building (CPP-651) at INTEC in FY 2012 with NNSA funds appropriated for this purpose in FY 2008 ($4.9M in operating funds and $14.7M in capital funding). This facility previously stored similar amounts of SNM and is considered an ideal location for storage of the LEU disposition product. The facility, along with surrounding buildings that could be used as construction staging areas or for material storage, would be isolated from the rest of INTEC by a property protection fence.

All sodium-bonded UNF requiring treatment will be treated; UNF not needing treatment will be kept in long-term storage. Long-term storage and/or treatment capabilities will be established to support continued generation of UNF from ATR. No decision has been made with respect to material located in the ZPPR facility.

4.2.3 Remote-Handled Low-Level Waste Disposal Facility

INL is working to establish remote-handled LLW disposal capability to replace the current disposal operations in the Subsurface Disposal Area located at the Radioactive Waste Management Complex. The new Remote-Handled LLW Disposal Facility, a hazard category 2 nuclear facility, was submitted for Critical Decision-1 approval in March 2011. The facility will consist of an in-ground vault area with supporting infrastructure (i.e., roads, security and access control structures, administrative building, maintenance building, and fire suppression).

Nuclear programs conducted at INL generate remote-handled LLW. These programs include spent nuclear fuel handling and operations at the NRF and operations at the ATR Complex. New programs and the segregation and treatment (as necessary) of remote-handled scrap and waste currently stored in the RSWF at the MFC also generate remote-handled LLW that requires disposal.

Completion of the Remote-Handled LLW Facility, a $90M congressional line item, capital asset project, joint-funded by DOE-NE and Naval Reactors, will yield the following benefits:

1. Provide remote-handled LLW disposal capability, thereby minimizing potential impacts on existing INL and NRF operations
2. Allow continued processing of Navy fuels at the NRF in accordance with the Idaho Settlement Agreement (State of Idaho 1995; State of Idaho 2008)

3. Provide remote-handled LLW management and disposal consistent with DOE Order 435.1, *Radioactive Waste Management*

4. Provide a consistent, site-wide waste management system, reducing requirements to identify and implement cost-effective waste management options.

4.2.4 On-Site Transportation Road

The capability to transport nuclear materials on Site roads from INTEC, NRF, and ATR Complex to nuclear programs and operations at the MFC is a key element of the INL nuclear material management strategy. A new 13-mile, single-lane on-site gravel road between paved roads at the MFC (Taylor Blvd.) and the CITRC (Jefferson Ave.) areas will provide this transportation capability. This road will be completely on government land avoiding the problems associated with transportation of these materials on public highways. This project is managed by DOE-EM and funded under the American Recovery and Reinvestment Act. The new road will be constructed in 2011.

5. INVESTMENT STRATEGIES

Budget realities necessitate a strategy that enhances existing capabilities, builds upon existing infrastructure, and limits major new builds to those investments needed to achieve world-leading capability. INL bases its investment strategy on a business case that recognizes the economy and efficiency of investing in existing concentrations of capabilities that are relevant to the DOE-NE mission and to INL's multiprogram mission.

5.1 Defining Investment Needs

As discussed in Sections 3 and 4, INL retains a set of core nuclear energy and multiprogram capabilities dedicated to R&D mission goals. INL has assessed and identified investments needed to enhance its core capabilities to support the multiprogram mission. Through strategic plans and capability assessments, INL is establishing a strategy for developing these capabilities. Table 5-1 summarizes the mission-critical infrastructure strategy and briefly describes gaps between current conditions and the essential capabilities needed to achieve mission goals.

The strategies over the next 10 years for PIE, ceramic-fuel fabrication, and advanced separations and waste forms research to support DOE-NE mission needs include limiting the size and number of new line items proposed, and building R&D capabilities in a few smaller facilities such as the IMCL. There is also a focused sustainability effort for the ATR.

In addition, DOE-NE approved the mission need for the Resumption of Transient Testing of Nuclear Fuels Project in December 2010. DOE-ID, through the NEPA process, is investigating restarting TREAT as one of three potential alternatives to meet this mission need. TREAT is an attractive alternative as it is the only facility in existence specifically designed to test prototypic sized reactor fuel pins and bundles under transient overpower accident conditions. TREAT has been maintained in good condition since it last operated in 1994. If chosen as the preferred alternative, it would require refurbishment and restart as an operations-funded nonacquisition project exceeding $5M. While it would not be a line-item project, it would be managed in accordance with the principles of DOE Order 413.3B, *Program and Project Management for the Acquisitions of Capital Assets*.

With respect to INL ancillary missions, the infrastructure needs identified for N&HS strategically align with INL's nuclear energy mission. It provides the proving grounds and equipment, along with the classified and secure offices and laboratories needed for performing the RD&D to enhance the security and efficiency of our nation's critical infrastructure including energy systems, nuclear reactors, and transportation systems. INL also provides a similar infrastructure to support nuclear nonproliferation by securing and protecting nuclear and radiological activities and materials.

INL is also performing RD&D in support of a secure energy future, including RD&D on hybrid energy systems, and addressing challenges of energy demands associated with water and environmental sustainability. This mission relies on a number of facilities on the REC Campus. INL is consolidating capabilities and addressing growth issues by leasing two new facilities, the ESL and the REL. The strategy to address this mission identifies these facilities along with the equipment needed to establish essential capabilities needed for RD&D.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Irradiation-Thermal			
ATR – Steady-state thermal spectrum irradiation facilities within ATR: - Static capsule - Flux trap - Instrumented-lead test capability.	**World-leading irradiation capabilities** – Comprehensive fuels and materials irradiation utilizing a number of capabilities, including additional in-pile tubes, high fast-to-thermal neutron ratios, and instruments/ capabilities extended to both simpler and more complex irradiation facilities. Full-loop test capability with transient testing, sophisticated in-pile instrumentation.	**Reactivation of Loop 2A** – Additional resources, personnel, and material (e.g., reactor fuel) to operate and maintain new capabilities. Additional loops that can simulate boiling-water reactor and fast reactor operating conditions (if needed). Additional sophisticated instrumentation that can be applied to a wider variety of tests.	Reactivation of Loop 2A to be completed in FY 2012.
ATR reliability - ATR availability – ATR availability at risk.	**Sustainment of ATR reliability through maintaining material condition –** Replacement maintenance activities are ongoing. Continuous improvement through condition-based maintenance program.	Enhancements for improving reliability and responding to severe accident analyses are under consideration.	INL is evaluating submission of a justification of mission need analysis for this effort in FY 2012.
Test train assembly capability – Encapsulation of test specimens and assembly of test train components into fully instrumented test trains, including welding and brazing activities.	**World-class, laboratory-scale, integrated process irradiation capabilities –** The ability to irradiate and analyze tests; test assembly capabilities to reconfigure tests following analysis and reintroduce R&D into the ATR in a comprehensive process for irradiation and testing.	Completed.	Operating.
Out-of-Pile Testing			
Separate-effects testing – None. **Advanced instrumentation development capability** – diffuse effort. **Advanced materials development capability** – None. **Nuclear physics** – diffuse effort.	**Innovative science-based separate-effects testing** – The science-based approach to nuclear fuels and materials development requires novel data and innovative measurement techniques that are synergistically bound to the modeling effort; the right environment for these measurements is essential for rapid and broad development. The variables that impact the performance dynamics must be controllable, variable, and measurable and as independent from one another as possible, to insure the widest range of conditions are understood and incorporated into the models. Minimizing measurement and environmental uncertainties along with direct sample access and variable separate-effect capability (which are not easy to do during in-pile testing) will provide an optimized laboratory in a science-based approach to understanding the fundamental phenomenon that impacts performance during irradiation.	**Unique beginning-of-life testing** environment is critical for understanding the massive reorganization of the fuel matrix during the first few hours of irradiation. Separate Effects experimentation will be needed to fully understand the impact of current and future irradiation environments. **Advanced instrumentation** will be needed to provide 3-dimensional, high-resolution (grain-level and smaller), in-core measurements. **Advanced materials** development is key to not only fabricating science-based samples and targets but critical to developing the radiation-hard instrumentation needed for high-resolution in-situ measurements. **Charged particle irradiations** will be necessary as an accelerated surrogate aging technique on samples and detector materials.	INSIGHTS (Intense Neutron Spectra with Independent Gammas, Hydraulics, and Temperature Separate-effects) is under consideration in collaboration with ISU and the Idaho Accelerator Center. Design studies and simulations have been carried out and initial testing will take place in the next fiscal year. An accelerator has been purchased to develop the neutron source and charged particle irradiation capabilities. Advanced Materials fabrication capabilities are being developed in collaboration with ISU with NEUP support.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Out-of-Pile Testing (continued)			
		Nuclear physics. Uncertainties in the nuclear data propagate into uncertainties in integral fuel and materials behavior. Precision differential cross section measurements, along with advanced correlated fission yields measurements will provide the best underlying science in performance calculations.	
Irradiation-Transient			
TREAT – Air-cooled, thermal, heterogeneous test facility, with a 1.2-m core height, designed to subject reactor fuels and structural materials to conditions simulating various types of transient overpower and undercooling representative reactor situations; currently in standby mode.	**Transient testing** – Transient testing capabilities to establish the U.S. as the world leader in nuclear fuel testing and experimentation under transient conditions: including the capability to test a variety of fuel systems in prototypic transient conditions using advanced testing and diagnostic methods. Includes full service transient experiment services, including loops for multiple test configurations and state-of the-art instrumentation and in-situ characterization.	**Operation** – Refurbish and restart TREAT systems, including HFEF support infrastructure and R&D on advanced in-situ measurements. – TREAT control system and data acquisition – Upgrade hodoscope temporal resolution – Design and build new test loops – Upgrade transient testing results analyses capabilities.	The Department requested funds in FY 2012 for planning, gathering information, and exploring future options. Activities may include alternative analysis and environmental studies.
HFEF – Nuclear facility, cask receipt, front- end PIE, NDE (NRAD), size reduction, mechanical testing, and disassembly. Some of the equipment used in HFEF for preparing transient tests using already irradiated fuels exists but hasn't been used in some time.	**World-leading consolidated test preparation and PIE capabilities** – Comprehensive fuel and material postirradiation characterization and analytical capabilities, including nuclear, radiological, and nonradiological environments (see PIE capabilities) complemented by capabilities to prepare tests to be deployed in TREAT using preirradiated fuel.	**Obtain equipment** needed to handle pre and posttest assembly and disassembly of transient experiments in HFEF. **Other PIE services**, as discussed under PIE Capability.	Equipment is expected to be programmatically funded and will depend on the nature of the experiment.
Irradiation-Fast Spectrum			
Fast-spectrum test capability – None with the exception of being able to increase the fast to thermal neutron ratio via filtering in ATR.	**Fast-spectrum test irradiation capabilities.**	Fast-spectrum test capability needed for fast-spectrum reactor fuels and materials testing.	No near-term plans.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
PIE and Characterization			
HFEF Hazard Category 2 nuclear facility – Cask receipt, experiment disassembly, nondestructive examination, size reduction for shipment to satellite facilities, and mechanical testing.	**World-leading consolidated national PIE capabilities** – Complete macroscopic, microscopic, nanostructural, thermal, chemical, and mechanical characterization comparable to a major research university, but for use on irradiated fuels and materials. Facilities that house modern analytical equipment and allow efficient use of this equipment by a wide range of users from national laboratories, academia, NRC, and industry.	**Unique-in-the-world analytical instruments and technology** – Access to innovative tools that are able to handle highly radioactive fuels and materials. **New facilities** – Purpose-built, to house sensitive analytical instrumentation.	HFEF equipment is being retrofitted to state-of-the art status for baseline PIE capabilities.
EML – Radiological characterization facility housing basic sample preparation capability and three electron-beam microscopes. **AL Hazard Category 3 Nuclear Facility** – Chemical and isotopic analysis, and thermal characterization of irradiated and unirradiated materials. **FASB** – Fuels fabrication laboratory that also houses basic characterization and testing tools. **CESB** – Radiological storage warehouse. **CAES MaCS** – High-end equipment for characterization of low-level and nonradioactive materials. Nucleus of advanced capabilities. **PIE instruments** – Basic and state of the art equipment installed in available laboratory space that is not suitable for routine examination of high activity materials. Aging and need to be replaced.		**IMCL** – Nuclear facility housing core characterization capability in shielded cells for full-spectrum analysis of irradiated fuels and materials. Micro and nanoscale R&D with limited mechanical testing (final location is new PIE Line-Item Building and then mechanical equipment from HFEF installed in IMCL). **Advanced PIE –** Nuclear facility R&D hub expands and further consolidates advanced PIE capability: – Advanced fuel characterization – Nuclear material characterization – Bench through laboratory-scale process demo – Reconfigurable to meet DOE needs for next 40 years. **DOE-NE NSUF (Housed in REL)** – Provides front-end for the NSUF gateway. Expands CAES ability to house high-end PIE instruments that mimic capabilities at MFC, and will link to MFC facilities to allow remote analysis. Accessible to visiting researchers. **FASB** – Transition to a lab-scale radiological characterization and testing laboratory. **CESB** – After IMCL is operational, transition to a bench-scale radiological characterization and testing laboratory. Replace old characterization equipment with state-of-the-art characterization equipment. **Obtain equipment** for complete macroscopic, microscopic, nanostructural, thermal, chemical, and mechanical characterization.	IMCL is in final design. Contract awarded for construction in FY 2011. To be completed by the end of Calendar Year 2012. Advanced PIE – Initiate alternatives analysis in FY 2012, followed by conceptual design in FY 2012 and preliminary design in FY 2013/2014. NSUF capabilities being incorporated into the redefinition of REL, completion planned for 2013. FASB – Underway; several pieces of RERTR equipment have relocated to CESB. CESB conversion project authorized, completion planned for completion in FY 2013. Nuclear Operations is deinventorying the waste to reduce the facility to less than Hazard Category III threshold quantity and allow downgrading to a radiological facility.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Nuclear Fuel Development			
FASB – Radiological facility, basic DU and EU metallic and dispersion fuel fabrication, and characterization at lab and bench scale (mostly plate design). **FMF** – Hazard Category II facility, basic contact-handled transuranic metallic and ceramic fuel fabrication at lab scale (pin design). **AL** – Nuclear facility, contact-handled transuranic metallic fuel fabrication (pin design) within the casting lab glovebox. **CAES** – DU ceramic fuel fabrication at lab and bench scale (in development).	**World-leading, complete, and consolidated fuel fabrication capabilities** – Comprehensive fuel development capabilities spanning most types, scales, and hazard levels of nuclear fuel. **CESB** – Fundamental process testing and fabrication of uranium fuels. **FMF** – Flexible and reconfigurable shielded SNM glovebox capability for laboratory and bench scale ceramic and metallic fuel development.	**Enriched uranium capability for all fuel types** – Consolidate and expand EU and DU comprehensive fabrication and characterization capabilities in FASB (lab scale) and CESB (bench scale) for all fuel types. **Contact-handled transuranic ceramic and metallic fuel types** – Expand FMF flexible and reconfigurable shielded glovebox capabilities to include lab and bench-scale for ceramic and metallic. Expand AL bench-scale characterization capabilities. **Remote-handled and contact-handled transuranic ceramic and metallic fuel types** – Hot cells with capabilities to remotely fabricate and characterize ceramic and metallic fuels at lab and bench scale, including the capability to refabricate fuel specimens for continued irradiation experiments. **Remote-handled and contact-handled transuranic ceramic and metallic fuel types** – Hot cells with capabilities to remotely fabricate and characterize ceramic and metallic fuels at engineering and lead test assemblies.	FMF SNM glovebox completed in 2011. FMF glovebox support-line project authorized, completion scheduled for 2012. SNM Glovebox being installed in FMF, with the readiness activities starting in September 2011-operational the first quarter of FY 2012.
Electrochemical Separations			
Electrochemical separations development – **FCF (engineering scale separations)** – First generation electrochemical equipment for treatment of used sodium-bonded EBR-II and FFTF fuel. **HFEF** – Single, small electrochemical cell with limited access. **FASB** – Single, small electrochemical cell for radiological testing with limited quantities of radioactive materials. **Engineering Development Laboratory** – Single, small electrochemical cell for cold surrogate work.	**Complete treatment capability for multiple fuel types** – The ability to completely disposition used EBR-II and FFTF fuel, as well as the ability to disposition-limited quantities of other fuel types–such as small quantities of fuel brought in for PIE and other programs. The ability to return recovered uranium to the commercial market is also a key future capability. Lab-scale cold, warm/TRU R&D capabilities. Integrated/enhanced engineering-scale capabilities. Develop integrated modeling and simulation expertise.	**Electrochemical technology development capabilities** –Additional warm and hot laboratory scale testing capabilities are necessary to test adaptations to first generation process for additional fuel types. **Improved uranium product** – Modifications to the first generation process equipment are necessary to achieve form and purity required for commercial uranium market. **Inert glove boxes** installed in radiological facilities.	

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Aqueous Separations			
Aqueous separations development **REC Laboratory and Bonneville County Technical Center** – cold surrogate work in Idaho Falls. **RCL/MFC**– warm, radiological R&D. **FASB** – warm radiological R&D. **CFA-625** – warm radiological R&D.	**Integrated world-class, advanced aqueous capabilities –** Laboratory and engineering scale capabilities via radiological and nuclear facilities dedicated to separations (i.e., RAL, REL). Also integrated engineering-scale capabilities with surrogates and nuclear materials. Ability to perform integrated process demonstrations at engineering-scale as well as process various SNM. Integrated modeling and simulation expertise. Science-based research capability closely coupled with R&D experiments.	**Hot cell integrated and shielded R&D separations capability** at lab/bench scale and engineering scale, RAL for expanded hot bench scale and early transition to initial engineering scale that could continue to expand in a phased manner via CPP-666 and CPP-691 at INTEC. The RAL will also be used for separations research.	RAL is expected to be transferred from DOE-EM to DOE-NE by the end of FY 2011. A readiness assessment is planned for early FY 2012 in order to support separations, experiment disassembly, and other projects at RAL.
Waste Form Development			
Waste form development **HFEF** - Warm/TRU, hot R&D and processability capabilities **MFC** - Metal waste form equipment and some ceramic waste form equipment for treatment of used sodium-bonded fuel at MFC. HIP and Cold Crucible Induction Melting.	**Waste form development capabilities** – Unified/ consolidated capabilities, techniques and expertise in waste forms that can be leveraged for multiple programs - Integrated modeling and simulation expertise - Hot engineering and pilot-scale R&D capabilities at INL - Maintain HIP capabilities.	Facility space, equipment, and expertise dedicated to Waste Form R&D (furnaces, melters, dissolution apparatus, analytical equipment).	
Used Fuel Storage Research			
At planning stage	**A scaled used fuel storage test with on-line instrumentation, with strong ties to advanced characterization and PIE capabilities and to modeling and simulation.**	This capability currently does not exist to justify extended storage (up to 120 years) for used fuel. Higher burnup fuel that may be used in the future result in additional gaps in the used fuel storage licensing.	An integrated test plan will be developed and issued in FY 2012.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Nuclear Energy Science and Technology Gateway			
CAES – Provides office space and laboratory space for visiting scientists with primary focus on the Idaho universities.	**World-leading nuclear technology R&D Capabilities** – Comprehensive fuel and material characterization and analytical capabilities, including nuclear, radiological, and nonradiological environments. Unique facilities for conducting nuclear physics experiments. Space for high-energy experiments. **Gateway for visitors** – Portal for hosting visitors, providing space for collaboration, analyzing nonradioactive and lightly radioactive materials, and conducting nuclear physics measurements.	**NSUF capability in REL** – High-end PIE instruments that parallel capabilities at MFC; add unique space for nuclear physics and high-energy experiments; accessible to visiting researchers. Collaboration space.	REL is currently planned for occupancy in FY 2013.
Critical Infrastructure Protection – Electric Test Grid			
Operational site electric grid – With limited testing and technology insertion capabilities; testing increases vulnerabilities of site activities to power outages.	**Full-scale, isolatable and reconfigurable power grid** – Able to meet high impact DOD, DOE, DHS missions and industry R&D needs; a unique national asset.	Phased grid enhancements: reconfigurable substation, Smart Grid infrastructure components and monitoring systems, generation/ energy storage sources, adjustable loads, data/ communications and grid control systems (fiber, wireless) and test support areas.	
Critical Infrastructure Protection – Real Time Power System Modeling and Simulation			
High fidelity grid simulators and infrastructure analysis tools – For customer specific analysis.	**Expanded high- fidelity grid simulators and infrastructure modeling tools** – To support operator training, reliability/resiliency/cyber security modeling, smart grid models, DOD/ other government missions.	Additional grid simulators/ infrastructure modeling tools and additional secure data communications connectivity.	
Critical Infrastructure Protection – Control Systems Security Analysis and Testing			
Industrial Control System Cyber Emergency Response Team (ICS CERT) – Providing national-level support to DHS through the Malware laboratory and control system testbeds with worldwide-deployed vendor equipment.	**Expanded ICS-CERT capabilities** – Including 24/7 support, full classified network connectivity and data feeds. Expanded INL-owned control system test beds with connectivity to test ranges (classified/ unclassified), hardware-in-the-loop control system testing and modeling and simulation capabilities.	Facility space to support expanded ICS-CERT capabilities, access to classified networks and secure communication links (including VTC). Additional control system equipment with connectivity to ranges.	

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Critical Infrastructure Protection – Wireless Communications			
Open range, field-scale cellular system test bed and network operations center; client training, system maintenance and staff supported with various facilities at CITRC and CFA. REC classified and unclassified offices and shared laboratories.	**Wireless Communications Research and Testing Complex** – Supporting multiple, independent full-scale research, development and demonstrations of next generation cognitive communications, capabilities to support national spectrum sharing research and testing.	Wireless Control Center Facility at CFA supporting staff, training, laboratories, testing operations, and system upgrades. R&D laboratories supporting bench-scale prototyping, anachoic chamber signal analysis, indoor RF characterization. Robust classified networks integrating Idaho Falls communication laboratories, INL range testing systems, and off-site clients.	
Nuclear Nonproliferation Safeguards and Security - Nuclear and Radiological Training and Testing in Support of Emergency Response			
Classroom, laboratory, and field training and testing at CITRC and TREAT using INL nuclear and radiological materials.	**Integrated training, demonstration, and exercise Nuclear and Radiological Complex** for emergency responders.	Dedicated Testing and Training Facility in proximity to INTEC 651. (Need driven by potential restart of TREAT; also driven by International Safeguards and Security work). Field test range for radiological material handling, environmental and forensic sampling, infield detection, and decontamination (also applies to Nuclear and Radiological Forensics).	
Nuclear Nonproliferation Safeguards and Security - International Safeguards and Security			
Limited international material protection control and accountability training in MFC Bldg 714 in support of NNSA. Limited access to SNM in quantities up to Category 1 in support of IAEA-related training and technology demonstrations.	**Research, Development and Training Center** – supporting international nuclear energy safeguards and security technologies. .	Safety basis upgrades to allow routine use of the ZPPR reactor cell area for training and testing.	
Signatures, Detection and Response - Special Nuclear Material Detection			
Accelerator-Based Active Interrogation at CITRC, the Idaho Falls PINS Laboratory, and Idaho State University.	**National Development and Testing Area** – For high-energy accelerator-based active interrogation at stand-off distances.	Stand-Off Detection Experiment Range and Facility on INL Site. Access to INL SNM for active interrogation testing and analysis.	
Material and Survivability Support to the DOD			
National Security Test Range – live-fire ballistics testing with no permanent infrastructure or facilities to house and accommodate data collection and observation.	**World-class National Security Test Range** – that includes infrastructure and facilities that allow for conference rooms, work areas, live fire testing observation, video and data collection, and special access programs.	New multiuse facilities at the National Security Test Range that are purpose-built to accommodate observation, video and data collection, special access programs, work areas, and storage.	

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Material and Survivability Support to the DOD (Continued)			
SMC Facility – Research, development, and fabrication facility dedicated to the development and production of armor and survivability systems.	**Enhanced SMC Facility** – Expanded, world-class multiprogrammatic materials research facility with increased material handling capabilities, enhanced development, prototype, and assembly areas and a redundant, high-reliability electrical power supply to ensure the continuity of critical operations.	**TAN Multiuse Facility** – New high bay facility equipped with overhead cranes, material storage areas, work areas, and office space. **Second feeder** for the existing double-ended SMC substation.	
Nuclear Material - Treatment Capabilities to Enable Disposition of Surplus Unirradiated Materials			
INL is currently developing the capabilities (gloveboxes and process equipment) needed to treat a large portion of its surplus unirradiated EU materials, including sodium-bonded materials.	Disposition paths and capabilities are established and implemented to disposition all of INL's surplus plutonium, unirradiated uranium, and recovered EU from UNF treatment.	Disposition paths and capabilities need to be developed for surplus plutonium and uranium/plutonium mixed materials. Capabilities need to be further developed to clean up the EU recovered from used fuel treatment. This may also require developing additional capabilities to further cleanup the recovered EU so it is suitable for reuse or recycle.	
Nuclear Material - UNF Treatment Capabilities			
Treatment capabilities currently exist for sodium-bonded UNF; however, current throughput is low. Treatment capabilities for other INL fuel types (e.g., nonsodium-bonded, oxides fuels, etc.) do not exist. Capabilities to treat wastes resulting from treating UNF do not exist.	Treatment throughput for sodium-bonded UNF is substantially increased and fuel treatment is completed as quickly as possible. Treatment capabilities are established for other INL fuel types. Metal and ceramic waste form production capabilities are available to treat wastes resulting from treating UNF.	Treatment throughput needs to be increased for sodium-bonded UNF. Treatment capabilities for INL's nonsodium-bonded UNF need to be developed and implemented to support disposition of those fuel types. Metal and ceramic waste form production capabilities need to be developed and implemented.	
Infrastructure Revitalization and Enhancements			
Ongoing as funding is available.	Focused and prioritized to support the above capability strategies. Maximize the use of alternative funding strategies such as Energy Savings Performance Contracts, Utility Energy Savings Contracts, and Utility Incentive Programs to achieve measurable efficiency upgrades and ongoing infrastructure improvements. Reinvest savings from completed efficiency projects and activities into continued infrastructure efficiency upgrades.	Revitalization strategy focused on supporting above capabilities. **Alternatively funded projects** - Efficient implementation process for alternatively funded projects and ability to perform alternatively funded upgrades in leased facilities. Program or mechanism to reinvest efficiency savings into new efficiency projects.	

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Process Engineering and Modeling			
Established modeling and experimental tools for design and analysis of processes involving kinetics and heat and mass transfer. System dynamic modeling of mass flows for complex systems.	Expanded experimental systems and measurement capabilities for model verification and development. Modeling and verification of non-steady-state systems. System dynamic modeling with linked geographical components and energy and economic feedback relationships.	Fully instrumented testing lab to validate advanced dynamic models. Sufficient computer resources to effectively perform real-time multiphysics based process simulation.	ESL is under construction. Teaming with ICIS to develop the test bed infrastructure needed to develop advanced monitoring and control technology. Integrating with Center for Advanced Modeling and Simulation to leverage and enhance advanced computing and visualization systems and capabilities.
Geoscience			
Innovator in creating physically based numerical codes of tightly coupled subsurface processes and complementary experimental capabilities for code validation. Understanding of large aquifer behavior, amendment addition for environmental protection, and remote sensing are distinguishing characteristics. Innovative models for the deformation and fracture of geomaterials, which provide INL with cutting-edge capabilities.	Simulate physical, chemical, and biological coupled processes accurately to support in situ energy recovery and geologic sequestration of materials for both environmental and energy related problems. Experimental capabilities will be advanced to provide information and data for calibrating the models.	Experimental capabilities (including pressure, temperature, and chemical simulation of subsurface environments, high-resolution imaging etc.) need to be developed to keep pace with modeling and simulation advancements and capabilities. Sufficient computer resources to effectively perform real-time multiphysics-based process simulation.	Enhancing existing Geoscience laboratory through IGPCE funded equipment to improve experimental verification of models. Integrating with Center for Advanced Modeling and Simulation to leverage and enhance advanced computing and visualization systems and capabilities.
Chemical Conversion and Separations			
Steady state catalysis, thermal and nonthermal plasma processing, extremophilic organisms capable of performing chemistries in harsh environments, supercritical fluid chemistry, and targeted chemical separations.	Expand expertise in: nanosized catalytic materials, alternate catalytic materials to replace platinum and rare earth catalysts, high-temperature polymer and membrane materials to replace energy intensive separations and perform selective separations in harsh environments, electrocatalysts for utilization of carbon dioxide and low waste production of unique chemical compounds, and separation strategies for recycling and recovery of rare earths and other strategic and critical materials.	Enhanced equipment and laboratory space for analytical and synthesis chemistry, catalysis, and polymeric materials.	A Synthesis Workflow System for multiparameter evaluation for chemical synthesis and catalyst development is on IGPCE list. A 12T Fourier Transform Mass Spectrometer for molecular characterization at very low concentrations and high mass resolution is on IGPCE list. REL is in planning stage.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status
Process Characterization and Monitoring			
Thermodynamic life analysis, advanced physical and materials modeling, and the research and development of advanced electrolyte and electrode technologies for batteries. Hybrid Energy Systems Laboratory conducts integrated prototype component testing and demonstration for transient operating conditions. Engineering design, analysis model, and conceptual strategy for a feedstock supply system that can sustainably provide uniform-format lignocellulosic biomass at a commodity scale. Developing processes that address the complex chemical and physical properties of biological feedstocks. Engineering scale monitoring and evaluation of innovative decontamination techniques for infrastructure.	Testing and monitoring of Smart Grid concepts for vehicles and develop improved models for characterization and prediction of battery health. Provider of advanced electrolyte and electrode technologies. Demand matched integrated production of energy and chemical products. Real time monitoring and control of complex integrated non-steady-state industrial systems. Diversification in the range of biomass types processed (e.g., algae); improvement of the economics of production through enhanced process control; and enhancement of the deployability and reliability of biofeedstock systems. Infrastructure decontamination expertise will be expanded to address water security threats; this work will include a demonstration facility and modeling and sensor development to meet the water security needs identified by the Environmental Protection Agency for water supply and sewer systems.	Dry room for advanced energy storage research. Engineering scale test facility for bioenergy feedstock evaluation. High-bay space for engineering scale hybrid energy system components. National Water Security Test Bed facility.	ESL is under construction and will address most of the facility needs for vehicles and energy storage, biofeedstocks, and hybrid energy systems. Dry room is on INL IGPP internal priority list. Current raking will not support capability development need. Process Demonstration Unit for engineering scale testing and evaluation of bioenergy feedstocks is being assembled. National Water Security Test Bed facility concepts are being developed and are expected to be added to the IPL in FY 2012.
Materials Characterization and Evaluation			
Evaluation of metals and light-weight materials under relevant high temperature, chemically corrosive, high radiation, high stress environments to understand creep, creep-fatigue, stress corrosion cracking in metals, and mechanical and thermal properties in both metals and carbon-based materials.	Materials characterization and monitoring will cover a much broader range of energy-relevant materials and processes, including understanding of lightweight materials for transportation efficiency, development of new materials to substitute for existing materials that become more rare, difficult or prohibitively expensive to produce, development and understanding of new materials for a wide variety of modern devices and materials associated with the safe operating lifetime of energy-production plants. INL will adapt existing capabilities and develop new capabilities to characterize materials on smaller length scales and in more challenging environments. INL will focus measurement technologies on nanoscale thermal transport (for nuclear fuels and thermoelectric applications), ultrafast thin film metrology, inpile characterization of nuclear material including application of new nondestructive evaluation capability for online monitoring.	Enhanced and updated materials characterization and evaluation tools for metals, composites, polymer and other industrially important materials.	REL is in planning stage. Initial equipment needs are on IGPCE list.

Table 5-1. Idaho National Laboratory mission-critical project and equipment acquisition strategy.

Current	Future	Gaps	Status

AL = Analytical Laboratory
ATR = Advanced Test Reactor
CAES = Center for Advanced Energy Studies
CESB = Contaminated Equipment Storage Building
CFA = Central Facilities Area
CITRC = Critical Infrastructure Test Range Complex
DHS = Department of Homeland Security
DOD = Department of Defense
DOE = Department of Energy
DOE-NE = Department of Energy Office of Nuclear Energy
DU = depleted uranium
EBR-II = Experimental Breeder Reactor II
EML = Electron Microscopy Laboratory
ESL = Energy Systems Laboratory
EU = enriched uranium
FASB = Fuels and Applied Science Building
FCF = Fuel Conditioning Facility
FFTF = Fast Flux Test Facility
FMF = Fuel Manufacturing Facility
FY = fiscal year
HFEF = Hot Fuel Examination Facility
HIP = Hot-Isostatic-Pressing
IAEA = International Atomic Energy Agency
ICIS = Instrumentation, Control and Intelligent Systems Signature
ICS-CERT = Industrial Control System Cyber Emergency Response Team
IGPCE = Indirect General Purpose Capital Equipment
IGPP = Institutional General Purpose Plant Project
IMCL = Irradiated Materials Characterization Laboratory
INL = Idaho National Laboratory
INSIGHTS = Independent Gamma, Hydraulics, and Temperature Separate-Effects
INTEC = Idaho Nuclear Technology and Engineering Center
ISU = Idaho State University
MaCS = Microscopy and Characterization Suite
MFC = Materials and Fuels Complex
NDE = nondestructive examination
NEUP = Nuclear Energy University Program
NNSA = National Nuclear Security Administration
NRAD = Neutron Radiography Reactor
NRC = Nuclear Regulatory Commission
NSUF = National Scientific User Facility
PIE = postirradiation examination
R&D = research and development
RAL = Remote Analytical Laboratory
RERTR = Reduced Enrichment for Research and Test Reactor
RCL = Radiochemistry Laboratory
REC = Research and Education Campus
REL = Research Education Laboratory
SMC = Specific Manufacturing Capability
SNM = special nuclear material
TREAT = Transient Reactor Experiment and Test Facility
TRU = transuranic
UNF = used nuclear fuel
ZPPR = Zero Power Physics Reactor

Appendix A contains an assessment of INL's Real Property Infrastructure, an enabling capability to accomplish the INL 10-year vision. The appendix provides a detailed description and discussion of INL's strategy for managing utilities and supporting infrastructure capabilities, and INL's approach to proactively sustain of real property assets. The assessment evaluates the deferred maintenance backlog and asset condition index for the mission-critical and mission-dependent buildings and other structures and facilities, and identifies the funding needed to meet the DOE goals for the asset condition index and enable the INL mission.

5.2 Investment Approach

To address these infrastructure needs, INL is leveraging its investment resources by aligning its direct program and indirect investment plans to effectively support the laboratory mission priorities. INL's leadership councils are addressing investment needs using a prioritized investment approach. INL has also dedicated a larger percentage of its strategic indirect resources toward investments to benefit the laboratory, including laboratory directed research and development, capital investments and other strategic investments. Most recently, DOE approved INL's request to implement Institutional General Purpose Plant Projects (IGPPs) as part of this investment strategy. This investment approach enables INL to apply these limited and valuable resources most effectively to support national mission needs.

Figure 5-1 illustrates the laboratory infrastructure funding needs specifically delineated in the Ten-Year Site Plan, as well as additional investment needs not specifically discussed in this plan at a detailed level. The profile includes maintenance needs from Appendix A, *Real Property Asset Management*; capital asset acquisition, upgrade, and disposition needs from Appendix B, *Prioritized Resource Needs*; and sustainability needs from Appendix D, *Sustainability and Energy Management Program*. The figure also incorporates needs not otherwise addressed in the TYSP: the ATR Life Extension Program, MFC sustainment, INL base maintenance, the estimated cost of construction of an Advanced PIE Facility at INL, and ongoing out-year Line-Item Construction Project (LICP) funding. Table 5-2 identifies investment needs that comprise the investment bands in Figure 5-1 and provides an association between the graph data series and specific sections of the TYSP.

INL is transitioning into the strategic investment approach described above during FY 2011. Appendix B captures a more complete set of strategically driven asset investment needs to address many of the infrastructure and capability gaps. Over the next year, the project lists in Appendix B will be matured and refined, and these improvements will be reflected in the planning basis. INL is using its investment resources as described below.

5.2.1 Program and Nuclear Facility Investments

- **Infrastructure Facility Management** – The Idaho Facilities Management (IFM) Program and ATR Program activities provide the critical infrastructure, unique capabilities, and highly trained workforce to enable and facilitate INL core mission outcomes such as essential nuclear RD&D activities. The strategic priorities for use of this funding are to: 1) sustain core capabilities, 2) strengthen core and enabling capabilities, 3) build world-leading capabilities, and 4) enable INL "user facility" and "open campus environment.

  The IFM portion of INL's asset investment primarily supports compliance-based maintenance and repair of nuclear facilities with limited closure of gaps to excellence and limited funding for new capabilities. It includes approximately $20M to $25M annually to support transient testing, advanced PIE capabilities, and remote-handled LLW disposal capability. It is also evaluating submission of a justification of mission need analysis for ATR Diesel Electric Bus and Switch Gear Replacement, ATR Primary Coolant Pump and Motor Replacement, and ATR Emergency Firewater Injection System Replacement. It also includes a modest facility and infrastructure revitalization program, consisting mainly of General Plant Projects.

As such, the current IFM target budget is not sufficient to fund the desired new end-state capabilities, which are essential to fulfilling the nuclear energy mission goals and INL 10-year vision.

- **Programs** are aligning their funding resources to the strategic plans and enhancing or establishing capabilities needed to achieve RD&D solutions toward INL mission-directed need.

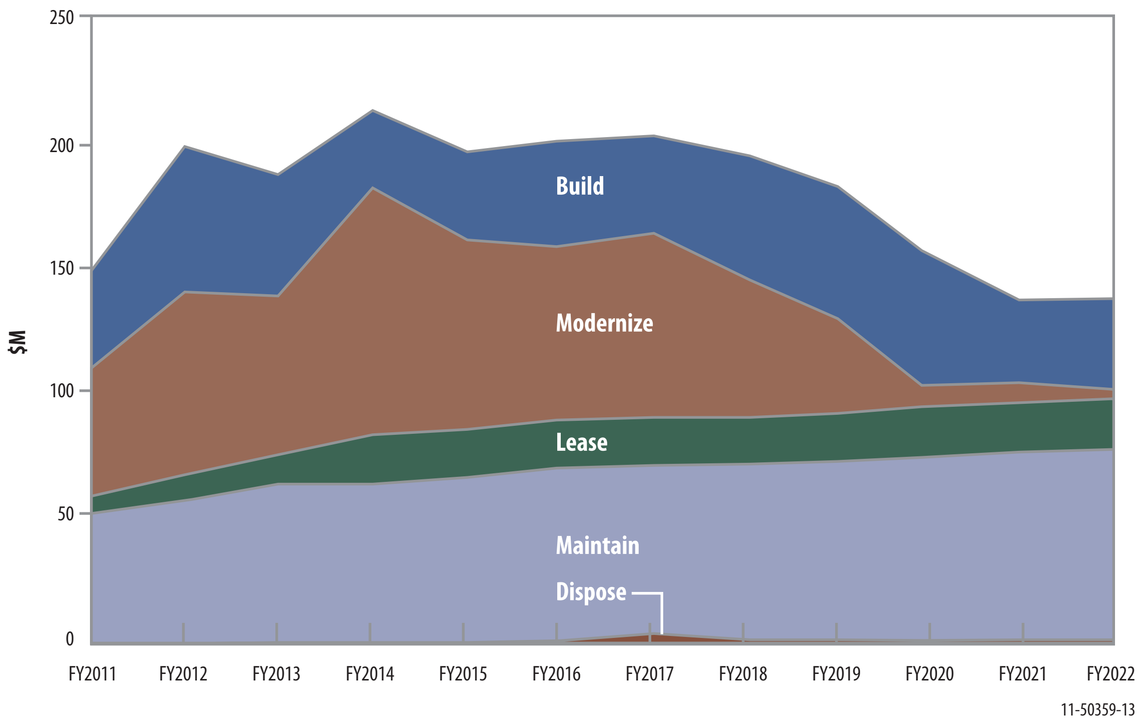

Figure 5-1. INL facilities, maintenance, equipment, and disposition needs.

Table 5-2. Investment types comprising the investment bands in Figure 5-1.

Need Profile	Reference / Comment
Build	
Remote-handled LLW LICP	Table B-7
Advanced PIE Capability	Table B-7 – Project engineering and design only
Potential Follow-on LICP funding (after Advanced PIE Capability)	Best estimate of cost to construct a proposed INL Advanced PIE facility - not otherwise included in the TYSP
General Plant Project Construction	Table B-2
IGPP Construction	Table B-1
Modernize	
Programmatic Capital Equipment	Table B-6
IGPCE	Tables B-3, B-4, and B-5
ATR Life Extension Program	Not otherwise included in the TYSP
ATR Reliability Projects: ATR Diesel Electric Bus and Switch Gear Replacement Project, ATR Primary Coolant Pump and Motor Replacements Project, and ATR Emergency Firewater Injection System Replacement Project	Table B-7
Transient Test Capability	Table B-8
General Plant Project Retrofits	Table B-2
IGPP Retrofits	Table B-1
Sustainability	Table D-1 as well as ATR Complex/CFA Energy Savings Performance Contract and REC Utility Energy Savings Contract described in Appendix D text
Lease	
Facility Leases	Table A-7
Maintain	
Proactive Sustainment	Proactive sustainment of mission critical and mission dependent facilities as well as roof repair and replacement as described in Appendix A text and Table B-8
NR Direct M&R	Baseline maintenance funding – not otherwise included in the TYSP
DOD Direct M&R	Baseline maintenance funding – not otherwise included in the TYSP
DOE-NE Direct M&R	Baseline maintenance funding – not otherwise included in the TYSP
MFC Sustainment	Refurbishment of MFC subsystems and operational capabilities – not otherwise included in the TYSP
Indirect M&R	Baseline maintenance funding – not otherwise included in the TYSP
Dispose	
Facility Disposition	Table B-9

Table 5-2. Investment types comprising the investment bands in Figure 5-1.

Need Profile	Reference / Comment
ATR = Advanced Test Reactor	*LLW = low-level waste*
CFA = Central Facilities Area	*M&R =maintenance and repair*
DOD = Department of Defense	*MFC = Materials and Fuels Complex*
DOE-NE = Department of Energy Office of Nuclear Energy	*NR = Naval Reactors*
IGPCE = Institutional General Purpose Capital Equipment	*PIE = postirradiation examination*
IGPP = Institutional General Plant Project	*REC = Research and Education Campus*
LICP = Line-Item Construction Project	*TYSP = Ten-Year Site Plan*

5.2.2 Other INL Strategic Investments

- **The IGPP process**, implemented in FY 2011, established an initial $10M in IGPP specific projects. INL is developing a formal and consistent process for defining, qualifying, approving, reporting, and tracking capital investments.
- **Institutional General Purpose Capital Equipment** has been expanded beyond the multiprogram infrastructure-related needs of science and technology to encompass the infrastructure-related needs of INL.
- **WFO** has also provided opportunity for infrastructure investment at INL, most notably by the DOE – Naval Reactor Program, supplying a portion of the maintenance and repair funding for the ATR; and the DOD, which provides the maintenance and repair funding for SMC.
- **Laboratory Directed R&D** develops new capabilities through R&D and plays a small infrastructure investment role. Annual investment in LDRD has grown to more than 3% of total business volume. The growth in LDRD, mostly funded from cost savings, supports joint appointments, graduate fellowships, intern programs at INL, and development of capabilities (including equipment). LDRD through the Institute for Nuclear Energy and Technology also supports targeted programs to engage the university community in strategic research and to identify key new hires.
- **Alternatively Funded Projects** are the primary method to fund efficiency projects and savings are reinvested into new efficiency projects. Site Sustainability Metrics will be met if alternatively funded projects (Energy Savings Performance Contracts) are completed and additional efficiency projects, as listed on Table D-1 of Appendix D, are concurrently completed.

INL continues to seek efficiencies in space management to ease the infrastructure demand for space. Telecommuting pilots and revised strategies for space management, and laboratory utilization directly support space optimization objectives.

6. CONCLUSION

The INL TYSP provides an integrated, long-term vision of infrastructure requirements that support R&D goals outlined in DOE strategic plans and the DOE-NE Roadmap. The 2011 TYSP reflects the progress INL has made towards attaining the vision:

- Vision and core capabilities are stable and remain unchanged
- Core capability strategies are maturing and were updated based on newly developed program strategic plans
- Discussions regarding multi-program capabilities and strategies for non-NE mission areas are expanded and matured to include N&HS, energy, and environment R&D capabilities
- Infrastructure investments are focused and prioritized toward maintaining, modernizing, and building INL capabilities
- Project and equipment investment strategies have shifted from the IFM program budget to strategic indirect funding
- The INL Sustainability Program was institutionalized and focused on execution and performance
- The condition of mission-critical infrastructure was assessed and strategies were developed for sustaining these enduring assets.

The appendices to the TYSP serve as the basis for documenting and justifying infrastructure investments needed to sustain existing capabilities and bring new capabilities online, as follows:

- **Appendix A, Real Property Asset Management,** assesses the INL real property infrastructure from the perspective that it is an essential enabling capability central to INL mission accomplishment. The appendix also includes a detailed description and discussion of the strategy for managing utilities and supporting infrastructure capabilities, and the approach to proactive sustainment of real property assets.

  The assessment evaluates the deferred maintenance backlog and asset condition index of mission-critical and mission-dependent buildings as well as select support systems and utilities, and identifies the funding needed to meet DOE asset condition goals and enable the INL mission. The appendix describes and discusses the INL real property inventory and utilization.

- **Appendix B, Prioritized Resource Needs,** presents plans for line-item construction projects, direct-funded operating funded projects, and IGPPs at INL for the current and subsequent 10 fiscal years. The IGPP program, new to INL this year, enables the strategic application of indirect resources to fund general-purpose capital project acquisitions at the laboratory. The appendix also provides plans for program-funded capital projects, operating-funded projects, institutional general purpose capital equipment, and program-funded capital equipment acquisitions over a 4-year planning window. Finally, the appendix discusses the INL Footprint Reduction Plan and lists the facilities planned for deactivation, demolition, or transfer through FY 2021.

- **Appendix C, Cognizant Secretarial Offices, Program Secretarial Offices, and Non-DOE Site Programs,** identifies other tenant organizations that reside at INL and describes the facilities they occupy and/or the work they perform. The largest non-DOE-NE tenants are the DOE-EM-funded ICP and Advanced Mixed Waste Treatment Project, and the NRF, funded by the Office of Naval Reactors. The ICP provided a tenant-specific TYSP, which appears in this appendix in its entirety. Finally, the appendix summarizes the Long-Term Stewardship activities that will transition to INL responsibility as DOE-EM activities decline.

- **Appendix D, Sustainability Program,** provides an overview of INL Sustainability and Energy Management Program strategy and goals, and discusses implementation of the SSP. The appendix identifies sustainability investment-project candidates, assesses progress meeting the sustainability goals, and provides a sustainability gap analysis.

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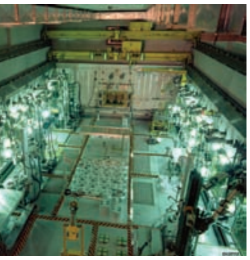
APPENDIX A



Real Property Asset Management

CONTENTS

Figures

Tables

ACRONYMS

ACI	asset condition index
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ATR	Advanced Test Reactor
AUI	asset utilization index
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
DM	deferred maintenance
DOE	Department of Energy
DOE-EM	Department of Energy Office of Environmental Management
DOE-NE	Department of Energy Office of Nuclear Energy
ERI	Equipment Reliability Indicator
ESL	Energy Systems Laboratory
FIMS	Facility Information Management System
FY	fiscal year
HFEF	Hot Fuel Examination Facility
HPSB	High Performance Sustainable Building
IGPP	Institutional General Plant Project
INL	Idaho National Laboratory
INPO	Institute of Nuclear Power Operations
INTEC	Idaho Nuclear Technology and Engineering Center
LEED	Leadership in Energy and Environmental Design
M&R	maintenance and repair
MC	Mission Critical (One of three FIMS Mission Dependency categories)
MD	Mission Dependent, Not Critical (One of three FIMS Mission Dependency categories)
MFC	Materials and Fuels Complex
MII	Maintenance Investment Index
MR&R	major repair and replacement
NMD	Not Mission Dependent (One of three FIMS Mission Dependency categories)
NNSA	National Nuclear Security Administration
NRF	Naval Reactors Facility
OSF	other structure and facility (One of the four FIMS categories of real property)
PIE	postirradiation examination
R&D	research and development
RAMP	Roof Asset Management Program
REC	Research and Education Campus
REL	Research and Education Laboratory
RPV	replacement plant value
RWMC	Radioactive Waste Management Complex
S&S	safeguards and security
SCADA	Supervisory Control and Data Acquisition
SMC	Specific Manufacturing Capability
T&D	transmission and distribution
TAN	Test Area North
TYRT	Three-Year Rolling Timeline
TYSP	Ten-Year Site Plan

APPENDIX A
REAL PROPERTY ASSET MANAGEMENT

A-1. ASSESSMENT OF REAL PROPERTY

Appendix A describes the Idaho National Laboratory (INL) real property inventory. It also describes the strategy for sustaining enduring assets and includes an assessment of the condition of these assets and the investment strategy for sustaining Department of Energy Office of Nuclear Energy (DOE-NE) owned and operating assets over the next 10 years (2012 through 2021).

INL includes 895 real property assets that are located in the eight on-site complexes, or distributed across the 889 mi^2 of the INL Site and 48 assets located in the City of Idaho Falls (i.e., the Research and Education Campus [REC]). The 943 Department of Energy (DOE)-owned and contractor-leased assets (excluding Naval Reactors Facility [NRF] assets) have a total Facility Information Management System (FIMS) replacement value of $4.86B.

The DOE-NE is the lead program secretarial office for the INL Site and manages 611 (65%) of INL assets, with a total estimated replacement value of $3.39B. This includes 331 buildings and trailers covering a gross 3.2 million ft^2.

In May 2011, DOE-NE established the asset condition index (ACI) targets for operating assets (FIMS status codes 1, 2, and 6) at INL that are based on the targets specified in DOE's "Three-Year Rolling Timeline (TYRT); Implementing the Goals and Objectives of Asset Management Plan" (DOE 2010). The targets for Fiscal Year (FY) 2011 are 0.971, 0.925, and 0.920 for Mission Critical (MC); Mission Dependent, Not Critical (MD); and Not Mission Dependent (NMD) assets, respectively. The TYRT also establishes long-term ACI targets of 0.980, 0.930, and 0.920 for MC, MD, and NMD assets, respectively. Achievement of the long-term targets is set for 2015. The average ACI for INL assets currently meets the 2015 DOE TYRT ACI targets. Sections A-1.4 and A-1.5 provide additional discussion concerning the ACI of INL MC and MD assets and INL's strategy to maintain the condition of its assets at these targets.

INL is continuing to transition to a more proactive maintenance strategy to manage safety, health, environmental, and mission-related risk. INL bases its proactive sustainment scope and investment forecasts on the outputs of the Whitestone Research, Inc. MARS® sustainment-modeling tool. INL uses condition assessment surveys, engineering analysis, and knowledge gained from facility management interaction with the assets to adjust the MARS® output for actual condition. In 2011, the focus is on identification of the appropriate sustainment activities for MC assets. This effort will continue in FY 2012 with a focus on sustainment planning for MD assets.

To focus proactive sustainment investment on the most critical assets, INL and DOE reviewed the list of MC assets in 2010 in order to identify those assets that have direct links to accomplishing the research and development (R&D) objectives of INL program sponsors or other external commitments. DOE-NE approved the resulting list in September 2010. The list includes the Advanced Test Reactor (ATR), a programmatic other structure and facility (OSF)[1], and 24 non-programmatic buildings and OSFs. Section A-1.4.3 includes the resulting list and capability assessment for the 25 MC assets.

INL historically invests approximately $7.5M[2] each year for preventive, predictive, and reactive

[1] OSFs are one of the four categories of real property assets that include buildings, trailers, OSFs, and land.
[2] Based on average of actual annual maintenance charges reported in FIMS between 2007 – 2010, inclusive.

corrective maintenance of 17 MC buildings[3] at INL that are not located at the Specific Manufacturing Capability (SMC) area.[4] This level of investment equates to a below target Maintenance Investment Index (MII)[5] of 1.4% for these buildings. Sustainment modeling indicates that an annual investment of approximately $2M, or $20M over the 10-year period of this Ten-Year Site Plan (TYSP), in proactive sustainment activities is required to maintain the ACI for these buildings at the current level. The estimated annual investment levels for proactive sustainment of MC buildings have been escalated and incorporated in Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2). Adding $2M of proactive sustainment to the current annual sustainment investment level of $7.5M raises the MII for these buildings to 1.8%. A total annual sustainment investment of between $11M and $21M would be required to restore the MII for these buildings to the target range.[6]

INL historically invests approximately $8M each year[2] for preventive, predictive, and reactive corrective maintenance of MD buildings[3] at INL that are not located at the SMC area[4]. This level of investment equates to an on-target MII[5] of 3% for these buildings. Although sustainment modeling for MD assets is not yet complete, the current level of sustainment modeling indicates that an annual investment of approximately $4M, or $40M over the 10-year period of this TYSP, in proactive sustainment activities is required to maintain the ACI for these MD buildings at the current level. The estimated annual investment levels for proactive sustainment of MD buildings have been escalated and incorporated in Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2). Adding $4M of proactive sustainment to the current annual sustainment investment level ($8M) raises the MII for these buildings to 4.6%. A total annual sustainment investment of between $5M and $10M is required for the MII for these buildings to be in the target range.[6]

The Infrastructure Capability Assessment in Section A-1.4 provides a discussion of the ACI-based condition of DOE-NE owned and operating MC and MD assets, with an estimate of the deferred maintenance (DM) reduction and proactive sustainment investment needed to restore and maintain these assets above the ACI target. There is also similar discussion and estimates for specific asset groups, including roofs, primary and secondary roads, emergency and standby diesel generators, high-voltage transmission and distribution (T&D) system, and safeguards and security (S&S) related assets.

The 10-Year Infrastructure Investment Strategy discussed in Section A-1.5 describes INL's strategy and plans for leasing assets, infrastructure capability gaps, and investment in sustainment. Considering the current economic and federal funding situation, INL expects sustainment investment to remain at or below FY 2010 levels. The challenge for INL is to focus available funding to improve the sustainability of its assets and to incorporate additional proactive sustainment and DM reduction scope into its sustainment strategy in order to maintain the ACI within targets. INL will focus proactive sustainment efforts on MC assets. Sustainment of the remaining real property assets will be limited to preventive/predictive and reactive corrective maintenance. However, INL's sustainment-modeling and planning efforts will continue to define the appropriate scope and cost estimate for implementation of risk-based and mission-focused proactive sustainment for INL real property assets.

[3] Only buildings are discussed here because OSFs have not been loaded into our sustainment-modeling tool.
[4] SMC area buildings are excluded from this analysis because they are direct funded by the U.S. Army.
[5] MII = Total FIMS Annual Actual Maintenance Investment / Total FIMS Replacement Plant Value.
[6] The MII target is 2% to 4%.

Finally, this appendix closes with a discussion of the INL's strategy and effectiveness of utilizing DOE-NE real property assets, as indicated by the asset utilization index (AUI).

A-1.1 INL Real Property Inventory

The INL Site occupies 889 mi^2 in southeast Idaho. INL real property assets are distributed across the desert site (the Site-wide area) or grouped in the eight on-site complexes (see Table A-1) situated on an expanse of otherwise undeveloped, high-desert terrain. Approximately 40 INL leased and DOE owned assets are also located in the city of Idaho Falls, Idaho. The 943 non-land real property assets (i.e., buildings, trailers, and OSFs) listed in the FIMS at INL are clustered within the facility areas listed in Table A-1, which are typically less than a few square miles in size and separated by miles of open land. Table A-2 shows the FIMS replacement plant value (RPV) for these assets.

Of the 10 site areas listed in Table A-1, three are primary mission areas for DOE-NE. Two (the ATR Complex and Materials and Fuels Complex [MFC]) are located on the INL Site.

Table A-1. Summary of Idaho National Laboratory real property buildings[a] and land.

			Total Buildings[a, b]		DOE-NE Buildings[a, b]		DOE-EM Buildings[a, b]	
Complex	Primary Program Office	Land Area (acres)	Count	Gross ft^2	Count	Gross ft^2	Count	Gross ft^2
ATR Complex	DOE-NE	102	88	484,606	76	394,140	12	90,466
MFC	DOE-NE	1,707	90	618,213	85	582,501	5	35,712
REC	DOE-NE	Minimal[c]	48	1,311,584	42	1,132,727	6	178,857
CITRC	DOE-NE	967	9	48,532	9	48,532	0	0
CFA	DOE-NE	968	54	623,810	53	623,410	1	400
INTEC	DOE-EM	385	91	913,641	6	18,882	85	894,759
NRF[d]	Pittsburgh Naval Reactors	4,400	34	686,402	0	0	0	0
RWMC	DOE-EM	187	87	1,078,451	0	0	87	1,078,451
Site-wide	DOE-NE	560,199	29	71,622	29	71,622	0	0
TAN	DOE-NE	220	36	359,167	31	350,959	5	8,208

a. Buildings include owned and leased real property buildings and trailers regardless of operational status.
b. Building count and ft^2 data source = 04/03/2011 Facility Information Management System.
c. The majority of REC land is associated with leased facilities; only a few acres are DOE-owned.
d. NRF is not under the purview of the Department of Energy Idaho Operations Office.
ATR = Advanced Test Reactor
CFA = Central Facilities Area
CITRC = Critical Infrastructure Test Range Complex
DOE-EM = DOE Office of Environmental Management
DOE-NE = DOE Office of Nuclear Energy
INTEC = Idaho Nuclear Technology and Engineering Center
MFC = Materials and Fuels Complex
NRF = Naval Reactors Facility
REC = Research and Education Campus
RWMC = Radioactive Waste Management Complex
TAN = Test Area North

Table A-2. Facility Information Management System real property replacement plant value.

	Replacement Plant Value ($B)		
Asset Type	DOE-NE	DOE-EM	Total
Total Non-Programmatic Assets	$2.00	$1.22	$3.86
Building/Trailers	$1.44	$1.00	$2.44
Other Structures and Facilities	$0.56	$0.22	$0.78
Total Programmatic Assets	$1.39[a]	$0.25[b]	$1.64
TOTAL ASSETS	$3.39	$1.47	$4.86

a. Advanced Test Reactor and the Transient Reactor Experiment and Test Facility.

b. Experimental Breeder Reactor II.

The third, the REC, is located in the city of Idaho Falls, which is 25 miles east of the INL Site border.

Primary mission areas for other program offices responsible for real property at the INL Site (i.e., Department of Energy Office of Environmental Management [DOE-EM] and Pittsburg Naval Reactors) include the Idaho Nuclear Technology and Engineering Center (INTEC), the Radioactive Waste Management Complex (RWMC), and the NRF.

A-1.2 Real Property Sustainment Strategy

A-1.2.1 Strategy for Management of Utilities and Supporting Infrastructure Capabilities

INL real property infrastructure includes 531 DOE-NE-owned and operating real property assets. These assets include 291 operating buildings[7] totaling 2.3 million ft^2 with a total RPV of $1.19B, and 240 OSFs that have a total RPV of $940M. OSFs include real property assets that are (1) not buildings (i.e., bridges, communications towers, roads, railroads, etc.) and (2) site utility systems that are used to collect or distribute utility services (i.e., steam, electricity, compressed gases, liquid waste streams, natural gas, and water).

[7] *The term "Operating Buildings" includes all operating buildings and trailers that have a FIMS status of operating (FIMS status codes 1, 2, and 6).*

Like other DOE sites, INL has many facilities and supporting infrastructure that have suffered from a lack of revitalization investment over the last few decades. As a result, INL focused limited sustainment dollars on routine preventive/predictive maintenance and reactive corrective maintenance/repair when equipment failures occurred. Proactive replacement of equipment at the optimum time to balance sustainment cost with equipment reliability has generally not been a component of INL's sustainment strategy.

As part of the 10-year vision for sustainment, INL is committed to implementing a proactive, mission driven, and risk-based approach to sustain INL infrastructure in a manner that ensures mission-supporting infrastructure is in a mission-ready state. The INL sustainment strategy is focused on (1) maximizing asset service life, (2) revitalizing assets at the optimum time in their life cycle, and (3) upgrading assets to support the mission needs of the R&D programs.

Supporting infrastructure consists primarily of buildings, including equipment (e.g., telecommunications; heating, ventilation, and air conditioning; and lighting) and utilities (e.g., electrical power distribution, sewer, water, and emergency utilities) that support the laboratory's core R&D capabilities and MC facilities. The key elements of INL's real property management strategy are:

- Effective management of the capabilities provided by enduring assets
- Investment in new supporting infrastructure to continue to reliably support current missions and make new mission capabilities possible
- Implementation of sustainability concepts into enduring and new infrastructure assets to enhance energy and water efficiency and improve employee health and productivity
- Efficient and timely disposition of non-enduring assets.

A-1.2.1.1 Management of Enduring Assets

Enduring assets are mainly support buildings and utilities that serve the long-term needs of INL missions. INL applies a risk-based approach to evaluate and prioritize investments based on the role and importance of each asset in achieving INL missions. Also critical to successful and efficient implementation of this approach is the application of engineering and facility management principles toward assuring a full understanding and mitigation of the risk that an unplanned equipment failure could have on worker safety, environmental protection, and mission accomplishment. The strategy for managing enduring assets is to:

- **Sustain** assets in good working order by performing condition monitoring, condition assessment surveys, proactive replacement of aging equipment at the optimum time, incorporation of sustainable design principles, and timely repair if an unexpected failure occurs
- **Revitalize** assets so that they remain relevant to mission needs and are reliable, modern, sustainable, and cost-effective to operate and sustain throughout their life cycle
- **Enhance** existing assets to incorporate sustainability principles, support expansion of existing capabilities, and develop new sustainable capabilities to support changing missions.

A-1.2.1.2 Disposition of Non-Enduring Assets

Non-enduring assets are primarily buildings that are no longer needed, no longer capable of performing their intended function, or no longer economically justifiable to support current and/or future INL mission needs. The strategy for managing non-enduring assets is to minimize long-term cost liabilities, optimize space utilization, identify and control legacy hazards to worker safety and the environment, and reduce the overall INL footprint. The process for disposition of these buildings consists of:

- Declaring non-enduring assets as excess real property
- Vacating the asset, stabilizing hazards and hazardous materials, and taking steps to minimize the risk and cost of long-term stewardship activities
- Controlling access and monitoring the asset for degradation and/or changing hazardous conditions
- Demolishing non-radioactively contaminated buildings
- Transferring radioactively contaminated buildings to DOE-EM for final disposition.

Appendix D, Section D-3, describes INL's plans for disposition of non-enduring assets.

A-1.2.1.3 Investment in New Supporting Infrastructure

This TYSP identifies the capabilities needed to accomplish INL's 10-year vision and the supporting infrastructure resources required to enable the new capabilities. For example, establishing world-leading postirradiation examination (PIE) capabilities at INL will require revitalization and expansion of the underlying utilities (e.g., electrical supply, sewage collection, and data transmission) and support facilities (e.g., office and relevant laboratory space) at MFC. Appendix B, *Prioritized Resource Needs*, lists the specific infrastructure investments needed to achieve the vision identified in the TYSP.

A-1.2.2 Implementing a Proactive Sustainment Approach for INL Real Property Assets

A-1.2.2.1 *Proactive Sustainment*

The preferred sustainment strategy for enduring assets is to perform proactive major repair and replacement (MR&R) of aging equipment based on actual condition degradation information obtained from condition monitoring and assessment activities. Application of a proactive sustainment strategy reduces the risk of unplanned failure. It also eliminates the costly, intrusive inefficiencies associated with the repetitive corrective maintenance necessary to keep worn out equipment running.

A-1.2.2.2 *FY 2010 Implementation Accomplishments*

FY 2010 implementation activities focused on characterizing the importance of INL real property assets and included equipment used to accomplish INL's missions. To this end, INL performed a complete review of the FIMS mission dependency classification for all INL DOE-NE real property assets in 2010. Additionally, INL evaluated the importance of each building component to the function of MC and MD buildings. When used together, the mission dependency of a building and the importance of equipment to building function establish a key component of a risk-based hierarchy for prioritizing investments in proactive sustainment, as well as identifying components that can be "run-to-failure" and, therefore, are not candidates for proactive sustainment.

A-1.2.2.3 *2011 Implementation Activities*

In FY 2011, INL will complete the following proactive sustainment implementation activities:

- Identify the 10-year maintenance and repair (M&R) requirements for INL's 24 nonprogrammatic MC real property assets. These requirements will reflect sustainment investment levels required to reduce DM backlog and sustain these MC assets in a condition that maintains their ACI at target levels. Development of these plans includes identifying work scope followed by performing budget and advanced work planning activities to complete designs, work plans, cost estimates, and resource-loaded project plans to accomplish MR&R activities forecast for 2012.
- Population of the INL sustainment forecasting tool with components for DOE-NE owned OSFs and development of associated sustainment models. Lack of sustainment models for OSF type assets, the need for OSF system boundary definition, and the need to populate the INL sustainment forecasting tool with OSF component inventory are limiting the application of the proactive sustainment to INL OSF assets. INL has contracted with Whitestone Research, Inc. to develop models and populate MARS® for 78 MC and MD buildings and OSFs in 2011 using direct funding provided by the DOE-NE Office of Facilities Management (NE-32). The contract includes consolidation of some of these 78 individual OSF assets into new FIMS assets at the OSF system level, rather than the component level. This consolidation will simplify annual FIMS reporting and enhance the accuracy of the ACI for OSF assets.
- Completion of efforts started in 2010 to populate the INL sustainment forecasting tool with components for MFC assets managed by the Nuclear Operations Directorate. This includes most MC assets at the MFC.

Executing proactive sustainment for INL MC buildings is estimated to be approximately $20M over the 10-year period of this TYSP. Although sustainment modeling for MD assets is not yet complete, the current level of sustainment modeling indicates that executing proactive sustainment for MD buildings is approximately $40M over the 10-year period of this TYSP. These estimates have been escalated and are incorporated in Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2). Refinement of the scope and cost to implement proactive sustainment for MD assets is in progress as part of the FY 2011 FIMS DM update.

A-1.3 Sustainability of INL Assets

Incorporation of High Performance Sustainable Building (HPSB) design concepts is an integral part of all new infrastructure and significant upgrade projects over $5M, with a goal of certification to Leadership in Energy and Environmental Design (LEED)-Gold as a minimum. Projects under the $5M threshold adhere to Executive Order 13423, “Guiding Principles,” for HPSB. In addition, the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 189.1 - 2009, *High Performance Green Buildings*, is considered for achieving the:

- Mandatory energy efficiency goal of 30% better than ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*
- Future Executive Order 13514 goal of net-zero energy-use buildings beginning in FY 2020.

Additionally, INL is assessing enduring assets for conformance to the guiding principles for HPSB, for potential certification to LEED for existing buildings operations and maintenance, and/or for efficient operations using the Environmental Protection Agency *Portfolio Manager* on-line tool.[8] The results of these analyses are used to identify cost-effective facility upgrades that will improve employee health and productivity and enhance the efficiency of enduring asset operations to ensure the sustainability of INL assets while meeting INL mission requirements.

A-1.4 Infrastructure Capability Assessment

A-1.4.1 Assessment Approach

This infrastructure capability assessment evaluates the ACI for individual MC and MD assets in order to provide the data facility managers need to understand facility condition and focus DM reduction and sustainment investments toward the appropriate assets.

A-1.4.2 ACI Targets

In May 2011, DOE-NE established the ACI targets for operating assets (FIMS status codes 1, 2, and 6) at INL that are based in the targets specified in DOE’s TYRT (DOE 2010). The targets for FY 2011 are 0.971, 0.925, and 0.920 for MC, MD, and NMD assets, respectively. The TYRT also establishes long term ACI targets of 0.980, 0.930, and 0.920 for MC, MD, and NMD assets, respectively.

Achievement of the long-term targets is set for 2015. The average ACI for INL assets currently meets the 2015 DOE TYRT ACI targets. Sections A-1.4 and A-1.5 provide additional discussion concerning the ACI of INL MC and MD assets and INL’s strategy to maintain the condition of its assets at these targets.

[8] *http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.*

Mission Critical Assets

- ***INL Definition:*** *MC assets include INL assets that have direct links to accomplishing the R&D objectives of INL program sponsors or other external commitments. They are unique and enable DOE-NE to make progress toward its R&D objectives and its various programs' missions.*
- ***INL MC assets*** *(See Table A-3):*

  ✓ *ATR*

  ✓ *20 buildings*

  ✓ *4 other structures and facilities.*

A-1.4.3 Assessment of MC Assets

INL defines MC assets as those that have direct links to accomplishing the R&D objectives of INL program sponsors or other external commitments. They are unique and enable DOE-NE to make progress toward its R&D objectives and its various programs' missions. Therefore, these facilities are vital to the long-term research mission of INL.

INL and DOE reviewed INL assets in 2010 in order to identify those assets that have direct links to accomplishing the R&D objectives of INL program sponsors or other external commitments. DOE-NE approved the resulting list in September 2010. The updated list of 25 MC assets includes the ATR, a programmatic OSF[9], 20 buildings, and 4 OSFs. Table A-3 provides a list of INL MC assets and the associated program objective or commitment.

The ACI for the portfolio of 24 nonprogrammatic MC buildings and OSFs is 0.987 (EXCELLENT), which exceeds the 2015 ACI target for MC assets (0.980).

The ACI measure is not applicable to a programmatic OSF asset such as the ATR. Therefore, INL has proposed adaptation of the Institute of Nuclear Power Operations (INPO) Equipment Reliability Indicator (ERI) to the ATR in order to have a measure of the ATR condition. The ERI is a measure developed by the INPO Equipment Reliability Working Group for implementation throughout the nuclear power/reactor industry. The ERI combines sound performance indicators that reflect the performance in key areas identified by INPO to give an indication of overall reactor performance, the longer-term trend of improvements, and adherence to reliability principles. Adoption of the ERI as the condition measure for the ATR is still under discussion with DOE.

Mission Critical Asset ACI Summary

- *The ACI is not applicable to the ATR – a programmatic real property asset*
- *Long-term (2015) ACI target for MC assets is 0.980*
- *Average ACI for INL MC assets is 0.987.*

[9] OSFs are one of the four categories of real property assets that include buildings, trailers, OSFs, and land.

Table A-3. Idaho National Laboratory Mission Critical assets and mission association.

Property ID	Property Name	ACI	Mission, Core R&D Capability, External Commitment
CFA-690	Radiological and Environmental Science Lab	0.96	Commitment to HSS; traceable to NIST
IF-603	IRC Laboratory Building	0.98	E&E and National and Homeland Security primary missions
IF-605	Energy Storage Technology Laboratory	0.99	Battery Test Lab
IF-638	IRC Physics Lab	1.00	DOE-NE Nuclear Science and Technology missions
IF-657	INL Engineering Demonstration Facility	1.00	National and Homeland Security primary missions
MFC-1702	Radiochemistry Laboratory	1.00	Aqueous Chemistry R&D capability
MFC-704	FMF	0.96	Fuel Cycle R&D capability
MFC-704A	FMF Compressor Building	0.95	Required for operation of MFC-704 (FMF)
MFC-709	Safety Equipment Building	0.81	Required for MFC-785 (HFEF) operation
MFC-752	Lab and Office Building	1.00	Fuel Cycle R&D capability
MFC-764	200 Ft Suspect Stack	1.00	Required for MFC-765 (FCF) operation
MFC-765	FCF	0.97	Fuel Cycle R&D capability
MFC-774	ZPPR Support Wing	0.99	Fuel Cycle R&D capability
MFC-785	HFEF	0.97	Fuel Cycle R&D capability
MFC-785A	HFEF Cooling Tower	1.00	Required for MFC-785 (HFEF) operation
MFC-787	Fuels and Applied Science Building	1.00	Fuel Cycle R&D capability
MFC-792	SSPSF Control Room	0.98	Space Battery Program commitment to NASA
MFC-792A	SSPSF Annex	0.99	DOE-NE Space and Defense Power Systems mission
TAN-629	SMC Assembly Building	0.99	Commitment to U.S. Army
TAN-679	Manufacturing and Assembly Bldg.	0.99	Commitment to U.S. Army
TAN-679A	Manufacturing and Assembly Annex	1.00	Commitment to U.S. Army
TRA-670	ATR Reactor Building	1.00	Thermal Irradiation capability
TRA-770	ATR Vent Stack	1.00	Required for ATR operation
TRA-771	ATR Cooling Tower	0.77[a]	Required for ATR operation
ATR	ATR	N/A[b]	Thermal Irradiation capability

a. Low ACI is likely due to an inaccurate RPV. Calculation of a new RPV is in progress.

b. ACI is not applicable to programmatic assets like ATR.

ATR = Advanced Test Reactor
DOE-NE = Department of Energy Office of Nuclear Energy
E&E = DOE Office of Ecology and Environment
FCF = Fuel Conditioning Facility
FMF = Fuel Manufacturing Facility
HFEF = Hot Fuel Examination Facility
HSS = DOE Office of Health, Safety, and Security
INL = Idaho National Laboratory
IRC - Idaho Falls Research Complex
NASA = National Aeronautics and Space Administration
NIST = National Institute for Standards and Technology
R&D = research and development
SMC = Specific Manufacturing Complex
SSPSF = Space and Security Power Systems Facility
ZPPR = Zero Power Physics Reactor

A-1.4.4 Assessment of MD Assets

Most of the INL DOE-NE owned and operating real property assets fall into the MD category and include 169 building/trailers and 158 OSFs. The average ACI for these 327 assets (0.937) exceeds the long-term ACI target for MD assets (0.930).

A-1.4.5 Assessment of Infrastructure Impacting S&S

INL has identified 5 MC and 25 MD real property assets considered important to the S&S function at INL. (See the insert for a summary of the statistics associated with these 30 assets.) Table A-4 provides a list of these assets and the associated program office and ACI for each.

The asset condition deficiencies and capability gaps listed below affect the S&S functions and working environment of protective force personnel working in these assets:

- The indoor pistol range (B21-608) is out-of-service due to a worn out bullet trap and lead accumulation in the ventilation system.
- Deterioration of the non-slip coating on the walking surfaces in Firing Ranges 3 (B21-609) and 5 (B21-610) present a safety hazard and require restoration.
- There is inadequate space at MFC for facilities that are important to the training and fitness of the protective force stationed there.
- The capacity and noise level of the heating, ventilating, and air conditioning system in the basement of MFC-774 is inadequate and too noisy for the improvised workout area, locker space, and to hear the alarms from and cool the Central Alarm System located there.
- There is inadequate classroom space and roof leaks in the gun cleaning and other areas of the Weapons Range House (B21-608).

S&S Asset - Statistics

- *30 INL assets are important to the S&S function*
- *26 / 4 S&S assets owned by DOE-NE / DOE-EM, respectively*
- *Total RPV = $211M*
- *Total DM backlog = $5.8M*
- *Average ACI 0.973.*

- There is inadequate heating in some gate posts, INTEC East and West Guardhouses, and CF-699 office areas.
- The Security Headquarters (CF-609) has a history of leaking windows and poor reliability of the heating boiler.
- The "DELTA" barrier at the ATR Complex main gate has frequent failures due to damage caused during a recent vehicle impact.

Facility management is working with the INL Campus Development Office and S&S management to assign the appropriate resources (e.g., labor and funding) and put work documents (i.e., designs, maintenance, and/or subcontracts) in place to address each of these deficiencies.

A-1.4.6 Assessment of the Ability for MFC Infrastructure to Support Future Expansion

Chapter 1 of this TYSP discusses the vision for the INL core R&D capabilities and the need for expanding INL infrastructure to support the future at MFC. Due to the overcrowded situation, anticipated future growth, and its importance to current and future mission capabilities, INL is focusing considerable attention to identify and manage support infrastructure capability gaps at MFC. INL has identified and is executing the following MFC support infrastructure enhancements.

Table A-4. Safeguards and security assets.

ID	Property Name	Program Office	Mission Dependency	ACI
B21-608	Weapons Range House	NE	MD	0.99
B21-609	Weapons Range Firing Line	NE	MD	1.00
B21-610	Firing Line Cover 5	NE	MD	0.71
B21-611	Weapons Range Firing Enclosure	NE	MD	1.00
B27-603	Security Badging Facility	NE	MD	0.86
CF-1611	CFA Fire Station	NE	MD	0.94
CF-1614	Fire Training Facility	NE	MD	1.00
CF-609	Security Headquarters	NE	MD	0.92
CF-623	Multi-craft Shop #3	NE	MD	1.00
CF-699	Radio and Alarm Shop	NE	MD	0.98
CPP-1663	Security and Fire Protection Support	EM	MC	0.99
CPP-1671	Protective Force Support Facility	EM	MC	0.99
CPP-1674	Central Alarm Station	NE	MD	0.97
CPP-1686	Access Control Facility	EM	MC	1.00
IF-606	INL Admin Building	NE	MD	1.00
IF-616	Willow Creek Building	NE	MD	1.00
MFC-701	Security Building	NE	MD	1.00
MFC-710	Engineering Office Building	NE	MD	0.87
MFC-713	Modular Office Bldg T-13	NE	MD	0.96
MFC-714	Modular Office Bldg T-12	NE	MD	0.81
MFC-725	MFC Fire Station	NE	MD	1.00
MFC-752	Lab and Office Building	NE	MC	1.00
MFC-759	Emergency Reentry Building	NE	MD	0.84
MFC-768	Power Plant	NE	MD	0.84
MFC-774	ZPPR Support Wing	NE	MC	1.00
MFC-791	Instrument and Maintenance Facility	NE	MD	0.85
TRA-604	MTR Utility Basement	EM	MD	1.00
TRA-620	Office Building	NE	MD	0.76
TRA-658	TRA Access Control Facility	NE	MD	0.99
TRA-680	Emergency Control Center	NE	MD	0.99

CFA = Central Facilities Area
EM = DOE Office of Environmental Management
MC = mission critical
MD = mission dependent
MFC = Materials and Fuels Complex
MTR = Materials Test Reactor
NE = DOE Office of Nuclear Energy
TRA = Test Reactor Area
ZPPR = Zero Power Physics Reactor

- The capacity of MFC sanitary wastewater collection system is inadequate to support current, as well as projected, future sanitary waste loads. An $7.5M Institutional General Plant Project (IGPP) to construct new evaporation lagoons of sufficient capacity is currently underway. Construction of additional lagoon capacity will begin in FY 2012.
- The transformers in the MFC main substation are operating at capacity following the conversion of steam generation and space heating to electric power. INL will execute a $7M IGPP to increase substation capacity in FY 2012 through FY 2015.
- The capacity of MFC Dial Room and the components in the MFC electrical distribution system is limiting the ability to expand the MFC. Replacement and expansion of the existing dial room is underway. A path forward to address the inadequate capacity of the electrical distribution system is under development.

A-1.4.7 Assessment of MFC Emergency and Standby Diesel Generators

MFC Diesel Generators

Deferred Maintenance:

- *4 of 17 MFC diesels have DM totaling $1M*
- *$400K DM is associated with two diesels in MC buildings.*

10-Year Sustainment Forecast:

- *3 of 17 MFC diesels are forecast to need replacement 2011 – 2020 for $500K*
- *$350K sustainment is associated with two diesels in the MC Zero Power Physics Reactor support wing / Electron Microscopy Laboratory (MFC-774).*

Real property assets at MFC include 17 diesel generators. There is $1M of DM associated with replacement of four of these generators reported in FIMS. Two of these four deferred generator replacements, at an estimated cost of $400K, are associated with the MC Hot Fuel Examination Facility (HFEF).

Additionally, sustainment forecasting indicates that three of MFC's 17 generators will come due for replacement over the term of this TYSP and have an estimated replacement cost of approximately $500K (see Table A-5). Two of these three future generator replacements are associated with the MC Zero Power Physics Reactor support wing/Electron Microscopy Laboratory (MFC-774) and have an estimated replacement cost of approximately $350K.

Table A-5. Materials and Fuels Complex diesel generator sustainment forecast for 2011 through 2020.

Building	Name	Mission Dependency	Task	Forecast Year	Estimated Cost (2011$)
MFC-774	ZPPR Support Wing	MC	Replace 30-kw Generator	2015	$96,555
MFC-774	ZPPR Support Wing	MC	Replace 125-kw Generator	2020	$253,567
MFC-798	Rad.Liq. Waste Treat. Facility	MD	Replace 30-kw Generator	2020	$96,555

MC = Mission Critical

MD = Mission Dependent, Not Critical

ZPPR = Zero Power Physics Reactor

The estimated annual investment levels for proactive sustainment of these three generators have been escalated and incorporated in the proactive sustainment activities for MC and MD buildings that are listed in Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2).

In July 2010, INL experienced a 109,000-acre (170-mi^2) wildfire that required interruption of commercial electrical power to MFC. The diesel generators, which provided minimum electrical service to MFC nuclear facilities[10] and associated safety systems, operated flawlessly with one exception - the 20-year-old generator in MFC-752A experienced a voltage regulator failure approximately 2 hours into the event resulting in a total loss of power to the MC Analytical Laboratory portion of MFC-752, a Hazard Category 3 nuclear facility. The 54-year old standby generator for the MD MFC Power Plant (MFC-768) also shutdown unexpectedly due to fuel starvation and could not be restarted due to a starter motor failure.

There was no significant safety, environmental, or operational consequence associated with the failure of the MFC-768 generator. The portable industrial grade generators brought in to help mitigate the generator failures also experienced readiness and reliability problems.

The age and untimely failure of these generators during an actual emergency have prompted INL to initiate an engineering lead condition assessment and evaluation of the life cycle management practices for emergency and standby generators at MFC and across INL. Based upon the results of this assessment and evaluation, INL will formulate a path forward and sustainment strategy to manage the risk associated with failure of these generators.

[10] *Hazard category 2 and 3 nuclear facilities.*

A-1.4.8 Assessment of INL Roads

A-1.4.8.1 DOE-NE Primary Roads

INL includes 51 miles of two-lane high-speed primary roads. INL buses; emergency services; S&S; and government-, subcontractor-, and staff-owned light vehicles use these roads for transiting to and from the main research complexes and the state highways surrounding the INL Site. These roads have historically been the focus of maintenance investments and, therefore, are in the best condition (ACI = 0.99). However, several primary roads (e.g., Lincoln Boulevard, Washington Boulevard, and Nile Avenue) are starting to show the need for more significant maintenance and reconstruction activities in the next few years.

In the case of Nile Avenue, the 1.7-mile road to SMC, there has been little maintenance investment in over 20 years. Lack of maintenance investment, coupled with many years of heavy-vehicle traffic associated with DOE-EM demolition at Test Area North (TAN), has resulted in significant degradation of the road. A detailed engineering evaluation of Nile Avenue in 2010 identified the need to invest $700K for crack sealing, full-depth patching and pothole repairs, and chip seal coating to restore the friction characteristics and seal the road surface. However, these repairs will only restore the road surface for 1 to 3 years. Core sampling identified that water intrusion has degraded 50% of the roadbed. Correction of

INL Primary Roads Investments

- *Resurface 1.3-mile Washington Blvd. to NRF*
- *Significant crack sealing and chip seal coating of Lincoln Blvd. – the main North-South INL road from Central to TAN*
- *Short-term restoration of Nile Ave.*
- *Reconstruction of Nile Ave.*

this condition requires total reconstruction of 50% of Nile Avenue and resurfacing of the remaining 50% of the asphalt surface. A $4.4M IGPP for reconstruction and resurfacing project will begin in 2013.

A-1.4.8.2 DOE-NE Secondary Roads

DOE-NE owns 26 miles of secondary roads. Low-speed government, delivery, and subcontractor vehicles use these roads to move staff and equipment between buildings and parking areas within the various building complexes (i.e., Central Facilities Area [CFA], ATR Complex, MFC, and TAN) across the site. Personal vehicles use secondary roads at CFA.

Secondary roads only receive corrective maintenance necessary to keep them in adequate condition for the slow moving vehicles moving within the complexes. These maintenance activities include filling potholes and repairing other hazards to snow removal or vehicle and pedestrian traffic. This level of maintenance has proven to keep frequently used secondary roads throughout the complex in a condition that is adequate for the low-speed traffic that uses these roads.

However, MFC and ATR Complex secondary roads will require maintenance and recapitalization investment in the next few years to address water drainage and damage caused by many years of heavy loads and traffic associated with construction and demolition activities. Secondary roads in the eastern part of TAN have also suffered damage as a result of past demolition activities. However, these damaged roads will not have any impact on current and future operations at TAN, which are limited to SMC, located in the western end of TAN.

2010 RAMP Roof Assessment Results

- *INL roof average remaining service life is 10 years*
- *36% / 60% of INL roof area requires replacement in the next 5 / 10 years, respectively*
- *Forecast 5-year / 10-year roof replacement investment requirement = $17M / $28M, respectively.*

2010 RAMP Accomplishments

- *Design for replacement of worst 15 roofs (187,000 ft² of roof area)*
- *Condition assessment of DOE-NE-owned roof area (1.7 million ft²)*
- *Five roof replacement pilot project (66,000 ft²).*

INL will be initiating an engineering study and evaluation of secondary roads at the MFC and ATR Complex in FY 2012. The goal of this study will be to understand the traffic flows and condition of roads that will support ongoing and future operations of ATR and MFC. The results will be used to develop a multiyear plan for restoration of these roads.

A-1.4.8.3 Assessment of DOE-NE Owned Roofs

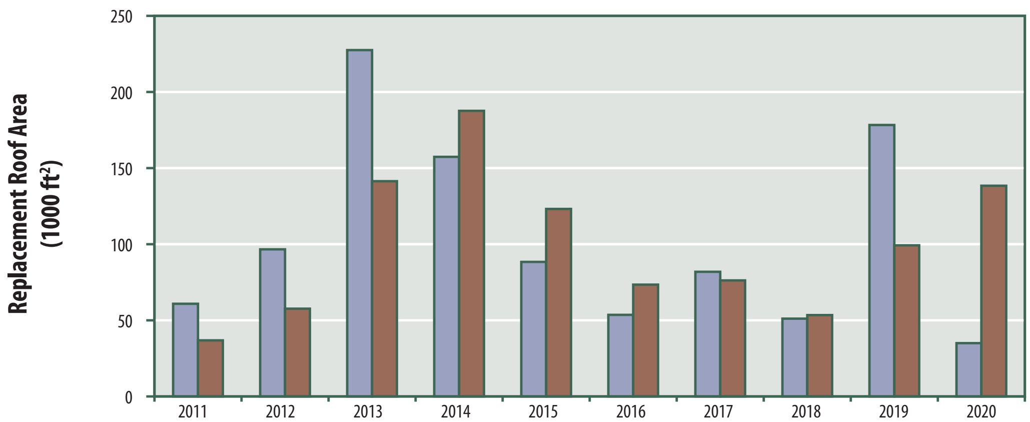
The 291 DOE-NE buildings and trailers at INL include 1.7 million ft² of roof. In 2010, INL made the decision to manage DOE-NE owned roofs using the National Nuclear Security Administration (NNSA) Roof Asset Management Program (RAMP).

The 2010 assessment of INL roofs by the RAMP indicated that INL roofs have an average remaining service life of 10 years. The RAMP assessment identified that 60% of INL's total roof area will need replacement in the next 10 years, equaling an estimated total investment of approximately $28M. Section A-1.5.2 and Appendix B, Table B-8, discuss the plan for investing $20M in roof replacement over the next 10 years.

The 2010 roof assessment identified approximately $400K of "OPTIMUM" roof repairs that would address a significant number of current roof leaks and postpone replacement of 140,000 ft^2 of roof area by several years. Performing the optimum repairs will reduce the near-term (1 to 3 years) roof replacement costs from $5.8M to $3.5M, a near-term cost avoidance of $2.3M. Performing the optimum repairs will also convert the $4M spike in roof replacement forecast for FY 2013 by approximately $1M into a wave spread over FY 2013 through FY 2015.

Figure A-1 compares the roof replacement requirements projected by the RAMP assessment over the next 10 years, with and without optimum repairs, and illustrates the impact of performing the recommended optimum repairs.

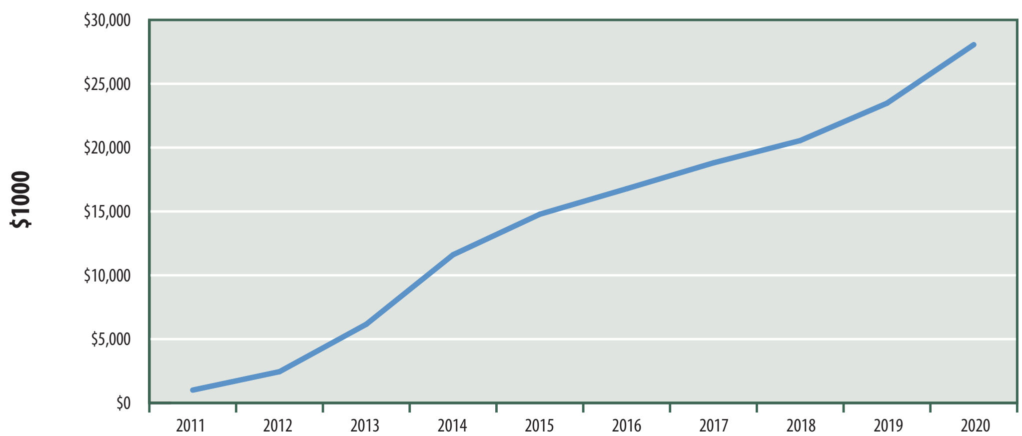
Figure A-2 illustrates the annual and cumulative investments for roof replacements projected over the next 10 years by the RAMP roof assessment.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Pre-Optimum (sf)	60,889	96,636	277,526	157,391	88,391	53,612	81,894	51,115	178,315	35,024
Post-Optimum (sf)	36,852	57,668	141,404	187,615	123,181	73,456	76,223	53,456	99,288	138,421

11-50359-15

Figure A-1. 2010 Roof Asset Management Program projected roof replacement area (pre- versus post-optimum repairs).



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Total ($K)	$1,008	$1,443	$3,713	$5,445	$3,173	$1,995	$2,027	$1,747	$2,926	$4,585
Cumm Total Investment $K	$1,008	$2,451	$6,164	$11,609	$14,782	$16,777	$18,804	$20,551	$23,477	$28,061

11-50359-16

Figure A-2. Cumulative estimated roof replacement cost (Roof Asset Management Program assessment).

Impact of Performing $400K of Optimum Repairs

- *Large number of current leaks repaired*
- *Replacement of 140,000 ft² of roof area postponed by 3+ years*
- *Near-term (1-3 years) replacement costs reduced by $2.3M*
- *FY 2013 spike reduced by ~$1M and spread over FYs 2013 through 2015*
- *5-year / 10-year investment forecast reduced by $2.4M / $1M.*

These cost projections assume $25/$35[11] per square feet for indirect-/direct-funded roof replacements.

A-1.4.8.4 Assessment of INL High-Voltage Transmission and Distribution System

The INL high-voltage T&D system consists of 65 miles of 138-kV transmission lines connecting the seven main substations that deliver electrical power to the operating complexes across the INL Site. There are also 65 miles of lower-voltage (13.8kV, 12.4kV, and 2,400V) distribution lines that provide electric power to various substation loads. This system continues to operate with a reliability that far exceeds the industry standard.

However, the critical T&D system condition and capability concerns listed below will require maintenance and capital investment over the next 10 years to mitigate the risk associated with equipment currently at or beyond their design service life. INL routinely maintains and monitors these aging pieces of equipment for indications of impending failure or wear-out. Critical T&D system condition and capability concerns include:

- The INL Supervisory Control and Data Acquisition (SCADA) system is 2 years past its 15-year design service life. The system vendor will phase out support for this equipment beginning next year (2012) and will only support the repair of components. Additionally, the RWMC substation has no SCADA capabilities. Failure of this system requires stationing of staff at the individual substation switchgear to manually monitor and control operation of the system.
- The transformers in the MFC main substation are operating at capacity following the conversion of steam and heating to electric power. This situation limits the ability of this substation to support expansion at MFC associated with establishment of some mission capabilities discussed in Chapter 1 of this TYSP.
- Expansion at MFC is also limited by the capacity of 13.8-kV and 2,400-V electrical distribution switchgear and distribution components within the complex.

Other T&D system infrastructure concerns include:

- The age of transformers in the main substations serving the TAN/SMC, MFC, Critical Infrastructure Test Range Complex (CITRC), and NRF are more than 20 years past their 30-year design service life.
- The age of transformers in the main substation serving CFA are approaching their 30-year design service life and are experiencing failures with internal output-voltage control components.
- Underground cables between substation transformers and switchgear at several substations are over 30 years old.

[11] 40% of additional general and administrative burdening is added to direct-funded activities. This additional 40% burdening is not applicable if funding is provided directly to the Kansas City Plant DOE-NE headquarters rather than passing the funding through the Idaho Facilities Management Program.

- Three 138-kV oil-filled circuit breakers are approaching 30 years old and have a history of operating mechanism failures and difficulty finding repair parts.
- Approximately 2.5% of the transmission and distribution system power-line support poles and structures suffer from major decay. Replacement of these poles will require approximately 4 years.
- Failures have been experienced with underground equipment and cables associated with the RWMC electrical distribution system.

A-1.5 10-Year Infrastructure Investment Strategy

A-1.5.1 Capital Investment

Appendix B discusses INL capital investment strategy and plans.

A-1.5.2 Investment in Sustainment

INL expects the level of sustainment funding for the near future to remain at or below 2010 levels due to the significant pressure put on federal budgets by the current recession and efforts to reduce federal spending. The challenge for INL is to focus available funding toward improving the sustainability of its assets and toward incorporating additional proactive sustainment and DM reduction scope into its sustainment strategy in order to maintain the ACI within targets. The INL will focus proactive sustainment efforts on MC assets. Sustainment of the remaining real property assets will be limited to preventive/predictive and reactive corrective maintenance. However, INL's sustainment-modeling and planning efforts will continue to define the appropriate scope and cost estimate for implementation of risk-based and mission focused proactive sustainment for INL real property assets.

INL MC Buildings (except SMC) MII Summary (except ATR – a programmatic OSF)

- *MII = actual maintenance $ / RPV $*
- *MII target is 2% to 4%*
- *MII target equates to an annual total sustainment investment of $11M to $21M; past annual maintenance investment in MC assets has been $7.5M*
- *INL MC asset MII is 1.4%*
- *Annual proactive sustainment investment forecast is ~$2M*
- *INL MC asset MII with $2M sustainment is $1.8%.*

A-1.5.2.1 Mission Critical Assets

INL historically invests approximately $7.5M each year[12] for preventive, predictive, and reactive corrective maintenance of INL's 17 MC buildings not located at SMC.[13] This level of investment equates to a below target MII[14] of 1.4% for these buildings. Sustainment modeling indicates that an annual investment of approximately $2M, or $20M over the 10-year period of this TYSP, in proactive sustainment activities is required to maintain the ACI for these 17 buildings at the current level. The estimated annual investment levels for proactive

[12] *Based on average of actual annual maintenance charges reported in FIMS between 2007 – 2010, inclusive.*
[13] *SMC MC buildings are excluded from this analysis because they are direct funded by the U.S. Army.*
[14] *MII = Total FIMS Annual Actual Maintenance Investment / Total FIMS Replacement Plant Value.*

sustainment of MC buildings have been escalated and incorporated in Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2). Adding $2M of proactive sustainment to the current annual sustainment investment level of $7.5M raises the MII to only 1.8%. A total annual sustainment investment of between $11M and $21M is required to restore the MC MII to the target range[15].

A-1.5.2.2 *Mission Dependent Assets*

INL historically invests approximately $8M each year[16] for preventive, predictive, and reactive corrective maintenance of INL's MD buildings[17] that are not located at the SMC area.[18] This level of investment equates to an on-target target MII[19] of 3% for these buildings.

Although sustainment modeling for MD assets is not yet complete, the current level of sustainment modeling indicates that an annual investment of approximately $4M, or $40M over the 10-year period of this TYSP, in proactive sustainment activities is required to maintain the ACI for these MD buildings at the current level. The estimated annual investment levels for proactive sustainment of MD buildings have been escalated and incorporated in Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2). Adding $4M of proactive sustainment to the current annual sustainment investment level of $8M raises the MII for these buildings to 4.6%. A total annual sustainment investment of between $5M and $10M would be required for the MII for these buildings to be in the target range.[19]

[15] *The MII target is 2% to 4%.*
[16] *Based on average of actual annual maintenance charges reported in FIMS between 2007 – 2010, inclusive.*
[17] *Only buildings are discussed here because OSFs have not been loaded into the sustainment-modeling tool.*
[18] *SMC buildings are excluded from this analysis because they are direct funded by the U.S. Army.*
[19] *MII = Total FIMS Annual Actual Maintenance Investment / Total FIMS Replacement Plant Value.*

A-1.5.2.3 *Investment in Roads*

Table A-6 shows that INL has historically invested approximately $700K annually in road maintenance. This level of maintenance investment will continue over the next 10 years. Additionally, INL plans to invest $4.4M in of IGPP funding (Table B-1) for the reconstruction of Nile Avenue in 2012 through 2014. INL will consider additional investments based on the recommendations from the secondary roads engineering study discussed in Section A-1.4.8.2.

A-1.5.2.4 *Investment in Roof Repair and Replacement*

An annual investment of approximately $4M is required to address the backlog as well as future roof replacements forecast for 2011 through 2016. Subsequently, the annual investment forecast decreases to approximately $2.5M. Appendix B (Table B-8) and Chapter 5 (Figure 5-1 and Table 5-2) include the investments needed to address roof replacement.

INL MD Buildings (except SMC) MII Summary (except the ATR – a programmatic OSF)

- *MII = actual maintenance $ / RPV $*
- *MII target is 2% to 4%*
- *MII target equates to an annual total sustainment investment of $5M to $10M; past annual sustainment investment in MD buildings has been $8M*
- *INL MD asset MII is 3%*
- *Although not complete, current planning indicates annual proactive sustainment investment forecast for MD buildings is ~$4M*
- *INL MD asset MII with $4M sustainment is $4.6%.*

Table A-6. Road maintenance statistics.

Asset Name	Pri Qty (Miles)	2-Year Avg. Actual Maint. ($K)	Maint. % of RPV	DM ($M)	RPV	ACI	$ to ACI Goal ($M)
Total Primary Roads	51	691	0.6	1.5	107.2	0.99	0
Total Secondary Roads	26	30	0.1	4.0	22.1	0.82	3.1
Total Tertiary Roads	60	5	0.2	0	2.4	1.00	0

INL and DOE have committed to a roof management program that includes participation in the NNSA RAMP (approximately $300K/year program and design costs) and completion of one $1.5M roof repair and/or replacement project within the RAMP each year. Including RAMP participation and construction support costs, this level of investment would bring the total annual cost of participation in RAMP to approximately $2.5M.

A-1.5.3 Investments in Achieving Sustainability Goals

Appendix D discusses the projects and investment options for achieving INL's sustainability goals.

A-1.5.4 Leasing of Facilities

INL currently leases 27 buildings (Table A-7) totaling 816,000 gross ft^2 with an annual rent of $7.4M. Most of these buildings are located in the REC in Idaho Falls, Idaho.

INL has also entered into agreements for construction of two additional buildings that INL will lease and occupy when construction is complete. Both of these buildings are located in Idaho Falls, Idaho.

Overall, INL employs facility leasing when it is in the best interest of the government and the INL mission (functionally and financially). Facility leasing enables timely building terminations as more appropriate government-owned or consolidated property becomes available for occupancy. Leased buildings are systematically used to provide the best value to government; to maximize employee comfort, health, and productivity; and to minimize operating and utility costs. New and build-to-suit leases are designed and constructed to achieve LEED-Gold certification whenever possible. Existing building leases include provisions to evaluate the facility prior to occupancy for energy efficiency and the ability of the building systems to provide the appropriate indoor environmental quality.

Whenever possible, existing building leases provide for updates to maximize energy efficiency and employee productivity by incorporating the guiding principles for HPSBs. For existing building leases intended to be very short-term temporary occupancies, the buildings are evaluated for updating on a case-by-case basis with a preference for a facility that demonstrates better energy efficiency and indoor environmental quality.

During the past several decades, INL has experienced substantive swings in both mission goals and the corresponding employment base. With mission changes, facility requirements also change. To accommodate varying facility needs, INL employs facility leasing as a tool to optimize the facility inventory, with a guiding focus on minimizing the number of buildings and maximizing occupancy. INL applies this leasing strategy in two different ways. On an INL site campus, leasing is practiced only as an option for temporary structures (e.g., construction and short-term office trailers) with

Table A-7. Current Idaho National Laboratory Department of Energy Office of Nuclear Energy leased building information.

FIMS Property ID	Property Name	Usage Code Description	Leased ft²	Lease Expiration Date	Annual Rent ($)	FY 2010 Other Cost ($)	Total Occ.	Planned Action Year	Planned Action
B60-606	Boise Outreach Office #2	101 Office	2,390	08/31/2013	$44,813	$0	0	2013	Renew
IF-606	INL Admin Bldg	101 Office	65,550	07/31/2012	$489,876	$491,507	231	2012	Renew
IF-606A	RAP Addition to IAB (IF-606)	401 Programmatic General Storage	2,176	07/31/2013	$1,371	$0	0	2013	Renew
IF-613	North Boulevard Annex	703 Applied Science Laboratory	14,077	09/30/2011	$97,536	$51,171	16	2011[a]	Renew[a]
IF-616	Willow Creek Bldg	101 Office	272,309	05/31/2014	$1,132,880	$1,864,730	757	2014	Renew
IF-617	Willow Creek Mechanical Bldg.	694 Other Service Buildings	7,767	05/31/2014	$1	$209,251	1	2014	Renew
IF-618	University Place	290 Library	12,094	2/28/2012	$153,231	$7,412	3	2012	Renew
IF-619	North Holmes Complex	101 Office	6,157	12/31/2011	$59,040	$17,652	2	2011	Renew
IF-631	Bus Dispatch Facility	621 Vehicle Repair Shops	3,500	6/15/2011	$102,000	$73,554	3	2011	Renew
IF-639	North Holmes Laboratory	791 Laboratories, General (Non Nuclear)	22,030	4/30/2013	$183,793	$73,553	14	2013	Renew
IF-651	North Yellowstone Laboratory	791 Laboratories, General (Non Nuclear)	8,000	10/31/2012	$45,600	$57,535	2	2012[a]	Renew[a]
IF-654	Engineering Research Office Bldg	101 Office	243,063	01/31/2018	$1,422,259	$1,130,565	869	2018	Renew
IF-654A	EROB Mechanical Building Annex	694 Other Service Buildings	1,083	01/31/2013	$1	$1,306	0	2013	Renew
IF-665	Center for Advanced Energy Studies (CAES)	703 Applied Science Laboratory	38,611	03/05/2028	$850,104	$219,432	40	2028	Renew
IF-670-A	Bon. County Technology Cntr Bay # 1	791 Laboratories, General (Non Nuclear)	2,255	9/30/2014	$15,849	$219,432	0	2014[a]	Renew[a]
IF-670-B	Bon. County Technology Cntr Bay # 2	791 Laboratories, General (Non Nuclear)	2,182	9/30/2014	$16,066	$5,866	0	2014[a]	Renew[a]
IF-670-C	Bon. County Technology Cntr Bay # 3	791 Laboratories, General (Non Nuclear)	2,180	9/30/2012	$16,380	$6,136	0	2012[a]	Renew[a]
IF-670-D	Bon. County Technology Cntr Bay # 5	791 Laboratories, General (Non Nuclear)	2,300	9/30/2014	$15,447	$7,142	0	2014[a]	Renew[a]

Table A-7. Current Idaho National Laboratory Department of Energy Office of Nuclear Energy leased building information.

FIMS Property ID	Property Name	Usage Code Description	Leased ft²	Lease Expiration Date	Annual Rent ($)	FY 2010 Other Cost ($)	Total Occ.	Planned Action Year	Planned Action
IF-670-E	Bon. County Technology Cntr Bay # 9	791 Laboratories, General (Non Nuclear)	2,234	9/30/2014	$15,760	$12,119	0	2014[a]	Renew[a]
IF-670-F	Bon. County Tech Center Bays 6, 7 & 8	791 Laboratories, General (Non Nuclear)	7,222	5/17/2015	$47,366	$22,129	0	2015[a]	TBD[a, b]
IF-670-G	Bon. County Technology Cntr Bay # 4	791 Laboratories, General (Non Nuclear)	2,094	1/31/2015	$16,149	$6,768	0	2015[a]	TBD[a, b]
IF-673	Idaho Innovation Center Bay 2	791 Laboratories, General (Non Nuclear)	2,095	9/30/2014	$15,949	$5,443	0	2014	Renew
IF-674	International Way Building	101 Office	13,457	3/31/2012	$262,751	$79,834	16	2012	Terminate
IF-675	PINS Laboratory	792 Laboratories, General (Nuclear)	6,500	03/31/2012	$50,050	$25,448	1	2012	Renew
IF-680	University Boulevard #1 (UB1)	101 Office	7,649	08/31/2018	$185,673	$59,824	36	2018	Renew
IF-681	University Boulevard #2 (UB2)	101 Office	33,145	07/31/2018	$1,338,289	$80,224	51	2018	Renew
IF-682	University Boulevard #3 (UB3)	541 Fabrication Facility	34,118	07/31/2018	$790,873	$80,224	16	2018	Renew
IF-684	University Boulevard #4	731 Electrical/Electronics Laboratory	32,160	02/28/2020	$585,876	$27,160	63	2020	Renew
		Totals	**848,398**		**$7,954,982**	**$4,835,416**	**2,121**		

a. The data in the "Planned Action Year" and "Planned Action" columns of this table reflect the planned action for the current lease expiration date. Table B-9 indicates the planned final disposition year and method. The year and action will only match Table B-9 if FINAL disposition will occur on the current lease expiration date.

b. INL will evaluate terminating the leases for IF-670F and IF-670G in 2015 and relocating the activities to the Research and Education Laboratory (REL) or Energy Systems Laboratory (ESL), which are planned for occupation by 2015.

General Plant Projects satisfying long-term space needs. On the REC campus, the property is privately owned and therefore long-term leases are utilized to acquire the essential space for a consolidated campus. INL consistently emphasizes this consolidation of in-town activities in and around the REC through lease agreements for nearby private property.

The new long-term leased Energy Systems Laboratory (ESL) under construction, and the Research and Education Laboratory (REL) to follow, will both significantly enhance this REC centrally focused campus. Consolidation on the campus has also enabled INL to eliminate many smaller leased buildings around the community.

INL is unique in one important way: the lease rates of the laboratory's two primary REC office buildings in Idaho Falls are extremely favorable, with an average rate of $5.25/ft^2 annually for over 500,000 ft^2 leased. Although INL intends to occupy government-owned buildings whenever possible, facility leasing will continue to be an important component in the INL's facility management.

A-2. FOOTPRINT REDUCTION

Refer to Appendix B, Section B-3, for a discussion of INL's plans for disposition of excess DOE-NE facilities.

A-3. ASSET UTILIZATION

The FIMS database quantifies utilization based on the AUI, as shown below.

$$\text{AUI} = \frac{\sum(\text{Operating Asset Gross Sq.Ft.} \times \text{Operating Asset Utilization Factor})}{\text{Gross Operating Sq.Ft.} + \text{Gross Shutdown Sq.Ft.})}$$

The AUI provides a combined appraisal of two related real property utilization factors: (1) the rate of utilization of operating buildings and trailers, and (2) the elimination of excess facilities.

A-3.1 Current Utilization of DOE-NE Nonprogrammatic Facilities

The AUI improves as excess facilities are eliminated and as consolidation increases the space utilization rate of the remaining buildings. The factor can be assessed for individual facilities, groups of facilities, entire sites, or the entire DOE complex. Table A-8 includes the FIMS AUI ratings for INL.

When compared to the previous year's results, the MFC AUI has improved from 0.98 to 1.00; the ATR Complex AUI has improved from 0.96 to 0.99; and the REC AUI has remained at 1.00. These high utilization ratings reflect the transition to a three-campus focus.

The 100% REC utilization rate also reflects the large percentage of leased space in Idaho Falls. Leased space is not included in the AUI calculation; however, leased space allows the REC footprint to be adjusted to accommodate for changing space demands, and thus maintain full utilization of REC DOE-NE owned space.

The AUI for the balance of INL facilities has remained constant at 0.92. Overall, INL's AUI has increased from 0.95 to 0.96.

A-3.2 Future Utilization of DOE-NE Nonprogrammatic Facilities

The INL goal is to achieve and maintain an AUI performance rating of GOOD to EXCELLENT for active MC INL facilities by 2014.

Table A-8. Idaho National Laboratory asset utilization index.

Site Area	Owned Facilities (nsf)[a]	Asset Utilization Index[a]	Rating
MFC	493,351	1.00	Excellent
ATR Complex	322,400	0.99	Excellent
REC	240,194	1.00	Excellent
Balance of INL	985,114	0.92	Adequate
All INL Facilities	2,041,059	0.96	Good

a. Based on 03/30/2011 data.

ATR = Advanced Test Reactor

INL = Idaho National Laboratory

MFC = Materials and Fuels Complex

REC = Research and Education Campus

Having modern facilities optimized for mission needs will ensure that INL's active facilities can be classified in FIMS as 100% used. Transfer or demolition of excess facilities will eliminate unused facilities. Both of these footprint reduction-related actions are necessary to improve INL's AUI performance.

A-3.3 Space Utilization

The following objectives convey the strategy for managing the utilization of INL space:

- Utilization of essential INL assets is optimized in support of INL missions
- Staff move plans are based on the integration of long-range campus and mission planning
- Modernization of excess/obsolete facilities is included in options to address the need for additional space when economically viable
- Nonessential assets are vacated and processed for footprint reduction
- The actual space occupied is linked to the cost to maintain and operate the space in order to promote the efficient use of space.

INL continuously evaluates occupancy and utilization of facilities as part of day-to-day space management activities. Current results are weighed against future needs, and alternatives are developed to satisfy the differences between the current state and future requirements. The best alternatives are developed into occupancy plans that efficiently use available space. When required, alternatives are developed into projects, including facility upgrades, new facilities, and facility disposal. Only mission-needed facilities continue to be used. Excess facilities are identified for inactivation and final disposition.

Day-to-day space management is accomplished to accommodate organizational and personnel changes in ways that optimize use of existing facilities. Longer-range space management processes are accomplished to support transformation of INL into three modern campuses that fully support the INL mission and vision. Figure A-3 illustrates INL's efficient use of available space.

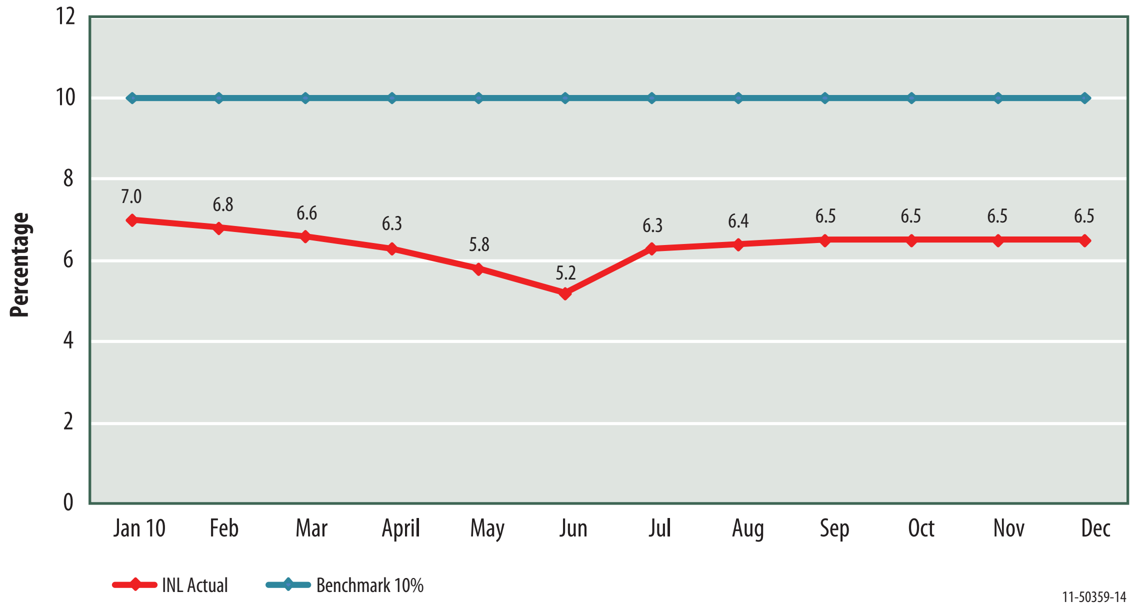


Figure A-3. Idaho National Laboratory space utilization for the past year compared with an international facility management association benchmark.

A-4. REFERENCES

ASHRAE Standard 90.1 – 2007, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, American Society of Heating, Refrigeration, and Air Conditioning Engineers.

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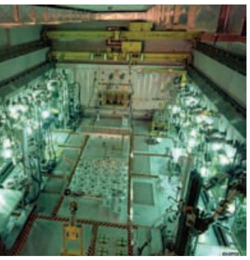
APPENDIX B




Prioritized Resource Needs

CONTENTS

Figures

Tables

ACRONYMS

ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance, LLC
CDO	Campus Development Office
DOE	Department of Energy
DOE-NE	Department of Energy Office of Nuclear Energy
FY	fiscal year
GPCE	General Purpose Capital Equipment
GPP	General Plant Project
IGPCE	Institutional General Purpose Capital Equipment
IGPP	Institutional General Plant Project
INL	Idaho National Laboratory
OFP	Operating Funded Project
PIE	postirradiation examination
TYSP	Ten-Year Site Plan

APPENDIX B PRIORITIZED RESOURCE NEEDS

B-1. INTRODUCTION

The Idaho National Laboratory (INL) Campus Development Office (CDO) maintains prioritized lists of capital project and equipment needs in a configuration-managed, controlled database, and provides 10-year project and equipment information to the Ten-Year Site Plan (TYSP). INL capital projects and equipment are procured using a mix of direct and indirect funds (in accordance with funding determinations), as described in the sections below. While INL, like other national laboratories, requires a large number and variety of capital projects and equipment to maintain its infrastructure and support mission goals, some projects and equipment acquisitions (including the timing of the acquisitions) are key to achieving INL and Department of Energy (DOE) strategic objectives. Figure B-1 is a timeline depiction of key capital projects and equipment acquisitions.

B-2. PRIORITIZED CAPITAL PROJECTS AND EQUIPMENT

B-2.1. Institutional General Plant Projects

In late Fiscal Year (FY) 2010, INL developed an Institutional General Plant Project (IGPP) process for developing and executing general-purpose projects using an indirect funds pool. The new IGPP process was implemented beginning in FY 2011. Formerly, all INL projects were developed and executed as direct-funded General Plant Projects (GPPs), Program-Funded Capital Projects, or Operating-Funded Projects (OFPs). While INL continues to use program funds and OFPs for project development and acquisition (when appropriate), indirect IGPP funding is the primary funding source pursued for developing and executing projects determined to be general purpose. However, nothing would preclude a specific program from seeking and executing a programmatic GPP based on the critical need for, and benefit to, the program in question.

The annual INL IGPP process flow is depicted in Figure B-2.

Implementing an IGPP process provides the INL more flexibility in applying funding to overall institutional needs. Utilizing indirect IGPP funding rather than direct funding for developing and executing general-purpose projects makes more direct funding available for critical program needs.

Specific IGPP project information is provided in Table B-1.

B-2.2. Direct Program-Funded Capital Projects and Operating-Funded Projects

INL also maintains prioritized lists of direct program-funded capital projects and OFPs. Each INL Directorate provides direct-funded project information to the CDO annually. Specific direct-funded project information is provided in Table B-2. The prioritized lists only include the current year (FY 2011) plus three additional years (2012-2015) because of the inherent uncertainties in program direction, priorities, and funding levels.

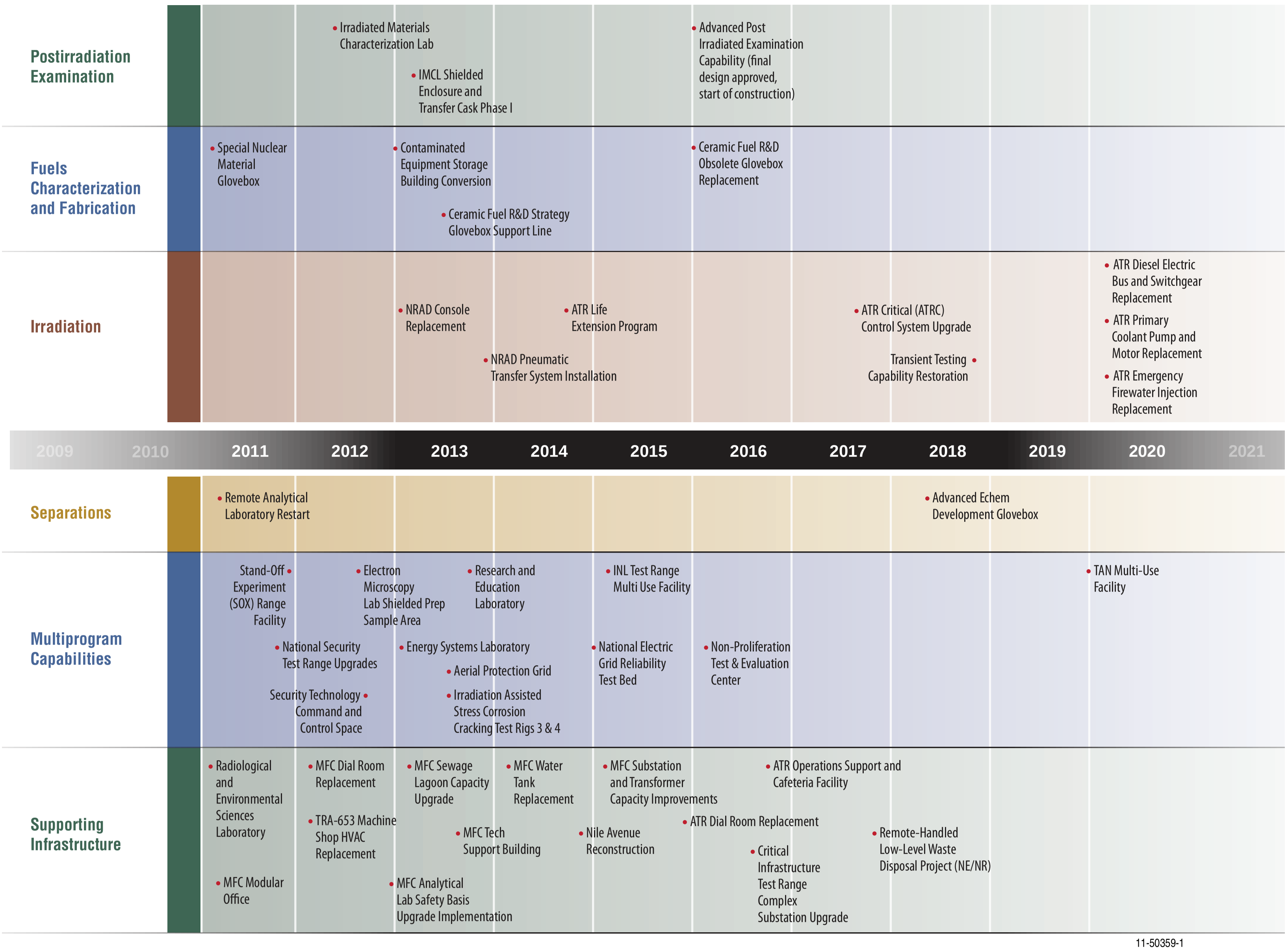


Figure B-1. Timeline depiction of key Idaho National Laboratory capital projects and equipment acquisitions.

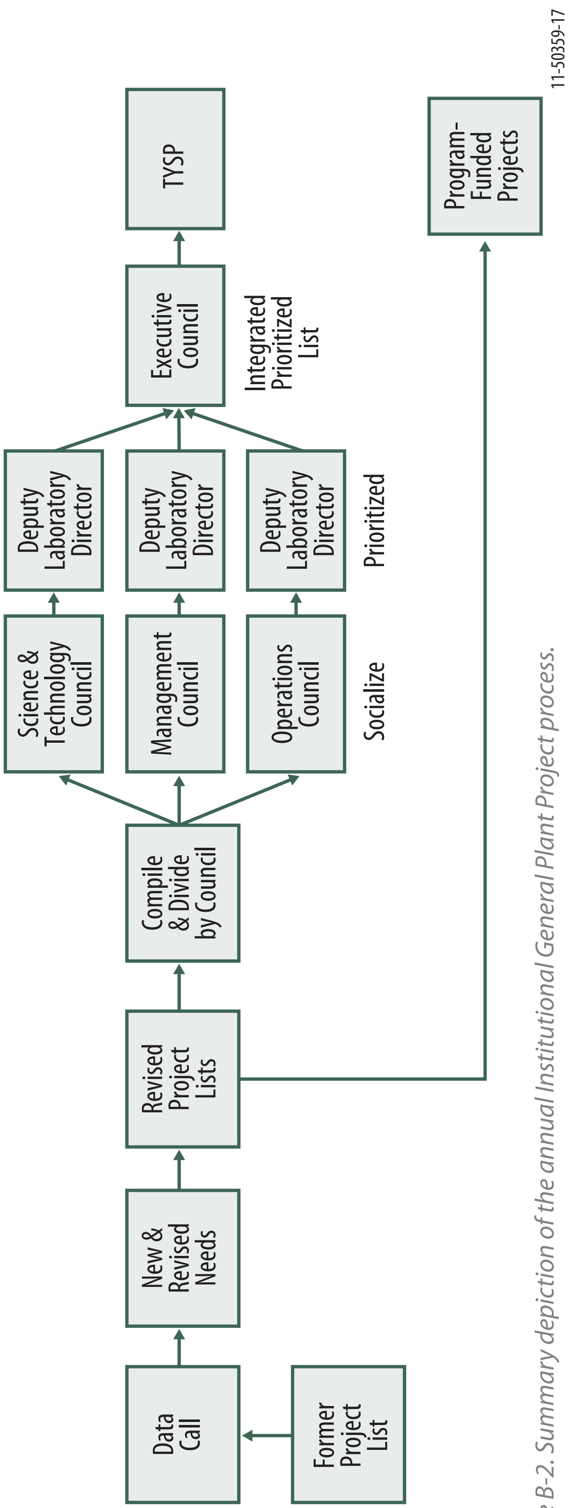


Figure B-2. Summary depiction of the annual Institutional General Plant Project process.

Table B-1. Institutional General Plant Project list (INL indirect-funded [$K]).

Reference No.	Area/ Sub Area[a]	Project	ROM TPC[b,c]	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
1	MFC	MFC Tech Support Building	9,188	2,100	3,988	3,100	-	-	-	-	-	-	-	-	-
2	ATR Complex	TRA-653 Machine Shop Heating, Ventilating, and Air Conditioning Replacement	906	900	6	-	-	-	-	-	-	-	-	-	-
3	MFC	MFC Sewage Lagoon Capacity Upgrade	7,522	544	6,802	176	-	-	-	-	-	-	-	-	-
4	REC	Energy Systems Laboratory Lease-Hold Improvements[d]	8,618	986	7,043	589									
5	MFC	Contaminated Equipment Storage Building Conversion	2,455	307	2,148	-	-	-	-	-	-	-	-	-	-
6	MFC	Ceramic Fuel Research and Development Strategy Glovebox Support Line	5,741	1,112	2,761	1,868	-	-	-	-	-	-	-	-	-
7	SW/SMC	INL Test Range Multi Use Facility	10,748	250	256	2,364	5,008	2,870	-	-	-	-	-	-	-
8	MFC/ FASB	Irradiation Assisted Stress Corrosion Cracking Test Rigs 3 & 4	5,600	-	2,500	3,100	-	-	-	-	-	-	-	-	-
9	MFC	MFC Substation and Transformer Capacity Improvements	7,188	-	308	1,786	3,769	1,325	-	-	-	-	-	-	-
10	SW/SMC	Nile Avenue Reconstruction	4,634	-	-	4,203	431	-	-	-	-	-	-	-	-
11	MFC	Ceramic Fuel Research and Development Obsolete Glovebox Replacement	8,827	-	-	3,152	4,571	1,104	-	-	-	-	-	-	-
12	ATR Complex	ATR Dial Room Replacement	11,528	-	-	2,101	4,846	4,581	-	-	-	-	-	-	-
13	CITRC	Critical Infrastructure Test Range Complex Substation Upgrade	2,757	-	-	-	323	2,208	226	-	-	-	-	-	-
14	MFC	Non-Proliferation Test & Evaluation Center	11,119	-	-	-	862	6,071	4,186	-	-	-	-	-	-
15	ATR Complex	ATR Operations Support and Cafeteria Facility	11,881	-	-	-	-	1,104	9,617	1,160	-	-	-	-	-

Table B-1. Institutional General Plant Project list (INL indirect-funded [$K]).

Reference No.	Area/ Sub Area[a]	Project	ROM TPC[b,c]	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
16	ATR Complex	Advanced Test Reactor Critical Control System Upgrade	10,739	-	-	-	-	828	4,808	5,103	-	-	-	-	-
17	MFC/FCF	Advanced Electrochemical Development Glovebox	5,804	-	-	-	-	-	566	4,442	796	-	-	-	-
18	MFC	MFC Fiber Optic Backbone Capacity & Reliability Upgrade (Manhole 50 Reconfiguration)	1,736	-	-	-	-	-	119	1,617	-	-	-	-	-
19	MFC	MFC Cable Upgrades	4,537	-	-	-	-	-	566	3,971	-	-	-	-	-
20	MFC	FCF Suited Entry Repair Area Crane	522	-	-	-	-	-	-	522	-	-	-	-	-
21	MFC	Neutron Radiography Reactor Elevator Control System	360	-	-	-	-	-	-	360	-	-	-	-	-
22	MFC	Install Fume Hoods at FASB	145	-	-	-	-	-	-	145	-	-	-	-	-
23	MFC	Advanced Electrochemical Actinide Process Development & Monitoring Laboratory	4,087	-	-	-	-	-	-	580	3,507	-	-	-	-
24	MFC	Electric Discharge Machining Installation	3,557	-	-	-	-	-	-	348	3,209	-	-	-	-
25	MFC	Nuclear Operations Support Facilities Cable Upgrades at MFC	5,358	-	-	-	-	-	-	870	4,160	328	-	-	-
26	SW/SMC	TAN Multi-Use Facility	12,030	-	-	-	-	-	-	928	4,279	6,823	-	-	-
27	SW/SMC	Extend Feeder to TAN 679A	606	-	-	-	-	-	-	-	606	-	-	-	-
28	MFC	Installation of Electron Probe Micro-Analyzer instrument into the Irradiated Materials Characterization Lab (IMCL)	1,189	-	-	-	-	-	-	-	1,189	-	-	-	-
29	MFC	Installation of Focused Ion Beam instrument into the IMCL	1,189	-	-	-	-	-	-	-	1,189	-	-	-	-
30	ATR Complex	ATR Complex Common Support Building II	6,191	-	-	-	-	-	-	-	297	1,523	4,371	-	-

Table B-1. Institutional General Plant Project list (INL indirect-funded [$K]).

Reference No.	Area/ Sub Area[a]	Project	ROM TPC[b,c]	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
31	REC	Interim Engineering Demonstration Facility Upgrade	2,638	-	-	-	-	-	-	-	238	2,400	-	-	-
32	SW/CFA	CFA-1618 Whole Body Counter/ Lung Counter Annex	2,432	-	-	-	-	-	-	-	178	2,254	-	-	-
33	ATR Complex	Diesel Oil Header System Upgrade	5,121	-	-	-	-	-	-	-	357	4,264	500	-	-
34	ATR Complex	TRA-604 Switchgear Upgrade – 2400 Volt Transfer Switch	609	-	-	-	-	-	-	-	-	609	-	-	-
35	SW/CFA	Convert CFA-601/623/624/674 to Electric Heat	518	-	-	-	-	-	-	-	-	518	-	-	-
36	MFC	Installation of Micro X-Ray Diffractometer instrument into the IMCL	1,242	-	-	-	-	-	-	-	-	305	937	-	-
37	ATR Complex	ATR Complex Nuclear Training Center	6,200	-	-	-	-	-	-	-	-	426	5,620	154	-
38	SW	INL Power System Reliability Enhancement with Transformer Circuit Switchers	7,205	-	-	-	-	-	-	-	-	609	6,307	289	-
39	MFC	Layered Network Infrastructure	8,207	-	-	-	-	-	-	-	-	-	749	6,272	1,186
40	SW	National Security Test Range Enhancements	6,412	-	-	-	-	-	-	-	-	-	562	4,800	1,050
41	SW	Video Conferencing and Multimedia Enterprise Standard	6,011	-	-	-	-	-	-	-	-	-	624	4,736	651
42	REC	REC Information Technology Corridor Build-Out	2,770	-	-	-	-	-	-	-	-	-	312	2,458	-
43	SW/SMC	TAN/SMC Dial Room Replacement	8,046	-	-	-	-	-	-	-	-	-	-	640	6,560
44	REC	Enterprise Computing Data Center	9,218	-	-	-	-	-	-	-	-	-	-	640	6,560
45	REC	Replace Obsolete IRC Fire Alarm System	1,223	-	-	-	-	-	-	-	-	-	-	-	1,223

Table B-1. Institutional General Plant Project list (INL indirect-funded [$K]).

Reference No.	Area/ Sub Area[a]	Project	ROM TPC[b,c]	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
46	MFC	Stack Monitor Replacement (includes FASB)	1,050	-	-	-	-	-	-	-	-	-	-	-	1,050
47	REC	Dry Room	787	-	-	-	-	-	-	-	-	-	-	-	787
48	SW/SMC	TAN Multi-Use Trailers TAN-671 & 672	918	-	-	-	-	-	-	-	-	-	-	-	918
		Total		**6,199**	**25,812**	**22,439**	**19,810**	**20,091**	**20,088**	**20,046**	**20,005**	**20,059**	**19,982**	**19,989**	**19,985**

a. Areas, sub areas, and facilities include Materials and Fuels Complex (MFC), Advanced Test Reactor (ATR) Complex (ATR Complex), Research and Education Campus (REC; Idaho Falls), Idaho Nuclear Technology and Engineering Center (INTEC), Fuel Conditioning Facility (FCF), Fuels and Applied Science Building (FASB), Sitewide (SW), Central Facilities Area (CFA), and Specific Manufacturing Capability (SMC).

b. Total project cost (TPC) values are based on preliminary scoping, evaluation, and rough-order-of-magnitude (ROM) estimates. As planning and execution funds are appropriated, scope, schedule, and costs will continue to be refined, resulting in changes to individual TPC. TPC can also reflect prior-year(s) costs and costs beyond 2022.

c. Capital funding (total estimated cost) for a general plant project cannot exceed $10M according to the U.S. Department of Energy Budget Formulation Handbook. However, based on the escalation rates of 2.5%, a capital project with an estimated total estimated cost of $10M in FY 2011 would have a total estimated cost of $12.5M in 2020. In addition, capital projects require both operating and capital funds for execution, the estimated aggregate of which is known as the TPC. Typically, TPC for a capital project will range between 115% and 130% as compared to the total estimated cost. That is, a project with a total estimated cost of $10M could have a TPC between $11.5M and $13M.

d. Source of indirect funding being evaluated.

Table B-2. Program-funded capital projects and operating-funded projects list (INL direct-funded [$K]).

INL Project / Program	INL Area	Project Description	ROM Total Equipment Cost	FY 2011	FY 2012	FY 2013	FY 2014
Idaho Facilities Management	MFC	Irradiated Materials Characterization Lab	11,388[b]	10,642	-	-	-
	MFC	MFC Dial Room Replacement	9,842[b]	9,080	-	-	-
	MFC	MFC Modular Office	3,526[b]	1,774			
	MFC	MFC-752 Analytical Lab Safety Basis Upgrade Implementation	1,230[b]	720	510	-	-
	MFC	Neutron Radiography Reactor Console Upgrade	4,444[b]	1,396	815	-	-
	MFC	MFC Water Tank Replacement	2,001	-	-	-	2,001
National and Homeland Security (Work for Others)	SW	National Electric Grid Reliability Test Bed *Note: Funding has been requested but no formal commitments have been established*[a]	40,000	-	16,000	16,000	4,000
	SW	Stand-Off Experiment Range Facility (for high-energy accelerator testing)	1,500	1,500	-	-	-
	MFC	Electron Microscopy Lab Shielded Prep Sample Area	3,300	2,300	1,000	-	-
	SW	Upgrades to the National Security Test Range (explosives range) – Data Collection Systems	300	300	-	-	-
Safeguards and Security	MFC	Security Technology Command and Control Space	3,221	-	3,221	-	-
	MFC	Aerial Protection Grid	250	-	-	250	-
Next Generation Nuclear Plant	MFC	Neutron Radiography Reactor Pneumatic Transfer System Installation	3,900	-	-	3,900	-
	MFC	Bulk Thermal Conductivity of Irradiated Fuel Measurement Device	300	-	-	300	-
		Total Program Funded Capital Projects		**27,712**	**21,546**	**20,450**	**6,001**

a. Funding extends beyond FY 2014.

b. TPC reflects prior-year(s) costs.

FY = fiscal year

MFC = Materials and Fuels Complex

ROM = rough order of magnitude

SW = Sitewide

B-2.3. Institutional General-Purpose Capital Equipment

Beginning in FY 2011, INL expanded its Institutional General-Purpose Capital Equipment (IGPCE) process using an indirect funds pool as the primary source for general-purpose capital equipment (GPCE) acquisitions. Formerly, the majority of INL GPCE acquisitions were direct-funded. Now, indirect IGPCE funding will be the initial funding source pursued for acquiring INL GPCE. However, direct GPCE and program funding can be used to acquire GPCE if IGPCE funding is not available.

Implementation of an expanded IGPCE process provides INL more flexibility in applying funding to overall institutional needs. Utilizing indirect IGPCE funding rather than direct funding for acquiring GPCE makes more direct funding available for critical program needs.

At INL, each of the three leadership councils (Management, Operations, and Science and Technology) is provided an annual pool of indirect money to acquire GPCE. Each council provides a list of IGPCE planned acquisitions and needs to the CDO for inclusion in the TYSP.

The annual INL IGPCE process flow is depicted in Figure B-3.

Specific information for the INL Science and Technology Council IGPCE pool is provided in Table B-3; INL Operations Council IGPCE information is provided in Table B-4; and INL Management Council IGPCE information is provided in Table B-5.

B-2.4. Program-Funded Capital Equipment

INL also maintains prioritized lists of program-funded (direct-funded) capital equipment. Each INL Directorate provides direct-funded equipment information to the CDO annually. Specific direct-funded equipment information is provided in Table B-6.

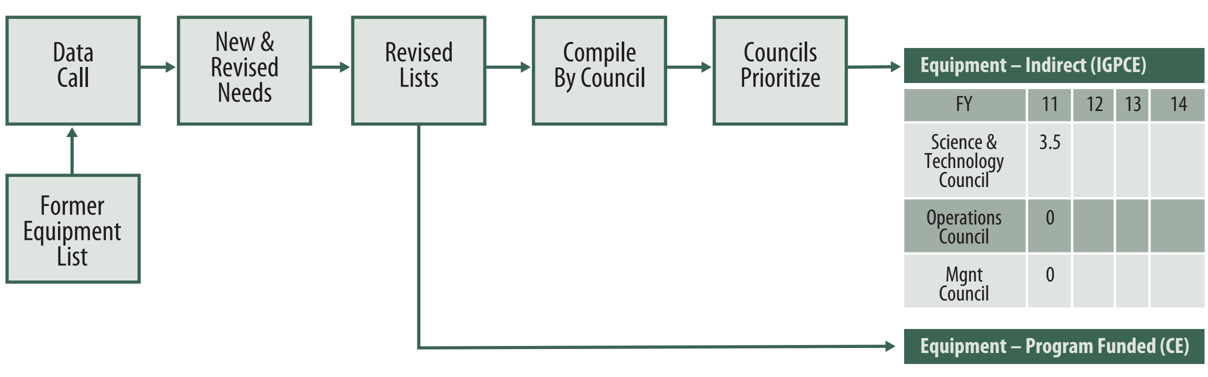


Figure B-3. Summary depiction of the annual Institutional General-Purpose Capital Equipment process.

Table B-3. Idaho National Laboratory Science and Technology Council Institutional General Purpose Capital Equipment (INL indirect-funded [$K]).

Reference No.	Area/Sub Area	Equipment	ROM TPC	FY 2011	FY 2012	FY 2013	FY 2014
1	MFC	Inductively Coupled Plasma Mass Spectrometer	1,400	1,400	-	-	-
2	REC	International Atomic Energy Agency Equipment Phase 3&4	1,000	1,000	-	-	-
3	REC	Gas Chromatography Time-of-Flight Mass Spectrometer (GC x GC - TOFMS)	250	250	-	-	-
4	REC	Liquid Chromatograph Mass Spectrometer	250	250	-	-	-
5	REC	Dry Room Engineering Equipment	100	100	-	-	-
6	REC	Sterilizer System	160	160	-	-	-
7	REC	Rocking Autoclave System	150	150	-	-	-
8	REC	High Resolution Scanner	136	136	-	-	-
9	REC	X-Ray Imaging System	250	250	-	-	-
10	REC	Fourier Transform Infrared Microscope	250	250	-	-	-
11	TBD	Insight Equipment	450	450	-	-	-
12	REC	Inductively Coupled Plasma Mass Spectrometer	150	150	-	-	-
13	REC	Thermogravimetric Analysis/Infrared/Mass Spectrometer (TGA/IR/MS)	200	200	-	-	-
14	REC	Chemisorption Analyzer	175	175	-	-	-
15	REC/IRC	Material Characterization	280	280	-	-	-
16	REC	Helium 3 Neutron Proportional Detector Tubes	160	160	-	-	-
17	MFC	Hot Fuel Dissolution Apparatus for Cold work	275	275	-	-	-
18	REC	IF-638 Source Vault	62	62	-	-	-
19	REC/EROB	High Speed Data Storage	100	100	-	-	-
20	REC/EROB	High Performance Computing Large Memory Compute Node	100	100	-	-	-
21	SW/CFA	Computer Tomography System	404	404	-	-	-
22	REC/CAES	Transmission Electron Microscope Camera	120	120	-	-	-
23	REC	Joint Worldwide Intelligence Communication Connectivity	1,200	-	1,200	-	-
24	MFC	Shielded Enclosure and Transfer Cask Phase I	4,880	800	4,080	-	-
25	TBD	400 MHz Nuclear Magnetic Resonance	400	-	400	-	-
26	REC/EROB	High Performance Computing Hybrid Computing Platform	200	-	200	-	-
27	TBD	Spark Plasma Sintering Furnace with Integrated Inert Atmosphere Glovebox	800	-	800	-	-
28	REC	Long Term Evolution, Network in a Box, Semi Permanent Install	2,072	-	2,072	-	-
29	REC/IRC	EM63-MK2 Full Transient Metal Detector	66	-	66	-	-
30	REC/IRC	Nanoparticle Glovebox	60	-	60	-	-
31	IRC	ERTLabtm DAS -1 High Precision Digital Data Acquisition System	56	-	56	-	-

Table B-3. Idaho National Laboratory Science and Technology Council Institutional General Purpose Capital Equipment (INL indirect-funded [$K]).

Reference No.	Area/Sub Area	Equipment	ROM TPC	FY 2011	FY 2012	FY 2013	FY 2014
32	REC	VPanel Full-Scope Nuclear Simulator	750	-	750		-
33	CAES	Thermo Gravimetric Analysis	180	-	180		-
34	IMCL	Shielded Enclosure and Transfer Cask Prototype Phase II	2,900	-	-	2,900	-
35	REC	Classified Ci Prism Production Model	450	-	-	450	-
36	REC	Fourier Transform Mass Spectrometer - Electrospray Ionization - Matrix Assisted Laser Desorption Ionization	1,800	-	-	1,800	-
37	MFC	Energy Dispersion Spectrum for Transmission Electron Microscope	100	-	-	100	-
38	CAES	Thermal Diffusivity Analyzer (Laser Flash Analysis)	330	-	-	330	-
39	SW	T-25 Explosives Storage Upgrade	190	-	-	190	-
40	IRC	454 or SOLiD High Throughput Sequencer	1,500	-	-	1,500	-
41	MFC	Gas Mass Spectrometry Upgrade	220	-	-	-	220
42	CAES	Radiation Detection Upgrades	200	-	-	-	200
43	REC	System Hardware Lab	350	-	-	-	350
44	IRC	Dual Beam Focused Ion Beam Microscope	2,000	-	-	-	2,000
45	TBD	20 Liter Dust Combustion Chamber	200	-	-	-	200
46	EROB	High Performance Computing EROB 109 Visualization Center	400	-	-	-	400
47	REC	Instrument , Control, and Intelligent Systems Signature: Resilient Control Test Network	650	-	-	-	650
48	IRC	Agilent Nano Liquid Chromatography – Quadrapole Time-of Flight (QToF) High-Performance Liquid Chromatography	600	-	-	-	600
49	MFC	Thermal Flash Diffusivity	720	-	-	-	720
50	CAES	Differential Thermal Analysis Differential Scanning Calorimetry / Thermogravimetric Analysis (DSC/TGA)	325	-	-	-	325
51	CFA	Transformer for Cell On Wheels Bang Board	50	-	-	-	50
52	REC	Advanced Metering Infrastructure Modular Test System	140	-	-	-	140
53	IRC	Synthesis Workflow System	2,000	-	-	-	2,000
		Total		**7,222**	**9,864**	**7,270**	**7,855**

CAES = Center for Advanced Energy Studies
CFA = Central Facilities Area
EROB = Engineering Research Office Building
FY = Fiscal Year
IMCL = Irradiated Materials Characterization Laboratory
IRC = INL Research Center
MFC = Materials and Fuels Complex
REC = Research and Education Campus
ROM = rough order of magnitude
SW = Sitewide
TBD = to be determined
TPC - total project cost

Table B-4. Idaho National Laboratory Operations Council Institutional General Purpose Capital Equipment (INL indirect-funded [$K]).

Reference No.	Area/Sub Area	Equipment	ROM TPC	FY 2011	FY 2012	FY 2013	FY 2014
1	SW/CFA	400 Gallons Per Minute Liquid Flow Calibrator (Dedicated to Water)	336	336	-	-	-
2	MFC	Replace Components of the Visual Exam Machine	379	379	-	-	-
3	SW	D-7 Bull Dozer	300	300	-	-	-
4	ATR Complex	Radiological Waste Bag Monitor	103	103	-	-	-
5	SW	Two – Type I Ambulances	365	-	365	-	-
6	SW/CFA	Replace Structural Fire Engine No. 5	816	-	816	-	-
7	CFA	150 Gallons Per Minute Liquid Flow Calibrator (Dedicated to Simulated Fuel Oil)	305	-	305	-	-
8	SW	Wildland Fire Brush Truck	400	-	400	-	-
9	ATR Complex	Gantry Milling Machine	220	-	220	-	-
10	SW	All Terrain Forklift	170	-	170	-	-
11	MFC	Replace Structural Fire Engine No. 2	845	-	-	845	-
12	MFC	Computer Numerical Control (CNC) Lathe	231	-	-	231	-
13	ATR Complex	Computer Numerical Control (CNC) Mill	110	-	-	110	-
14	MFC/HFEF	HFEF Fabrication of 2nd Feedthrough Glovebox	838	-	-	-	838
15	CFA	Replace Wildland Fire Engine No. 1	670	-	-	-	670
16	TAN	Replace Wildland Fire Engine No. 3	670	-	-	-	670
		Total		**1,118**	**2,276**	**1,186**	**2,178**

ATR = Advanced Test Reactor
CFA = Central Facilities Area
HFEF = Hot Fuel Examination Facility
MFC = Materials and Fuels Complex
ROM = rough order of magnitude
SW = Sitewide
TAN = Test Area North
TPC = total project cost

Table B-5. Idaho National Laboratory Management Council Institutional General Purpose Capital Equipment (INL indirect-funded [$K]).

Reference No.	Area/Sub Area	Equipment	ROM TPC	FY 2011	FY 2012	FY 2013	FY 2014
1	SW	Enhanced 911 System	729	729	-	-	-
2	REC/EROB	High Performance Computing Network Transport	1,859	1,859	-	-	-
3	REC	EROB Dial Room INL Network Uninterrupted Power Supply (UPS) Expansion	81	81	-	-	-
4	REC	Internet Router Redundancy	128	128	-	-	-
5	REC	Campus Switch Replacement (level 2)	5,829	5,829	-	-	-
6	SW	Enterprise Network Switch Replacement	1,278	1,278	-	-	-
7	SW	Enterprise Storage Area Network	1,802	1,802	-	-	-
8	SW	INL Paging System	1,513	1,513	-	-	-
		Total		**13,219**			

EROB = Engineering and Research Office Building

REC = Research and Education Campus

SW = Sitewide

Table B-6. Program-funded capital equipment project list (INL direct-funded [$K]).

INL Project/ Program	INL Area	Equipment Description	ROM Total Equipment Cost	FY 2011	FY 2012	FY 2013	FY 2014
Bioenergy Program	REC	Deployable Pilot Development Unit	27,500[a]	1,100	1,500	1,000	1,000
	REC	Thermochem Laboratory equipment	2,000[b]	150	150	-	-
	REC	Biochem Laboratory equipment	1,775[b]	150	150	-	-
	REC	Third Generation Torrification System	1,000	-	-	-	1,000
Advanced Energy Storage	REC	Battery Testing Equipment	9,077[b]	1,848	2,529	-	-
	REC	3000A Single Channel Battery Cycler System	1,000	-	-	-	1,000
Hybrid Energy Systems	REC	Biomass Feedstock Conversion System	6,000[a]	-	-	-	4,000
Carbon Resource Management	REC	Unconventional Fossil Energy Laboratory Equipment	500	-	-	-	500
National & Homeland Security	REC	Accelerator Mass Separator	2,000	-	-	-	2,000
	MFC	Hot Fuel Examination Facility Element Plate Checker	3,000	900	2,100	-	-
National & Homeland Security (Work for Others)	REC	Mass Spectrometer	1,500	-	1,500	-	-
Radioisotope Power Systems	MFC	Capital Equipment (glovebox, replacement environmental equipment, high temperature vacuum furnace, two trailer systems)	6,000[a]	500	500	500	500

Table B-6. Program-funded capital equipment project list (INL direct-funded [$K]).

INL Project/ Program	INL Area	Equipment Description	ROM Total Equipment Cost	FY 2011	FY 2012	FY 2013	FY 2014
Fuel Cycle Research and Development Separations - Aqueous	MFC	1-cm Centrifugal Contactor System	50	50	-	-	-
	MFC	Fluorimeter/Time Resolved Laser Induced Fluorescence System	150	150	-	-	-
Very High-Temperature Reactor Technology Development	ATR/ MFC Use, CFA Storage	ATR Shipping Cask	5,000	-	5,000	-	-
	REC CAES	Procurement and Installation of Aberration Corrected Field-Emission Gun Scanning Transmission Electron Microscope	4,200	-	4,200	-	-
	REC CAES	High Speed 3D Particle Image Velocimetry System-1	465	-	-	-	465
	REC CAES	3D Laser Doppler Velocimetry System-2	279	-	-	-	279
	REC CAES	Planar Laser Induced Fluorescence System-3	175	-	-	-	175
National Scientific User Facility	REC CAES	Irradiation Assisted Stress Corrosion Cracking Test Rigs 1 and 2	4,459[b]	1,234	-	-	-
Safeguards and Security	SW	Site-wide Video Upgrade	3,500	-	3,500	-	-
	MFC	Replace Armored Vehicles	1,100	-	1,100	-	-
	MFC	Entry Control Systems	3,200	-	-	3,200	-
Center for Advanced Energy Studies	REC	Electron Probe Micro-Analyzer	1,700	1,700	-	-	-
	REC	Spark Plasma Sintering System	550	550	-	-	-
	REC	Hot Press	250	-	250	-	-
	REC	Thermal Analysis Equipment (Thermo Gravimetric Analysis/Differential Scanning Calorimetry [TGA/DSC], TGA/DSC/Mass Spec, Laser Flash Thermal Diffusivity)	880	-	880	-	-
	REC	Powder Characterization	122	-	122	-	-
	REC	High Temperature, Controlled Atmosphere Creep Rig	500	-	500	-	-
	REC	Induction Power Supply	100	-	100	-	-
	REC	Ion Mill	90	-	90	-	-
	REC	High Pressure Add-On for X-ray Diffraction	280	-	280	-	-
	REC	Electrochemical system (ac/dc)	80	-	80	-	-
		Total Program Funded Capital Equipment		**8,332**	**24,531**	**4,700**	**10,919**

a. Funding extends beyond FY 2014.
b. TPC reflects prior-year(s) costs.
ATR = Advanced Test Reactor
CAES = Center for Advanced Energy Studies
CFA = Central Facilities Area
FY = fiscal year
MFC = Materials and Fuels Complex
REC = Research and Education Campus
ROM = rough order of magnitude
SW = Sitewide

B-2.5. Line-Item Construction Projects

Table B-7 reflects the forecasted funding expenditures for the following INL line-item construction projects:

- **INL Remote-Handled Low-Level Waste Disposal Project** – This project will provide on-site replacement of the remote handled low-level waste disposal capability for ongoing and future programs at INL.
- **Advanced Postirradiation Examination (PIE) Capability Project** – A better understanding of nuclear fuels and material performance in the nuclear environment (at the nanoscale and lower) is critical to the development of innovative fuels and material required for tomorrow's nuclear energy systems. This multi-program, third-generation PIE analytical laboratory will further consolidate and expand capabilities that function on the micro, nano, and atomic scale.
- **Material Security and Consolidation Project** – Will meet the mission need for additional storage at INL for sodium bonded fuel disposition product, which is low-enriched uranium (LEU). The Material Security and Consolidation Project funding was provided in the 2008 Appropriations Act under the National Nuclear Security Administration.
- **Advanced Test Reactor (ATR) Reliability Projects** – These three projects will replace obsolete equipment and provide a renewed level of plant reliability while supporting an improved defense-in-depth posture against postulated beyond-design-basis accidents. The scope (pre-alternatives analysis) is described below:
    1. **ATR Diesel Electric Bus and Switch Gear Replacement Project** will replace the ATR diesel-electric power system with commercial electric power, replace the emergency backup power system, and replace obsolete electrical distribution equipment. In 2010, new regulations were promulgated that mandate a reduction in emissions from applicable ATR diesel powered generators by May 2013. The two options being considered to comply with this new regulation are: (1) a retrofit of the three diesel powered generators with appropriate emissions control technology, which would be funded and prioritized through the ATR base operations budget; or (2) execute the ATR diesel bus and switchgear replacement project. INL is in the process of requesting a compliance waiver that would allow for additional time to pursue the diesel bus and switchgear replacement project, thus eliminating the requirement to retrofit the diesel engines by the May 2013 compliance date. Both options are being pursued in parallel to ensure compliance by the established date.
    2. **ATR Primary Coolant Pump and Motor Replacements Project** will replace the original primary cooling system pumps and motors.
    3. **ATR Emergency Firewater Injection System Replacement Project** will replace the emergency firewater injection system to incorporate utilization of reactor-grade water, full-system testability, and the ability to recirculate coolant, as may be required from postulated accident scenarios.

Table B-7. Line-item construction project list (DOE-NE direct-funded [$K]).

Reference No.	Area[a]	Project	ROM TPC	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
1	INL	Remote-Handled Low-Level Waste Disposal Project (NE/NR)	47,290[a]	2,883	2,000	6,710	10,400	10,510	5,790	1,800	-	-	-	-	-
2	MFC	Advanced Post-Irradiation Examination Capability (Project engineering and design only)	TBD	-	4,040	7,500	4,500	8,500	11,000	3,000	-	-	-	-	-
3	INTEC	Materials Security and Consolidation Project	19,700[b]	-	-	1,300	900	930	950	980	1,000	1,040	1,070	1,100	1,100
4	ATR Complex	ATR Diesel Electric Bus and Switch Gear Replacement Project	94,200				10,700	17,000	19,900	19,500	15,000	12,100			
5	ATR Complex	ATR Primary Coolant Pump and Motor Replacements Project	84,400				9,700	15,000	17,700	17,900	13,300	10,800			
6	ATR Complex	ATR Emergency Firewater Injection System Replacement Project	51,400				5,900	9,000	10,900	10,900	8,100	6,600			
		Total		**2,883**	**6,040**	**15,510**	**42,100**	**60,940**	**66,240**	**54,080**	**37,400**	**30,540**	**1,070**	**1,100**	**1,100**

a. DOE-NE portion only.

b. Funding extends beyond FY 2022.

ATR = Advanced Test Reactor

FY = fiscal year

INL = Idaho National Laboratory

INTEC = Idaho Nuclear Technology and Engineering Center

MFC = Materials and Fuels Complex

ROM = rough order of magnitude

TPC = total project cost

B-2.6. Operating Funded Projects

Table B-8 reflects the forecasted funding expenditures for the following major INL OFPs:

- **Transient Testing Capability Restoration** — DOE has a need to test nuclear fuels now being developed under high-speed (millisecond to second) transient operating conditions. Testing fuel behavior in a prototypic neutron environment and obtaining time-resolved data are essential for guiding the development, and validating time-dependent computer models, of fuel and core behavior representing reactor transient events.
- **Proactive Sustainment Projects** — The proactive sustainment projects for mission critical buildings; mission dependent, not critical buildings; and roof replacement in Table B-8 represent the forecasted annual cost estimate to perform proactive sustainment for these three groups of real property assets/components. Although the raw forecasted annual investment varies from year to year, the annual investment levels for these projects are based on a 10-year average of the forecast. The 10-year average was chosen to allow sustainment funding levels to be more stable. The scope planned for each year is derived from the scope forecast for each year (by moving the scope forward or back from the forecast year) to stay within annual funding constraints. Roof replacement project costs are split into two stable funding levels, with higher annual costs forecast ($4M in 2011) for 2012 through 2016, to account for working off the backlog of deferred roof replacements over the first 5 years of the TYSP period. Once the backlog is worked off, it is estimated that the stable annual funding level can be reduced to approximately $2.5M in 2011. The 10-year forecast for replacement of MFC diesel generators (Appendix A, Section A-1.4.7) are included in the proactive sustainment projects for mission critical and mission dependent, not critical buildings.

B-2.7. Sustainability Performance Metrics Projects

INL must implement energy and water reduction projects in addition to planned Energy Savings Performance Contract projects to meet sustainability performance requirements from the various federal and DOE orders and directives. A summary of projects identified to date is included in Appendix D, Table D-2.

B-3. FACILITY DISPOSITION PLAN

Table B-9 provides information on the DOE-NE-funded disposition of INL buildings, as required by DOE Order 430.1B, *Real Property Asset Management*. The facilities are listed in the table according to the year disposition is anticipated to be completed.

From its inception as a national research laboratory nearly 60 years ago, INL has built facilities and support infrastructure that were occupied and utilized by numerous programs to accomplish a diverse range of mission assignments. Due to the age and declining condition of many of the buildings and support infrastructure, they are now inadequate to provide the research, development, and demonstration capabilities required to support today's mission requirements. Investments in infrastructure improvements for many INL facilities can be made to further these capabilities; however, funding for upgrades to keep some of the facilities functional and in use cannot be justified. INL's annual Footprint Reduction Plan identifies severely underutilized and/or unusable facilities.

Table B-8. Operating-Funded Project list (DOE-NE direct-funded [$K]).

Reference No.	Area	Project	ROM TPC	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
1	MFC	Transient Testing Capability Restoration	66,000	-	4,000	9,000	12,500	16,500	17,000	14,000	12,000	-	-	-	-
2	INL	Mission-Critical Proactive Sustainment	27,591	2,000	2,050	2,101	2,154	2,208	2,263	2,319	2,377	2,437	2,498	2,560	2,624
3	INL	Mission-Dependent Proactive Sustainment	55,182	4,000	4,100	4,203	4,308	4,415	4,526	4,639	4,755	4,874	4,995	5,120	5,248
4	INL	Roof Repair and Replacement	21,025	900	4,000	4,100	4,203	4,308	4,415	2,500	2,563	2,627	2,692	2,760	2,829
		Total		**6,900**	**14,150**	**19,404**	**23,165**	**27,431**	**28,204**	**23,458**	**21,695**	**9,938**	**10,185**	**10,440**	**10,701**

FY = fiscal year

INL = Idaho National Laboratory-wide projects

MFC = Materials and Fuels Complex

ROM = rough order of magnitude

TPC = total project cost

Table B-9. INL buildings to be inactivated, demolished, or transferred from Fiscal Year 2011 through Fiscal Year 2021.

Building ID	Name	Floor Area (ft^2)	Year Built	Status	Inactivation Date	Disposition Complete Date	Method of Disposition	Estimated Demolition Cost[a] (K)	Expected NEPA Category
MFC-750B	EBR-II Storage Shed	848	1969	Operating	2011	2011	Demolish	41	CX
TAN -664	Automotive Service Attendant Shed	138	1956	Operating	2011	2011	Demolish	7	CX
TRA-615	Meteorological Instrument Building	36	1970	Shutdown pending D&D	2002	2011	Transfer or demolish	27	CX
TRA-629	Cold Storage Building	640	1956	Operating	2011	2011	Demolish	31	CX
TRA-631	Acid and Caustic Pumphouse	289	1952	Shutdown pending D&D	2002	2011	Transfer or demolish	72	CX
TRA-669	Cold Storage Building	2,269	1968	Operating	2011	2011	Demolish	336	CX
TRA-673	Storage Building	1,188	1971	Operating	2011	2011	Demolish	220	CX
TRA-675	Waste Oil Dumpster Shed	155	1987	Shutdown pending D&D	1997	2011	Transfer or demolish	8	CX
CF-688	Technical Center Office Building	19,312	1963	Operational Standby	2007	2012	Demolish	940	CX
CF-689	Technical Center Office Building	26,795	1963	Shutdown pending D&D	2007	2013	Demolish	1,304	CX
MFC-TR-1	Bus Driver's Trailer	624	1978	Operating	2014	2014	Demolish	30	CX
MFC-713	Modular Office	10,725	1978	Operating	2014	2014	Sell or demolish	180	CX
MFC-716	Department of Energy Area Group-West (Modular Office) T-16A	1,660	1962	Operating	2014	2014	Sell or demolish	81	CX
MFC-751	Safeguards & Security Support Building	620	1961	Operating	2014	2014	Demolish	30	CX
MFC-759	Emergency Reentry Building	2,550	1961	Operating	2014	2014	Demolish	124	CX
B25-601	Subsurface Disposal Area Engineering Barriers Test Facility	2,166	1996	Shut down pending D&D	2015	2015	Demolish	106	CX
CF-612	Office Building	9,813	1983	Operating	2015	2015	Demolish	267	CX
CF-695	Fire Safety Equipment Storage	1,584	1966	Operating	2015	2015	Demolish	77	CX
PBF-632	Office Building	8,050	1981	Operational Standby	2015	2015	Demolish	392	CX

Table B-9. INL buildings to be inactivated, demolished, or transferred from Fiscal Year 2011 through Fiscal Year 2021.

Building ID	Name	Floor Area (ft^2)	Year Built	Status	Inactivation Date	Disposition Complete Date	Method of Disposition	Estimated Demolition Cost[a] (K)	Expected NEPA Category
IF-613	North Boulevard Annex	14,201	1963	Operating	2015	2015[b]	Terminate lease[b]	0	N/A
IF-651	North Yellowstone Laboratory	8,000	1984	Operating	2015	2015[b]	Terminate lease[b]	0	N/A
IF-670	Bonneville County Technology Center	19,504	2000	Operating	2015	2015[b]	Evaluate termination of some leased space (relocate to REL and ESL)[b]	0	N/A
CF-690	Radiological Environmental Science Lab	32,394	1963	Operating	2013	2016	Demolish	1,800	CX
TAN-601	Guard House	2,995	1954	Operating	2017	2017	Demolish	146	CX
CF-674	Excess Warehouse	56,508	1952	Operating	2017	2017	Demolish	2,751	CX
CF-614	Office	8,017	1986	Operating	2017	2017	Demolish	241	CX
CF-601	Warehouse	51,951	1950	Operating	2018	2018	Demolish	1,156	CX
MFC-714	Office Building T-12	6,048	1977	Operating	2019	2019	Demolish	294	CX
MFC-717	Technical Consolidation Building (Modular Office) T-2	11,417	1985	Operating	2019	2019	Sell or demolish	556	CX
MFC-718	Project Building (Modular Office)	7,100	1985	Operating	2019	2019	Sell or demolish	346	CX
MFC-TR-51	Sodium Process Facility Operations Trailer	870	2000	Operating	2019	2019	Sell or demolish	42	CX
CF-664	Storage Building	16,385	1951	Operating	2020	2020	Demolish	798	CX
PBF-612	CITRC Control System Research Building	6,248	1960	Operating	2020	2020	Transfer to DOE-EM to D&D	524	CX
PBF-622	CITRC Explosives Detection Research Center	5,185	1989	Operating	2020	2020	Transfer to DOE-EM to D&D	252	CX

Table B-9. INL buildings to be inactivated, demolished, or transferred from Fiscal Year 2011 through Fiscal Year 2021.

Building ID	Name	Floor Area (ft^2)	Year Built	Status	Inactivation Date	Disposition Complete Date	Method of Disposition	Estimated Demolition Cost[a] (K)	Expected NEPA Category
TRA-614	Office Building	6,218	1952	Operating	2021	2021	Demolish	303	CX
TRA-616	Cafeteria	4,417	1952	Operating	2021	2021	Demolish	215	CX
TRA-620	Office Building	2,030	1952	Operating	2021	2021	Sell or demolish	99	CX
TRA-621	Nuclear Material Inspection and Storage	7,287	1982	Operating	2021	2021	Demolish	355	CX
TRA-638	Office Trailer	2,049	1979	Operating	2021	2021	Demolish	100	CX

a. Demolition cost is estimated in 2009 dollars.

b. The data in the "Disposition Complete Date" and "Method of Disposition" columns of this table indicate the planned final disposition year and method. The data in the "Planned Action Year" or "Planned Action" columns in Appendix A, Table A-7, indicate the planned action at the current lease expiration date. The date and method will only match Table A-7 if final disposition will occur on the current lease expiration date.

CITRC = Critical Infrastructure Test Range Complex

CX = categorical exclusion

D&D = decontamination and decommissioning

DOE-EM = Department of Energy Office of Environmental Management

EBR II = Experimental Breeder Reactor II

ES&H = environment, safety, and health

ESL = Energy Systems Laboratory

NEPA = National Environmental Policy Act of 1969

REL = Research and Education Laboratory

The original *FY 2005 Performance Evaluation Measurement Plan* (BEA 2004) established future footprint reduction measurements and reporting requirements as:

- Square footage for facility leases that are terminated
- Square footage placed in cold, dark, and/or dry condition (min-safe condition, as defined by DOE)
- Square footage restricted from demolition by agreements with the State Historical Preservation Office
- Square footage transferred to other entities
- Square footage deactivated and demolished.

Footprint reduction is projected to total 668,376 ft^2 by the end of FY 2020. From February 2005 (when Battelle Energy Alliance, LLC [BEA] became the INL Management and Operating Contractor) to September 31, 2010, a total of 364,247 ft^2 (or 55%) of the projected footprint reduction goal has been completed.

Footprint reduction planning is a very dynamic process, with footage projection totals changing from year-to-year. Footprint reduction opportunities are influenced and affected by a number of factors, including:

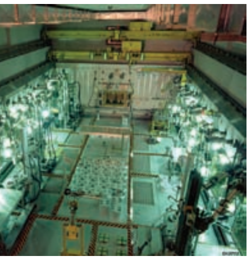
1. Availability of funding to demolish buildings
2. Availability of funding to construct or lease buildings to provide replacement or expansion space
3. Changes in program space needs ranging from space that is no longer required to space designated for reuse/revitalization/remodeling
4. Agreements with DOE=NE to transfer contaminated excess assets with hazardous materials to the Idaho Cleanup Project for decontamination and demolition. To date, the BEA Footprint Reduction Program has been successful in meeting its goals for eliminating surplus and unusable space, and is expected to continue doing so in the future.

B-4. REFERENCES

DOE Order 430.1B, *Real Property Asset Management*, U.S. Department of Energy, February 2008.

BEA, 2004, *Fiscal Year 2005 Performance Evaluation Measurement Plan*, Battelle Energy Alliance, LLC, November 9, 2004.

APPENDIX C




Cognizant Secretarial Offices, Program Secretarial Offices, and Non-DOE Programs

CONTENTS

Figures

Tables

ACRONYMS

AMWTP	Advanced Mixed Waste Treatment Project
ARRA	American Recovery and Reinvestment Act
ATR	Advanced Test Reactor
CAIS	Condition Assessment Information System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSO	Cognizant Secretarial Office
D&D	decommissioning and demolition
DOE	Department of Energy
DOE-EM	Department of Energy Office of Environmental Management
DOE-ID	Department of Energy Idaho Operations Office
DOE-NE	Department of Energy Office of Nuclear Energy
DRR	domestic research reactors
EBR-II	Experimental Breeder Reactor-II
FIMS	Facility Information Management System
FRR	foreign research reactors
FSV	Fort St. Vrain
FY	fiscal year
HVAC	heating, ventilation, and air conditioning
ICDF	Idaho CERCLA Disposal Facility
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISFSI	Independent Spent Fuel Storage Installation
LLW	low-level waste
LTS	Long-Term Stewardship
MFC	Materials and Fuels Complex
MLLW	mixed low-level waste
NOO	Notice of Opportunity
NRF	Naval Reactors Facility
OU	operable unit
PBF	Power Burst Facility
PSO	Program Secretarial Office
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SRS	Savannah River Site
TAN	Test Area North
TMI	Three-Mile Island
TRU	transuranic
TYSP	Ten-Year Site Plan
UNF	used nuclear fuel
VCO	Voluntary Consent Order
WIPP	Waste Isolation Pilot Plant

APPENDIX C COGNIZANT SECRETARIAL OFFICES, PROGRAM SECRETARIAL OFFICES, AND NON-DOE SITE PROGRAMS

Under Department of Energy (DOE) Order 430.1B, Chg 1, *Real Property Asset Management*, the landlord of a site has the responsibility to act as a host landlord for its resident Cognizant Secretarial Offices (CSOs) or Program Secretarial Offices (PSOs), including coordinating all CSO/PSO programmatic needs and presenting a single coordinated Ten-Year Site Plan (TYSP), which includes any tenant-specific TYSPs. The site landlord also has the responsibility to ensure that the TYSP reflects infrastructure agreements between the lead PSOs and CSOs. Projected programmatic needs and potential growth are analyzed and reviewed with the programs, and their infrastructure support requirements are integrated into the planning process.

The Department of Energy's Office of Environmental Management (DOE-EM) and Office of Naval Reactors are the two largest non-Department of Energy Office of Nuclear Energy (DOE-NE) organizations at the Idaho National Laboratory (INL) Site. DOE-EM, which is a CSO, owns most facilities at the Idaho Nuclear Technology and Engineering Center (INTEC) and the Radioactive Waste Management Complex (RWMC), and manages the Idaho Cleanup Project (ICP) and the Advanced Mixed Waste Treatment Project (AMWTP). The Office of Naval Reactors owns the Naval Reactors Facility (NRF). This appendix describes the facilities occupied and/or work performed by DOE-EM and the Office of Naval Reactors at INL.

C-1. IDAHO CLEANUP PROJECT AND ADVANCED MIXED WASTE TREATMENT PROJECT OVERVIEW

DOE-EM's contract for the ICP at the INL Site is to safely accomplish as much of DOE-EM's cleanup mission as possible within available funding, while meeting regulatory requirements through the contract completion date.

C-1.1 Idaho Cleanup Project Mission

The Department of Energy Idaho Operations Office (DOE-ID)/INL mission is to develop and deliver cost-effective solutions to both fundamental and advanced challenges in DOE-NE (and other energy resources), national security, and DOE-EM. The DOE-EM ICP goal is to complete the environmental cleanup in a safe, cost-effective manner, consistent with the DOE-EM Five-Year Plan (dated February 2007). The objectives include:

- **Objective DOE-EM 1:** Complete efforts to safely accelerate risk reduction, footprint reduction, and continued protection of the Snake River Aquifer
- **Objective DOE-EM 2:** Complete shipment of transuranic (TRU) waste offsite and meet commitments in the Idaho Settlement Agreements
- **Objective DOE-EM 3:** Identify innovative approaches to post-2012 work scope, such as calcine, spent fuel, decommissioning and demolition (D&D), and institutional control
- **Objective DOE-EM 4:** Maintain federal baseline management and government-furnished services and items-delivery systems, and apply to administration of new contracts.

C-1.1.1 Scope and Schedule

Section C of the ICP contract, as amended by a number of contract modifications, defines the "Target" scope of work to be completed by September 30, 2012. In addition to the target scope, a substantial amount of ICP work is being conducted under Section B.5 of the contract (items not included in target cost). Further, in April 2009, the American Recovery and Reinvestment Act (ARRA) provided funding to accelerate some high-priority target work and added a new B.5 scope to the ICP contract. All ARRA funded work scope is scheduled to be completed by March 2012. The current scope of the ICP is summarized below.

INTEC

- Target Scope:
  - Demolish or disposition all excess facilities
  - Design, construct, and operate a treatment facility for liquid sodium-bearing waste
  - Provide interim storage of steam reformed product generated during the term of the contract
  - Empty all Tank Farm Facility waste tanks (subject to specific DOE authorization)
  - Place all DOE-EM used nuclear fuel (UNF) in safe, dry storage (complete)
  - Deactivate DOE-EM UNF wet storage basins (CPP-603) (complete)
  - Dispose of or disposition all excess nuclear material (complete)
  - Complete all voluntary consent order (VCO) tank system actions (complete)
  - Complete all required Operable Unit (OU) 3-13 remediation (complete)
  - Complete OU 3-14 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Tank Farm Interim Action
  - Maintain and operate the Idaho CERCLA Disposal Facility (ICDF)
- Non-Target (B.5) Scope:
  - Transfer Navy fuel, stored at INTEC, to dry storage at the Naval Reactors Facility (NRF)
  - Perform management and oversight for safe storage of UNF at the Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI) and the Three-Mile Island, Unit 2 (TMI 2) ISFSI
  - Provide support and subject matter expert services for the activities required to ensure proper and timely response to requests in support of the removal of UNF from the State of Idaho (currently stored at INTEC) and at the FSV Colorado facility (complete)
  - Receive UNF from domestic research reactors (DRRs) and foreign research reactors (FRRs) and place the fuel in dry storage at INTEC
  - Initial preparations to retrieve Experimental Breeder Reactor II (EBR-II) material, and packaging and transportation to the Materials and Fuels Complex (MFC) of fuel element containers of EBR-II UNF currently stored at INTEC
  - Provide the preparatory work to initiate the transfer of aluminum-clad UNF from INL to the Savannah River Site (SRS) for recycling, and the shipment of non-aluminum UNF from SRS to INL in support of the L-Basin Closure at SRS
  - Provide the necessary design of the selected treatment process for INTEC calcine, hot isostatic pressing, to support the development and submittal of two permit modification requests of existing Resource Conservation and Recovery Act (RCRA) Part B permits

- ARRA (B.5) Scope:
  - Complete activities that support the receipt, processing, and ultimate disposition of 160 containers of remote-handled TRU waste, located primarily at MFC
  - Complete activities that support the disposition of an estimated 1,970 ft^3 of low-level waste (LLW) and/or mixed low-level waste (MLLW) (including alpha-contaminated waste) retrieved from AMWTP
  - Demolish or disposition additional excess facilities
  - Disposition of LLW, MLLW, and hazardous waste resulting from ARRA D&D activities.

RWMC

- Target Scope:
  - Retrieve stored remote-handled LLW and dispose of it at the Subsurface Disposal Area (SDA) or other appropriate disposal facility
  - Retrieve stored remote-handled TRU waste and dispose of it at the Waste Isolation Pilot Plant (WIPP) or transfer to MFC (complete)
  - Retrieve and dispose of waste resulting from the DOE-EM cleanup activities, including LLW, MLLW, hazardous, alpha-contaminated mixed low-level, and newly generated mixed and non-mixed TRU waste, at an appropriate disposal facility
  - Demolish and remove facilities no longer needed (ARRA-funded post April 2009)
  - Continue operation of the vapor vacuum extraction system
  - Continue groundwater monitoring program
  - Complete contract-specified remediation of buried TRU waste, including exhumation and disposal
  - Finalize and submit the final comprehensive Record of Decision (ROD) for Waste Area Group 7, OU 7-13/14 (complete)
- ARRA Target Scope:
  - Complete in situ grouting of mobile radionuclide sources, as identified in the OU 7-13/14 ROD (complete)
  - Complete Pit 5 Targeted Waste Exhumation, Packaging, and Characterization (complete)
  - Complete Pit 6 Targeted Waste Exhumation, Packaging, and Characterization (complete)
  - Exhumation of 0.25 acres of Pit 9 Targeted Waste
- ARRA (B.5) Scope:
  - Complete Pit 4W exhumation facility design and construction
  - Start Pit 4W excavation of the pit area footprint, retrieval and packaging, and shipment to WIPP of TRU and targeted waste.

Test Area North (TAN)

- Target Scope:
  - Demolish all DOE-EM facilities (only facilities required for groundwater remediation remain) (complete)
  - Complete all VCO tank system actions (complete)
  - Complete all remediation of contaminated soils and tanks at TAN (OU 1-10) (complete)
  - Continue CERCLA remedial pump and treat activities (OU 1-07B)
  - Close or transfer the TAN landfill to the INL contractor following completion of TAN demolition (complete).

Advanced Test Reactor (ATR) Complex

- Target Scope:
  - Demolish all DOE-EM-owned facilities (ARRA-funded post April 2009)
  - Disposition of the Engineering Test Reactor and the Materials Test Reactor complexes
  - Complete all VCO tank systems actions
  - Complete the 5-year review of OU 2-13
  - Complete remedial actions for ATR Complex release sites under OU 10-08
- ARRA (B.5) Scope:
  - Demolish or disposition all excess facilities
  - Disposition of LLW, MLLW, and hazardous waste resulting from ARRA D&D activities.

Critical Infrastructure Test Range Complex

- Target Scope:
  - Disposition Power Burst Facility (PBF) Reactor (complete)
  - Complete the 5-year review of OU 5-12
- ARRA (B.5) Scope:
  - Demolish or disposition excess facilities (complete)
  - Disposition of LLW, MLLW, and hazardous waste resulting from ARRA D&D activities (complete).

Miscellaneous Sites

- Complete all required remedial actions for OU 10-04
- Perform actions necessary to complete the OU 10-08 ROD by the enforceable milestone and implement the ROD if finalized and signed during the contract period.

MFC

- ARRA (B.5) Scope:
  - Demolish or disposition excess facilities
  - Disposition of LLW, MLLW, and hazardous waste resulting from ARRA D&D activities.

A high-level summary schedule for completion of this scope of work is shown in Figure C-1.

C-1.1.2 Performance Measures

The ICP is held accountable for work scope through performance metrics based on measurable milestones or actions. Specifically, the ICP "Gold Chart" quantifies DOE's expectations by year for cleanup activities such as disposal of LLW and MLLW, offsite shipment of stored TRU waste, UNF moved from wet to dry storage, and remediation of contaminated release sites and facilities. The Gold Chart metrics provide a consistent set of performance measures for the complex-wide DOE-EM program, and are a component of the DOE-Headquarters DOE-EM annual performance plan reported to Congress with the annual budget submittal. Gold Chart metrics are under DOE-EM configuration control and are statused monthly to the Office of the Assistant Secretary for Environmental Management. The March 2011 Gold Chart is shown in Table C-1.

With the addition of the ARRA-funded work scope, an additional set of performance metrics, separate from the "Gold Chart," was instituted. Those metrics quantify the ICP's performance against the expectations set by the ICP contract modifications that authorize the ARRA-funded work scope. ARRA metrics report the quantities of remote-handled TRU received, processed, and shipped; the amount of buried waste retrieved and the number of facilities demolished; and the number of jobs created or retained as a result of ARRA work scope. The March 2011 ARRA Metric Chart is shown in Table C-2.

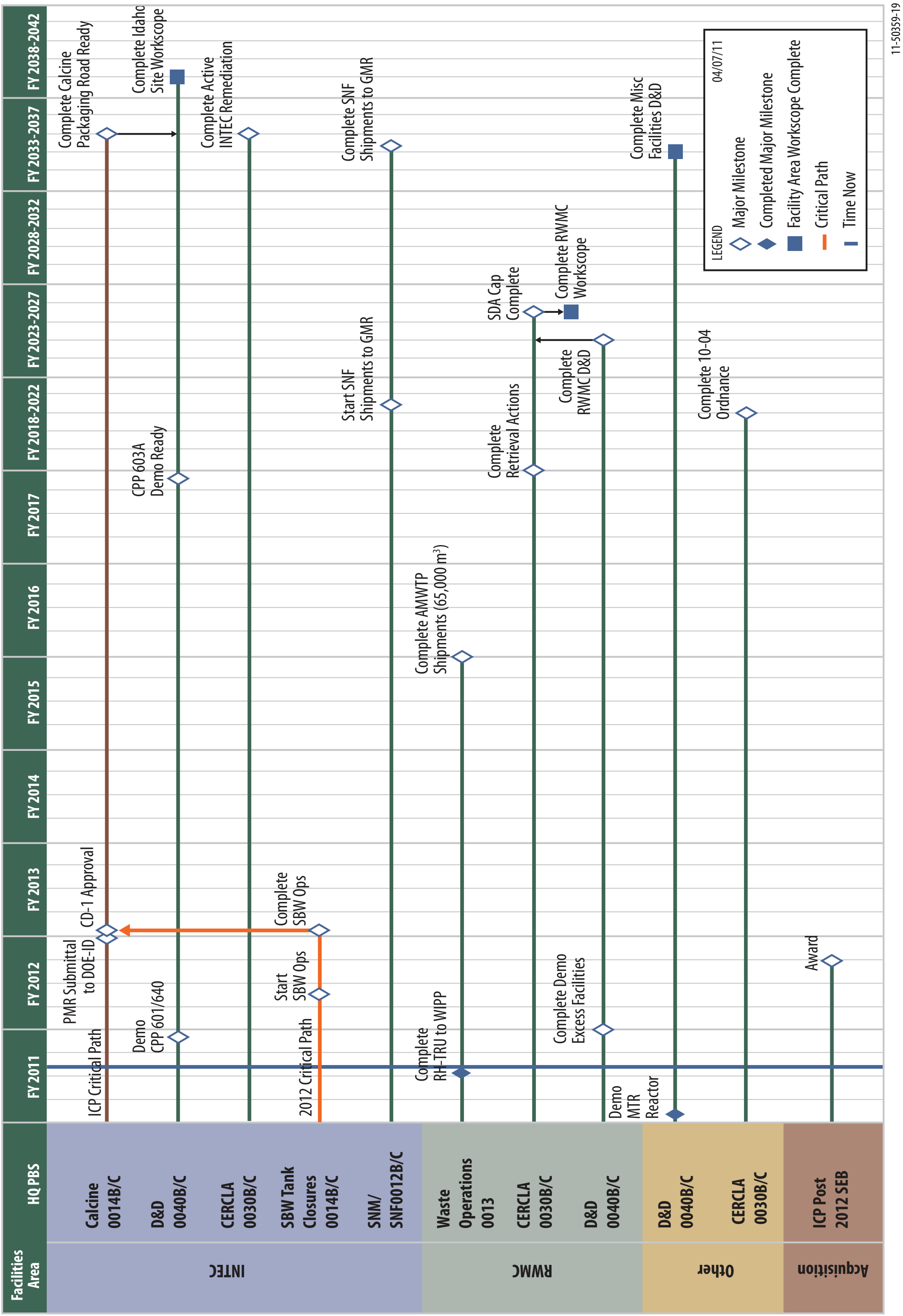


Figure C-1. Idaho Cleanup Project life-cycle schedule.

Table C-1. Idaho Cleanup Project CH2M-WG Idaho, LLC Gold Chart performance metrics.

CH2M-WG Idaho, LLC Gold Chart Performance Metrics March 2011 Monthly Report[a]										
		FY-2011[b]			Contract Through Current FY End[c]			CWI Contract		
Gold Chart Metric	Units	Planned[d]	Actual	Status	Planned	Actual	Status	Planned	Status	
DU Packaged for Disposition	Kg									
eU Packaged for Long-Term Storage	Cntnrs		Complete	N/A	652	652	100%	652	100%	
High-Level Waste Packaged	Cntnrs									
Industrial Facility Completions[e]	Facilities	32	2	N/A	94	102	109%	107	95%	
Liquid Waste Eliminated	Gallons									
Liquid Waste Tanks Closed	Tanks		Complete		11	11	100%	11	100%	
LLW/MLLW Disposed[f]	m^3	788	804	102%	37,044	29,930	81%	37,874	79%	
Material Access Areas Eliminated	Areas		Complete	N/A	1	1	100%	1	100%	
Nuclear Facility Completions[e]	Facilities	3	0	0%	16	24	150%	25	96%	
Plutonium Metal or Oxide Packaged	Cntnrs	-	-	-	-	-	-	-	-	
Plutonium or Uranium Residues Packaged	Kg	-	-	-	-	-	-	-	-	
Radioactive Facility Completions[e]	Facilities	7	1	14%	36	38	106%	39	97%	
Remediation Complete	Sites	2	1	50%	119	119	100%	120	99%	
Spent Nuclear Fuel (Foster Wheeler)	MTHM	-	-	-	-	-	-	-	-	
CH-TRU Waste Shipped to WIPP[d]	m^3	395	493	125%	3,274	3,658	112%	5,108	72%	
RH-TRU Waste Shipped to WIPP[g]	m^3	4.58	4.66	102%	80	96.86	121%	80	121%	

CH2M-WG Idaho, LLC Internal Performance Metrics									
		FY-2011[b]			Contract Through Current FY End[c]			CWI Contract	
CH2M • WGI Proposed Metric	Units	Planned[d]	Actual	Status	Planned	Actual	Status	Planned	Status
VCO Tank Systems Closed	Systems	-	-	-	65	67	103%	68	99%
SBW Treated	Gallons	-	-	-	-	-	-	750,000	0%
Spend Fuel (wet→dry)	Units	-	-	-	3,186	3,186	100%	3,186	100%
Remediation Waste Disposed at ICDF[f,h]	m^3	12,300	9,646	78%	168,801	178,291	106%	194,778	92%

Table C-1. Idaho Cleanup Project CH2M-WG Idaho, LLC Gold Chart performance metrics.

Buried Waste Metrics[a]	Units	Current Month	Project To Date	Lifecycle Planned	Percent Complete
Targeted Waste Retrieved	m^3	91	4,306		
Targeted Waste Packaged	m^3	109	4,733		
Targeted Waste Shipped Out of State	m^3	26	3,864		
Pit Area Exhumed	Acres	0.05	2.17	5.69	38.1%

a. Metrics are reported 1 week in arrears with the exception of Buried Waste Metrics.

b. "Planned" is goal for the current fiscal year, per Gold Chart submitted to DOE-ID in September 2010. "Actual" is sum from October 1st of the current fiscal year through the current month; "Status" is "Actual"/"Plan."

c. "Planned" is sum of current fiscal year and all previous fiscal years of CH2M-WG Idaho, LLC contract, per Gold Chart submitted to DOE-ID in September 2010. "Actual" is sum from May 1, 2005 through current month; "Status" is simple ratio of "Actual"/"Plan."

d. Planned CH-TRU quantities updated 04/09 to align CH-TRU activities with SDA waste exhumation (BCP-09-088).

e. D&D metrics include ARRA-funded, target scope facilities (i.e., these facilities are also shown on the ARRA Metrics Chart). Non-target (B.5) facilities are not included in this Gold Chart.

f. An error in cumulative data was corrected in the March 2011 reporting cycle.

g. Final package volume of RH-TRU is greater than planned. Planned RH-TRU 80 m^3 volume covered 675 drums of waste. Of this total, 638 of the 675 drums have been shipped to WIPP. The remaining 37 drums have been disposed as LLW/MLLW.

h. Volumes disposed at the ICDF include waste associated with target, recovery act, and other B.5 work scope.

ARRA = American Recovery and Reinvestment Act
CH = contact-handled
DU = depleted uranium
eU = enriched uranium
ICDF = Idaho CERCLA Disposal Facility
LLW = low-level waste
MLLW = mixed low-level waste
MTHM = metric tons of heavy metal
RH = remote-handled
SBW = sodium bearing waste
SDA = Subsurface Disposal Area

TRU = transuranic
VCO = Voluntary Consent Order
WIPP = Waste Isolation Pilot Plant

cntnrs = containers
Kg = kilogram
m^3 = cubic meters

Table C-2. Idaho Cleanup Project March 2011 American Recovery and Reinvestment Act metrics.

DOE Ref. #	Work Scope Metrics	Units	Current Month Actual	Cum-to-Date Actual	Planned Cum-to-Date	Cum-to-Date Status (% Complete)	Life-Cycle Planned	Life-Cycle Status (%)	Notes
PBS 1K13 - Remote-handled Transuranic									
13.New.R1	Remote-handled TRU Received	Containers[a]	0	151	144	105	160	94.4	160 "Planned" quantity decreases by 1 (per BEA). Mod 136 updates Containers and Cubic Meters.
		Cubic Meters	0	23.94	20.40	117	25.6	93.5	
	Remote-handled TRU Processed (Certification Ready)	Containers	0	109	139	78	150	72.7	Original received waste repackaged and ready for real-time radiography and dose to curie measurements. Mod 136 updates Containers and Cubic Meters. Lifecycle planned value reflects funded portion only. If additional funding is received, 160 containers equating to 25.6 cubic meters would be processed.
		Cubic Meters[a]	0	17.63	20.3	87	22.6	78	
	Remote-handled TRU Shipped	Shipments[a,b]	0	26	60	43	88	29.5	Original received waste released for disposal as LLW/MLLW or TRU.
		Cubic Meters	0	3.9	9	43	13.2	29.5	
13.R1	LLW Disposed	Cubic Meters	N/A	N/A	N/A	N/A	N/A	N/A	All LLW disposed is D&D generated waste.
	MLLW Disposed	Cubic Meters	N/A	N/A	N/A	N/A	N/A	N/A	All MLLW disposed is D&D generated waste.
	D&D Debris and Remediated Soils Disposed	Cubic Meters[c]	1,520	23,919	18,378	130	24,439	97.9	% complete is a measure of actual waste generated and disposed vs. estimated quantities.
	Remote-handled TRU and Suspect Remote-handled TRU Transported from AMWTP to INTEC	Drums	N/A	18	18	100	18	100	Remaining process/disposal scope deleted by DOE Contracting Officer direction (Section 1.G.b.5), Mod 097.
	D&D Industrial Waste	Cubic Meters	83	11,981	11,981	100	28,275	42.4	Includes INTEC D&D, MFC D&D, and Offsite industrial waste shipments.
	LL/LLM "Other" Waste from AMWTP Processed/Shipped for Disposal	Cubic Meters	0	47.41	26	N/A	47.41	100	Section 1.G.b.4, Mod 097 - Complete

Table C-2. Idaho Cleanup Project March 2011 American Recovery and Reinvestment Act metrics.

DOE Ref. #	Work Scope Metrics	Units	Current Month Actual	Cum-to-Date Actual	Planned Cum-to-Date	Cum-to-Date Status (% Complete)	Life-Cycle Planned	Life-Cycle Status (%)	Notes
PBS 1K 30 – Buried Waste[d]									
30B.R1	Complete In-Situ Grouting of Mobile Rad Sources	Insertions	0	2,168	2,168	100	2,168	100	Complete
	Complete Pit 4W Exhumation Facility (ARP VI) Construction	% Complete	1%	100%	100%	N/A	100	100	
	CH-TRU Waste Processed (Certification Ready)	Cubic Meters	N/A	N/A	N/A	N/A	N/A	N/A	Contact-handled TRU waste characterization is not ARRA funded.
	Pits 5 and 6 (NTB)	Acres	0	1.06	0.58	183	0.76	139.5	Exhumation in Pit 5, scheduled for FY 2012 under Target, has been accelerated into FY 2011 using ARRA funds.
	Pit 9 (NTB)	Acres	0.05	0.08	0.00	N/A	0.25	32	Exhumation in Pit 9, scheduled to begin in May FY 2011 under Target, has been accelerated using ARRA funds.
	Pits 4W/10W (OPER)	Acres	0	0	0	N/A	0.15	0	
PBS 1K40 – D&D									
40B.NEW.R1.3	D&D Industrial Facility Completions (New)	No. of Facilities	0	1	1	N/A	1	100	
		Sq. Ft.	0	2,300	2,300	N/A	2,300	100	
	D&D Nuclear Facility Completions (New)	No. of Facilities	0	5	5	100	9	55.6	
		Sq. Ft.	0	17,454	17,454	100	67,921	25.7	
	D&D Radioactive Facility Completions (New)	No. of Facilities	0	2	3	67	5	40	Area of MFC-793E adjusted downward by 193 square feet (with DOE agreement) in Feb. 2010 for planned and actual.
		Sq. Ft.	0	963	1,963	49	17,134	5.6	
40B.NEW.STRETCH	D&D Stretch Goals (New)	No. of Facilities	0	2	2	100	2	100	
		Sq. Ft.	0	1,411	1,411	100	1,411	100	

Table C-2. Idaho Cleanup Project March 2011 American Recovery and Reinvestment Act metrics.

DOE Ref. #	Work Scope Metrics	Units	Current Month Actual	Cum-to-Date Actual	Planned Cum-to-Date	Cum-to-Date Status (% Complete)	Life-Cycle Planned	Life-Cycle Status (%)	Notes
40B.NEW.R1.3	D&D Facilities Reduced (New)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	D&D Facilities Demolished (New) Subtotal	No. of Facilities	0	10	11	91	17	58.8	
		Sq. Ft.	0	22,128	23,128	96	88,766	24.9	
40B.R1.1	D&D Industrial Facility Completions (NTB)	No. of Facilities	1	8	9	89	12	66.7	
		Sq. Ft.	5,000	8,938	37,536	24	67,512	13.2	
	D&D Nuclear Facility Completions (NTB)	No. of Facilities	0	11	10	110	12	91.7	
		Sq. Ft.	0	70,450	70,450	100	114,968	61.3	
	D&D Radioactive Facility Completions (NTB)	No. of Facilities	0	14	14	100	16	87.5	
		Sq. Ft.	0	70,018	70,018	100	75,742	92.4	
	D&D Facilities Reduced (NTB)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	D&D Facilities Demolished (NTB) Subtotal	No. of Facilities	1	33	33	100	40	82.5	
		Sq. Ft.	5,000	149,406	178,004	84	258,222	57.9	
40B.R1.2	D&D Industrial Facility Completions (OPER)	No. of Facilities	0	20	17	118	20	100	
		Sq. Ft.	0	49,092	14,555	337	49,092	100	
	D&D Nuclear Facility Completions (OPER)	No. of Facilities	0	3	1	300	5	60	
		Sq. Ft.	0	39,545	402	9,837	193,217	20.5	
	D&D Radioactive Facility Completions (OPER)	No. of Facilities	0	6	6	100	7	85.7	
		Sq. Ft.	0	221,518	223,360	99	223,518	99.1	
	D&D Facilities Reduced (OPER)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	D&D Facilities Demolished (OPER) Subtotal	No. of Facilities	0	29	24	121	32	90.6	
		Sq. Ft.	0	310,155	238,317	130	465,827	66.6	
	D&D Totals	**No. of Facilities**	**1**	**72**	**68**	**106**	**89**	**80.9**	**Footprint reduction only; not gross square feet**
		Sq. Ft.	**5,000**	**481,689**	**439,449**	**110**	**812,815**	**59.3**	

Table C-2. Idaho Cleanup Project March 2011 American Recovery and Reinvestment Act metrics.

DOE Ref. #	Work Scope Metrics	Units	Current Month Actual	Cum-to-Date Actual	Planned Cum-to-Date	Cum-to-Date Status (% Complete)	Life-Cycle Planned	Life-Cycle Status (%)	Notes
Jobs Status									
	Number of Jobs Created or Retained	FTEs	N/A	724	N/A	N/A	550	131.6	FTEs are reported based on "productive hours" vs. "scheduled hours."

a. Adjustments have been made in Remote-handled TRU Current Month Actuals to update Cum-to-Date Actuals. Actual quantities performed in April are – Remote-handled TRU Received Containers – 0, Cont'd. Remote-handled TRU Processed cm – 0.7, Remote-handled TRU Shipped Shipments – 7. Life Cycle planned number for Remote-handled TRU will be updated when definitized.

b. Remote-handled TRU Shipped Units – Containers have been changed to Shipments.

c. D&D waste quantities do not include industrial waste, which are being provided by DOE-ID by the projects.

d. Buried waste metrics are reported through the end of the accounting period rather than 1 week in arrears.

AMWTP = Advanced Mixed Waste Treatment Project
ARP = Accelerated Retrieval Project
ARRA = American Recovery and Reinvestment Act
BEA = Battelle Energy Alliance
D&D = decommissioning and demolition
FTE = Full-time Equivalent
INTEC = Idaho Nuclear Technology Engineering Center
LLW = low-level waste
LL/LLM = low-level/low-level mixed
MFC = Materials and Fuels Complex
MLLW = mixed low-level waste
NTB =near-term baseline
OPER =operating
TRU = transuranic

C-1.1.3 Funding and Staffing

The ICP is funded by DOE-EM. The annual projected funding for ICP, through Fiscal Year (FY) 2012, is shown in Table C-3.

The ICP staffing will be aligned with project work scope, as necessary, throughout the course of the contract. Figure C-2 shows currently projected ICP staffing through the year 2012.

Table C-3. Idaho Cleanup Project funding schedule ($M).

Funding	FY 2005[a]	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011[b]	FY 2012[c,d]	Total
ICP Target Funding (contract Section B.2)	237	477	464	371	357	335	337	335	2,913
Actual Funding									
ICP Target Funding (non-ARRA)	320	518	375	380	303	134	242	265	2,538
ARRA Funding (Target)					142	-21	-6		114
B.5 Funding (non-Target, non-ARRA)	27	9	30	12	31	61	9		179
ARRA Funding (non-Target)					296	6	6		308
Total Funding	320	518	375	380	772	181	251	265	3,062

a. Table excludes $16.5M in FY 2005 funding for contract transition activities.

b. FY 2011 funding includes current funding as of Contract Mod 173, dated March 29, 2011, and includes an expected increase of $122M overfunding through Mod 173.

c. FY 2012 funding is per DOE guidance, with Section B.5 funding developed annually, with no future commitment.

d. No current contract coverage exists beyond the year 2012.

ARRA = American Recovery and Reinvestment Act

ICP = Idaho Cleanup Project

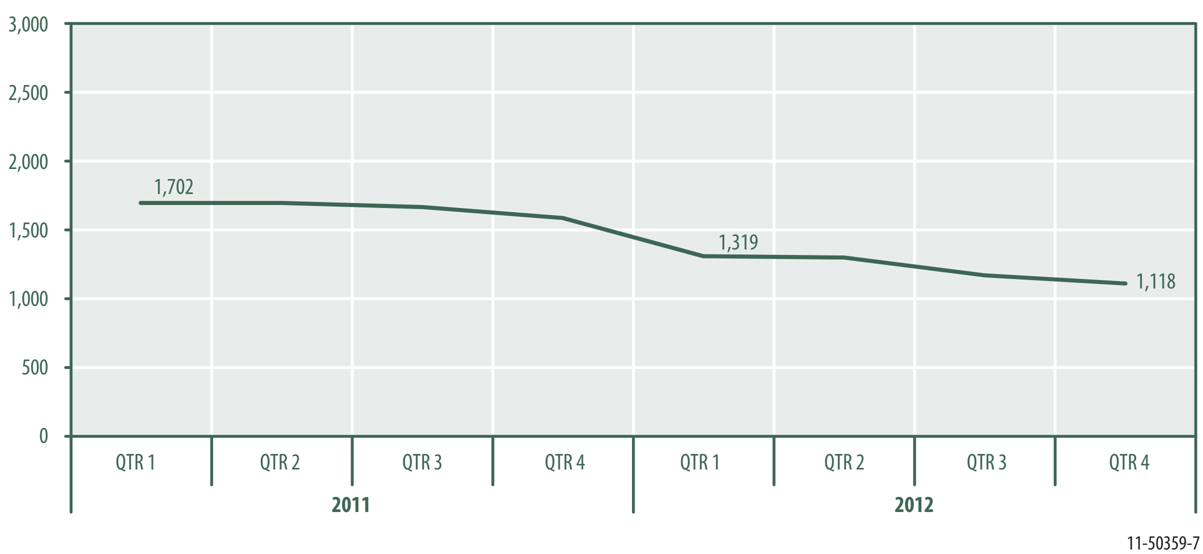


Figure C-2. Projected Idaho Cleanup Project staffing for full-time equivalents averaged over the fiscal year.

C-1.1.4 Facilities and Infrastructure Overview

A breakdown of building ownership showing DOE-EM-owned buildings (assigned to the ICP) versus DOE-NE-owned buildings is available in the Facilities Information Management System (FIMS) database. As of March 2011, the FIMS database showed 130 DOE-EM-owned buildings and trailers at INL assigned to the ICP, with a total area of 1,222,385 ft^2.

Table C-4 provides a description of the buildings assigned to the ICP and their overall operating status, size, age, usage, and hazard description.

The current conditions of existing DOE-EM buildings assigned to ICP are illustrated in Figure C-3.

C-1.1.4.1 Maintenance

ICP will continue to maintain mission essential facilities/utility systems in accordance with DOE Order 430.1B, Chg 1. Facilities/utility systems that no longer have a defined mission, and are considered candidates for decommissioning, will continue to undergo surveillance and maintenance adjustment according to the guidelines of DOE Guide 430.1-2, *Implementation Guide for Surveillance and Maintenance during Facility Transition and Disposition*.

A graded approach is implemented for surveillance and maintenance by ICP. The graded approach being used is commensurate with the facility/utility systems condition, mission need, and schedule for demolition.

Maintenance, whether preventive, predictive, or corrective, is performed at a level to sustain property in a condition suitable for the property to be used for its designated purpose.

Surveillance is the scheduled periodic inspection of facilities, utility systems, equipment, or structures to demonstrate compliance, identify problems requiring corrective action, and determine the facility's present environmental, radiological, and physical condition.

Facility/utility systems will be considered for recommendation of recapitalization based on facility/utility systems conditions established by scheduled surveillance/inspections and estimated remaining duration of the facility/utility systems mission. Table C-5 is a list of the proposed ICP recapitalization projects for facilities, structures, systems, and equipment. Recapitalization recommendations will be described in the Condition Assessment Information System (CAIS) database section for the identified facility/utility system. Surveillance will be performed in a manner that ensures protection of the worker, the public, and the environment.

Facility management, with assistance from designated experts in each discipline, will identify facility-specific surveillance and maintenance activities. The source of any such surveillance requirements and the end points at which the surveillance and maintenance activities can be stopped for facilities and structures slated for D&D also will be identified.

Any reduction in surveillance and maintenance will be justified and documented in accordance with company procedures.

ICP also is responsible for over 120 small support structures (e.g., septic tanks, fuel storage tanks, and concrete pads), many of which will be demolished as the need for them is eliminated. These structures are identified in the FIMS database as other structures and facilities and are not specifically addressed in this discussion. They include facilities such as CPP-749 (underground storage vaults for Peach Bottom fuel), CPP-1774 (TMI 2 dry storage modules), and CPP-2707 (dry UNF cask storage pad).

Table C-4. Idaho Cleanup Project building data.

ID	Name	Type	Gross ft^2	Year Built	Usage Code Description	Hazard Description
Idaho Cleanup Project Operating Facilities with Future Missions (no D&D planned under the Idaho Cleanup Project contract)						
CF-TR-01	Central Facilities Area CERCLA Staging Office	Trailer	400	1990	101 Office	10 Not Applicable
CPP-1604	Office Building	Building	22,633	1986	101 Office	10 Not Applicable
CPP-1605	Engineering Support Building	Building	17,105	1986	101 Office	10 Not Applicable
CPP-1606	Plant Support Warehouse	Building	16,267	1986	400 General Storage	10 Not Applicable
CPP-1608	Contaminated Equip. Storage	Building	4,000	1987	607 Other Buildings Trades Shops	04 Radiological Facility
CPP-1615	Equipment Building 7th Bin Set	Building	263	1989	593 Nuclear Waste Processing and/or Handling Building	04 Radiological Facility
CPP-1617	Waste Staging Facility	Building	1,044	1986	593 Nuclear Waste Processing and/or Handling Building	02 Nuclear Facility Category 2
CPP-1618	Liquid Eff. Treat. Disp. Building	Building	5,845	1990	593 Nuclear Waste Processing and/or Handling Building	04 Radiological Facility
CPP-1631	Production Computer Support	Building	12,000	1988	297 Computer Buildings	10 Not Applicable
CPP-1642	Fire Pumphouse	Building	656	1992	694 Other Service Buildings	10 Not Applicable
CPP-1643	Fire Pumphouse	Building	656	1992	694 Other Service Buildings	10 Not Applicable
CPP-1647	Water Treatment Facility	Building	2,879	1991	694 Other Service Buildings	10 Not Applicable
CPP-1650	Training Support Facility	Building	6,990	1992	230 Traditional Classroom Buildings	10 Not Applicable
CPP-1659	Contaminated Equipment Maintenance Building	Building	1,846	1986	601 Maintenance Shops, General	02 Nuclear Facility Category 2
CPP-1663	Security & Fire Protection Support	Building	4,891	1992	101 Office	10 Not Applicable
CPP-1671	Protective Force Support Facility	Building	3,107	1993	296 Security Headquarters/Badge Issuance/Gate Houses	10 Not Applicable
CPP-1673	Utility Control Center	Building	1,600	1993	615 Electrical/Motor Repair Shops	10 Not Applicable
CPP-1676	Oil Hazardous Materials Building	Building	113	1994	410 Hazardous/Flammable Storage	05 Chemical Hazard Facility
CPP-1681	Box Staging Area	Building	5,100	1994	401 Programmatic General Storage	04 Radiological Facility
CPP-1683	Waste Operations Control Room	Building	2,018	1996	642 Communications/Control Centers	02 Nuclear Facility Category 2
CPP-1684	Standby Generator Facility	Building	3,760	2000	694 Other Service Buildings	10 Not Applicable

Table C-4. Idaho Cleanup Project building data.

ID	Name	Type	Gross ft^2	Year Built	Usage Code Description	Hazard Description
CPP-1686	Access Control Facility	Building	7,469	2000	296 Security Hq/Badge Issuance/Gate Houses	04 Radiological Facility
CPP-1689	SSSTF Administration Building	Building	1,960	2003	101 Office	04 Radiological Facility
CPP-603	Wet & Dry Fuel Storage Facility	Building	40,759	1953	412 Special Nuclear Material Storage	02 Nuclear Facility Category 2
CPP-604	Rare Gas Plant/Waste Building	Building	21,175	1953	593 Nuclear Waste Processing and/or Handling Building	02 Nuclear Facility Category 2
CPP-605	Blower Building	Building	3,436	1953	593 Nuclear Waste Processing and/or Handling Building	04 Radiological Facility
CPP-606	Service Building Powerhouse	Building	14,921	1953	694 Other Service Buildings	10 Not Applicable
CPP-611	Water Well #1 Pumphouse	Building	216	1953	694 Other Service Buildings	10 Not Applicable
CPP-612	Water Well #2 Pumphouse	Building	216	1953	694 Other Service Buildings	10 Not Applicable
CPP-613	Substation #10	Building	1,823	1953	694 Other Service Buildings	10 Not Applicable
CPP-614	Diesel Engine Pumphouse	Building	626	1984	694 Other Service Buildings	10 Not Applicable
CPP-615	Waste Water Treatment Plant	Building	171	1982	694 Other Service Buildings	10 Not Applicable
CPP-616	Emergency Air Compressor	Building	424	1979	694 Other Service Buildings	10 Not Applicable
CPP-626	Office/Change Room	Building	2,068	1953	101 Office	10 Not Applicable
CPP-639	Instrumentation Building Bin Set 1	Building	169	1978	593 Nuclear Waste Processing and/or Handling Building	02 Nuclear Facility Category 2
CPP-644	Substation #20 Emergency Power	Building	1,805	1960	694 Other Service Buildings	10 Not Applicable
CPP-646	Instrument Building 2nd Bin Set	Building	91	1966	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-647	Instrument Building 3rd Bin set	Building	91	1966	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-649	Atmospheric Protection System	Building	4,825	1976	591 Materials Handling or Processing Facilities	04 Radiological Facility
CPP-652	Cafeteria/Offices	Building	8,858	1976	291 Cafeteria	10 Not Applicable
CPP-655	Craft Shop/Warehouse	Building	16,757	1977	601 Maintenance Shops, General	10 Not Applicable
CPP-658	Instrument Building 4th Bin Set	Building	81	1980	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-659	New Waste Calcine Facility	Building	84,080	1981	593 Nuclear Waste Processing and/or Handling Building	02 Nuclear Facility Category 2

Table C-4. Idaho Cleanup Project building data.

ID	Name	Type	Gross ft^2	Year Built	Usage Code Description	Hazard Description
CPP-662	Maintenance/ Fabrication Shop	Building	4,000	1979	601 Maintenance Shops, General	10 Not Applicable
CPP-663	Maintenance/Crafts/ Warehouse Building	Building	64,197	1980	601 Maintenance Shops, General	04 Radiological Facility
CPP-666	FDP/FAST Facility	Building	152,388	1983	412 Special Nuclear Material Storage	02 Nuclear Facility Category 2
CPP-671	Service Building 5th Bin Set	Building	240	1981	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-673	Service Building 6th Bin Set	Building	256	1986	694 Other Service Buildings	10 Not Applicable
CPP-677	UREP Load Center #2	Building	512	1983	694 Other Service Buildings	10 Not Applicable
CPP-679	Tent Fabrication Facility	Building	2,023	1983	605 Carpentry Shops	10 Not Applicable
CPP-684	Remote Analytical Lab	Building	13,101	1985	712 Chemical Laboratory (Nuclear)	03 Nuclear Facility Category 3
CPP-692	Waste Stack Monitor System	Building	663	1983	591 Materials Handling Or Processing Facilities	04 Radiological Facility
CPP-697	East Guardhouse & VMF	Building	4,082	1986	296 Security Hq/Badge Issuance/Gate Houses	10 Not Applicable
CPP-TB-1	Carpenter Shop	Building	1,261	1980	601 Maintenance Shops, General	10 Not Applicable
CPP-TB-3	TB-3 FPR Eastside Guardhouse	Building	176	1986	641 Guard Houses	10 Not Applicable
CPP-TR-19	Office Trailer	Trailer	300	1974	101 Office	10 Not Applicable
CPP-TR-54	Control Trailer	Trailer	400	2001	101 Office	10 Not Applicable
CPP-TR-56	TF Washdown Support Office	Trailer	317	2001	101 Office	10 Not Applicable
CPP-TR-57	ICDF Rad Con Trailer	Trailer	638	2003	694 Other Service Buildings	04 Radiological Facility
TAN-1611	Pump and Treatment Facility	Building	1,500	2000	591 Materials Handling Or Processing Facilities	10 Not Applicable
TAN-1614	In Situ Bioremediation Facility	Building	1,482	2003	591 Materials Handling Or Processing Facilities	10 Not Applicable
TRA-604	MTR Utility Basement	Building	18,346	1952	694 Other Service Buildings	10 Not Applicable
WMF-1612	Retrieval Enclosure II	Building	46,038	2007	593 Nuclear Waste Processing and/or Handling Building	02 Nuclear Facility Category 2
WMF-697	Retrieval Enclosure I (PIT 4)	Building	56,688	2004	591 Materials Handling Or Processing Facilities	02 Nuclear Facility Category 2
WMF-698	ARP Storage Enclosure	Building	20,800	2005	415 Nuclear Waste Storage Facility	02 Nuclear Facility Category 2
WMF-TR-1	ARP Sample Support Trailer	Trailer	1,680	2004	694 Other Service Buildings	10 Not Applicable
WMF-TR-13	ARP Restroom/Change Room	Trailer	1,106	2006	631 Change Houses	10 Not Applicable
WMF-TR-2	ARP Operations Support Trailer	Trailer	1,420	2003	694 Other Service Buildings	10 Not Applicable

Table C-4. Idaho Cleanup Project building data.

ID	Name	Type	Gross ft^2	Year Built	Usage Code Description	Hazard Description
WMF-TR-3	ARP Non Destructive Assay East Trailer	Trailer	317	2006	101 Office	10 Not Applicable
WMF-TR-4	ARP Office Trailer	Trailer	317	2004	101 Office	10 Not Applicable
WMF-TR-6	ARP Men's Change Trailer	Trailer	660	2003	631 Change Houses	10 Not Applicable
WMF-TR-7	ARP Women's Change Trailer	Trailer	400	2003	631 Change Houses	10 Not Applicable
WMF-TR-8	637 West Office Trailer	Trailer	1,432	2005	101 Office	10 Not Applicable
WMF-TR-9	637 East Office Trailer	Trailer	1,432	2005	101 Office	10 Not Applicable
CPP-1688	SSSTF Decon Building	Building	6,266	2003	593 Nuclear Waste Processing and/or Handling Building	10 Not Applicable
Idaho Cleanup Project Facilities Operating Pending D&D						
CPP-1635	Hazardous Chemical Storage Facility	Building	2,507	1992	410 Hazardous/Flammable Storage	05 Chemical Hazard Facility
CPP-1636	Warehouse	Building	4,800	1989	400 General Storage	10 Not Applicable
CPP-1646	Anti-C Safety Handling	Building	3,708	1991	411 Nuclear Contaminated Storage	10 Not Applicable
CPP-1651	Operations Training Facility	Building	6,242	1992	231 Specialized Training Buildings	10 Not Applicable
CPP-1653	Subcontractor's Warehouse	Building	10,773	1991	400 General Storage	10 Not Applicable
CPP-1656	Warehouse	Building	6,000	1991	400 General Storage	10 Not Applicable
CPP-1662	Remote Inspection Engr. Facility	Building	3,173	1992	781 Large Scale Demonstration/ Research Building	10 Not Applicable
CPP-1666	Engineering Support Office	Trailer	7,168	1993	101 Office	10 Not Applicable
CPP-1678	Contractors Lunch Room	Building	2,044	1994	631 Change Houses	10 Not Applicable
CPP-618	Tank Farm Measure/ Control Building	Building	249	1955	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-623	Tank Farm Instrument House	Building	64	1960	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-628	Tank Farm Control House	Building	1,552	1953	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-632	Instrument House Tank Farm Area	Building	67	1960	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-635	Waste Station WM-187-188	Building	331	1960	694 Other Service Buildings	02 Nuclear Facility Category 2
CPP-636	Waste Station WM-189-190	Building	363	1965	694 Other Service Buildings	02 Nuclear Facility Category 2

Table C-4. Idaho Cleanup Project building data.

ID	Name	Type	Gross ft^2	Year Built	Usage Code Description	Hazard Description
CPP-654	Receiving Warehouse/ Offices	Building	19,301	1976	401 Programmatic General Storage	10 Not Applicable
CPP-674	UREP Substation #40	Building	425	1983	694 Other Service Buildings	10 Not Applicable
CPP-698	Morrison Knudson Offices/Warehouse	Building	23,958	1984	101 Office	10 Not Applicable
TRA-610	MTR Fan House	Building	3,217	1952	593 Nuclear Waste Processing and/or Handling Building	04 Radiological Facility
WMF-601	Radcon Field Office	Building	5,044	1976	101 Office	02 Nuclear Facility Category 2
WMF-603	Pumphouse	Building	1,435	1977	694 Other Service Buildings	10 Not Applicable
WMF-604	Change House & Lunch Room	Building	1,272	1977	631 Change Houses	10 Not Applicable
WMF-605	Well House 87	Building	33	1979	694 Other Service Buildings	10 Not Applicable
WMF-609	Heavy Equipment Storage Shed	Building	11,133	1979	450 Shed Storage	02 Nuclear Facility Category 2
WMF-619	Communication Building	Building	945	1989	642 Communications/Control Centers	10 Not Applicable
WMF-620	Work Control Center, Trailer	Trailer	1,577	1988	101 Office	10 Not Applicable
WMF-621	Work Control Support, Trailer	Trailer	1,538	1988	101 Office	10 Not Applicable
WMF-622	Office Annex, Trailer	Trailer	1,605	1985	101 Office	10 Not Applicable
WMF-637	Operations Control Building	Building	24,262	1995	101 Office	10 Not Applicable
WMF-639	Firewater Pumphouse #2	Building	1,812	1995	694 Other Service Buildings	10 Not Applicable
WMF-645	Construction Support Trailer	Trailer	1,568	1991	101 Office	10 Not Applicable
WMF-646	Field Support Trailer	Trailer	1,568	1991	101 Office	10 Not Applicable
WMF-653	Office Annex #2, Trailer	Trailer	1,513	1993	101 Office	10 Not Applicable
WMF-655	Material Handling Facility	Building	5,483	1995	400 General Storage	04 Radiological Facility
WMF-656	Maintenance Facility	Building	4,999	1995	601 Maintenance Shops, General	10 Not Applicable
WMF-657	Const Field Support, Trailer	Trailer	1,568	1960	101 Office	10 Not Applicable
WMF-658	RWMC Office	Building	4,518	1995	101 Office	10 Not Applicable
WMF-661	Hazardous Material Storage	Building	128	1996	410 Hazardous/Flammable Storage	10 Not Applicable
WMF-680	Building Trailer	Trailer	720	2001	101 Office	10 Not Applicable

Table C-4. Idaho Cleanup Project building data.

ID	Name	Type	Gross ft^2	Year Built	Usage Code Description	Hazard Description
WMF-681	Building Trailer	Trailer	720	2001	101 Office	10 Not Applicable
Idaho Cleanup Project Facilities Shutdown Pending D&D						
CPP-TR-35	Office Trailer	Trailer	1,904	1991	101 Office	10 Not Applicable
MFC-750A	Experimental Equipment Building	Building	199	1975	410 Hazardous/Flammable Storage	10 Not Applicable
MFC-766	Sodium Boiler Building	Building	14,547	1962	792 Laboratories, General (Nuclear)	04 Radiological Facility
MFC-767	EBR-II Reactor Plant Building	Building	18,967	1963	783 Research Reactor	04 Radiological Facility
MFC-793B	SCMS Alcohol Recovery Annex	Building	576	1979	694 Other Service Buildings	04 Radiological Facility
TAN-TR-23	TAN Landfill Trailer	Trailer	332	2004	694 Other Service Buildings	10 Not Applicable
TRA-612	Retention Basin Sump Pump House	Building	64	1952	694 Other Service Buildings	04 Radiological Facility
TRA-632	Hot Cell Building	Building	11,862	1952	782 Hot Cells	02 Nuclear Facility Category 2
WMF-643	Vapor Vacuum Extract Monitoring Well	Building	16	1990	694 Other Service Buildings	10 Not Applicable
WMF-TR-5	ARP Radcon Trailer	Trailer	229	2004	101 Office	10 Not Applicable
Idaho Cleanup Project Facilities Shutdown Pending Disposal						
CPP-691	FPR Facility	Building	160,611	1992	400 General Storage	10 Not Applicable
Idaho Cleanup Project Facilities with D&D In Progress						
CPP-602	Laboratory/Offices Building	Building	52,393	1953	712 Chemical Laboratory (Nuclear)	02 Nuclear Facility Category 2
TRA-603	Materials Test Reactor Building	Building	44,724	1952	793 Multifunction Research/Lab Building	04 Radiological Facility

ARP = Accelerated Retrieval Project
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
D&D = decommissioning and demolition
EBR-II = Experimental Breeder Reactor II
FAST = Fluorinel Dissolution Process and Fuel Storage
FDP = Fluorinel Dissolution Process
FPR = Fuel Processing Restoration
ICDF = Idaho CERCLA Disposal Facility
MTR = Materials Test Reactor
RWMC = Radioactive Waste Management Complex
SCMS = Sodium Component Maintenance Shop
SSSTF = Staging, Storage, Sizing, and Treatment Facility
TAN = Test Area North
TF = Treatment Facility
UREP = Utilities Replacement Enhancement Project
VMF = Vehicle Monitoring Facility

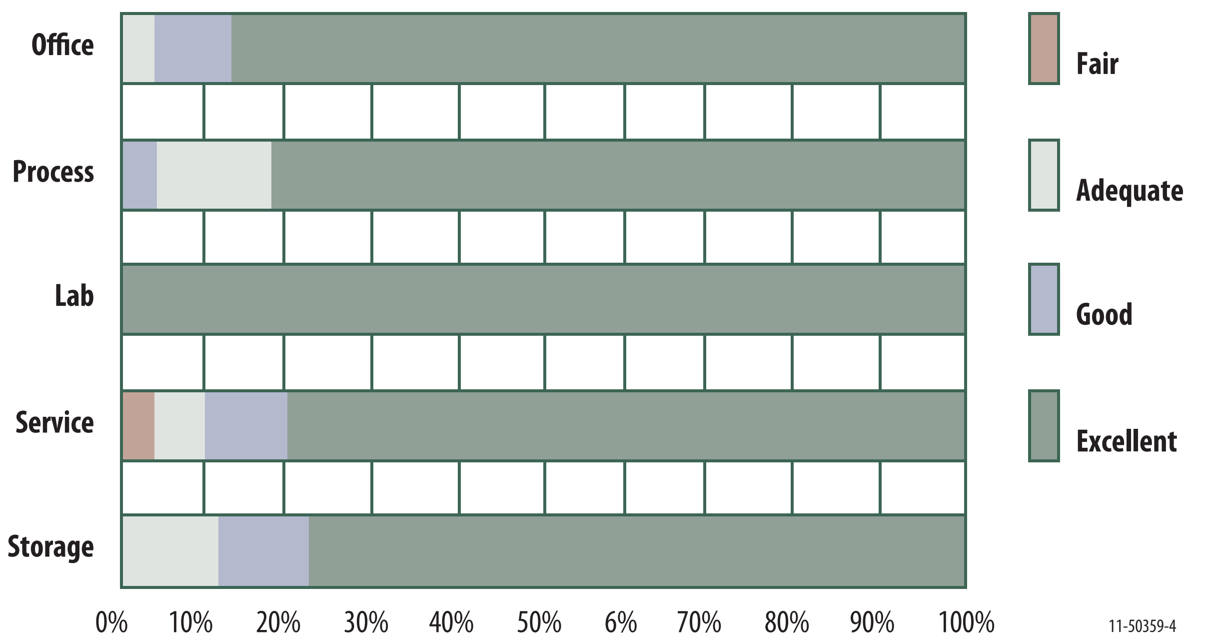


Figure C-3. Fiscal Year 2010 Facility Information Management System conditions of Department of Energy Office of Environmental Management buildings assigned to the Idaho Cleanup Project.

Table C-5. Idaho Cleanup Project proposed recapitalization projects (updated 01/19/11).

Facility	System	Description	Justification (e.g., end of service life, modernization, major repairs, etc.)	Rough Order of Magnitude Estimated Cost	Comments
CPP-666	FAST Distributed Control System	Water treatment and HVAC controls	Modernization - obsolete system	$2,000K	Spare parts are no longer available
CPP-666	Basin Water Treatment	Resin Bed Replacement	End of service life	$3,000K	Includes removal of spent resin in hold tanks
CPP-666	Basin Water Treatment	VACCO filter replacement	End of service life	$800K	
CPP-666	Basin Water Treatment	Replace pumps, valves and flow control	Major repair	$1,200K	
CPP-666	HVAC	Flow Element Replacement	End of service life	$320K	Replace only primary elements, 18 of 40
CPP-666	HVAC	Blower Replace / Rebuild	End of service life	$380K	Assumes 1/2 of currently installed, includes FDP

Table C-5. Idaho Cleanup Project proposed recapitalization projects (updated 01/19/11).

Facility	System	Description	Justification (e.g., end of service life, modernization, major repairs, etc.)	Rough Order of Magnitude Estimated Cost	Comments
CPP-666	HVAC	I&C Replacement	End of service life - obsolete	$500K	Includes FDP
CPP-666	Roof	Roof Replacement	End of service life	$2,000K	
CPP-666	Basin Area Communication	Public Address System Upgrade - Improve Clarity	Cannot hear - comp measures req'd	$500K	
CPP-603	Roof	Re-slope Roof & Remove Duct Work	End of service life	$2,000K	
CPP-1683	DCS-WN-900	LGWDCS Console Replacement	The consoles are the highest cost for maintenance of the DCS	$1,000K	In communication with Rockwell Automation
CPP-659	Acid Recycle System Valves	Replaces valves in the acid recycle system	Valves have PEEK seats that are not suitable for concentrated acid. Valve failure could result in 18,000 gallon acid spill.	$540K	Cost to remove acid
CPP-1618	FRAC-WLK-171	Replacement LET&D Tube Bundle	Single point failure. Continued operation of the LET&D puts in jeopardy the remaining reboiler.	$500K	A damaged, used reboiler is in storage. Extent of damage is unknown. Decontamination and repair would be needed to reuse.
CPP-604	HE-WL-307	Replacement PEW Evaporator Tube Bundle	Single point failure. Continued operation of the PEW Evaporator will eventually lead to a reboiler failure.	$500K	HE-WL-300 reboiler for the VES-WL-161 evaporator could be used, but has seen 42 months of operation.
CSSFs (various buildings)	Hatch Plugs	Install inspection plugs or fabricate new hatches to allow periodic inspection without pulling the hatches.	Modernization (suggested by Management as cost savings)	$1,000K	
CPP-606	Air Compressors	Replace Air Compressors com-uti-614 and com-uti-617 and relocate to FAST	End of Service - replace	$1,500K	
CPP-1769	Potable Water	Replacement of Chlorinator	End of Service Life	$150K	Assumes design, materials, and installation.

Table C-5. Idaho Cleanup Project proposed recapitalization projects (updated 01/19/11).

Facility	System	Description	Justification (e.g., end of service life, modernization, major repairs, etc.)	Rough Order of Magnitude Estimated Cost	Comments
CPP-603	Doghouse Entry Platform/ Roof Access	Install a platform to allow radiological personnel more room to don radiological equipment.	Safety	$1,000K	
CPP-603	In-Cell Cranes and Par Upgrade	B5 Previously funded project	Cranes need to be refurbished and installed	$610K	
CPP-666	Cranes	Spare parts, inventory and warehousing of existing spare parts	End of Service Life-Upgrade	$500K	
INTEC	Emergency Communication System	Upgrade Emergency Communication System	Upgrade will being Emergency Communication System will correct deficiencies and non-compliances, TFR-427	$5,000K	Based on a conceptual estimate in 2007 less buildings removed since then.
INTEC	Utility Control System	Electrical Distribution System	End of Service Life-Obsolete	$3,000K	
CPP-666	HVAC	Damper Actuators	End of Service Life	$500K	Estimated 24 actuators are failing and need replacement
INTEC	RAMs	RAMs	End of Service Life	$350K	
INTEC	CAMs and Air Samplers	CAMs and Air Samplers	End of Service Life	$800K	
INTEC	Portable Instruments	Portable Instruments	End of Service Life	$350K	
INTEC	Filter Counters	Filter Counters	End of Service Life	$150K	
INTEC	EDs and Readers	EDs and Readers	End of Service Life	$300K	
INTEC	TLDs	TLDs	End of Service Life	$1,000K	
INTEC	RCIMS	RCIMS	End of Service Life	$250K	
INTEC	Whole Body Counters	Whole Body Counters	End of Service Life	$700K	
CPP-652	Monitors, Computers, Communication Equipment	ECC Systems Upgrade	ECC losing ability to interface with site Emergency Operations Center	$1,000K	Upgrade systems will eliminate technological differences in the interface

Table C-5. Idaho Cleanup Project proposed recapitalization projects (updated 01/19/11).

Facility	System	Description	Justification (e.g., end of service life, modernization, major repairs, etc.)	Rough Order of Magnitude Estimated Cost	Comments
CPP-603	Shield Door	Upgrade Repairs to west side shield door	End of Service Life-Upgrade	$1,000K	
INTEC	Outdoor Lighting	Outdoor Lighting		$1,000K	
INTEC	Roads/Sidewalks	Roads / Sidewalks		$2,000K	
CPP-603	Crane	CRN-SF-001 Crane only	End of Service Life-Upgrade	$250K	
INTEC	MSMs	Replace All	Electronic Parts Obsolete	$3,500K	Replace 34 MSMs, include parts and labor
INTEC	PARs	Replace with new	End of Service Life-Obsolete	$5,000K	
CPP-666	FDP Exhaust Fan	Upgrade or replace the fans	End of Service Life	$250K	
CPP-666	FO-960 Cranes	Upgrade to new crane	End of Service Life-Upgrade	$1,500K	
CPP-666	FO-905 Cranes	Upgrade and replace parts	End of Service Life-Obsolete	$250K	
CPP-659	Lights	Replace Mercury Vapor Lights	Replacements Unavailable - Obsolete	$1,000K	
CPP-606	OOS Equipment & Building	D&D OOS Equipment and Partial Building	Reclaim footprint of building no longer in use	$2,000K	
			Total	**$51,150K**	

CAM = continuous air monitor
CSSF = Calcine Solid Storage Facility
D&D = decommissioning and demolition
DCS = distributed control system
ECC = Emergency Communications Center
ED = electronic dosimeter
FAST = Fluorinel Dissolution Process and Fuel Storage
FDP = Fluorinel Dissolution Process
HVAC = heating, ventilation, and air conditioning
I&C = instrumentation and control
INTEC = Idaho Nuclear Technology and Engineering Center
LET&D = Liquid Effluent Treatment and Disposal
LGWDCS = Liquid/Gaseous Waste Distributed Control System
MSM = master-slave manipulator
OOS = out of service
PAR = programmable and remote (manipulator)
PEW = process equipment waste
RAM = radiation air monitor
RCIMS = Radiological Control Information Management System
TLD = thermoluminescent dosimeter

The ICP will complete a minimal number of capital equipment and line-item projects to maintain facilities that are safe, compliant, and capable of supporting ICP mission needs. Table C-6 identifies those contained in the ICP life-cycle budget at this time.

C-1.1.4.2 Utilities

Utilities and operations DOE-EM funds directly support site area missions. Utilities services and funding outside the site areas are maintained and operated by the lead PSO (DOE-NE).

By the year 2012, ICP plans to reduce its cleanup missions down to two primary areas — INTEC and RWMC. The RWMC utility systems are structurally sound and are expected to sustain operations until mission completion without major upgrades. The utility systems will be maintained as described in Section C-1.1.4.1.

The INTEC electrical distribution system received a major upgrade, which was completed in FY 2003 using line-item construction project funding. The underground water systems are old (i.e., over 40 years of service) and may require upgrades. Utility systems that are considered part of the Vital Safety Systems will be maintained as priorities, and the remaining utilities will have maintenance conducted as described in Section C-1.1.4.1.

Utility systems will be considered for recommendation of recapitalization based on utility conditions established by scheduled surveillance/inspections and the estimated remaining duration of the utility mission. Recapitalization recommendations will be described in the CAIS database section for the identified utility system.

Utility metering per building is not present at RWMC or INTEC. Based on the planned footprint reduction at RWMC and INTEC, both areas are expected to have a minimum reduction of 25% in utilities costs. The other three areas (TAN, PBF, and the ATR Complex) are to have the DOE-EM presence eliminated, which will eliminate associated DOE-EM utilities costs.

C-1.1.4.3 Energy Management

With regard to energy management, the ICP is focusing its efforts in two areas. First, energy consumption is being reduced by terminating utilities to facilities no longer necessary for the DOE-EM cleanup mission. Secondly, the ICP is continuing to implement specific projects to improve energy efficiency in enduring DOE-EM facilities.

Process changes at INTEC during 2008 and 2009 have reduced water use by over 196 million gallons/year. A water pump replacement project and D&D activities completed at INTEC during 2010 have resulted in a further reduction in water use of 60 million gallons per year. Along with the reduction in water use are associated electrical energy savings from the reduced run time of the water pumps.

A site data package was issued by DOE in 2010 as part of a Notice of Opportunity (NOO). The NOO requested interested Energy Savings Performance Contractors to submit proposals for an energy and sustainability project for the INTEC and RWMC facilities (planned to begin in 2011).

Table C-6. Idaho Cleanup Project capital and line-item projects ($).

Project	Costs[a,b]	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Capital Projects									
Remote Waste Disposal Project / HFEF Cans CPP-666	Actual	0	0	0	0	847,357	-557	0	0
CPP-603 (IFSF) HVAC	Actual	266,509	224	-5,441	0	0	0	0	0
CPP-604 Embedded Lines	Actual	34,011	886,420	186,332	82,940	807,258	-2,791	0	0
CPP-652 Cafeteria Safety Upgrade	Actual	189,715	225,336	1,401,087	-85,408	0	0	0	0
INTEC Security Fence	Actual	80,609	471,351	-2,965	0	0	0	0	0
RWMC Transuranic Analytical Lab Trailer	Actual	0	0	0	0	3,875,207	11,492	0	0
Dial Room Upgrade	Actual	0	0	0	0	0	1,115,959	3,166,183	0
Rad Liquid Tank Waste	Actual	0	326,661	68,930	0	0	0	0	0
CPP-602 Navy Conference Room	Actual	0	0	0	0	0	236,744	0	0
RWMC Office Complex (ARRA funded)	Actual	0	0	0	0	0	803,221	29,856	0
Stack Monitors (ARRA funded)	Actual	0	0	0	0	0	1,225,895	-6,915	0
INTEC Operations Trailer (TR-79) (ARRA funded)	Actual	0	0	0	0	0	510,585	0	0
Line-Item Projects									
IWTU PED	Actual	3,996,434	47,186,234	31,337,484	1,699,531	1,928,961	4,013	0	0
IWTU Construction	Actual / Budget	0	1,410,472	43,932,005	76,837,480	123,812,841	106,860,291	20,551,534	0
Remote Treatment PED	Actual	0	0	2,272,643	2,504,731	67,558	18,568	0	0

a. Actual costs shown through FY 2010.

b. Budgeted costs shown are from FY 2011 through FY 2012 (unless no FY 2011 budget is in place, in which case FY 2011 costs-to-date are shown).

ARRA = American Recovery and Reinvestment Act
HFEF = Hot Fuel Examination Facility
HVAC = heating, ventilating, and air conditioning
IFSF = Irradiated Fuel Storage Facility
INTEC = Idaho Nuclear Technology and Engineering Center
IWTU = Integrated Waste Treatment Unit
PED = project engineering and design
RWMC = Radioactive Waste Management Complex

This project will include an investment-grade energy audit, including an evaluation for installation of advanced metering (for electricity, water, and steam), for numerous enduring facilities. Additionally, it requests evaluations for nine specific actions, as follows:

1. Repair of the CPP-647 roof
2. Insulation of the Fluorinel Dissolution Process and Fuel Storage Annex
3. Repair or replacement of the CPP-655 roof
4. Energy and water conservation upgrades for the INTEC service waste system
5. Replacement or reconfiguration of the CPP-697 heat pumps to eliminate the water discharge to ground
6. Advanced metering capability for ICDF
7. CPP-603 heating, ventilating, and air conditioning (HVAC) dismantlement and roof repairs
8. CPP-606 boiler replacement or upgrades
9. WMF-637 HVAC adjustments or upgrades.

C-1.1.4.4 Operating Facilities with Ongoing Missions (no D&D planned under ICP contract)

The ICP is responsible for 94 facilities (64 buildings and 30 trailers) with ongoing missions (i.e., facilities needed to complete the cleanup mission that are currently operating and not scheduled for D&D under the ICP contract). These include facilities for UNF storage, waste storage and processing, and for fire protection and security installations.

C-1.1.4.5 Facilities Scheduled for D&D

A significant portion of the ICP work scope involves D&D of excess facilities. Prior to receipt of ARRA funding in April 2009, 171 facilities were scheduled for D&D. In addition to funding the D&D of some of these facilities, which were subject to delays because of funding shortfalls, ARRA funded D&D of an additional 49 facilities — 220 in all. The original planned footprint reduction resulting from D&D of the 171 buildings was 1,626,845 ft^2. ARRA funding increases the total planned footprint reduction to 2,181,438 ft^2. As of March 2011, 203 buildings have been demolished, with a total footprint reduction of 1,845,312 ft^2.

The status of DOE-EM-owned buildings and structures scheduled for D&D in the course of the ICP contract are shown in Table C-7.

C-1.1.4.6 Active Facilities Awaiting D&D

There are five active buildings awaiting D&D under the ICP contract (Table C-7). These support facilities comprise warehouse, office, and hazardous waste storage space.

Transition for these facilities begins once the facility has been declared (or forecasted to be) excess to current and future DOE needs. Transition includes placing the facility in a stable and known condition; identifying, eliminating, or mitigating hazards; and transferring programmatic and financial responsibilities from the operating program to the disposition program.

Table C-7. Idaho Cleanup Project decontamination and decommissioning plan.

ID	Name	Condition	Gross ft²	Year Built	Est. Disp. Year	Model Building Description	Usage Code Description	Hazard Description
Idaho Cleanup Project Facilities Operating Pending D&D								
CPP-654	Receiving Warehouse/Offices	Excellent	19,301	1976	2011	MB05 Steel Light Frame	401 Programmatic General Storage	10 Not Applicable
CPP-1635	Hazardous Chemical Storage Facility	Excellent	2,507	1992	2011	MB05 Steel Light Frame	410 Hazardous/Flammable Storage	05 Chemical Hazard Facility
CPP-1653	Subcontractor's Warehouse	Adequate	10,773	1991	2011	MB05 Steel Light Frame	400 General Storage	10 Not Applicable
CPP-1656	Warehouse	Excellent	6,000	1991	2011	MB05 Steel Light Frame	400 General Storage	10 Not Applicable
TRA-610	MTR Fan House	Excellent	3,217	1952	2011	MB07 Steel Frame with Infill Shear Walls	593 Nuclear Waste Processing and/or Handling Building	04 Radiological Facility
Idaho Cleanup Project Facilities Shutdown Pending D&D								
MFC-766	Sodium Boiler Building	N/A	14,547	1962	2012	MB16 Other-Desc brief in comments field/supp doc	792 Laboratories, General (Nuclear)	04 Radiological Facility
MFC-793A	Alcohol Storage Pad and Tanks				2011		6009 Other, Other Service Structures	04 Radiological Facility
MFC-750A	Experimental Equipment Building	N/A	199	1975	2012	MB05 Steel Light Frame	410 Hazardous/Flammable Storage	10 Not Applicable
MFC-793B	SCMS Alcohol Recovery Annex	N/A	576	1979	2012	MB05 Steel Light Frame	694 Other Service Buildings	04 Radiological Facility
TRA-632	Hot Cell Building	N/A	11,862	1952	2011	MB13 Reinforce Masn Bear Walls/Wood, Metl Deck Dphm	782 Hot Cells	02 Nuclear Facility Category 2
MFC-767	EBR-II Reactor Plant Building	N/A	18,967	1963	2012	MB16 Other-Desc brief in comments field/supp doc	783 Research Reactor	04 Radiological Facility
Idaho Cleanup Project Facilities D&D in Progress								
TRA-713B*	Hot Waste Storage Tank				2011		4441 Tanks (Hazardous Contaminated)	10 Not Applicable
TRA-713C*	Hot Waste Storage Tank				2011		4441 Tanks (Hazardous Contaminated)	10 Not Applicable
TRA-713D*	Hot Waste Storage Tank				2011		4441 Tanks (Hazardous Contaminated)	10 Not Applicable
CPP-601*	Fuel Process Building	N/A	83,646	1953	2011	MB04 Steel Braced Frame	592 Nuclear Chemical Process Facilities	02 Nuclear Facility Category 2

Table C-7. Idaho Cleanup Project decontamination and decommissioning plan.

ID	Name	Condition	Gross ft²	Year Built	Est. Disp. Year	Model Building Description	Usage Code Description	Hazard Description
CPP-602	Laboratory/Offices Building	N/A	52,393	1953	2011	MB03 Steel Moment Frame	712 Chemical Laboratory (Nuclear)	02 Nuclear Facility Category 2
TRA-603	MTR Building	N/A	44,724	1952	2011	MB03 Steel Moment Frame	793 Multifunction Research/Lab Building	04 Radiological Facility

** As of 03/31/2011, physical demolition of the building or structure has been completed and the property archived in FIMS but final remediation of the area where it was located has not been completed.*
D&D = decommissioning and demolition
EBR-II = Experimental Breeder Reactor II
MTR = Materials Test Reactor
SCMS = Sodium Component Maintenance Shop

These facilities will be maintained only as needed to complete their missions and prepare them for D&D under the ICP contract.

C-1.1.4.7 *Inactive Facilities Awaiting D&D*

Currently, 12 facilities are already shut down and awaiting D&D (Table C-7). Following operational shutdown and transition, the first disposition activity for these facilities is usually to deactivate the facility. The purpose of deactivation is to place a facility in a safe shutdown condition that is cost effective to monitor and maintain for an extended period until the eventual decommissioning of the facility. Deactivation places the facility in a low-risk state with minimum surveillance and maintenance requirements.

C-1.1.4.8 *Deferred Maintenance*

Deferred maintenance will be reported in FIMS for those DOE-EM buildings with a designation of "Operating" (i.e., no D&D under the ICP contract). Reported deferred maintenance will be based on existing values for deferred maintenance and information resulting from scheduled facility-condition-assessment survey inspections.

Should facility inspections or surveillance activities identify the need to perform maintenance that has been deferred, ICP engineering and cost estimating will help establish that cost and it will be reported accordingly. However, because the ICP life-cycle baseline does not include any specific capital projects for the reduction of deferred maintenance, baseline changes will be pursued as necessary to address the issue.

C-1.1.5 Conclusions

By the year 2012, the following ICP achievements will have resulted in significant risk reduction at INL:

- Shipping a large majority of the stored TRU waste to WIPP for final disposition
- Treating most of the liquid sodium bearing waste
- Removing UNF from wet storage in spent fuel pools to safer dry storage
- D&D major facilities at TAN, ATR Complex, and PBF
- Removing and disposing of several hundred thousand cubic meters of contaminated soil
- Exhumation of a large majority of the targeted waste at SDA.

By the year 2012, the DOE-EM footprint at INL will have been reduced by over 1 million ft^2, and DOE-EM will have a presence solely at INTEC and RWMC.

While the ICP contract ends in the year 2012, there will be substantial DOE-EM scope to complete beyond that date. That scope includes shipping the remaining TRU waste to WIPP, treating the remaining liquid sodium bearing waste, emptying and grouting the last four tanks that currently hold that waste, completing the Calcine Disposition Project, continuing to operate the vapor vacuum extraction units at RWMC, cleaning up soils under INTEC buildings, finishing capping the INTEC Tank Farm area, continuing the packaging and final disposition of UNF, and capping the SDA at RWMC. By the year 2035, the DOE-EM cleanup mission at INL will be complete.

C-1.2 Advanced Mixed Waste Treatment Project Mission

The specific AMWTP requirements are to retrieve, characterize, treat, and dispose of TRU waste. The waste is currently stored in drums, boxes, and bins at the RWMC Transuranic Storage Area. The waste is anticipated to consist of heterogeneous mixtures of various solid materials, including paper, cloth, plastic, rubber, glass, graphite, bricks, concrete, metals, nitrate salts, process sludges, miscellaneous components, and some absorbed liquids. Most of the waste is believed to contain both RCRA hazardous waste constituents and radioactivity, thereby classifying it as mixed waste. Some waste may also contain Toxic Substances Control Act-regulated materials such as polychlorinated biphenyls and asbestos.

C-1.2.1 Advanced Mixed Waste Treatment Project Facility Status

AMWTP is a DOE-EM-funded program. The overall vision for AMWTP was to treat waste for final disposal by a process that provides the greatest value to the U.S. Government. The original contract called for the licensing, design, and construction of a treatment facility that has the capability to treat specified INL waste streams, with the flexibility to treat other INL and DOE regional and national waste streams. This treatment facility was constructed by British Nuclear Fuels, PLC. During April 2005, all AMWTP facilities and equipment owned by British Nuclear Fuels, PLC were purchased by DOE. Bechtel BWXT Idaho, LLC now operates those facilities, along with the DOE-provided RWMC facilities WMF-610, WMF-628, and WMF-711.

Currently, the AMWTP facilities are operational and require normal maintenance and repairs. No major facility upgrades are planned through FY 2011. Routine upgrades and facility modifications are expected to continue.

After disposition of the estimated 65,000 m^3 of stored TRU waste, DOE is evaluating use of the AMWTP facilities and equipment as a national asset to process materials from other sites across the DOE complex. Once the facilities are deemed as excess to the DOE-EM inventory, the facilities will be RCRA-closed, decontaminated, and demolished.

C-2. OFFICE OF NAVAL REACTORS

NRF is operated by Bechtel Marine Propulsion Corporation, under contract with and direct supervision of the Naval Nuclear Propulsion Program. NRF is not under the purview of DOE-ID; therefore, NRF real property assets information is not available in this plan.

INL provides support services to NRF, including, but not limited to, bus transportation, motor vehicle and equipment use, electrical power, electrical distribution system management, fire department services and firefighter training, telephone and other communications services, roads and grounds maintenance (outside NRF boundaries), medical support services, railroad operations, and specialized machine shop services.

Additionally, ICP routinely dispositions MLLW generated at NRF and has contract instruments in place to treat remote-handled TRU waste. ICP also dispositions hazardous waste at Clean Harbors and remote handled LLW via 55-ton scrap casks at RWMC for NRF. The NRF disposes some of its CERCLA waste at ICDF.

C-2.1 Naval Reactors Facility Background

Established in 1950 to support development of naval nuclear propulsion, NRF continues to provide support to the U.S. Navy's nuclear powered fleet (Figure C-4).

C-2.2 Naval Reactors Facility Forecast

NRF is one of the INL Site's primary facility areas that will continue to fulfill its currently assigned missions for the foreseeable future.

C-3. LONG-TERM STEWARDSHIP

Long-term stewardship (LTS) activities are expected to transition to INL in FY 2012 as DOE-EM activities taper off and DOE-NE/INL responsibilities for INL increase. INL's support during and following the transition will be to:

- Work with DOE to inventory closure sites and facilities being transferred
- Understand the regulatory compliance issues related to each site and facility
- Ensure measures are in place to protect public health and the environment.

The LTS program will be a central responsibility of the INL Land Use Group, which will take the lead role in initiating and implementing the program. The INL Land Use Group manages INL from a land use perspective. The group's land use management responsibilities include development of the INL Comprehensive Land Use and Environmental Stewardship Report, campus development planning, and Right of Way and Comprehensive Utility Corridor activities.

LTS Program activities will likely include, but may not be limited to:

- Groundwater and ecological monitoring
- Geographical Information System-based logging and tracking of LTS sites

Figure C-4. Naval Reactors Facility provides support to the U.S. Navy's nuclear powered fleet.

- Establishing and maintaining an internet-accessible Geographical Information System linked to the INL land use application (formerly known as the Comprehensive Utility Corridor/Right of Way application)

- Designing, installing, and inspecting environmental caps at LTS sites.

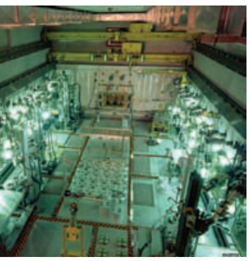
The LTS program will work with the DOE Headquarters LTS Committee and working groups to collect and review policies and procedures from across the DOE complex to aid in the development of policies and procedures for INL.

C-4. REFERENCES

DOE Guide 430.1-2, *Implementation Guide for Surveillance and Maintenance during Facility Transition and Disposition*, U.S. Department of Energy, September 29, 1999.

DOE Order 430.1B, *Real Property Asset Management*, U.S. Department of Energy, February 2008.

APPENDIX D




Sustainability and Energy Management Program

CONTENTS

Figures

Tables

ACRONYMS

ATR	Advanced Test Reactor
CFA	Central Facilities Area
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOE-NE	Department of Energy Office of Nuclear Energy
ESPC	Energy Savings Performance Contract
FEMP	Federal Energy Management Program
FY	fiscal year
GHG	greenhouse gas
HVAC	heating, ventilating, and air conditioning
INL	Idaho National Laboratory
LEED	Leadership in Energy and Environmental Design
LNG	liquefied natural gas
MFC	Materials and Fuels Complex
NRF	Naval Reactors Facility
SMC	Specific Manufacturing Capability
SSP	Site Sustainability Plan
SSPP	Strategic Sustainability Performance Plan
UESC	Utility Energy Savings Contract
USGBC	U.S. Green Building Council

APPENDIX D SUSTAINABILITY AND ENERGY MANAGEMENT PROGRAM

D-1. SUSTAINABILITY AND ENERGY MANAGEMENT PROGRAM STRATEGY

Sustainable INL

INL will carry out its mission of ensuring the nation's energy security with safe, competitive, and sustainable energy systems without compromising the ability of future generations to meet their own needs.

The Department of Energy Office of Nuclear Energy (DOE-NE), Department of Energy Idaho Operations Office (DOE-ID), and the Office of Engineering and Construction Management have identified sustainability as a high priority initiative with an emphasis on meeting federal energy, water, and greenhouse gas reduction goals by establishing high performance sustainable buildings that maximize employee health and productivity. The Idaho National Laboratory (INL) has institutionalized a program to implement sustainable practices in facility design and operation, procurement, and program operations that meet the requirements of the following: Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance; Executive Order 13423, Strengthening Federal Environment, Energy, and Economic Performance; Department of Energy (DOE) Order 430.2B, Departmental Energy, Renewable Energy, and Transportation Management; DOE Order 450.1A, Environmental Protection Program; and the DOE Strategic Sustainability Performance Plan (SSPP; DOE 2010). DOE Orders 430.2B and 450.1A are being replaced by DOE Order 436.1, *Departmental Sustainability*.

The goal of the INL Sustainability Program is to promote economic, environmental, and social sustainability for INL, helping to ensure its long-term success and viability as a premier DOE national laboratory. The Sustainability Program seeks to achieve measurable and verifiable energy, water, and greenhouse gas reductions. The Program is also responsible to advance sustainable building designs; explore the potential use of renewable energy; reduce utility costs across INL; and support cost-effective facilities, services, and program management.

The challenge of implementing sustainability is to minimize the impact to operations while increasing the health and viability of the laboratory. INL is integrating sustainability performance improvement in the areas that matter most to its stakeholders and the laboratory, including minimizing the environmental footprint, taking a progressive approach to climate change, and championing energy conservation.

Achieving sustainability means simultaneous consideration of economic prosperity, environmental quality, and social equity. The long-term goal of the sustainability program is to ensure the efficient and appropriate use of laboratory lands, energy, water, and materials, as well as the services that rely upon them. INL sustainability moves beyond compliance-oriented initiatives and is a key strategy for achieving both a competitive advantage and meaningful change. This transformation sharpens the laboratory's focus on new designs, building upgrades, and scientific research.

INL's vision for Fiscal Year (FY) 2022 is to be a leading laboratory in the United States in sustainability performance.

The first step toward sustainability is to educate managers and staff about the physical, biological, cultural, socioeconomic, and ethical dimensions of sustainability. The second step is to empower INL employees to understand and apply sustainable practices in their work activities. To achieve this desired result, INL will fully implement sustainability into its culture through thoughtful consideration of all aspects of sustainable design and facility operation, and through permanent culture changes and process modifications to establish sustainability as central to ongoing success as a company.

D-2. SUSTAINABILITY GOALS

INL has adopted the major programmatic sustainability goals contained in the Executive and DOE Orders and the SSPP. Sustainability is truly a performance improvement program that is readily validated through performance measurement and reporting. The primary energy, water, and fuels usage goals are the basis for validating the performance of INL sustainability.

D-3. IDAHO NATIONAL LABORATORY SITE SUSTAINABILITY PLAN

The *Idaho National Laboratory FY 2011 Site Sustainability Plan* (DOE-ID 2010) outlines a plan for continual efficiency improvements directed at meeting the goals and requirements of Executive Orders 13423 and 13514, and DOE Orders 430.2B and 450.1A, before the end of FY 2015. The Site Sustainability Plan (SSP) was developed primarily to address the requirements, goals, and activities included in the DOE SSPP, which addresses the greenhouse gas, energy, water, procurement, and environmental aspects of the Orders. The SSP also summarizes energy and fuel use reporting requirements and references criteria for performing sustainable design.

The INL SSP serves as the INL site energy and transportation fuels management plan. INL annually updates the plan, adding specificity as projects are developed and requirements change. The SSP encompasses all contractors and activities at the INL site under the control of DOE-ID. Naval Reactors Facility (NRF) operations are excluded because NRF planning and reporting occur through the Department of Defense. DOE Office of Environmental Management contributions and activities are included in the SSP, and INL/Battelle Energy Alliance, LLC is the primary author and contributor to the INL SSP. Only DOE-NE activities and plans from the SSP are included in this appendix.

INL Sustainability Program major goals to be achieved by FY 2015

- *Energy usage reduced 30% compared to FY 2003*
- *Water usage reduced 16% compared to FY 2007*
- *Petroleum fuels usage reduced 20% as compared to FY 2005*
- *Alternative fuels usage increased 100% compared to FY 2005*
- *Greenhouse gas emissions reduced 28% by FY 2020 as compared to base year FY 2008.*

Commencing in FY 2011, the INL Sustainability Program will mature a comprehensive sustainability leadership strategy to meet the Order goals and the requirements of the SSP. Progress of the development of this strategy will be reported regularly and the strategy will be fully incorporated in FY 2012. The final strategy will be summarized in the FY 2013 – FY 2022 Ten-Year Site Plan.

Funding is required to meet the goals of the SSP and to implement the practical measures and activities of the comprehensive sustainability leadership strategy. INL will continue to work with DOE to explore alternative funding options, including Energy Savings Performance Contracts (ESPCs), Utility Energy Savings Contracts (UESCs), utility incentive programs, tracking and reinvesting cost savings in sustainable actions, and special funding requests made to the Federal Energy Management Program (FEMP). INL's next ESPC project is under development for FY 2011 and should provide at least an additional 5% energy and water reductions on top of the 5% being provided by the Materials and Fuels Complex (MFC) ESPC project.

The INL SSP provides a plan to achieve progress towards meeting the required goals. However, the SSP does not guarantee success. As an example, plans are in place to develop INL's next ESPC project; however, after it is complete and the savings are added to the MFC ESPC savings and the current level of energy intensity reductions of 9.4%, there still remains a 10% savings deficit towards meeting the 30% energy reduction goal. Additional resources will be needed to develop and implement energy and water reduction projects to secure success for INL in meeting the sustainability program goals. Table D-1 provides a snapshot of some of the projects not associated with ESPC or UESC funding that will assist with meeting the program goals. This table illustrates the investment strategy for projects that have been identified to be prioritized against laboratory resources over the next three fiscal years. These projects will help INL to meet the site sustainability metrics if implemented in addition to the planned ESPC projects.

Table D-1. Idaho National Laboratory Sustainability Program investment project candidates.

Site Area	Project Title	Project Cost	Annual Cost Savings	Brief Description	Fiscal Year	Supports Performance Evaluation and Measurement Plan
Willow Creek Building (IF-616/617)						
REC	HVAC Controls Modification	$228,100	$24,700	Install on all air handler coils, 2-way automatic modulating control valves to be plumbed to hot water and chilled water coils. Included are (5) 2.5", (7) 4", and (5) 6" valves. Install VFDs on (2) 25 hp chilled water loop pumps, (1) 7.5 hp hot water loop pump, (1) 20 hp hot water loop pump, and (2) 7.5 hp cooling tower pumps. Reprogram control system to achieve savings offered by the above controls modifications.	Spread over 11, 12, & 13	Yes
REC	Chillers and Boiler Replacement	$1,612,200	$34,600	Replace the existing chillers with (2) new 250 ton variable speed drive chillers with an efficiency rating of at least 0.55 kW/ton and with a 0.365 kW/ton ARI IPLV efficiency rating. Install (4) 15 hp VFDs on the chilled water and condenser water pumps. Replace the existing electric boiler with a new 3,000 MBH high-efficiency gas fired condensing boiler with an efficiency rating of 94.1%. Reprogram control system to achieve savings offered by the above equipment replacements.	Spread over 11, 12, & 13	Yes

Table D-1. Idaho National Laboratory Sustainability Program investment project candidates.

Site Area	Project Title	Project Cost	Annual Cost Savings	Brief Description	Fiscal Year	Supports Performance Evaluation and Measurement Plan
REC	New HVAC Zones and VAV Boxes	$163,700	$25,300	Retrofit (718) existing Kite Light fixtures with new 55-watt compact fluorescent lamps. Add (9) new VAV boxes (approximately 3,000 cubic feet per minute each), associated controls, and 5,800 lbs of additional galvanized steel ducting to split an existing (9) zones into (18) zones to provide heating to areas served previously with the metal halide Kite Lights.	Spread over 11, 12, & 13	Yes
REC	Heat Recovery - Computer Room AC	$47,200	$3,000	Install new glycol-to-chilled water heat exchangers and associated components on the two computer room/telecommunications room air conditioning units (Liebert/EdPac).	Spread over 11, 12, & 13	Yes
REC	Interior Lighting Upgrade	$147,600	$15,100	Install (133) wall and ceiling mount occupancy sensors for lighting control in offices, break rooms, conference rooms, and mechanical rooms. Retrofit (1,118) T12 fluorescent fixtures with new electronic ballasts and T8 lamps. Retrofit (227) 40 and 60 watt task and spotlights with 12 watt compact fluorescent lamps.	Spread over 11, 12, & 13	Yes
REC	Exterior Lighting Upgrade	$74,100	$3,600	Replace (65) Exterior light fixtures with (26) 9 watt LED, (11) 60 watt LED or 100 watt Induction Lamp, (4) 20 watt LED, (7) 30 watt LED, and (17) 100 watt LED or 300 watt Induction Lamp fixtures.	Spread over 11, 12, & 13	Yes
REC	Water Fixture Upgrades	$164,900	$2,900	Replace (47) toilets, (25) urinals, (59) faucets, and (9) showerheads with new low-flow fixtures.	Spread over 11, 12, & 13	Yes
Willow Creek Building Total		**$2,437,800**	**$109,200**			
Engineering Research Office Building (IF-654)						
REC	CO_2 Sensors and VFD Controls	$27,900	$28,000	Install and program CO_2 sensors for AH-1, AH-2, MOAU-1, and MOAU-2 air handlers. Install new 5 hp VFDs on the MOAU-1 and MOAU-2 fan motors and program/control with the new CO_2 sensors.	11	Yes
REC	Liebert Glycool System	$32,700	$3,700	Install a new second Liebert Glycool economizer cooling coil and controls to the glycol Drycooler system on the (3) Liebert data cooling systems in rooms 143 and 149.	11	Yes

Table D-1. Idaho National Laboratory Sustainability Program investment project candidates.

Site Area	Project Title	Project Cost	Annual Cost Savings	Brief Description	Fiscal Year	Supports Performance Evaluation and Measurement Plan
REC	New VFD Controls	$46,100	$2,400	Install (1) 7.5 hp VFD on P-2, (1) 15 hp VFD on P-4, (1) 20 hp VFD on CT-1, (1) 40 hp VFD on CT-2, (2) 15 hp VFDs on the main hot water heating pumps, and (2) 10 hp VFDs on the Data Pump House condenser pumps.	11	Yes
REC	Exterior Lighting Upgrade	$100,700	$5,800	Replace (27) exterior wall pack fixtures with (11) 25 watt, (14) 28 watt, and (2) 30 watt new LED fixtures. Replace (43) parking lot fixture heads with new 100 watt LED or 250-watt Induction Lamp fixture heads.	11	Yes
REC	Water Fixture Upgrades	$145,800	$4,000	Replace (48) toilets, (21) urinals, (46) faucets, and (12) showerheads with new low-flow fixtures.	11	Yes
	Engineering Research Office Building Total	**$353,200**	**$43,900**			
	REC Area Total	**$2,791,000**	**$153,100**			
MFC						
MFC	Perimeter Lighting	$187,000	$7,233	Replace (35) parking lot, perimeter, and security pole mounted fixtures with new 100-watt LED or 250-watt Induction Lamp fixture heads.	12 & 13	Yes
MFC	Restroom Fixtures	$542,724	$19,707	Replace all restroom and kitchen fixtures throughout MFC with new low-flow fixtures. This project will assist with water waste reductions that will impact the new sewage-lagoon project desig6n. Estimated (169) Faucets, (159) toilets, (81) urinals, and (12) showerheads.	12 & 13	Yes
	MFC Total	**$729,724**	**$26,940**			
Site Wide						
Site Wide	Cool Roof Installations	$1,500,000	N/A	INL plans to invest $1.5 M annually in roof repair and replacement under their RAMP program. INL plans to install 3 cools roofs in FY 2011 totaling 43,453 ft^2 at a cost of $1.629M.	Each of 11, 12, & 13	Yes
Site Wide	Advanced Meter Installations	$200,000	$34,000	INL has requested and received funding from NE-32 to install 13 new advanced electric meters and provide for connections and programming, for a total of 21 facilities (Table D-3) to be monitored remotely with electric data compiling capability to support LEED-EB and the Guiding Principles.	11	Yes
	Site Wide Total	**$1,700,000**	**$34,000**			

Table D-1. Idaho National Laboratory Sustainability Program investment project candidates.

Site Area	Project Title	Project Cost	Annual Cost Savings	Brief Description	Fiscal Year	Supports Performance Evaluation and Measurement Plan
Transportation Projects						
	Bus Replacements	$700,000	$44,822	Lease an additional 10 new 55-passenger buses to replace older buses that are past their expected useful life. These buses will carry more passengers, provide a 40% increase in fuel economy, and are designed to run on biodiesel blend fuels.	Each of 11, 12, & 13	Yes
	Increase Bus Ridership/ Loading	$230,000	N/A	Decrease the price of bus passes to the same cost charged three years ago of $18.50 from the $22.00 per month currently charged. This is expected to encourage more employees to take the bus, reduce traffic on highway 20, and more effectively use the equipment and fuel resources currently expended by increasing bus loading from 65% to the current goal of 80%.	Each of 11, 12, & 13	Yes
Transportation Total		**$930,000**	**$44,822**			
Sustainability Program Totals		**$6,150,724**	**$258,862**			

AC = air conditioner
FY = fiscal year
HVAC = heating, ventilating, and air conditioning
INL = Idaho National Laboratory
IPLV = integrated part load value
LED = light-emitting diode
LEED-EB = Leadership in Energy and Environmental Design for Existing Buildings
MFC = Materials and Fuels Complex
RAMP = Roof Asset Management Program
REC = Research and Education Campus
VAV = variable air volume
VFD = variable frequency drive

D-3.1 Scope, Funding, and Schedule

To accomplish the major sustainability goals, INL will focus on reducing energy, water, and fleet petroleum usage while simultaneously increasing the use of fleet alternative fuels. These goals are being addressed through alternatively funded projects, internal infrastructure upgrades, process improvements, externally funded projects, and through securing more efficient high performance sustainable buildings. Meeting these goals will contribute to mandated sustainability goals such as greenhouse gas (GHG) reductions and upgrading facilities to meet Leadership in Energy and Environmental Design (LEED) and the Guiding Principles for High Performance Sustainable Buildings.

INL sustainability projects require funding external to the sustainability program. INL will pursue ESPC and UESC project funding as the primary source of capital to implement facility and process improvements. Other methods of funding projects include internal funding as available, external direct funding from DOE-NE and FEMP when available, third party funding, and utility incentives as a funding stream. Note that the projects outlined in Table D-1 are not readily applicable to ESPC or UESC projects and will need to be funded internally or possibly with external direct funding.

ESPC projects are comprehensive and time consuming to develop. Typically, an ESPC project can take over 9 months for project development

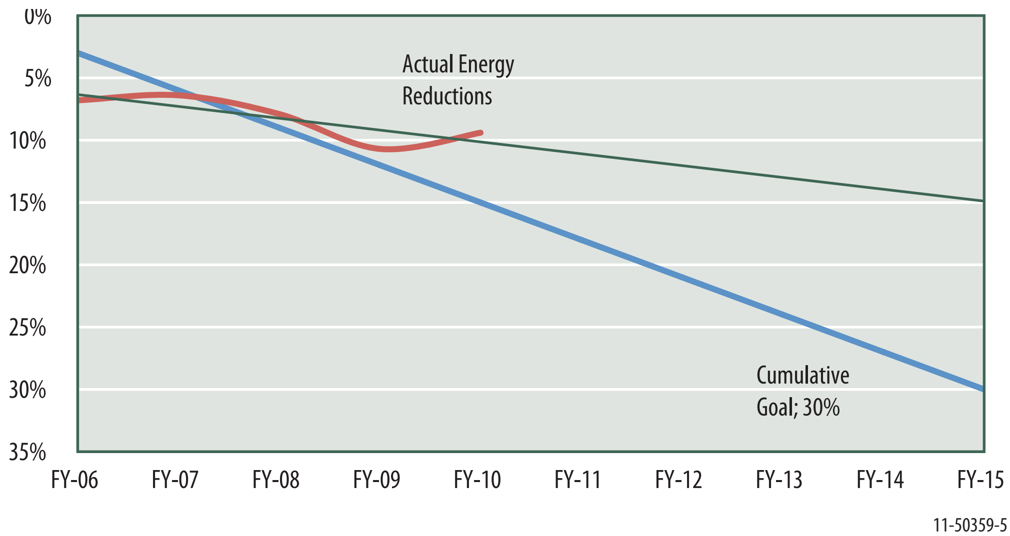


Figure D-1. Idaho National Laboratory energy intensity reduction goal.

followed by 18 months or more for design and construction. INL plans on one additional ESPC completed by FY 2014 and one UESC project completed by FY 2013. These two projects will provide a portion of the energy savings needed to help meet the goal by FY 2015.

D-3.2 Energy Reductions

The INL goal for energy usage is a 30% reduction of energy intensity[1] by FY 2015 (Figure D-1), as compared to the FY 2003 energy intensity baseline. On average, an annual energy use reduction goal of 3% supports meeting the overall goal and provides a means to measure and trend progress. The energy use is normalized for weather-related factors to provide an accurate comparison with base-year FY 2003. Energy intensive loads that are mission-specific are excluded from the goal. The Advanced Test Reactor (ATR) and its support facilities are exempted from the reporting goal but are not exempted from the responsibility to reduce energy use where practicable. Energy sources affected by this goal include electricity, natural gas, fuel oil, liquefied natural gas (LNG), and propane.

[1] *Energy Intensity is defined as Energy Use divided by Building Area and is measured in Btu/ft.*

Methods to reduce energy use include capital project upgrades, operational modifications, and behavior changes by the INL workforce.

As can be seen in Figure D-1, energy efficiency is not currently trending toward meeting the required reduction goal. Planned facility removal has resulted in an increase in energy intensity by decreasing the total building square footage while only minimally impacting the overall energy use. INL expects this trend to diminish as facility removal efforts end and ESPC projects are completed.

Capital project upgrades are funded primarily through ESPC and UESC projects. Both use external (non-DOE) funding for energy-related upgrades and are paid back over time using the energy cost savings generated by the project. INL is actively pursuing these two alternative funding strategies to obtain additional energy savings.

The MFC ESPC project included $33M in energy and water saving upgrades that will provide overall energy reductions of 5%. This project eliminated MFC's oil fired boilers and leaking underground condensate lines. The project converted most facilities to electric heat; upgraded all indoor lighting

ESPC

The ESPC being performed at MFC will reduce the INL deferred maintenance backlog by $10.5M of which $9.6M is associated with mission critical assets.

systems; replaced the primary utility air compressors; installed new digital heating, ventilating, and air conditioning (HVAC) controls; installed new advanced electric and water meters; and fabricated two new passive solar walls to provide renewable pre-heating to the make-up air in MFC-774 and MFC-782.

In addition to energy and water savings, the MFC ESPC project is providing a $10.5M reduction in INL's deferred maintenance backlog ($9.6M of which is associated with MFC mission-critical assets) by replacing aging equipment and systems. Reducing the INL maintenance backlog is an additional desired benefit beyond the reduced energy consumption and costs targeted by these types of projects.

INL's next ESPC project is being developed for the enduring assets at Central Facilities Area (CFA) and the ATR Complex with minor work at the Specific Manufacturing Capability (SMC). This project is expected to reduce energy and water usage approximately 5%. The project will begin final development during the fourth quarter of FY 2011; design and construction will begin in FY 2012.

One UESC project, planned for implementation in the federally-owned Idaho Falls facilities, is being evaluated for funding by the Bonneville Power Administration (BPA) and is planned for completion by the end of FY 2013. This project includes lighting, HVAC, and controls upgrades.

The City of Idaho Falls is planning to upgrade all of its electrical power meters to advanced smart meter technology. INL's Idaho Falls facilities should be upgraded during the summer of FY 2011 as part of the city's initial upgrade project. This upgrade will provide smart meters and a network to supply a central data-collection point, view and analyze the data, and provide demand management capabilities. INL will have access to this data-collection system, which will support improved demand management capabilities.

Metering is also planned for all buildings upgraded by ESPC projects, as identified by the INL Metering Plan. The metering installed by these projects will provide additional data compilation and utility management benefits. In addition to providing a means of trending and validating energy savings, metering also provides proactive space management opportunities. Energy and water usage information assists with electrical demand management, enhanced resource utilization, and transfer or assignment of energy costs to the user in a more accurate manner. Advanced metering provides a method to encourage and validate employee behavior change, and provides a dependable tool for facility managers to optimize building systems and controls.

Based on historic data and estimated efficiency impacts of current and planned projects, the energy consumption and generation projections for the entire INL Site through FY 2021 are provided in Table D-2.

This projection does not take into account potential energy increases due to new buildings or processes being completed, as there remains significant uncertainty on the number and size of both new buildings and subsequent building demolition. This projection only considers planned energy reduction projects and potential renewable energy projects. The projection also assumes that energy consumption is the amount of energy being purchased from the utility and that all renewable energy generated is being consumed on site. Note that if only two planned ESPC projects are completed, INL will only achieve a 19% reduction as compared to FY 2003 while using 865,557 MBtu/year of energy. Figure D-1 validates this concern, as the trend line indicates that only a 14% reduction may be achieved, which falls well short of the 30% goal. As stated earlier, INL will need additional project funding to reach the mandated 30% energy reduction goal.

D-3.3 Water Reductions

The INL goal for water usage is a 16% reduction of usage intensity by FY 2015 (Figure D-2), or 2% each year, as compared to the FY 2007 Water Usage Intensity Baseline measured in gal/ft².

INL reports water consumption as all water pumped from the ground onsite, and all water procured from the city of Idaho Falls. As can be seen on Figure D-2, INL is well poised to significantly exceed the water reduction goal by FY 2015.

Table D-2. Projected Idaho National Laboratory Site energy consumption and generation.

Fiscal Year	Site Nonrenewable Energy Consumption (MBtu/Year) Million Btu	Site Renewable Energy Generation (MBtu/Year) Million Btu
2010	960,798	102
2011	960,798	102
2012	912,165	602
2013	912,165	602
2014	912,165	602
2015	865,557	1,602
2016	865,557	1,602
2017	865,557	1,602
2018	821,279	2,602
2019	821,279	2,602
2020	821,279	2,602
2021	779,215	3,602

Notes:

- *FY 2010 energy consumption is provided to establish a baseline for actual energy use.*
- *FY 2012 indicates that the MFC ESPC is complete, providing a 5% reduction in energy consumption and an additional 500 MBtu of renewable thermal energy from the two installed solar walls.*
- *FY 2015 assumes that ESPC Project #3 is complete, providing an additional 5% in energy reductions and four more solar walls that are providing 1,000 MBtu of renewable thermal energy.*
- *FY 2018 and FY 2021 assume that an additional ESPC project is completed each year, providing 5% energy reductions and an additional 1,000 MBtu in renewable thermal energy each.*

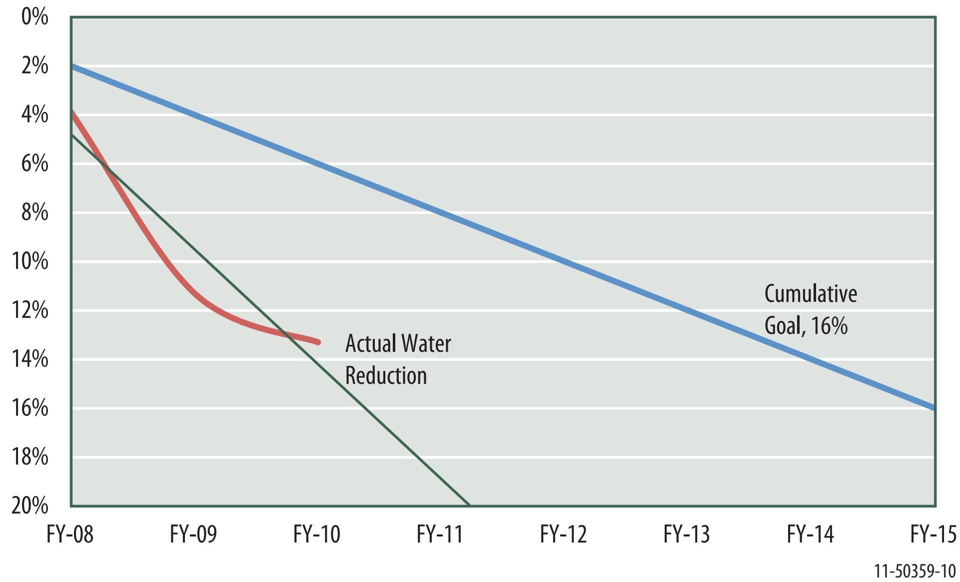


Figure D-2. Idaho National Laboratory water intensity reduction goal.

INL is also using alternative funding methods for water reduction projects. The MFC ESPC project will eliminate the existing leaking condensate lines that are costly to repair and result in increased water consumption. The ESPC project planned for the ATR Complex, SMC, and CFA will eliminate once-through HVAC cooling water, increase efficiency through fixture replacements, and locate and repair leaking water lines. Additionally, water reduction opportunities (i.e., wholesale water fixture upgrades at MFC) will continue to be evaluated that will increase water efficiency while addressing on-going water waste processing issues.

In all cases, water metering will be required for installation during ESPC projects and will provide for enhanced project validation in addition to operational and maintenance tools.

D-3.4 Fleet Fuels

INL is developing diversified strategies for reducing fossil fuel use and carbon emissions associated with light and heavy-duty vehicles. The DOE Order 430.2B transportation fuels goal is to reduce petroleum fuels by 20% (Figure D-3) while increasing the use of alternative fuels by 100% (Figure D-4) by FY 2015, as compared to the FY 2005 usage baseline. There are many opportunities to affect DOE's petroleum fuel usage by implementing fuel reduction and fuel switching activities at INL.

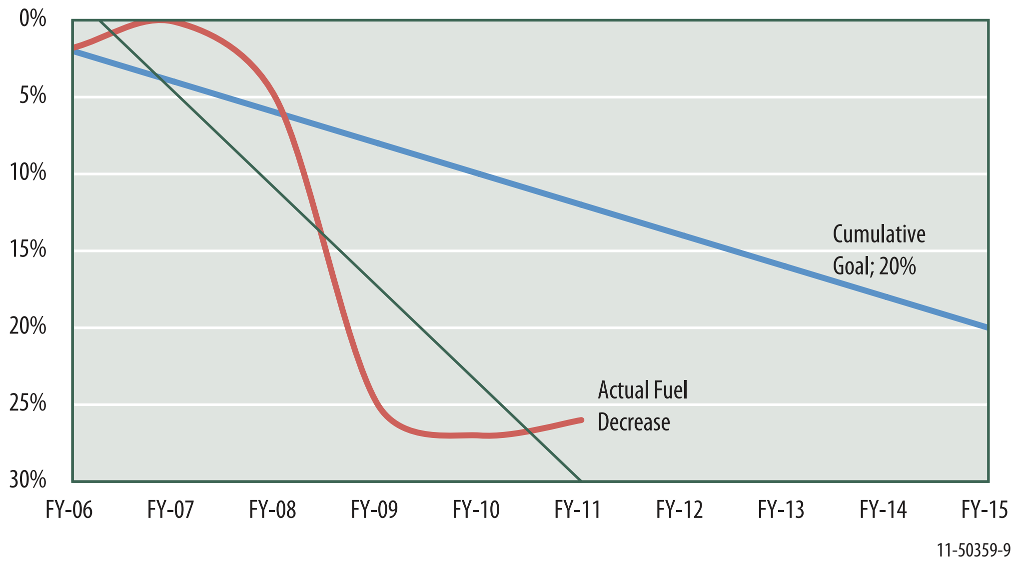


Figure D-3. Idaho National Laboratory petroleum fuel reduction goal.

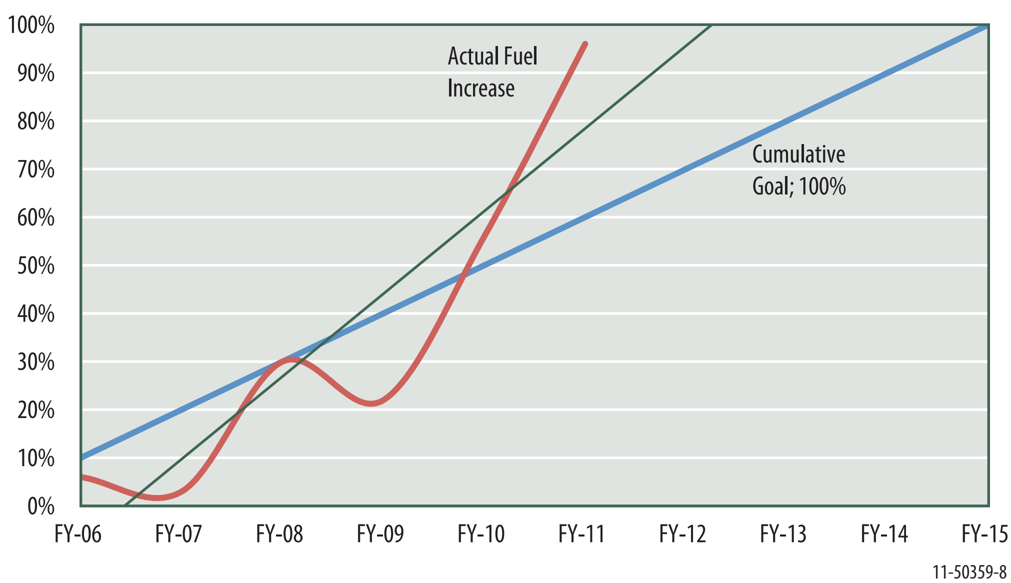


Figure D-4. Idaho National Laboratory alternative fuel increase goal.

INL is currently positioned to exceed both transportation fuel goals, as can be seen by the trending in Figures D-3 and D-4. In FY 2007, INL struggled with the availability and cost of both E-85 and biodiesel, which resulted in an increase in petroleum based fuels concurrent with a significant reduction in the use of alternative fuels. Again, in FY 2009, INL worked through a quality issue with biodiesel at the distributor's location that resulted in a temporary reduction in the use of alternative fuels.

INL continues to meet the transportation fuel goals through actively pursuing increased E-85 and biodiesel fuel usage. These increases are facilitated by increasing the availability of E-85 and the quality of biodiesel and mandating their use. INL is also researching and implementing the use of varying biodiesel blends in the INL bus fleet throughout the year and across varied climate conditions. Other potential opportunities include expanding park and ride programs, migrating the INL bus fleet to higher efficiency clean diesel technology and smaller hybrid mini-motor coaches, and expanding the availability of other alternative fuels in Idaho Falls and at the Site. INL will further reduce petroleum fuels use by obtaining additional hybrid vehicles through the General Services Administration, as long as flex fuel vehicles are available.

D-3.5 Carbon Footprint

DOE has committed to reduce Scope 1 and Scope 2 GHG emissions by 28% before the end of FY 2020 (Figure D-5), as compared to the FY 2008 baseline. INL has calculated the initial Carbon Footprint. This GHG inventory supports a major Battelle Corporate initiative to lead GHG emissions reduction efforts and is an accepted method of identifying environmental impacts by assessing major GHG contributors and the best methods to reduce them.

The INL FY 2008 Carbon Footprint baseline was slightly over 113,050 metric tons of carbon dioxide equivalent (mt CO_2e). Even though INL is currently meeting the goal, the long term trend indicates that INL may not meet the 28% goal by FY 2015. INL GHG emissions are directly related to energy use so the trend is similar to the energy reduction goal presented in Figure D-1.

Activities to reduce this baseline inventory will be funded primarily from alternative sources by increasing infrastructure efficiency and switching to fuel with less GHG-intensive emissions. INL is pursuing other opportunities to increase the efficiency of on-site transportation, business activities, and employee commutes, including:

- Planning a test for the use of B50 (50/50 diesel and bio-diesel) in approximately 10 buses
- Evaluating the outsourcing of the entire fueling operation, including the fuel islands, fuel delivery, and fuel storage tanks; INL would maintain responsibility for fuel quality and the fueling of vehicles
- Continuing to manage fuel use in vehicles to ensure that alternative fuels are used whenever possible
- Increasing bus ridership to reduce Scope 3 emissions from employee commuting
- Using the ESPC funding vehicle to reduce or eliminate fuel oil use in buildings for boiler and generator fuel.

By FY 2013, INL will track and allocate GHG emissions on a program-by-program basis to incorporate accountability. INL updates GHG emissions reports annually.

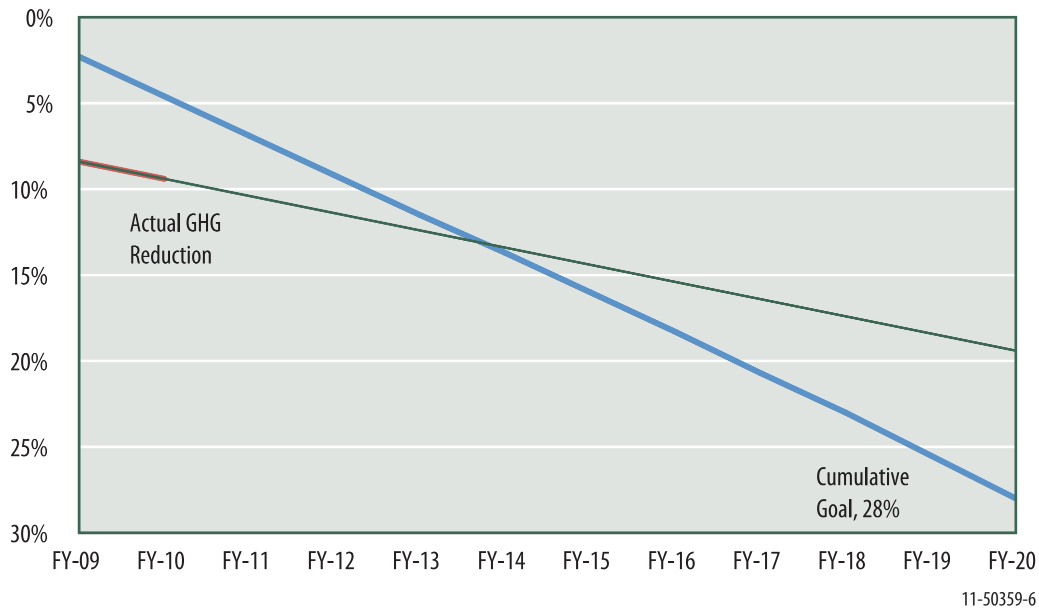


Figure D-5. Idaho National Laboratory greenhouse gas reduction goal.

D-3.6 Sustainability in Leasing

INL addresses sustainability in facility leasing by implementing new lease procurement requirements, as identified in DOE Order 430.2B. These requirements state:

> *Starting in FY 2008, all procurement specifications and selection criteria for acquiring new leased space, including build-to-suit lease solicitations, are to include a preference for buildings certified as Leadership in Energy and Environmental Design (LEED) Gold. When entering into renegotiation or extension of existing leases, the Department must include lease provisions that support the Guiding Principles for High Performance Sustainable Buildings.*

Leased buildings will be obtained that provide the best value to government; that maximize employee comfort, health, and productivity; and minimize operating and utility costs. New building leases or build to-suit leases will be designed and constructed to obtain LEED for New Construction Gold certification whenever possible. New leases on existing building will include provisions to evaluate the facility prior to occupancy for energy efficiency and the ability of the building systems to provide the appropriate indoor environmental quality. Whenever possible, renewed leases on existing buildings will include energy updates to maximize energy efficiency and employee productivity by incorporating the Guiding Principles for High Performance Sustainable Buildings. For leases intended to be very short-term temporary occupancies, the buildings should be evaluated and updated on a case-by-case basis, with a preference for a facility that demonstrates better energy efficiency and indoor environmental quality.

INL has demonstrated its commitment to these essential goals through recent building space acquisitions, including the build-to-suit Research and Education Laboratory and the Energy Systems Laboratory, both of which will attain the U.S. Green Building Council (USGBC) LEED Gold certification.

D-3.7 Sustainability in Owned Facilities

INL addresses sustainability in both new and existing owned facilities by ensuring that the Guiding Principles for High Performance Sustainable Buildings are implemented through new building designs and through the evaluation of existing buildings for physical and operational modifications to meet the Guiding Principles.

All new building projects are designed to meet the Guiding Principles as a minimum, with all new building projects over $5M designed to certify as LEED New Construction Gold. The INL's existing building inventory was evaluated using DOE's Metering Guidance to determine the best candidates for building level advanced metering. Buildings meeting the criteria for advanced meter installation will be evaluated for updates to meet the Guiding Principles by FY 2015. The Guiding Principles will be primarily met through facility upgrades that are planned for implementation with the ESPC and UESC funding mechanisms. Table D-3 outlines these buildings.

D-3.8 Regional and Local Integrated Planning

INL will seek to advance regional and local integrated planning by first integrating LEED for New Construction into all new building designs and seek certification credits in areas associated with site selection and transportation planning. In addition, INL will continue active involvement with local planning organizations, including:

- Idaho Strategic Energy Alliance
- Yellowstone Business Partnership
- Yellowstone-Teton Clean Cities Coalition
- Bonneville County Transportation Committee
- Targhee Regional Public Transportation Authority.

D-3.9 Additional Activities Focused on 2022

INL will continue to support energy and water efficiency reductions, transportation fuel efficiency, and GHG reductions through a variety of creative and proactive sustainable activities, including, but not limited to:

- Ensuring that all new construction and new infrastructure leases include provisions to obtain the USGBC LEED Gold certification, at a minimum.
- Applying the Guiding Principles for High Performance Sustainable Building of Executive Order 13423 to operations and renovations of all appropriate enduring INL infrastructure.
- Evaluating and supporting potential on-site renewable energy construction opportunities and purchasing renewable energy credits to support the growth and success of renewable energy generation industries and to reduce GHG emissions.
- Increasing the overall efficiency of the INL fleet, while focusing on increased opportunities to utilize alternative fuels.
- Incorporating new Executive Order 13514 requirements for net-zero facilities into design and construction of all new facility projects by FY 2020. Net-zero means that the facility generates at least as much renewable energy as the total energy it consumes.

Table D-3. Plan to meet Guiding Principles in Department of Energy-owned buildings (Template D).

	Number of Buildings[a]	Total Area of Buildings[a] (GSF)
(1) Site Building Area as of FY 2010 FIMS Snapshot	107	2,690,275
(2) Site Building Area Meeting Guiding Principles as of FY 2010 FIMS Snapshot	4	81,242
(3) FY 2015 Projected Site Building Area	21	957,964

	FY-2011[b]		FY 2012[b]		FY 2013[b]		FY 2014[b]		FY 2015[b]	
	Bldg No	GSF	Bldg No	GSF	Bldg No	GSF	Bldg No	GSF	Bldg No	GSF
(4) List of Existing Building Each Year[c]	IF-663	21,716	IF-601	20,100	MFC-710	11,612	CF-1611	29,801	TRA-628	13,013
	IF-665	38,451	IF-602	46,494	MFC-725	9,240	CF-1612	22,715		
	TRA-1608	16,592	IF-616	272,309	MFC-774	29,148	CF-1618	15,522		
	TRA-1626	4,483	IF-654	243,059	MFC-782	5,096	CF-609	38,934		
			IF-683	13,125			CF-621	11,787		
							CF-623	12,615		
							CF-696	82,152		
(5) Buildings Meeting Guiding Principles in Year	4	81,242	5	595,087	4	55,096	7	213,526	1	13,013
(6) Cumulative Total Building Meeting Guiding Principles	4	81,242	9	676,329	13	731,425	20	944,951	21	957,964
(7) Buildings Meeting Guiding Principles Achieved at the LEED-EB Silver Certification Level or Better in Year	1	38,451	1	13,125	0	0	1	15,522	0	0

a. Includes buildings >5,000 GSF and included in projected 2015 inventory.

b. Supporting projects should be identified in the Integrated Facilities and Infrastructure and/or Sustainability budget crosscut.

c. Identify each existing building using its FIMS Property Sequence Number. If using FIMS report (to be determined), the associated GSF will populate automatically with entry of the Property Sequence Number. If the building has not yet reached beneficial occupancy, leave the "Bldg No" column blank and enter the building GSF only.

Note:

For FY 2011, the four buildings listed are new or have been recently evaluated for conformance with LEED for New Construction or Existing Buildings. For FY 2012, these owned and leased buildings in Idaho Falls have been evaluated by McClure Engineering as part of the FY 2010 Bonneville Power Administration UESC development project and are the best candidates for implementation of the Guiding Principles. The remaining facilities, which are DOE-owned, will be evaluated and updated using the ESPC process. The MFC ESPC project is planned for completion late in FY 2011, and ESPC Project #3 is being developed for the enduring facilities at CFA and the ATR Complex.

Table D-3. Plan to meet Guiding Principles in Department of Energy-owned buildings (Template D).

ATR = Advanced Test Reactor	*FIMS = Facility Information Management System*
CFA = Central Facilities Area	*FY = fiscal year*
DOE = Department of Energy	*GSF = gross square feet*
EB = existing building	*LEED = Leadership in Energy and Environmental Design*
ESPC = Energy Savings Performance Contracts	*USEC = Utility Energy Savings Contract*

- Evaluating and updating INL engineering standards; the INL High-Performance Building Strategy; and other internal plans, goals, and documentation of sustainability-related activities to remain current with federal requirements.
- Actively leading and contributing to federal, Battelle Corporate, INL working groups and communities of practice, and the Energy Facility Contractors Group to influence future goals and requirements that will lead to increased efficiency, reduced emissions, and more productive infrastructure environments.
- Providing INL campus development and planning to address effective space management, facility utilization and disposal, and operations consolidation through trending and analyzing facility utilization and utility usage data.
- Reviewing and analyzing new building designs, proposed changes to existing buildings, and requests for new-leased facilities to ensure the integration of sustainable concepts.
- Actively pursuing advanced metering to provide central "real-time" energy and water usage evaluation, utility-level demand-side management, and tools to assist with facility and process operations.
- Achieving carbon neutrality for all infrastructure activities by FY 2025.
- Incorporating cool roof principles and technologies into roof replacements and new construction projects.

D-3.10 Sustainability Program Gap Analysis

Table D-4 provides a gap analysis illustrating areas where the INL Sustainability Program needs to focus efforts to ensure that the program goals are met. INL has six funding options available to implement projects:

1. Alternatively funded project (ESPC and UESC)
2. Internally indirect or direct funded
3. External direct funding (FEMP)
4. Third party, such as leased building owner participation
5. DOE-NE direct funding
6. Congressional line item.

The preferred INL method of funding project opportunities remains ESPC and UESC mechanisms; however, but all funding options will be considered to reduce the gap between the various DOE Order requirements and the potential to meet or exceed the requirements.

Table D-4. Sustainable goals gap general description.

Goal	Current	Future	Gaps
GHG Reduction	**INL Carbon Footprint Baseline Complete for Scopes 1, 2, and 3 GHG** – The DOE SSPP goal for Scope 1 and 2 GHG reduction is 28% by FY 2020. GHG emissions reductions are not a high priority at the programmatic level and the value of GHG reductions is not yet a commonly held priority.	**Facility Design and Operations Meet the Needs of a World Class Sustainable Laboratory** – Facilities are designed and operating to maximize energy efficiency, which in turn reduces associated GHGs. Commonly held value that energy savings and fuel switching contribute to reduced GHG emissions and energy savings are reinvested into additional sustainable upgrades and back into the benefitting programs that champion the energy efficiency improvements.	Very low cost electricity at INL ($.036/kWh). Limited alternative fuels available at INL and limited additional electric loading capacity at some INL site locations. Limited understanding that energy efficiency and fuel switching are directly related GHG reductions. Lack of up-front capital to make energy efficiency improvements. Long lead-time to develop and implement alternatively funded projects (ESPC and UESC).
Energy Reductions	**INL Infrastructure Designed and Operated to Meet Program Needs** – INL facilities are designed and operated to meet programmatic needs with energy and water usage usually considered as a second level priority. Energy reduction goal is 30% by FY 2015. INL is currently at a 9.4% reduction and is behind on annual incremental improvements towards the goal.	**Facility Design and Operations Meet the Needs of a World Class Sustainable Laboratory** – Facilities are designed and operated to maximize energy efficiency. Energy cost savings are equally reinvested into additional sustainable upgrades and back into the benefitting programs that champion the efficiency improvements.	Very low cost electricity at INL ($.036/kWh). Older existing facilities with significant operational problems that limit the ability of facilities personnel to operate efficiently. Entrenched belief that energy efficiency upgrades are too costly and take away from critical mission needs. Lack of up-front capital to make energy efficiency improvements. Long lead-time to develop and implement alternatively funded projects (ESPC and UESC).
Renewable Energy Purchase and Generation	**Renewable Energy Certificates (REC) are Purchased at a Minimum Amount of 7.5% of INL Electric Consumption** – INL purchases RECs in lieu of on-site renewable energy generation.	**INL Generates 10% of Electrical Energy Use On-Site** – INL incorporates renewable energy generation opportunities in ESPC projects and self-generates at least 10% of on-going electric energy needs.	Very low cost electricity at INL ($.036/kWh). Renewable energy options are expensive with long payback periods that negatively affect ESPC contract terms.
Water Reductions	**Water Usage as an Inexpensive Resource** – Water is used for cooling and service utilities as an inexpensive resource with little incentive to use efficiently.	**Facility Design and Operations Meet the Needs of a World Class Sustainable Laboratory** – Facilities are designed and operated to maximize potable and non-potable water efficiency. Water is valued as a limited commodity and water cost savings are equally reinvested into additional sustainable upgrades and back into the benefitting programs that champion the efficiency improvements.	Water is very inexpensive at INL ($.0006/gallon) and is plentiful from the Snake River Aquifer. Many existing one-pass cooling processes are inexpensive and require little or no maintenance.

Table D-4. Sustainable goals gap general description.

Goal	Current	Future	Gaps
Transportation Fuels – Diesel and Bio Diesel	**INL Bus Fleet** – Current INL bus fleet is efficient and provides employees with reliable transportation to and from the Site. INL bus fleet is aging and needs replacement for approximately one-half of the fleet. INL is in the unique position to provide DOE-HQ with a majority of its required petroleum reductions through an upgrade of the INL bus fleet and fuel switching to natural gas.	**Reduced Carbon, Non-Petroleum Transit Services for INL Employees** – INL bus fleet upgraded to higher efficiency clean-diesel technology and/or CNG intra-city buses that provide shared benefits with INL research organizations for a Natural Gas Liquefaction Station to be located in Idaho Falls. **Provide DOE-HQ Petroleum Reductions** – INL provides DOE-HQ with petroleum fuel reductions that will significantly reduce petroleum usage at the DOE level and allow DOE to meet its petroleum fuel reduction goal for the complex as a whole.	Funding needed from DOE to lease and maintain the new bus fleet of either clean-diesel or CNG technologies. Availability of CNG buses from GSA on the order that INL would need to acquire to change out the entire bus fleet over a 3-year period. Availability of CNG transport, storage, and dispensing infrastructure at INL.
Transportation Fuels – Gasoline and E-85	**INL Light-Duty Fleet** – INL is in a state of growth with alternative fueled vehicles and currently has more E-85 vehicles than can be conveniently fueled.	**World Class Vehicle Fueling Infrastructure for Government and Private Fueling** – INL fueling infrastructure provides alternative fuels conveniently across the entire INL and provides access to employees to use alternative fuels in private vehicles. 75% or more of INL light-duty vehicle acquisitions are alternative fuel vehicles.	Availability of fueling infrastructure for all employees is not convenient or at adequate locations to serve all needs. Employee culture needs to be refined to accept the use of alternative fuels in all vehicles that use alternative fuels. Cost of alternative fuels is still excessive in this area and needs to be obtained at a lower cost to compensate for the 30% reduction in energy content of E-85. INL is dependent upon the mix of vehicles that GSA provides. An increase in hybrid gasoline fueled vehicles to replace existing E-85 fuel vehicles will affect INL's ability to increase the use of alternative fuels.
Carbon Footprint	**Draft INL Carbon Footprint** – Completed carbon footprint for base year FY 2008. Carbon Footprint includes all Scopes 1, 2, and 3 GHG emissions, exceeding the minimum required emissions reporting of Scopes 1 and 2.	**Lead GHG Emissions Reduction Efforts – Battelle Initiative** – Provide technical leadership to FEMP for compilation, calculation, and reductions methods for Scopes 1, 2, and 3 GHGs.	Established guidance from FEMP defining scope categories and emissions compilation strategies. Carbon production not tied directly to programs. Carbon chargeback requires modification to accounting systems.

Table D-4. Sustainable goals gap general description.

Goal	Current	Future	Gaps
Sustainable Leasing	**Facilities Procured to Meet the Current Employee Quantity** – Facilities are procured as needed to house employees as missions and programs change. Acquisitions are worked the best as possible with the building stock that is available in Idaho Falls.	**Facility Acquisition and Design to Meet the Needs of a World Class Sustainable Laboratory** – Sustainable features are included in the solicitations for all new and leased facilities to the maximum extent possible. INL does not consider procuring or designing a facility or facility modification that does not promote sustainability and certify as LEED Gold at a minimum.	Current entrenchment of culture that INL cannot afford a sustainable facility on a lease contract and that the building owners will not step up and offer facilities that meet sustainable requirements and follow the guiding principles. Current entrenched belief that obtaining a below average facility for a short period has a higher priority than employee comfort or mission productivity.
High Performance Building Design	**INL Infrastructure Program** – INL building projects are designed to meet all technical aspects of operational and functional needs. Sustainable features are not currently accepted as required or desirable design features.	**Facility Acquisition and Design to Meet the Needs of a World Class Sustainable Laboratory** – Sustainable features are included in the designs of all new facilities to the maximum extent possible. INL does not consider procuring or designing a facility or facility modification that does not promote sustainability and certify as LEED Gold at a minimum. All new roofs or roof replacements are "Cool Roofs" as defined by Secretary Chu's memorandum. Existing buildings are modified and operated to meet the Guiding Principles for High Performance Sustainable Buildings.	Current entrenchment of culture that sustainability is a non-essential design requirement that does not contribute to laboratory function or productivity. Funding for the potential 6% premium in project cost needed to incorporate sustainability in design and construction activities. Funding for upgrades to existing facilities to increase their efficiency, comfort, and productivity.

CNG = compressed natural gas
DOE = Department of Energy
DOE-HQ = Department of Energy Headquarters
ESPC = Energy Savings Performance Contracts
FEMP = Federal Energy Management Program
FY = fiscal year
GHG = greenhouse gas
GSA = General Services Administration
INL = Idaho National Laboratory
LEED = Leadership in Energy and Environmental Design
LNG = liquefied natural gas
UESC = Utility Energy Savings Contract

D-4. REFERENCES

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