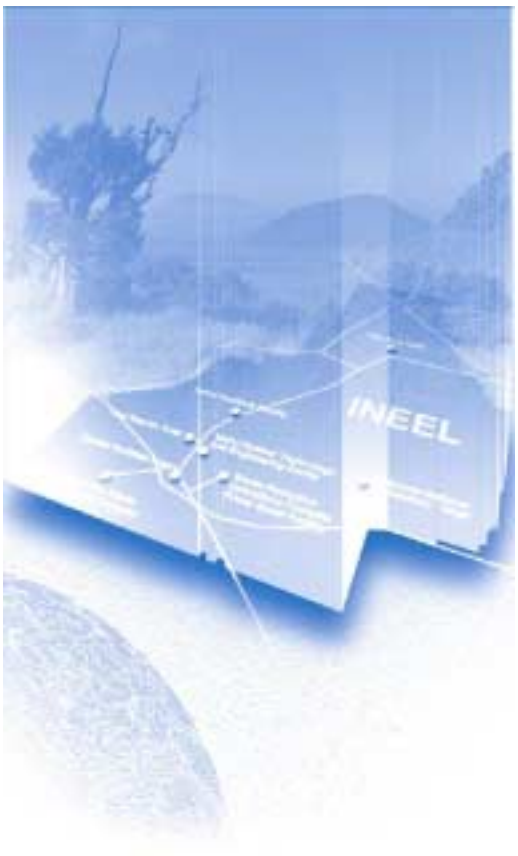
Idaho Engineering and Environmental Laboratory Baseline Report

U.S. Department of Energy
Office of Environmental Management
Office of Science and Technology



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Executive Summary

The purpose of this document is to provide an overview of the Idaho National Engineering and Environmental Laboratory (INEEL) and a status report of the management, programs and funding, staff and operations of INEEL. INEEL has recently undergone a contractor change from Lockheed Martin Idaho Technology Company (LMITCO) to Bechtel BWXT Idaho, LLC (BBWI). As such, BBWI has just begun to implement its practices and procedures.

Located on 890 square miles in the southeastern Idaho desert, INEEL is a science-based, applied engineering national laboratory. Under the programmatic direction of the Office of Environmental Management (EM) as the Lead Program Secretarial Officer, the laboratory couples scientific, engineering, systems, and business management expertise to execute multi-program missions for the U.S. Department of Energy (DOE).

INEEL specializes in research into, and engineering solutions for, nuclear waste, safety, and fuel-cycle issues. INEEL provides energy solutions through a research and development (R&D) portfolio including nuclear, fossil, and renewable energy sources, and energy efficiency. The laboratory plays a role in providing solutions to national security challenges in areas such as high-density armor, sensors for nonproliferation and law enforcement, and classified information management systems. The laboratory also supports the basic science mission of the DOE through participation in Office of Science programs in areas such as Chemical Science, Material Science, and Boron Neutron Capture Therapy.

INEEL's mission is:

> *Through exemplary performance, integration, and capability expansion, the INEEL mission is to develop, demonstrate, and deploy environmentally sustainable energy-related technologies for the DOE and the nation.*

The vision of INEEL is to be the premier provider of integrated, science-based, engineered solutions to national environmental and energy challenges. In order to achieve this vision, INEEL must work for:

- Operational excellence
- Completion of INEEL EM program
- Laboratory growth and development
- Leveraging technology and R&D
- Regional economic development and diversification.

In support of DOE missions over the years, INEEL has developed interrelated core competencies that include:

- Demonstrating applied environmental science, engineering, and technology
- Processing and managing radioactive and hazardous materials
- Developing, modeling, testing, and validating engineered systems and processes
- Complex engineering-economic systems analysis and integration.

INEEL's FY 1999 R&D funding was $179.9 million. In addition to serving as a lead lab for DOE EM and Office of Nuclear Energy (NE), INEEL's DOE customers also include Office of Defense Programs (DP), Office of Science (SC), Office of Energy Efficiency and Renewable Energy (EE), Office of Fossil Energy (FE), and Office of Nonproliferation and National Security (NN).

The laboratory performs work for a variety of other federal agencies including the Nuclear Regulatory Commission (NRC), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Defense (DoD).

INEEL currently has approximately 1,450 staff doing R&D. Exempt staff are highly educated and skilled scientists and engineers, many with years of experience in supporting site missions.

INEEL has requested a capital equipment budget of $1.3 million for R&D ($3.88 million site-wide) for FY 2000. In addition, a site-wide request for Program Construction funding of $12.29 million and $28.23 million for General Purpose Facilities (GPF), General Plant Projects (GPP), and General Purpose Equipment (GPE) has been submitted.

The INEEL manages two discretionary research programs: (1) Laboratory Directed Research and Development (LDRD) as authorized by DOE Order 413.2 and as a carryover activity associated with LMITCO's M&O contract, and (2) University Research Consortium (URC).

The LDRD program sponsors a diverse range of innovative research that is aligned with INEEL's objectives.

INEEL's goal is to be recognized as the leader in exemplary environment, safety, and health (ES&H) performance within the DOE complex by attaining Voluntary Protection Program (VPP) Star status. Full compliance with ES&H requirements is used as the baseline for effective and efficient continuous improvement while striving for ever-increasing standards of excellence.

INEEL's Quality Assurance (QA) program is comprehensive and addresses activities for planning, achieving, verifying, and maintaining the quality of items and activities in support of widely diversified programs, projects, and facilities. Flexibility and cost-effective application of the QA program is provided through a graded approach such that the program can be economically applied to small dollar value projects as well as large-scale nuclear programs and facilities.

Threats at INEEL are mitigated through a variety of programs dedicated to protecting INEEL, national security, and DOE interests. INEEL Operations Security, Counterintelligence, Export Control, Foreign Visitor Control, Technical Security, Classified/Sensitive Unclassified Information Control, Protective Force, and Safeguards Programs routinely work together to form an effective network capable of mitigating threats.

1 Overview of the Laboratory

1.1 Introduction

The Idaho National Engineering and Environmental Laboratory (INEEL) is a science-based, applied engineering national laboratory. It couples scientific, engineering, systems, and business management expertise to execute multi-program missions for the U.S. Department of Energy (DOE).

INEEL specializes in research into, and engineering solutions for, nuclear waste, safety, and fuel-cycle issues. As a national laboratory in environmental management, INEEL is a leader in technology and systems for environmental stewardship, nuclear materials disposition, subsurface science, fate and transport research, complex-wide requirements integration, and commercializing environmentally derived technologies.

INEEL provides energy solutions through a research and development (R&D) portfolio including nuclear, fossil, and renewable energy sources, and energy efficiency improvement. It is the lead laboratory in geothermal and hydropower research. The laboratory plays a role in providing solutions to national security challenges in areas such as high-density armor, sensors for nonproliferation and law enforcement, and classified information management systems.

The purpose of this document is to provide an overview of INEEL and a status report of management, programs and funding, staff and operations of INEEL. INEEL has recently undergone a change of contractors from Lockheed Martin Idaho Technology Company (LMITCO) to Bechtel BWXT Idaho, LLC (BBWI). As such, BBWI has just begun to operate the laboratory.

1.1.1 History

The INEEL site is on a federal reserve with an area of approximately 890 square miles, covering portions of five counties on the northeastern edge of the Snake River Plain in southeastern Idaho. The laboratory sits within the site. The current-day INEEL site began to emerge during World War II. A land area of 270 square miles in southeast Idaho was withdrawn from public domain for use as a gunnery range for the U.S. Naval Ordnance Station at Pocatello, Idaho, and as an aerial range by the Army Air Corps.

In 1950, the U.S. Atomic Energy Commission (predecessor to DOE) obtained land from the Navy and established the National Reactor Testing Station. The site became the first location where nuclear reactors were built to test the concept of nuclear power as a source of commercial energy. Over the years, 52 nuclear reactors were built and tested resulting in the largest concentration of nuclear reactors in the world. Most of them were first-of-a-kind facilities, and many made significant contributions to what were then the newly developing fields of reactor safety and design. For example, the Experimental Breeder Reactor I was the first reactor built on the site and the first reactor in the world to generate electricity. It began operating on December 20, 1951. This reactor, now a National Historic Landmark, provided the first proof that nuclear fuel breeding (creating more fuel than is used) was feasible.

The first boiling water reactor prototypes were built and operated at INEEL in the 1950s. One of them, the Boiling Water Reactor Experiment III, was first to light an American town—Arco, Idaho—in 1955. Scientists and engineers working in INEEL's Experimental Breeder Reactor proved the feasibility of using atomic energy to generate electricity.

Development of reactor prototypes for the U.S. Navy began in the 1950s. In 1953, the nuclear Navy was inaugurated with the initial power run of the prototype power plant for the first nuclear submarine, the Nautilus. This was followed in 1958 with a large ship reactor prototype facility and later another submarine reactor prototype.

INEEL has been the site of most of the long-term federal programs for investigating the safety of water-cooled reactors. In 1955, reactor safety studies began in the Special Power Excursion Reactor Test facilities.

INEEL site has a long history of radioactive materials processing, research, and waste storage. In 1953, the Idaho Chemical Processing Plant (now the Idaho Nuclear Technology and Engineering Center [INTEC]) began receiving, storing, and reprocessing nuclear materials, such as irradiated nuclear fuel from test, defense, and research reactors in the United States and other countries. However, the end of the Cold War and changes in public attitudes toward nuclear power reduced demand for highly enriched uranium reclaimed through reprocessing spent nuclear fuels. In April 1992, DOE announced that the reprocessing portion of the plant's mission would be phased out. The mission of the plant will continue to include fuel storage; waste processing for disposal in a repository; development and application of technologies to manage radioactive and hazardous wastes and to minimize waste generation; decontaminating and decommissioning facilities; and remediating the site.

Between 1954 and 1989, INEEL site received defense-related waste for storage. Until 1970, most of this waste was buried in shallow pits and trenches at the Radioactive Waste Management Complex (RWMC). After 1970, waste was stored aboveground in specially designed interim storage facilities at the complex. Since the mid-1970s, one of the specific purposes of INEEL has been to advance science and technology associated with environmental characterization and restoration of areas contaminated by earlier operations.

In 1974, the National Reactor Testing Station was renamed the Idaho National Engineering Laboratory to reflect an expanded mission, including waste management and minimization, environmental engineering and restoration, energy efficiency, renewable energy, national security and defense, nuclear technologies, and advanced technology and methods.

In 1975, INEEL became the nation's second, and second largest, National Environmental Research Park (NERP). DOE's designation of NERP recognizes the value of large land areas and biotic diversity of seven of its national laboratories for research in basic field ecology and the environmental consequences of energy use.

In January 1997, the name was again changed to the Idaho National Engineering and Environmental Laboratory to reflect further evolution in its mission to solve engineering and environmental problems. Much of the work done at INEEL now involves researching, engineering, and developing technologies in areas such as waste management, alternate energy,

biotechnology, and the environment. In many cases, INEEL personnel collaborate with personnel in private industry and academia to develop these technologies. In other cases, technology developed at INEEL is being transferred to the private sector for commercial applications.

1.1.2 Mission

INEEL's mission is:

> *Through exemplary performance, integration, and capability expansion, the INEEL mission is to develop, demonstrate, and deploy environmentally sustainable energy-related technologies for the DOE and the nation.*

1.1.3 Vision/Goals/Strategies

INEEL's vision is to be the premier provider of integrated, science-based, engineered solutions to national environmental and energy challenges. To achieve this vision, INEEL is working toward:

- Operational excellence
- Completion of INEEL EM program
- Leveraging technology and R&D
- Regional economic development and diversification.

To achieve operational excellence, INEEL develops and uses fully integrated lifecycle plans and proven business models to work more efficiently, staying on schedule and within budget. INEEL applies its expertise in science and technology to solve real problems at the site and throughout the DOE complex. INEEL continually strives to work in a safe environment with zero accidents as its primary goal. This is being furthered through implementation of an Integrated Safety Management System (ISMS) with zero tolerance for noncompliance. A comprehensive self-assessment program will be implemented to ensure operational excellence is fused into every aspects of INEEL.

To complete the EM program, INEEL will match its laboratory capabilities and technical expertise to provide EM with alternative strategies to meet complex cleanup problems. INEEL is currently designated as EM's Lead Laboratory. In its role as lead lab, INEEL will provide the EM program with a technical and scientific resource to direct focus on present and future challenges in remediation, environmental operations, and stewardship for the DOE complex. This role will be further defined and communicated in the near term. Looking toward the future, INEEL will develop and promote capabilities for long-term environmental quality stewardship and will continue to develop greater depth of research capabilities and facilities to support the EM mission.

To promote laboratory growth and development, plans are to institute a focused laboratory agenda that identifies critical goals and outcomes within the framework of key missions. This agenda will be focused on INEEL planning, resources, management, and evaluation processes. INEEL will develop strategies for enhancing and maintaining laboratory core competencies; as well as strengthen and expand the quality and depth of scientific underpinning of the INEEL

R&D portfolio. Procedures to ensure integration and coordination exist between program missions and science and research will be established. This approach will further the application of scientific expertise to INEEL Operations.

INEEL's strategies for leveraging technology and R&D are to:

- Emphasize integration of all program and operational elements
- Ensure synergy is evident between laboratory and operations through:
  - Demonstrated use of science-based decision making
  - Deployment of new technologies or solutions
- Manage, address, and resolve integration issues
- Interface with technology roadmaps to identify technology gaps
- Introduce needs-based planning and management systems to:
  - Acquire technology
  - Demonstrate and deploy innovative technologies
  - Identify R&D needs for new science and technology.

Implementation of these strategies will strengthen INEEL's contribution to regional economic development and diversification through partnerships with state and local entities. Currently INEEL is the third largest employer in Idaho, with the largest single payroll in the state. Each INEEL job yields one job in the regional service sector. INEEL families contribute millions of dollars in local and national charitable causes and pay over $100 million in taxes every year.

1.2 Organization

1.2.1 Structure

The shaded box in Figure 1 indicates the laboratory organizational structure within the context of the Management and Operations (M&O) contractor organization at INEEL. The Laboratory Director is also the Deputy General Manager of the INEEL and acts for the president when absent. The Laboratory Director oversees the R&D Organization along with the Deputy R&D Director and the Chief Scientist. There are seven divisions reporting to the Laboratory Director in the R&D Organization:

- Environmental and Energy Science
- Nuclear and Energy Systems Engineering
- Environmental Technology and Engineering
- National Security
- Education and Research Initiatives
- Program Integration
- R&D Operations.

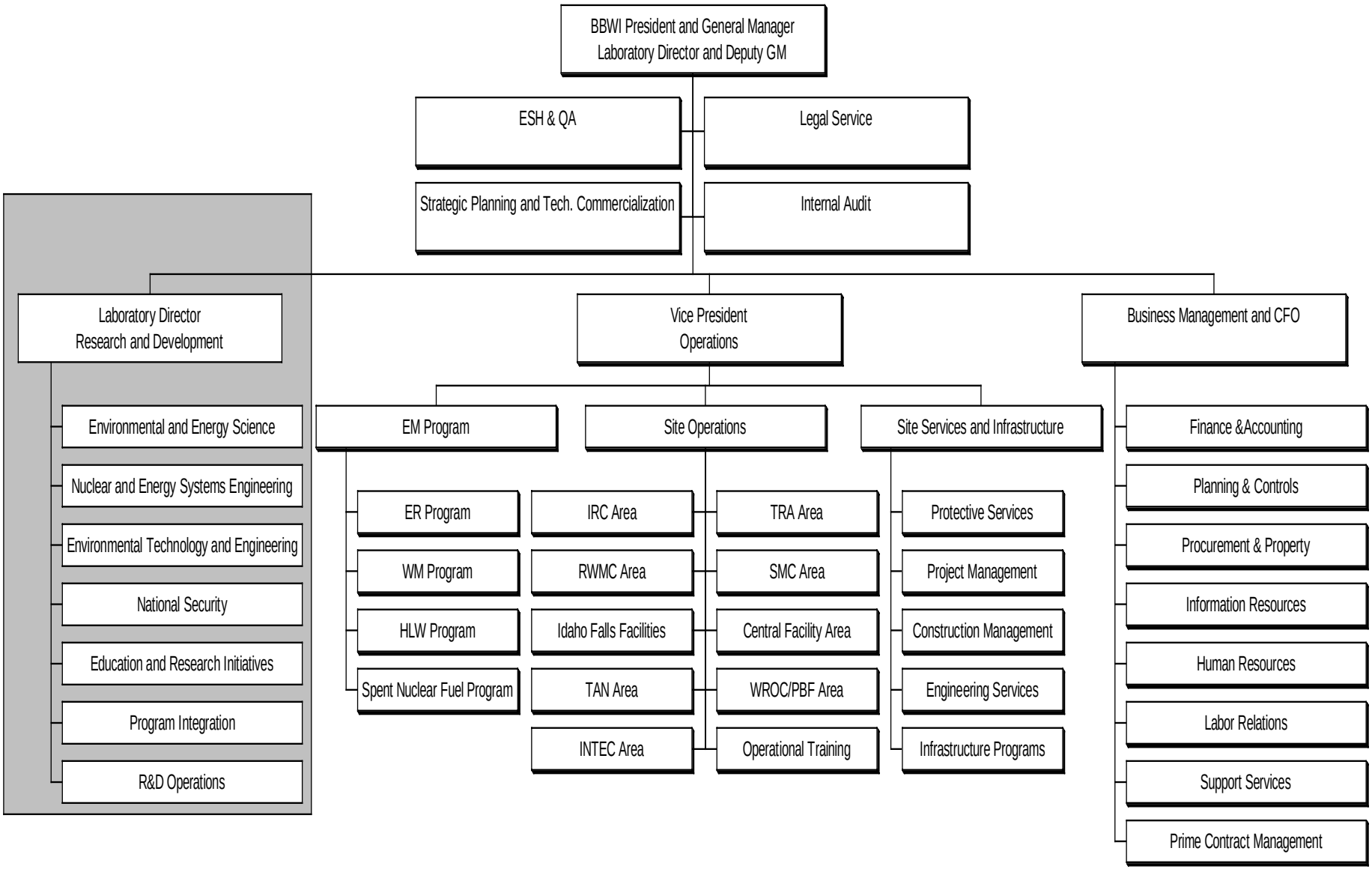

Figure 1. INEEL Organization within the context of the M&O contractor organization.

Environmental and Energy Science. Environmental and Energy Sciences has the lead role in developing and maintaining science for R&D. Specifically, the division provides leadership and technical infrastructure for the INEEL Subsurface Environmental Science Initiative, establishes a plan and increases participation in the DOE Office of Science (SC), provides science support to other R&D branches, and interfaces with operations organizations to provide science integration support for areas of responsibility.

Nuclear and Energy Systems Engineering. This division provides technical leadership and expertise supporting DOE's nuclear and non-nuclear energy strategies. INEEL's successful work with Argonne National Laboratory (ANL) in high-risk nuclear energy science, and technology R&D has led to the designation of INEEL and ANL as the Lead Laboratories for DOE's Office of Nuclear Energy, Science, and Technology (DOE-NE). Near-term goals include the creation and execution of an NE Lead Laboratory implementation plan and growth of the nuclear science and technology business base at INEEL. The division will develop and implement a "bio-energy" initiative in anticipation of DOE's next major energy thrust and enhance INEEL's position in DOE's methane hydrates research. It will be the focal point for continued investment in establishing INEEL as a major player in geothermal, hydropower, hydrogen, and other DOE alternative fuel programs.

Environmental Technology and Engineering. The mission of the Environmental Technology and Engineering Division is to provide solutions to waste and nuclear materials management, environmental restoration, and long-term stewardship challenges at INEEL and across the DOE complex. This division leverages technology and enhances environmental quality and performance of complex systems. A key activity of this division is to better define and implement INEEL's roles as an EM Lead Laboratory.

National Security. This division supports national security, promotes international nuclear safety, and reduces global danger from weapons of mass destruction (WMD), as outlined in the DOE Strategic Plan. It applies INEEL capabilities to address national security problems, e.g., countering the threat from WMD. The proposed International Center for Environmental Safety, approved by DOE in March 1999, will be established under this division to address such issues as:

- Proliferation-resistant Fuel Cycle Initiative
- Scientific Simulation Initiative.

This Center will plan and manage cooperative environmental technology development and demonstration projects associated with managing spent nuclear fuel, cleanup of nuclear sites, and creating a Russian environmental management infrastructure.

Education and Research Initiatives (ERI). The mission of the Education and Research Initiatives (formally the INEEL Institute) is to elevate the stature and recognition of INEEL through strategic investment in education, professional development, research, and information services. To this end, ERI plans to:

- Improve the Technical Library and Information Center
- Enhance educational stature of laboratory workforce

- Expand laboratory exchange and outreach programs
- Continue development of professional support activities.

The Program Integration and R&D Operations Divisions provide internal support to other INEEL divisions. Program Integration supports the Laboratory Director/Deputy General Manager, and Deputy Laboratory Director/Chief Scientist on external issues and activities relating to strategic planning, laboratory communications, R&D and operations integration. R&D Operations focus is on internally-related issues and activities generally associated with management and administration of the R&D Organization.

1.2.2 Responsibility and Accountability

INEEL is under the programmatic direction of the Office of Environmental Management (EM); both the Lead Program Secretarial Officer (LPSO) and Cognizant Secretarial Officer (CSO). Figure 2 shows the current lines of communication for the laboratory. The previous contractor's reporting relationship had separate Operation and Research branches reporting through the LMITCO Office of the President. This structure was not seen as the most optimum arrangement, often resulting in two separate and distinct agendas, areas of interest, and formal and informal priorities. Communications between the two branches, and the President, was insufficient for the level of importance of many issues and strategies.

The most significant difference under BBWI is the designation of the Laboratory Director and General Manager position. This arrangement is specifically intended to strengthen the ability to ingrate science and technology into mission execution. The resulting structure reinforces the vision of "One Laboratory" and enhances the Laboratory Director's role in the science community.

In order to achieve more effective and efficient management, the INEEL is establishing a horizontal matrix management structure to enhance synergy between project and functional managers, and support R&D and operations integration. Over the next twelve months, the INEEL will pursue a strategy to strengthen functional management organizations across the site, with particular emphasis on the functional areas of operations, project management, procurement, safety, quality assurance (QA), engineering, project controls, and document control. These organizations will integrate processes, systems, procedures, and standard tools across the INEEL to achieve higher quality and increased productivity while working safely to meet programmatic requirements. The functional manager's scientific or technical oversight of project performance provides constant feedback for continuous process improvements and for assessing core competencies in all disciplines. The functional management organizations will implement a strategy to revitalize a diverse work force, identify gaps, and ensure the competencies needed to support INEEL missions available. This includes recruiting needed personnel in selected fields, career planning and personnel development, and training to improve expertise in mission-related areas.

1.3 Summary of Major Programs

Programs of major importance to INEEL are organized below under the categories of the four main mission objectives: (1) environmental solutions, (2) energy solutions, (3) nuclear science and technology solutions, and (4) national security solutions.

Figure 2. INEEL communication and reporting structure.

1.3.1 Environmental Solutions

Environmental Restoration. The objectives of environmental restoration are to identify inactive contaminated facilities and sites, assess the nature and extent of contamination and its impact on human health and the environment, contain contamination to minimize its spread, and clean up and restore the site. Restoration actions are performed in accordance with applicable laws, regulations, and agreements negotiated with appropriate regulatory agencies.

The Environmental Restoration Program is responsible for decontamination and decommissioning, which consists of safe caretaking of surplus nuclear facilities and their subsequent characterization and decontamination for reuse or dismantlement and removal. Restoration of INEEL sites is being performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) under the Federal Facility Agreement and Consent Order (FFA/CO) signed by DOE, the Environmental Protection Agency (EPA), and the State of Idaho.

Waste Management. The goal of the INEEL Waste Management Program is to provide cost-effective storage, treatment, and disposal of waste being generated or stored at INEEL and to protect workers, the public, and the environment. The DOE Idaho Operations Office (DOE-ID) has established a goal of significantly reducing generated waste, with the ultimate objective of

using pollution prevention and waste avoidance to reduce the need for treatment, storage, and disposal facilities. The program includes operation and maintenance of radioactive waste treatment, storage, and disposal facilities; treatment and retrievable storage of transuranic waste; operation of transuranic waste certification facilities; and operation of material exchange and office-waste recycling programs.

The Waste Management Program is involved in eliminating DOE's legacy waste. Under INEEL's Site Treatment Plan, specified waste streams may come to INEEL for treatment. However, the plan requires any offsite waste received at INEEL to be removed from Idaho within six months of treatment.

In addition, a 1995 agreement between the State of Idaho, DOE, and U.S. Navy provides enforceable milestones for removing from Idaho any waste currently stored at INEEL. Program personnel are working aggressively to meet the milestones of this agreement.

National Programs. INEEL National Waste Management Programs provide technical assistance to states in developing new disposal capacity for commercially generated low-level radioactive waste. They assist DOE in planning for disposal of commercially generated greater-than-Class-C low-level radioactive waste. The programs assist DOE Headquarters and DOE-ID waste management programs in complying with external regulations and internal orders that apply to waste and materials managed by DOE EM Headquarters.

INEEL supports the National Transuranic Waste Program by developing guidelines for treatment and disposal of transuranic waste. Recently, DOE awarded a contract to a team led by British Nuclear Fuels Limited, Inc., to design and build the Advanced Mixed Waste Treatment Facility to treat approximately 65,000 cubic meters of transuranic waste at INEEL; this contract utilizes the INEEL guidelines for transportation and disposal of TRU waste. This facility may ultimately be used to treat other transuranic waste within the DOE complex.

INEEL has been designated the lead laboratory for management of DOE's spent nuclear fuel. In this capacity, INEEL's National Spent Nuclear Fuel Program coordinates and integrates all non-commercial spent nuclear fuel activities for DOE. Other support provided by INEEL includes direction of research, as well as development and testing of treatment, shipment, and disposal technologies for all DOE spent nuclear fuel. These activities are done in accordance with agreements reached with the DOE EM Program Office. The Savannah River Site (SRS) has maintained the lead role for the management of aluminum fuel.

INEEL is a partner with Los Alamos National Laboratory (lead lab) and six other laboratories in the Nuclear Materials Focus Area (NMFA). The NMFA analyzes plutonium stabilization needs and subsequently identifies and recommends candidate topics for concerted R&D efforts. This focus area's technology-specific program recommends solutions to site-specific and complex-wide technology issues associated with plutonium remediation, stabilization, and preparation for final disposition. The focus area seeks opportunities to participate with industry and universities in developing these technologies.

INEEL coordinates the Mixed Waste Characterization, Treatment, and Disposal Focus Area, a national effort to develop treatment technologies for mixed waste. The mission of the Mixed

Waste Focus Area is to provide acceptable technologies that enable mixed waste treatment systems developed in partnership with users and with participation of stakeholders, Tribal governments, and regulators.

Biological and Environmental Research. The 890-square-mile INEEL site is a National Environmental Research Park, one of only seven in the nation. As such, all land within INEEL boundaries is protected, enabling ongoing ecological studies. The Environmental Science and Research Foundation and university researchers under the foundation's direction perform these program activities. These activities include radioecology and ecology research such as INEEL site characterization of mammals, birds, reptiles, and plants; developing improved methods of land management; research on distribution, transport, and fate of contaminants in the environment; and research on effective natural protective caps for waste management areas. Microbial work is performed through INEEL's involvement in the Natural and Accelerated Bioremediation Research (NABIR) program. Funding is provided by DOE's Office of Biological and Environmental Research (OBER).

Environment, Safety, and Health. This program provides system safety research, development, training, measurement, reporting, and documentation services to DOE. The program, funded by EH, operates the DOE's automated Occurrence Reporting and Processing System and the Safety Performance Measurement System. These databases track DOE occurrence reports, appraisal recommendations and evaluations, and trends in injuries and accidents. The Environment, Safety, and Health Program develops and implements standards in areas of electrical safety, hoisting and rigging, and confined space entry.

Defense Program Environmental Surety. Since 1996, INEEL has worked with DOE's Office of Defense Programs (DP) in an innovative effort to integrate DOE EM skills with DP production skills and needs. This effort couples the lab's systems integration experience with its knowledge of minimization of waste generation and pollution prevention techniques to reduce environmental impacts relative to maintenance of the nuclear weapons stockpile. Note: Carryover FY 1999 funds have sustained the program into FY 2000. No new funds have been received for FY 2000, but proposals continue to be developed to enlist new funds. INEEL continues to maintain a secure area for the functional elements of the program (amount of overhead funds), as the costs are minimal and renewal or startup costs are high should potential new funds or related program scope be identified. INEEL also works cooperatively with other Defense Program laboratories and sites to assure that all environmental laws are implemented cost-effectively and that best engineering practices are applied.

Civilian Radioactive Waste Management. The Dry Rod Consolidation Technology-Disposition Project manages disposal of nonfuel-bearing components remaining from the Dry Rod Consolidation Technology Project. In addition, INEEL participates in the Civilian Radioactive Waste Research and Development Program that supports effective use of available storage and determines additional storage needs at civilian nuclear power reactors.

1.3.2 Energy Solutions

Geothermal. INEEL has the lead role in developing technologies to convert geothermal energy to electricity. In addition, INEEL subcontracts with several research organizations and works

cooperatively with Oak Ridge National Laboratory (ORNL) and Lawrence Livermore National Laboratory (LLNL). To encourage technology transfer to the geothermal industry, INEEL manages a program of cooperative geothermal research with industry.

Industrial. INEEL helps develop industrial energy conservation technologies in accordance with cooperative agreements with industrial concerns, universities, and DOE laboratories. Activities include proposal evaluation, research, technology transfer, and assistance with planning and development of new research initiatives. New research initiatives include alternative chemical feedstocks, industrial bioprocessing technologies, and thermal sciences. These new initiatives involve cooperation of other national laboratories and industry.

Transportation. Development and testing of electric vehicles, propulsion systems, and batteries will continue to help DOE fulfill requirements of the Electric and Hybrid Research, Development, and Demonstration Act of 1976. The program provides DOE with a test center for newly developed vehicles and propulsion systems and manages development of selected electric vehicle technologies, such as ultra-capacitors.

INEEL is currently DOE's lead laboratory for advanced high-power energy storage testing and evaluation in support of the Partnership for New Generation Vehicles (PNGV) and the U.S. Advanced Battery Consortium (USABC) hybrid vehicle propulsion programs. INEEL's major role is to test and evaluate advanced batteries, new engine systems, and energy saving devices, and to formulate new drive trains and energy-storage mechanisms such as ultra-capacitors.

The transit bus program is designed to provide a comprehensive study of alternative fuels currently used by the transit bus industry. The study focuses on reliability, fuel economy, operating and capital costs, and emissions of vehicles running on various alternative fuels. Since 1995, as part of a Cooperative Research and Development Agreement (CRADA) with Detroit Diesel, INEEL has converted six of its fleet of 126 buses from diesel fuel to Liquefied Natural Gas (LNG).

Other transportation related activities include modeling exhaust systems to decrease emissions for the Low Emission Partnership and development of powder metal forming applications (Rapid Solidification Process) for near-net-shape manufacturing as part of the Advanced Materials Partnership. INEEL is testing a Composite Bridge (a lightweight bridge that can be built in one day), and providing research and analytical engineering for the Idaho Heavy Vehicle Pilot Project.

As part of the National Intelligent Transportation System, INEEL is developing technologies for the Out-Of-Service Vehicle Field Operational Test, a federal and state partnership to help police identify unsafe vehicles.

Hydropower. According to data from the Federal Energy Regulatory Commission, undeveloped conventional hydropower capacity in the U.S. totals nearly 74,100 megawatts. INEEL Hydropower Program addresses this potential by conducting cost-shared studies, engineering research, and technology transfer with private industry.

INEEL began leading the National Hydropower Program in 1977. The objective is to establish a technology base to help industry pursue hydropower development. Working in conjunction with Oak Ridge National Laboratory, INEEL coordinates with DOE and works directly with industry and other government agencies. This program has resulted in deployment of successful low-head, low environmental impact hydropower turbines. Through the Advanced Hydropower Turbine System Program, INEEL is conducting research on both fish behavior and turbine design to develop fish friendly turbines.

In the Hydropower Program, INEEL manages hydropower projects funded under the Indian Energy Program. Currently there are four projects, with funding for four more projects underway. All projects are located in Alaska to help Native American villages reduce dependence on diesel fuel.

In-House Energy Management. Plans to reduce energy loss and consumption at existing facilities and in new construction are being implemented in accordance with DOE Order 430.2, "In-House Energy Management." Energy management construction projects currently scheduled will reduce INEEL's energy loss and consumption.

1.3.3 Nuclear Science and Technology Solutions

Reactor Programs. The Advanced Test Reactor (ATR), located at INEEL's Test Reactor Area (TRA), provides controlled nuclear irradiation environments for materials and fuel testing by various U.S. and international customers. The Naval Reactors Program is the primary sponsor of the ATR and funds operations and maintenance; environment, safety, and health (ES&H) activities; experiment program support; and training support. Recent reductions in Naval Reactors test space requirements within the ATR have made additional space available for pursuit of new business opportunities.

Policy and Management. INEEL supports nuclear safety policy, QA, and training. Activities include:

- Developing and maintaining the DOE Manual of Functions, Assignments, and Responsibilities for Nuclear Safety
- Developing configuration management/design-basis reconstitution and material condition and aging programs
- Reviewing existing DOE standard development implementation practices
- Supporting Occurrence Reporting and Processing System
- Supporting development of rules, orders, and safety guides for the Office of Nuclear Safety Policy and Standards
- Conducting QA assessments
- Assisting special studies
- Reviewing and maintaining guidance materials for conduct of operations
- Developing generic performance-based training resources, materials, and programs.

Nuclear Energy Research and Development. INEEL is pursuing a number of nuclear energy research programs, including safety assessments to preclude reactor accidents and isotope production to support a broad range of experiments and metallographic examinations.

Isotope Production. The Isotope Production and Distribution Program at the ATR formerly supported DOE's mission to supply industrial, medical, and research communities with radioisotopes. In response to a DOE initiative to move this mission to the private sector and save taxpayer dollars, INEEL radioisotope production, marketing, and sales activities were moved to the private sector. The commercial subcontractor now conducts all former INEEL isotope services with opportunity for profit. These services provide cobalt-60, iridium-192, and other important radioisotopes to national and international customers for nuclear medicine, nondestructive material examinations, agriculture, environmental sciences, food irradiation, and medical products sterilization. ATR irradiation and other services are provided to the commercial subcontractor at full cost recovery to DOE.

INEEL's Waste Reduction Operations Complex/Power Burst Facility is being considered for production of medical isotopes for cancer and heart disease screening and therapy uses. Production would include molybdenum-99, a widely used medical isotope.

Nuclear Science Reactor Support. The Nuclear Science Reactor Support Program (formerly the University Reactor Fuel Assistance Program) supplies nuclear reactor fuel to 33 university reactor programs. In addition, the program provides funding and assistance for removal of irradiated fuel from universities. The program assists in replacement of highly enriched uranium fuel with low enrichment fuel, as funding and space for returned fuel permit.

Fusion Safety. As the DOE-designated lead laboratory for fusion safety research, INEEL has developed the Fusion Safety Program to provide safety information for development and commercialization of fusion power and to recommend and develop safety standards and analysis methods. Research focuses on safety considerations for tritium and activation products and potential sources for their release, including chemical reactions, superconducting magnets, plasma disruptions, and coolant disturbances. Research is conducted to resolve fusion safety issues and to support fusion test facilities. The International Thermonuclear Experimental Reactor is an example of the research conducted by the INEEL in the area of fusion safety. The United States no longer participates in the International Thermonuclear Experimental Reactor program.

Nuclear Physics. INEEL measures and evaluates radioactive decay data for Nuclear Data Sheets and other purposes important to reactor research and technology.

Radiological Assistance Program. In the Radiological Assistance Program, INEEL provides technical and professional staff and specialized equipment in response to requests for radiological assistance from EPA's Region 10 (Idaho, Montana, Wyoming, Colorado, and Utah). Safety evaluations are conducted in support of numerous DP sites.

1.3.4 National Security Solutions

Materials Production. DP's involvement at INEEL has decreased significantly with the transfer of primary responsibility for managing INTEC to the EM Program. DP has retained responsibility for control and safeguarding of special nuclear material at the center. However, a

Memorandum of Agreement that would transfer this responsibility to EM has been drafted and is expected to be finalized shortly.

Support Activities. INEEL architects and engineers support DOE Headquarters in the design and construction of Forrestal and Germantown Emergency Operations Control Centers. The Radiological Assistance Program provides personnel and equipment on request for radiological assistance in Idaho, Montana, Wyoming, Colorado, and Utah.

Nonproliferation. Activities include R&D of technologies that support counterterrorism, counternarcotics, nuclear emergency response, special operations/low-intensity conflict, law enforcement, and security. Also addressed are sensors to detect threat devices and contraband, and transfer of technologies to the intelligence community. In addition, work is being done in information warfare, command and control, reliability of computers and networks, and protection of communications and data.

Fissile Materials Disposition. In this program, weapons-grade plutonium will be tested for use in commercial reactors. Capsules (sealed containers) of mixed oxide reactor fuel made from weapons-grade plutonium will be designed at ORNL, fabricated at Los Alamos National Laboratory, and irradiated at INEEL in the ATR. Capsules will remain sealed while in Idaho and will be returned to ORNL for examination. Eventually, mixed-oxide fuel could be used in commercial reactors if testing shows it is suitable. These experiments can provide useful scientific and materials data for the ultimate disposition of excess weapons-grade plutonium.

1.4 Core Capabilities

For DOE research missions, INEEL has developed interrelated core competencies that include:

- Demonstrating applied environmental science, engineering, and technology
- Processing and managing radioactive and hazardous materials
- Developing, modeling, testing, and validation of engineered systems and processes
- Complex engineering-economic systems analysis and integration.

Demonstrating Applied Environmental Science, Engineering, and Technology. INEEL has provided environmental characterization, analysis, remediation, and monitoring at the laboratory, in the U.S., and in other parts of the world from the Arctic to Antarctica. INEEL combines its sensor capabilities with its expertise in geology, biotechnology, ecology, and environmental restoration to provide solutions to complex environmental challenges. By leveraging these capabilities through alliances and partnerships with the private sector, INEEL will continue to develop advanced environmental analysis tools and management methods. For example, biotechnologies have been developed, and are being deployed and commercialized. These biotechnologies use naturally occurring microbes for decontamination of concrete and in-situ remediation of certain kinds of chemical contamination.

Processing and Managing Radioactive and Hazardous Materials. As a major reprocessor of DOE and Naval spent fuels, INEEL has developed expertise in processing, handling, using, transporting, storing, and disposing of radioactive materials, including low-level, high-level, transuranic, mixed, and hazardous wastes. Expertise in intelligent automation and remote

systems, chemistry R&D, and handling highly corrosive chemicals supports a variety of INEEL objectives.

The new Waste Calcining Facility allows solidification of liquid reprocessing wastes to enable safe interim storage while awaiting permanent disposition. This facility, combined with INEEL's experience managing temporary storage of low-level and mixed hazardous waste, will allow the laboratory to take a lead role in safe and responsible stewardship of the nation's legacy of nuclear by-products.

Developing, Modeling, Testing, and Validation of Engineered Systems and Processes. Having designed, constructed, operated, and tested 52 nuclear reactors since its inception; INEEL has long been regarded for its expertise in nuclear safety verification. This capability requires expertise in remote operation, nondestructive testing, thermal hydraulics, materials behavior, lifetime prediction, and failure analysis. The nuclear safety effort develops computational tools and models for nuclear reactor risk and safety assessment, including thermal hydraulic codes, neutron-flux calculations, and probabilistic risk assessment. Such modeling tools as Severe Core Damage Analysis Program (SCDAP) and Reactor Excursion and Leak Analysis Program, version 5 (RELAP5) are used worldwide for safety and risk assessment activities in operating reactor facilities. These codes are based on experimental measurement capabilities in heat transfer and fluid mechanics that have been developed at INEEL over several decades. Along with these capabilities, substantial depth in material technologies such as metallurgy, joining, and fracture mechanics has been developed.

Complex Engineering-Economic Systems Analysis and Integration. From its long history in design, construction, operation, and decommissioning of nuclear reactors, hazardous materials processing plants, and large-scale energy systems, INEEL has developed multidisciplinary expertise that enables it to implement large systems integration projects for DOE such as the Complex-wide EM Integration Program. This expertise in system integration, enhanced by systems engineering expertise of M&O contractors, positions INEEL to assume lead roles in developing integrated, technically-based solutions for complex problems facing DOE and other government agencies. It positions the laboratory to participate in future development of an Advanced Center for Environmental Testing, permanent waste storage facilities, advanced reactors, and advanced materials processing systems.

In addition to four core capabilities, INEEL has outstanding key technical capabilities in a wide range of disciplines, including systems engineering, earth science and environmental engineering, biotechnology, chemistry R&D, radiochemistry and radiochemical processing, nuclear science and engineering, materials and structural integrity, sensing and diagnosis, intelligent automation and remote systems, information management technologies, physical systems modeling, and applied engineering.

1.5 Customers/Funding Sources

INEEL has a broad and varied customer base. In addition to serving as a lead lab for DOE EM and NE, INEEL's DOE customers include DP, SC, Office of Energy Efficiency and Renewable Energy (EE), Office of Fossil Energy (FE), and Office of Nonproliferation and National Security (NN). The laboratory provides support to a variety of other federal agencies including NRC,

EPA, and Department of Defense (DoD). INEEL's FY 1999 R&D funding was $179.9M. Figure 3 shows INEEL's FY 1999 R&D funding profile.

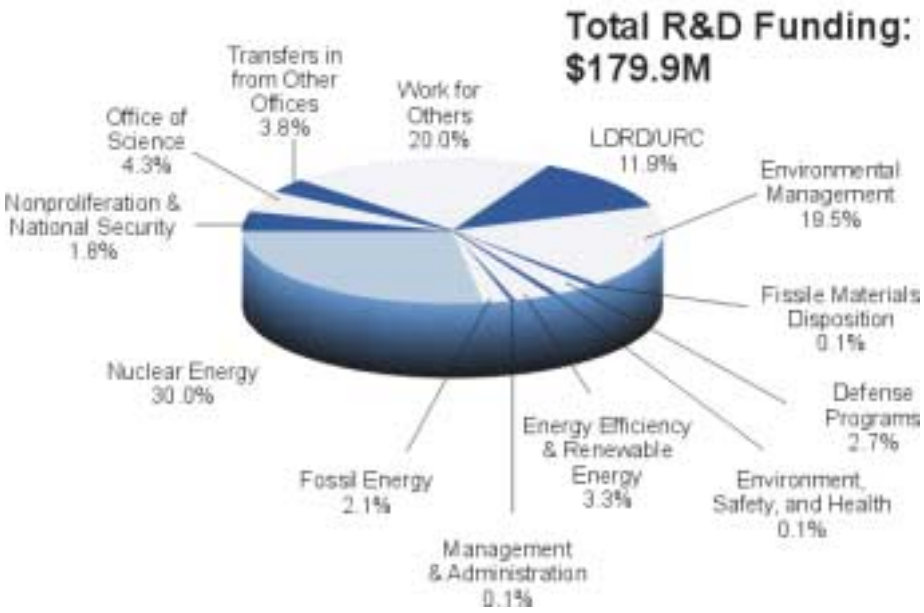

Figure 3. INEEL's FY 1999 R&D funding profile

1.6 Facilities

The INEEL site occupies 569,135 acres (890 square miles) in southeast Idaho. The site consists of several primary facility areas situated on an expanse of otherwise undeveloped, high-desert terrain. Buildings and structures at the INEEL are clustered within these primary facility areas, which are typically less than a few square miles in size and separated from each other by miles of primarily undeveloped land.

These primary facility areas are Argonne National Laboratory-West, the Central Facilities Area, the Idaho Nuclear Technology and Engineering Center, the Naval Reactors Facility, the Waste Reduction Operations Complex/Power Burst Facility, the Radioactive Waste Management Complex, Test Area North, and the Test Reactor Area. The remainder of INEEL site land is referred to as the Site-wide Area, which is composed of all INEEL land outside the boundaries of the primary facility areas listed above. In addition, several INEEL laboratories and administrative offices are located in the city of Idaho Falls, some 30 miles east of the INEEL site border.

Except for the Naval Reactors Facility and Argonne National Laboratory-West, all of the primary facility areas are operated by BBWI under the direction of the DOE Idaho Operations Office (DOE-ID). Westinghouse Electric Corporation operates the Naval Reactors Facility under the supervision of the Naval Nuclear Propulsion Program through the DOE's Office of Naval Reactors. The University of Chicago operates Argonne National Laboratory-West under the direction of the DOE's Chicago Operations Office.

Idaho Falls, a community of about 50,000 people, is located 30 miles east of the of the INEEL site. The DOE owns 14 buildings in Idaho Falls. An additional 18 buildings in Idaho Falls are leased. INEEL buildings located there are used by DOE and DOE-contractor personnel who administer and support work at the INEEL. About 40% of INEEL employees work at facilities in

Idaho Falls. These facilities include the DOE Idaho Operations Office-North and -South buildings, the Willow Creek Building, the Engineering Research Office Building, the Technical Support Annex, the INEEL Research Center, the INEEL Supercomputing Center, and several other administrative/technical support buildings.

INEEL facilities located in Idaho Falls provide training, administrative, technical, computer and laboratory workspace in support of the DOE and other U.S. Government agencies. The DOE owns the INEEL Research Center (which consists of 13 buildings) and the INEEL Supercomputing Center. All other facilities in the Idaho Falls area are leased.

Multi-discipline teams of scientists and engineers at the INEEL Research Center and five leased laboratory facilities in Idaho Falls work on a wide variety of advanced scientific research and development projects. Some of these projects are designed to produce new technologies that can be transferred to the private sector.

The INEEL Supercomputing Center provides computing services needed to accomplish the INEEL's engineering, scientific, and administrative functions.

Leased buildings in Idaho Falls provide general engineering, administrative office, and laboratory space in support of INEEL activities.

Leased laboratories in Idaho Falls are the North Boulevard Annex, North Holmes Laboratory, North Yellowstone Complex Laboratory, May Street North, and May Street South. The North Boulevard Annex is used by the robotics organization for research on remote retrieval, handling, analysis, monitoring, and inspection of surface and subsurface waste and equipment.

Several cryogenic cutting projects are also performed in the North Boulevard Annex. The North Holmes Laboratory is used for a number of projects, including the INEEL Supervisory Control and Data Acquisition Development Project, which will be used to control the INEEL 138-kV high-voltage power distribution system, develop optical sensors, assemble electronics, test metals, and conduct the Air Support Operations Center Project for the United States Air Force. The North Yellowstone Complex Laboratory is used to support the robotics work in the North Boulevard Annex, the Air Support Operations Complex Project, and other projects in the North Holmes Laboratory. May Street North houses Long-term Research Institute projects in the areas of controlled substance detection and measurement, agricultural spray nozzles, and aerosol technology. May Street South projects consist primarily of spray-forming technology projects.

Fifty-seven percent of the 965,000 square feet of office, laboratory, and storage space leased in the Idaho Falls Area is in good condition. Ten percent is in fair or poor condition. The Willow Creek Building and the Engineering Research Office Building account for more than 50% of the leased administrative space in Idaho Falls. The remainder of the leased space comprises smaller facilities throughout the city.

The 13 buildings DOE owns at the INEEL Research Center are no more than 15 years old and are in good condition. The DOE-owned INEEL Supercomputing Center building, which was built in 1968, is in good condition.

It is DOE and INEEL policy to manage all of its land and facilities as valuable national resources. INEEL stewardship is based on the principles of ecosystem management and sustainable development. The laboratory has integrated mission, economic, ecological, social, and cultural factors in an *INEEL Comprehensive Facility and Land-Use Plan* that guides land and facility use

decisions. Together with technical site information, this comprehensive plan provides a complete picture of current INEEL land and infrastructure, and a projection of future needs and plans. The status of current facilities and major construction projects are summarized in the document in several sections including: *Condition of Laboratory Space, Age of Laboratory Buildings, Use and Condition of Laboratory Space, Laboratory Space Distribution, Facilities Replacement Value,* and *Major Construction Projects*

1.7 Summary of Significant Accomplishments

In recent years, INEEL has had successes in environmental and energy science, nuclear science and technology, biotechnology, and chemical weapons assessment. As outlined in the March 1999 INEEL Laboratory Profile, accomplishments include:

- Discovery of extremophile microorganisms in deep subsurface that catalyze the fixation of metals, including radionuclides, and mineralize organic pollutants
- Characterization of microbes that produce methane hydrates from earth/ocean sources
- Development of new infrastructure technologies for liquefied natural gas transportation
- Development of new downhole seismic array concept for oil and gas exploration
- Discovery of new plasma processes for maximizing conversion efficiency of methane gas to higher value products
- New design of an advanced tensiometer that can take unattended measurements at almost any depth
- Demonstration of the occurrence of natural attenuation of chloroethenes through application of newly derived techniques
- Development and demonstration of three radiological assay instruments for measuring contamination in subsurface soil and groundwater
- Leader of US-wide effort to produce fusion safety standards
- Developed a new, lower risk process for chemical synthesis of boron-10 enriched decaborane, a key precursor to several advanced boron agents for neutron capture therapy treatment of brain cancer
- Production of tailored nanostructured materials for a range of environmental applications, e.g., catalysts, catalyst carriers, membranes, and porous electrodes
- Decontamination of concrete structures by using microbes that naturally damage concrete
- Treatment of toxic gases and vapors using biofiltration
- Development of advanced nonaqueous biocatalysts to increase their efficacy in breaking down organic compounds
- Development of integrated chemical weapon assessment systems for the Army's Non-Stockpile Materiel Program.

2 Status Report

2.1 Management Oversight

2.1.1 Program Management

In a continuing effort to build on existing strengths, as well as to develop new strengths, INEEL actively supports the Business Management Process. This results-oriented process fosters effective communication of expectations and provides both the contractor and DOE with timely information on effectiveness of financial processes used to attain mutual goals. In principle, specific procedures for execution of a program or project are based on and governed by DOE Order 430.1A Life-cycle Asset Management and its related policies and guides. The process uses the principles of Project Management found in the Project Management Institute's Project Management Body of Knowledge (PMBOK). To ensure continuous improvement, periodic assessments are done and information identified during these assessments is incorporated into performance measurement and business planning processes.

The Department recently signed a new M&O contract with BBWI to operate the INEEL laboratory. DOE-ID expects BBWI to continue to enhance the integrated work control process and to incorporate the five core functions of Integrated Safety Management into the execution of all its work. Implementation will be evaluated based on success in demonstrated leadership, work practices, and management systems that instill discipline, rigor, a standards-based approach to implementation of all work activities at INEEL, and evidence of employee involvement in work planning, control and execution.

To this end, DOE has issued the Performance Evaluation and Measurement Plan (PEMP) for INEEL, which is structured to reflect goals and objectives of:

- DOE Strategic Plan
- EM Paths to Closure Plan
- INEEL Institutional Plan FY 2000-2004.

Implementation of these plans for INEEL will be the primary basis on which performance will be measured and rewarded as described in the PEMP. Work as reflected in the PEMP must be accomplished with requisite quality and quantity, on time, and with controlled costs and within allocated budgets. Customer satisfaction weighted by priorities and success of management integration will be key factors in performance evaluation.

In addition to the PEMP measures, INEEL is evaluated on performance metrics evaluating laboratory research efficiency. These metrics are:

- Research-to-Support Ratio
- Percent of Technical Labor on Research
- Average Cost per Research FTE.

Figure 4 shows INEEL's past and projected performance with respect to these criteria.

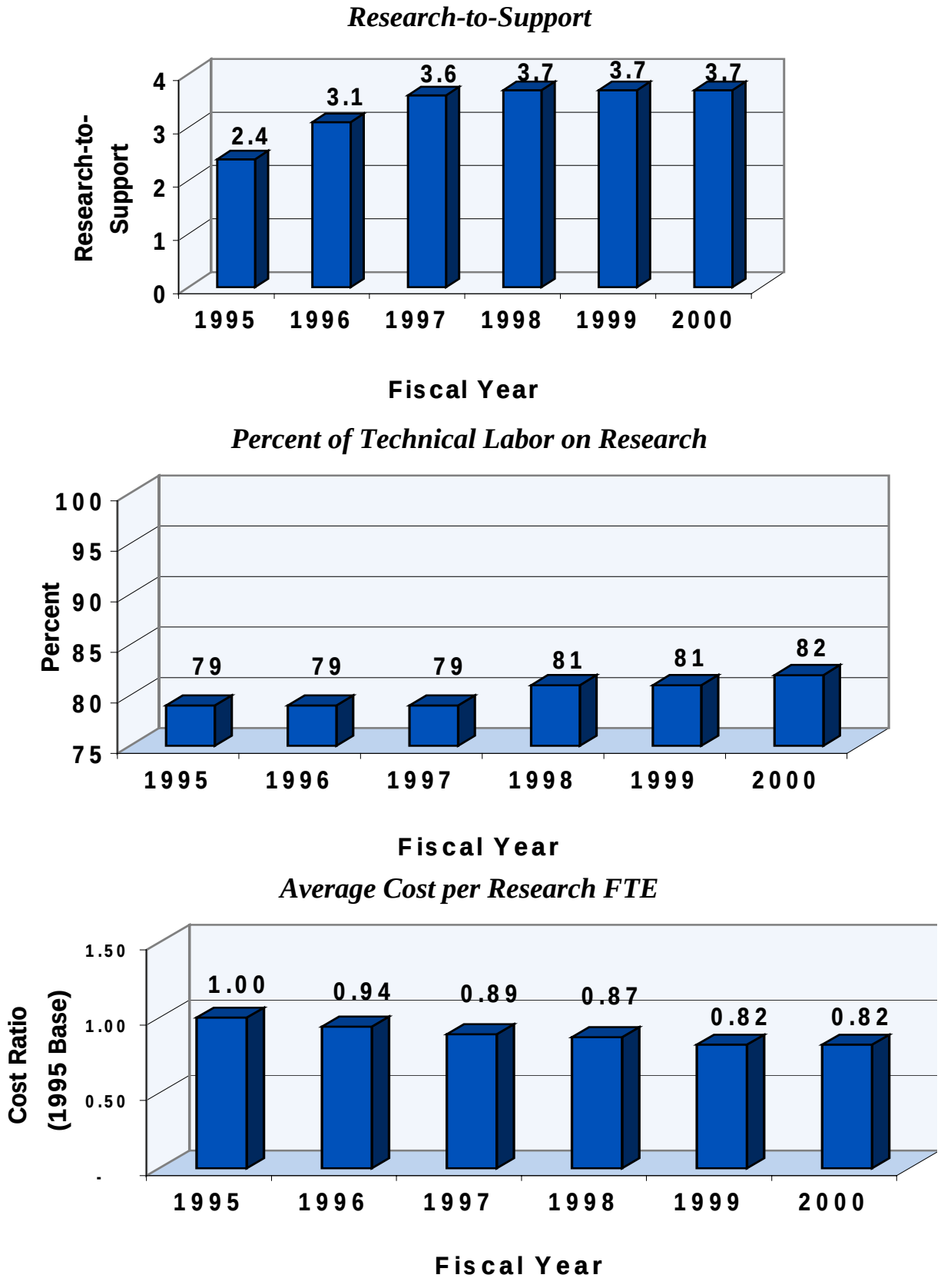

Figure 4. INEEL performance metrics FY 1995-2000.

2.1.2 Project Management

INEEL's financial/project management systems include integration of the following major functions: general ledger, cost accounting, human resources, time recording and labor distribution, payroll, procurement, materials and property management, work control, budgeting, resource planning, scheduling, and project cost performance reporting. INEEL's systems have historically been able to process financial data in a timely manner, allowing reporting of project costs within days of financial month-end closing. Planned enhancements include:

- Upgrade to a uniform standard project management software to strengthen the capabilities of critical path scheduling, resource planning and management, activity-based cost estimating, and overall project integration
- Increased flexibility in pricing/costing of work through implementing variable rate structures
- Expansion of data warehousing capabilities to include standard query tools and the ability to publish on the Internet.

2.1.3 Contracting Principles

BBWI is developing measures to improve contract management at INEEL. However, most measures are still in the formulation stage of development and are not yet advanced enough to discuss. Two of the more developed measures are performance-based incentives and best commercial practices.

BBWI believes that earning fees through meeting performance standards will lead to more efficient and cost-effective operations at INEEL. BBWI and DOE have made significant progress towards negotiation and implementation of a performance-based contract at INEEL.

BBWI also believes that contracting principles at INEEL can be improved through identification and implementation of best commercial practices. Through this implementation, INEEL's procurement practices will become closer to those used in private industry, thus simplifying the procurement process.

2.1.4 Management/Technical Reviews

INEEL engages in several review processes to evaluate managerial and technical aspects of work performed at the laboratory. INEEL has conducted a series of external reviews in recent past, including those performed by LMITCO. Emphasis was placed on the importance of peer reviews at INEEL during the October 1999 visit by Under Secretary Moniz and EM Assistant Secretary Huntoon. As a result, high quality peer review processes will be institutionalized over the coming year. In addition, BBWI is expected to implement its own internal review processes.

INEEL will use recognized scientific leaders and peer-review teams to guide focused capability expansion. To support this expansion, strategic investment in critical equipment and facilities will be made. In addition, a Strategic Advisory Council is being established to review and validate laboratory strategic planning. Past peer reviews at INEEL have included the following:

LMITCO Board of Visitors (BOV). The Board of Visitors (BOV) visited INEEL in July 1995, April 1998, and August 1999. Members of the review panel included distinguished representatives from private industry and universities. BOV reviews were to assess progress being made by LMITCO's Applied Engineering and Development Laboratory (AEDL) in meeting its mission: to establish INEEL as a world-class applied engineering and development resource for DOE and industry in support of energy and environmental domains. The latest BOV considered whether:

- Long-Range Plan is appropriate to support to INEEL's missions
- INEEL has collective skills, capabilities, and facilities to pursue its plans
- INEEL is applying appropriate resources to new business development and necessary core competencies
- INEEL is recognized in various business areas.

Long-Range Plan Peer Review Panel. The purpose of the Long-Range Plan Peer Review Panel was to conduct an ad hoc review of the draft plan by a blue ribbon team to validate technical content, plan integrity, credibility, and responsiveness to evolving missions of national significance; and advise on its successful implementation.

LMITCO Board of Directors (BOD). The charter of the LMITCO Board of Directors (BOD) was to ensure that LMITCO was achieving a key purpose: to perform technology development services and the transaction of any or all lawful business for which corporations may be incorporated under the Idaho Business Corporation Act. In this capacity, the BOD met with LMITCO senior management quarterly to determine progress on key business activities.

National Academy of Sciences Review for EM. EM's Office of Science and Technology (OST) engages in formal interactions with the National Academy of Sciences' (NAS)/National Research Council (NRC) Board on Radioactive Waste Management to ensure external review is implemented throughout EM programs. The Board has reviewed aspects of OST's programs at INEEL, including its approach to merit review, priority setting, decision-making, program structure, and research agendas for the EM Program. Most recently, NAS has reviewed the Mixed Waste Focus Area and INEEL's capabilities in long-term stewardship.

Laboratory Directed Research and Development (LDRD) and University Research Consortium (URC) External Peer Reviews. The INEEL has conducted independent external peer reviews on LDRD program elements. Nine external reviewers from universities and other government agencies, combined with business area leaders and internal INEEL staff participated in review of original proposals. Relevant members of the panel review progress of the Enterprises. In addition, each Enterprise has an advisory committee that contains external peers, business area leaders, and representatives of INEEL appropriate to that subject area. The other two program elements, Tactical and Exploratory, are reviewed internally by teams of technical leaders in respective subject areas. Only technically meritorious proposals can be funded.

The previous contractor, LMITCO, supported research proposals competing for URC funding and subject to external peer review for technical merit. Like LDRD, only technically meritorious projects are funded. An annual progress review is held at INEEL. Panels of reviewers comprised

of external peers and INEEL experts in respective areas provide feedback that enables the URC Program Manager to more effectively guide direction of the projects. The URC Program per se will be terminated on September 30, 2000. However, continued collaboration with universities beyond FY 2000 will occur as part of the INEEL LDRD Program.

2.2 Status of Programs and Program Funding

2.2.1 Major Customers/Funding

INEEL's FY 1999 R&D funding was $179.9 million. DOE is the principal sponsor of INEEL work. DOE-sponsored work is performed under the auspices of various DOE Secretarial Officers and administered through DOE-ID. EM is by far the largest source of funding for INEEL work. Figure 5 shows INEEL's major customers and projected outyear funding. The category "Other DOE" includes funding from SC, FE, NN, DP, and Office of Environment, Health, and Safety (EH) and transfers from other offices. These projections are extrapolations based on current percent of R&D funding to total funding from each office.

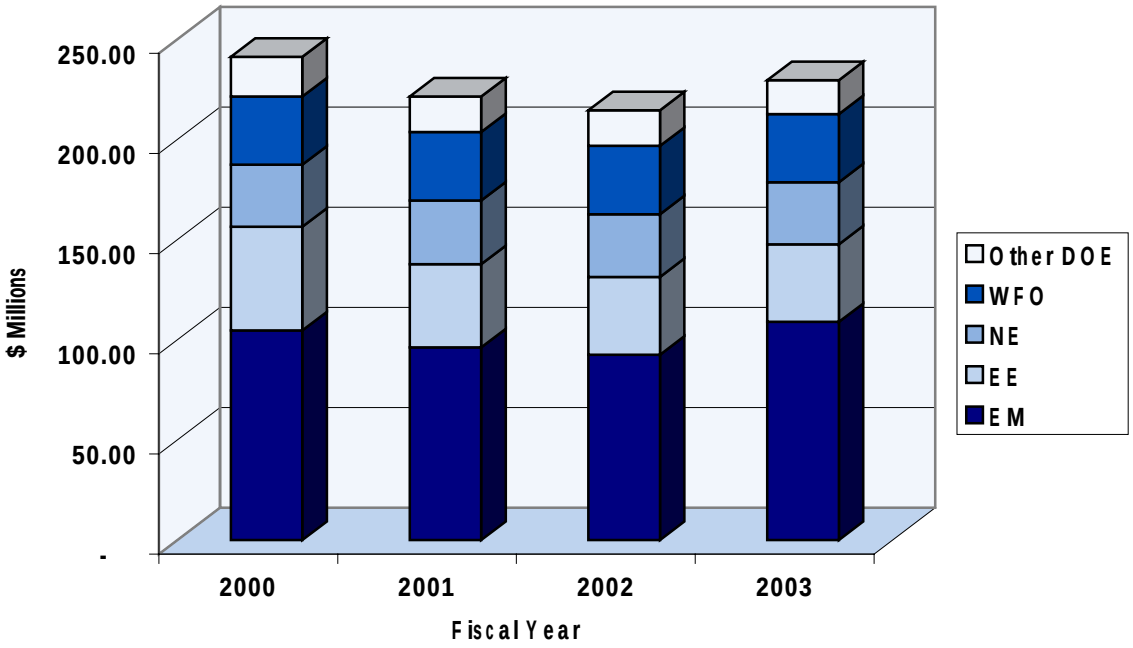

Figure 5. Projections of outyear customer funding: FY 2000 - FY 2003.

2.2.2 Work for Others

About 9% of INEEL's FY 1998 R&D funds ($21.7 million) came from federal entities other than DOE programs. Work for Others (WFO) at INEEL focuses on areas of unique laboratory capabilities unavailable to the private sector. Major customers include DoD, NRC, and nonfederal organizations such as state and local governments, private industry, and foreign entities. Figure 6 depicts INEEL's WFO process.

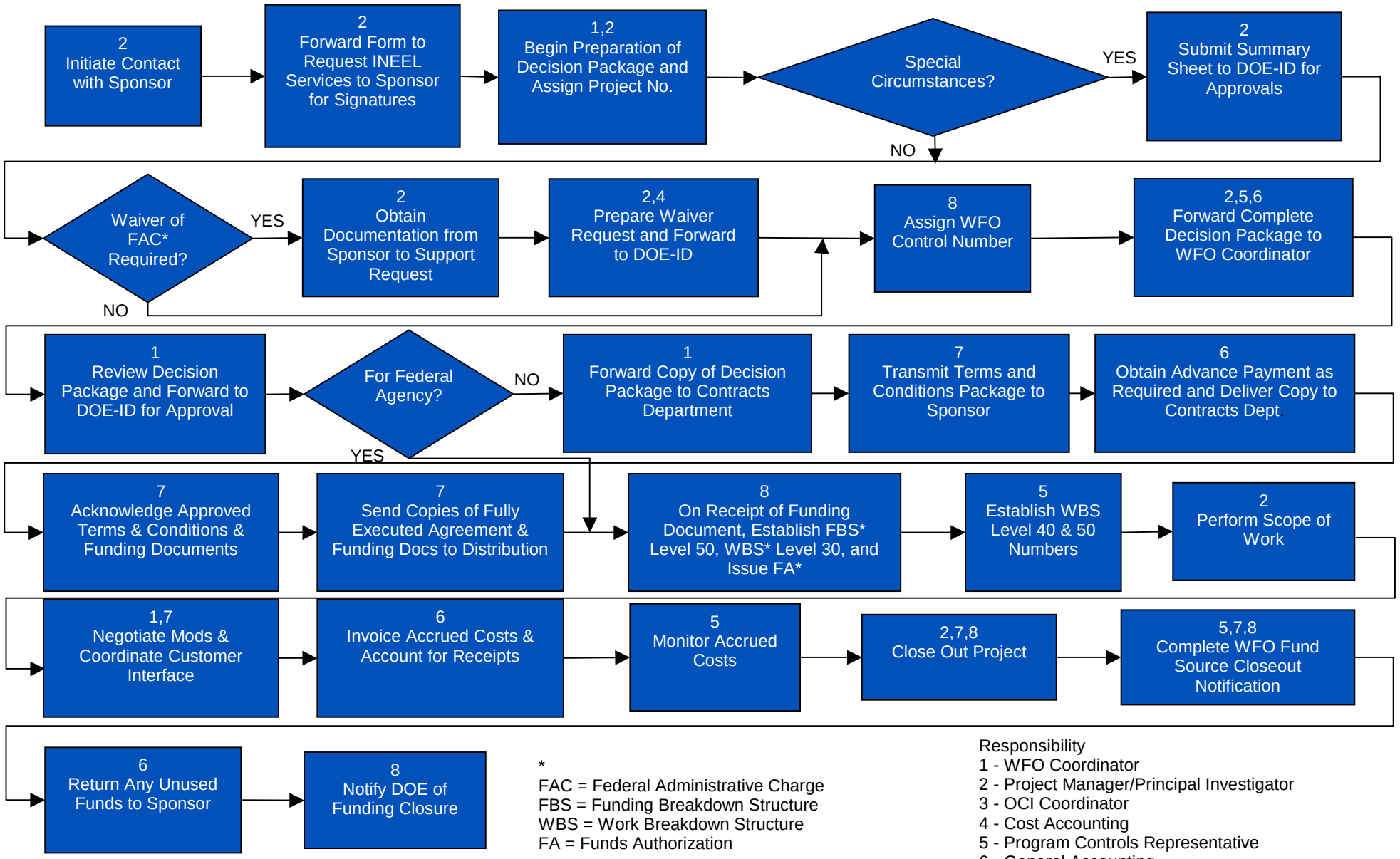

Figure 6. WFO Process at INEEL.

Nuclear Regulatory Commission

Work for the Nuclear Regulatory Commission (NRC) focuses on developing and validating computer codes for nuclear plant safety and risk analysis, developing and applying risk-based performance and regulatory parameters, and providing technical products and services for effective regulation of U.S. nuclear facilities and operations.

Nuclear Reactor Regulation. INEEL assists the NRC Office of Nuclear Reactor Regulation in operating reactor licensing review, advanced reactor certification, regional operator licensing examination, generic safety issue resolution, unresolved safety issues, plant inspections, compliance issues, and risk assessment.

Nuclear Regulatory Research. INEEL performs work in several areas for NRC's Office of Nuclear Regulatory Research. Areas include light-water reactor thermal-hydraulics, severe accident behavior, reactor aging, safety research, safety equipment operability, probabilistic risk assessment, and low-level radioactive waste research.

Analysis and Evaluation of Operational Data. INEEL supports the NRC Office of Analysis and Evaluation of Operational Data and the Information Resources Management Office in all phases of analyzing operational data from commercial nuclear power plants, including database design and maintenance, data classification, trends and patterns analysis, and overall assessment of data needs and resources. Statistical and risk analysis services are provided for operational event assessment programs.

Department of Defense

INEEL collaborates with DoD on a variety of programs aimed at furthering R&D of environmentally related technologies. These programs include efforts in environmental management and compliance technology, electronics, advanced computing, automatic identification technologies, and testing and evaluation.

Environmental Management and Compliance Technology. INEEL is working with DoD to research and develop new technologies and methods capable of enhancing waste minimization activities. For example, a DOE and U.S. Airforce Interagency Demonstration Program, mutually beneficial to both DOE national laboratories and DOE environmental research facilities, is developing infrastructure to integrate waste minimization activities. Initiatives being pursued are focused on coordinating DOE's waste minimization activities in defense programs, microelectronics, and hazardous waste treatment.

Another example of environmental management through waste minimization is INEEL's involvement in the U.S. Army's M1-A2 Abrams Tank heavy armor manufacturing. Production of heavy armor is accomplished at INEEL's Specific Manufacturing Capability facility. R&D in use of waste materials for production of heavy armor for tanks has helped INEEL's waste minimization program, while producing an improved armor for tanks.

Electronics. INEEL has teamed its scientists and engineers with DoD personnel to advance R&D efforts in electronics. These collaborative R&D efforts have resulted in:

- Video communications prototype for a worldwide intelligence communications system
- Relocatable Tactical Air Control Center (which has become the model for output produced under a commercial contract)
- Prototype Air Support Operations Center for Air Force Combat Command
- Special Operations Media System for psychological warfare
- Various video distribution systems key to upgrade of command and control capabilities of North American Air Defense Command.

Based on technical expertise gained through these collaborative efforts, INEEL has developed new technologies relative to environmental restoration efforts. One such example is electronics developed and implemented in the Light Duty Utility Arm (LDUA) utilized during characterization of an INEEL tank farm containing high-level radioactive waste.

Advanced Computing. INEEL has participated in several advanced computing R&D projects with DoD, including enhancing mission planning tools for the U.S. Air Force, and developing and applying a software development environment called SAGE ST for the Ada programming language. These collaborative efforts included product development, training, prototype development, and maintenance of an AdaSAGE Users Group.

Automatic Identification Technologies. For the past 3 years, INEEL has been involved in R&D to advance the technical capabilities and use of automatic identification technologies. Several government and private sector applications have been identified for recently developed two-dimensional bar codes that function as portable data files. Applications that have resulted from these R&D efforts include transportation and management of hazardous and nuclear materials, documentation management in office and remote environments, patient handling in hospitals, and logistics management.

Testing and Evaluation. INEEL is working with DoD in other R&D efforts relative to design and construction of test facilities and simulators. These efforts have included:

- A liquid rocket engine test stand for studying thrust chambers and gas generators for a liquid rocket engine
- One-of-a-kind environmental test chamber capable of using contaminated materials in live-fire exercises while maintaining containment integrity
- Test facility capable of simulating various weather conditions (105^{o} to -40^{o}F) during live-fire exercises
- Siting of several radiation effect simulators and associated facilities.

Other Federal Agencies

INEEL provides R&D services to other federal agencies such as the Federal Emergency Management Agency (FEMA), U.S. Department of Interior (DOI), U.S. Department of Transportation (DOT), EPA, and National Aeronautics and Space Administration (NASA). R&D work with other federal agencies enhances R&D capabilities of INEEL, thus better enabling INEEL to complete DOE missions. This broadened scope of R&D enhances INEEL's capabilities through R&D in areas that hold the potential to identify new technologies that will further DOE's missions needs. Examples of services provided include:

- Evaluating explosive vapor detection systems for the Federal Aviation Administration (FAA)
- Analyzing safety data for FAA
- Conducting environmental studies in the Antarctic for the National Science Foundation (NSF)
- Developing a human reliability model for NASA
- Developing a vehicle interdiction model for the Department of Justice (DOJ).

In addition, bimodal (nuclear and solar) systems research is being supported by the Air Force Space Command. The Hot Hydrogen Test Facility provides INEEL with a unique capability to conduct basic research in this area.

As part of a joint effort with the Air Force Phillips Laboratory, INEEL is working with Russian research institutes to acquire advanced technologies for identifying and tracking space debris.

Non-Federal Agencies

INEEL provides WFO R&D services to the private sector, universities, state and local governments, and foreign countries. These services include computer code support, irradiation, battery testing, and dosimetry services.

International Work for Others

The largest growth in WFO income is from international projects, which accounted for more than 10% of total WFO in FY 1999. Examples of significant international projects are materials irradiation for a Japanese company ($5M), demilitarization work in Greece ($3M), software development and transfer for a United Kingdom company ($2M) and a number of nuclear projects in Korea and Taiwan (>$2M).

Completed, current, and proposed WFO is being pursued in the United Kingdom, Norway, Spain, France, Estonia, Hungary, Poland, Czech Republic, Bulgaria, Italy, Greece, Turkey, Israel, Netherlands, Slovakia, Japan, Korea, Taiwan, Indonesia, Malaysia, Russia, Ukraine, Kazakhstan, Chile, South Africa, Australia, and Antarctica.

Major international WFO initiatives include environmental technologies, waste management, nuclear medicine, nuclear safety, spent nuclear fuel management, materials irradiation, decontamination and decommissioning, hazardous waste characterization and remediation, mission assurance, and oil and gas technologies.

2.2.3 Discretionary Research Programs

The INEEL manages two discretionary research programs: (1) Laboratory Directed Research and Development (LDRD) as authorized by DOE Order 413.2 and as a carryover activity associated with LMITCO's M&O contract, and (2) University Research Consortium (URC).

Funding for the two research programs was $21.4M in FY 1999. For FY 2000, restrictive language incorporated into Energy and Water Appropriation Bill H.R. 2605-14 prohibits charging LDRD activities to the EM Program. INEEL is pursuing a reprogramming effort, which

will result in EM sponsorship of direct program funding to support the INEEL leadership role of environmental research. The appropriation language constraint and EM reprogramming efforts resulted in additional considerations that needed to be evaluated for proper funding of research projects in FY 2000.

INEEL has assessed its planned FY 2000 research portfolio against these constraints. Issues that have arisen out of this assessment have been mutually discussed between INEEL and DOE-ID for determination of the best path forward. Consistent with recent legislation, LDRD will be funded in FY 2000 at $7.7M derived from indirect sources other than those provided by EM. The LDRD budget will be limited to 4% of non-EM INEEL base funding (approx. $192M). Projects that were approved by LMITCO that are perceived to be inconsistent with the objectives of LDRD have been removed from INEEL's FY 2000 LDRD portfolio.

Laboratory Directed Research and Development

INEEL LDRD Program is aligned with and supports objectives described in INEEL Institutional Plan. LDRD spans the spectrum from fundamental to applied science and engineering. The LDRD program's stated objectives are to:

- Enhance technical vitality of the laboratory
- Enhance ability to address future DOE missions
- Foster creativity; stimulate exploration of forefront science and technology
- Serve as a proving ground for new research
- Support high-risk, potentially high value R&D.

LDRD enables INEEL to stimulate mission-oriented technological development, assist with post-Cold War cleanup, and address environmental threats using modeling, simulation, and testing to reduce the risks of employing new technologies. Research enables INEEL to maintain its technical vitality so it can address nuclear, national security, and science missions of DOE.

A management system has been established to ensure that LDRD meets requirements and is responsive to laboratory needs and DOE. The LDRD Program Manager reports to the Director for Education and Research Initiatives, who in turn reports the Chief Scientist, who reports to INEEL Laboratory Director. The LDRD Program is supported by administrative and technical staff who:

- Develop and issue an annual Call for Proposals
- Support development of current-year research portfolio
- Monitor technical progress, including coordinating mid-year reviews and reviewing interim progress and final reports
- Analyze research portfolio performance
- Monitor and control expenditures
- Develop and maintain the LDRD Program Database
- Prepare an annual written report on the Laboratory's LDRD Program distributed to the DOE Cognizant Secretarial Office, DOE-ID, and Office of Scientific and Technical Information

- Communicate vision, results and status of the LDRD research portfolio to a variety of stakeholders within and outside the laboratory.

The annual LDRD Call for Proposals is developed and issued between January and May of the previous fiscal year. Relevant managers submit descriptions of strategic objectives and associated technology needs to the LDRD Office. A Call for Proposals is issued that considers science and technology needs, and the need to support key technologies and other crucial research including enabling or crosscutting technologies. The solicitation encourages innovative approaches proposed by individual researchers or small, multidisciplinary teams. It contains a description of the objectives and requirements of the LDRD Program, a schedule of key activities in the proposal process, guidance for preparing and submitting proposals responsive to three elements of the LDRD research portfolio, and proposal evaluation criteria.

Technical progress of LDRD projects is tracked through mid-year reviews and annual reports. All LDRD projects are reviewed for progress after approximately six months from the start date. The objectives of the review are to identify potential problems and suggest corrective actions as appropriate. It is an opportunity to encourage awareness within the research community of research activities in the LDRD Program and analyze early trends in the portfolio as a whole. Re-direction of funds is authorized in those cases where it has become apparent that originally proposed objectives are impossible, or when experimental results suggest value in altering emphasis.

An Annual Report is required for each research project funded by LDRD. From individual reports, a composite LDRD Program Annual Report is compiled and distributed to DOE and INEEL managers within six months of the end of the fiscal year. Periodic presentations and informal communications are scheduled to keep the DOE-ID staff informed of progress and issues. EM is informed of progress and issues during visits to INEEL or DOE-HQ.

National awards such as the prestigious R&D 100 Awards presented by R&D Magazine have recognized originality and significance of research sponsored by INEEL LDRD. In FY 1998, researchers at INEEL received three awards, and in FY 1999 an unprecedented five awards. An estimated 75% of intellectual property generated at INEEL has its roots in LDRD research. Approximately 75% of follow-on R&D that is performed by the laboratory is a result of successful research proposals that were rendered more competitive by virtue of previous LDRD research. LDRD has enabled visiting scientists, graduate students and postdoctoral scientists to conduct work in INEEL laboratories. Many of these students and post doctorates have been hired by INEEL, enriching technical expertise and capabilities at INEEL.

University Research Consortium Program

URC derived its funding as part of the LMITCO contract at the INEEL, and, as such, was not a direct part of LDRD. It was designed to engage the talent of university researchers in partnerships with INEEL researchers on topics of importance to INEEL science and engineering objectives in support of DOE missions. The program's stated objectives are:

- Engage university talent in research partnerships that support INEEL long-range objectives
- Enhance technical resource of INEEL

- Increase visibility and value of INEEL research enterprise to its customers
- Extend INEEL technical capabilities beyond historical core competencies.

Research foci include fundamental studies as well as applications-oriented R&D that have relevance to environmental and nuclear science and engineering. The program has engaged scientists from 63 universities in 36 states.

Under the terms of the LMITCO contract, INEEL's URC program was specifically designed to leverage INEEL research capabilities with those of selected universities to develop new technologies useful in the competitive economy or in meeting national needs consistent with DOE business lines. Continuation of this program in FY 2000 is in fulfillment of responsibility to assume the commitments and obligations resulting from subcontracts previously awarded by LMITCO. The URC program per se will be terminated on September 30, 2000. However, continued collaboration with universities beyond FY 2000 will occur as part of the LDRD program.

2.2.4 Partnerships

INEEL partners with industry, universities, and other DOE laboratories to fulfill its mission. Figure 7 summarizes the most recent partnerships and programs with these entities.

Category/Mission	Partner	Description
Environmental Quality	University of Idaho, PNNL, SRTC, EPA, AEA (UK)	Vadose zone and biogeotechnology research, natural attenuation of contaminants, characterization and remediation of surface and subsurface
	Canberra Industries, Envirocare, LANL, SRS	Focus Area Integration in the development of TRU waste assembly, mixed waste treatment, and disposition of Pu
	MIT, NRC, SRS, ANL, France, Japan, Russia	Technology for the development, recycling, safe storage, and regulation of spent nuclear fuel. International Criticality Evaluation Benchmark Program.
	Fernald, Parsons, BNFL, TLG Services	Accelerated Site Technology Development and Large Scale Demonstration of advanced deactivation and decommissioning technologies
	State of Idaho, Yellowstone Park	Natural Resource Initiative, environmental collaboration on energy, infrastructure, watershed management, aquatic habitat, and hazard mitigation
	Greece, Russia, Korean Nuclear Society	Water treatment technology, advanced separation technologies, and waste form evaluation and materials research
	U. of Arizona, Miss. St., Utah St., Washington St.	Agriculture sensors and information systems for productivity enhancement and reduced environmental impact
Energy Resources	MIT	R&D of advanced nuclear fuel cycles and power systems; development of improved regulatory system for DOE's nuclear facilities
	UK, Japan, Korea, Taiwan	Irradiation testing of materials, advanced nuclear power and nuclear regulatory technical support, technology development and transfer
	GM, Ford, Chrysler, SNL, ANL	Partnership for Next Generation Vehicle, electric/hybrid vehicle development, advanced battery R&D
	USACOE, Bonneville Power, ORNL	Advanced hydropower turbine development; passive fish migration survival research
	GRI, Pacific Gas &	R&D of technology for liquefied natural gas fueled

Category/Mission	Partner	Description
	Electric, BNL, ANL, et al.	vehicles and supporting fueling infrastructure
Science & Technology	20 Universities	Ongoing URC research on topics supporting DOE's missions for a total of $29 million since 1995
	LBNL, LLNL, ORNL, PNNL, SNL, BNL, Ames	Seven projects in DOE's Center of Excellence of the Synthesis and Processing of Advanced Materials
	PETN-Netherlands	Boron Neutron Capture Therapy (BNCT) partnerships with European Union BNCT research programs for treatment of brain cancer
National Security	US Army	Development of next-generation chemical weapons assessment systems to be deployed by the Technical Escort Unit
	Idaho State University	Collaboration to establish the Idaho Accelerator Center for nuclear application, includes nonproliferation applications
	LANL	Development of production process evaluation tools to support sound decisions for long term nuclear stockpile stewardship
	Idaho Criminal Investigation Bureau	Partnership to establish the Northwest Testbed for drug enforcement technologies for the Office of National Drug Control Policy

Figure 7. INEEL partnerships with industry, government agencies, and universities.

2.2.5 Technology Transfer

BBWI plans to grow the Technology Transfer function at INEEL consistent with the missions of DOE and INEEL. Within the missions, three main technology thrusts will be made:

Environmental Management: INEEL has developed substantial expertise in the general area of environmental management. Technology Transfer will ensure that benefits from these technologies are made available on both a national and international basis. This will provide benefits to the environment and associated population base.

Nuclear Energy: INEEL has a long history of technology development and deployment related to nuclear energy. In this era of concern related to global warming and carbon emissions, it is highly beneficial that this nuclear energy option be kept viable for the U.S. Technology transfer will assist by finding commercial and international applications of nuclear energy expertise consistent with national needs and policy. This will provide additional funding for maintaining the currency of nuclear technology.

Energy: INEEL has developed areas of expertise that can be applied to the broader mission areas of INEEL. Computer modeling of reaction kinetics, materials expertise, and an understanding of subsurface science can support additional DOE mission areas. Technology transfer will support these areas by marketing INEEL's technology base into associated commercial ventures.

It is the objective of INEEL in technology transfer to increase licensing of technology to the commercial sector by an order of magnitude over the planning period. Increased licensing could result in INEEL having a strengthened position regarding commercialization of technology within DOE Laboratories. It will have the joint benefits of improving the level of technology and competitiveness of U.S. industry and providing additional revenues to INEEL.

A unique feature of BBWI's commitment is in providing funding for technical organizations at INEEL in an amount equivalent to a percentage of fee earned by BBWI under its contract. BBWI partners will use this Corporate Funded Research & Development (CFRD) to grow technical capabilities at INEEL within assigned DOE mission areas. This investment in CFRD will necessarily be in technical areas of interest to BBWI partners, will build on technical capabilities that exist at INEEL, and will not interfere with assigned INEEL missions.

BBWI partners are committed to moving a portion of their research activities to the Idaho Falls area. This will allow interaction of corporate research personnel with INEEL personnel in peer review. Some interchange of personnel that will result in improvement of technical knowledge on both sides and some flow of funding into INEEL is expected. A final benefit is diversification of the local economy through moving personnel to Idaho Falls.

DOE-ID personnel are integral members of the technology transfer team in the vision of BBWI. A DOE-ID individual is the Chair of the Technology Transfer Working Group, a DOE-wide group working on issues associated with technology transfer. One of the BBWI Technology Transfer Directorate personnel is chairing a conference for DOE on technology transfer. This cooperative effort at INEEL will enable achievement of stated goals.

INEEL technology transfer and business development efforts are championed by Industry Focus Teams organized to work with companies and organizations in several industries, including environmental, petroleum, agriculture, manufacturing, nuclear, transportation, and software. Technology transfer has marketing and technical personnel from companies in pertinent industry areas as liaisons with its teams. Each team is supported by at least one Technology Transfer Office (TTO) account executive and is led by a product manager from a line organization. The team has a portfolio of technologies and expertise and is responsible for meeting specific business objectives for licensing, new business, and starting new companies. Technologies considered for licensing are given market evaluations as a first step in the technology transfer process.

Technology transfer activities, summarized in Figure 8, have demonstrated effective leveraging of programmatic funds to accomplish technology commercialization, new business, and business creation objectives of the laboratory. Since FY 1995, technology transfer efforts have resulted in:

- 192 patent applications filed and 72 patents issued
- 84 fee-bearing technology licenses ($1M in royalties) and 475 non-fee-bearing licenses
- 69 CRADAs or similar agreements ($7M)
- 28 new businesses spun out of the laboratory
- 129 new WFO agreements ($200M).

BBWI has reviewed all current license agreements to ensure they are being actively pursued and all required payments have been made. As a result of the review, it is expected that several license agreements will be terminated. Invoices have been forwarded to all licensees in arrears on their payments and appropriate action will be taken after licensees have ample time to bring payments up to date.

Another firm is suing a licensee for patent infringement. An arbitration hearing was held and the finding was in favor of the licensee. The third party firm has persisted in its suit, but it is not expected the suit will be successful based on legal opinion and the arbitration finding.

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	5-Year Total
Intellectual Property						
Invention Disclosure	140	97	102	108	102	549
Patents Applications Filed	38	47	62	69	66	282
Patents Issued	13	23	15	31	27	109
Licensing						
Licenses Signed-Fee Bearing	21	29	9	12	9	80
Licenses Signed-Non-Fee Bearing	14	19	78	315	319	745
Total Licenses Signed	35	48	87	327	328	825
Technologies Associated with Licenses (Fee and Non-Fee Bearing)	39	76	97	334	331	877
Royalties Received	$86,428	$212,206	$358,529	$414,840	$224,390	$1,296,393
CRADAs						
New CRADAs	19	23	10	6	8	66
CRADA Modifications	8	12	9	10	5	44
Delinquent CRADA Closeouts					25	25
CRADA Funds ($K)	$2,076	$588	$4,606	$1,778	$361	$9,409
Total CRADA Value ($K)	$39,551	$25,554	$7,090	$9,331	$6,824	$88,197
Work For Others						
New WFO Packages	28	32	34	45	37	176
WFO Dollars in the Door ($M)	$72.0	$65.8	$74.5	$70.5	$82	$364.8
Spin Off/Startup Companies	5	10	7	5	1	28
International Projects						
Booked Projects	N/A	3	1	11	24	39
Booked Funding ($M)	N/A	$0.31	$1.0	$7.4	$8.3	$17.0

Figure 8. Technology transfer summary data: FY 1995 - FY 1999.

2.2.6 New Business Based on INEEL-developed Technology.

Since 1995, commercialization of technologies at INEEL has resulted in 28 spin-off companies. In 1999, concealed weapons detection equipment was developed at INEEL and licensed to a company named IES to meet safety needs of government regulatory agencies. IES manufactures and sells equipment to protect law enforcement employees while dealing with criminals.

One method for recognition of the quality of the technology developed at INEEL is through R&D 100 Awards. *R&D Magazine* grants R&D 100 Awards to the top 100 R&D innovations each year. BBWI is committed to continuing testing its technology developments against the best to

be offered nationally in the R&D 100 Award annual competition. Employees at INEEL won five R&D 100 Awards last year. A typical example is a petroleum tank inspection robot that is the basis for a spinout company, Solex Robotics, from INEEL. The tank inspection robot has been commercially deployed and has advantages of lower cost, reduction in waste materials, and increased safety over conventional tank inspection techniques.

2.3 Status of Staffing

2.3.1 Demographics

INEEL currently has approximately 1,450 staff supporting its R&D efforts. Exempt staff are highly educated and skilled scientists and engineers, many with years of experience in supporting site missions. Approximately 45% of the staff have advanced degrees. Figure 9 depicts both skill mix and educational levels of R&D staff. Figure 10 shows the overall age distribution of INEEL R&D staff.

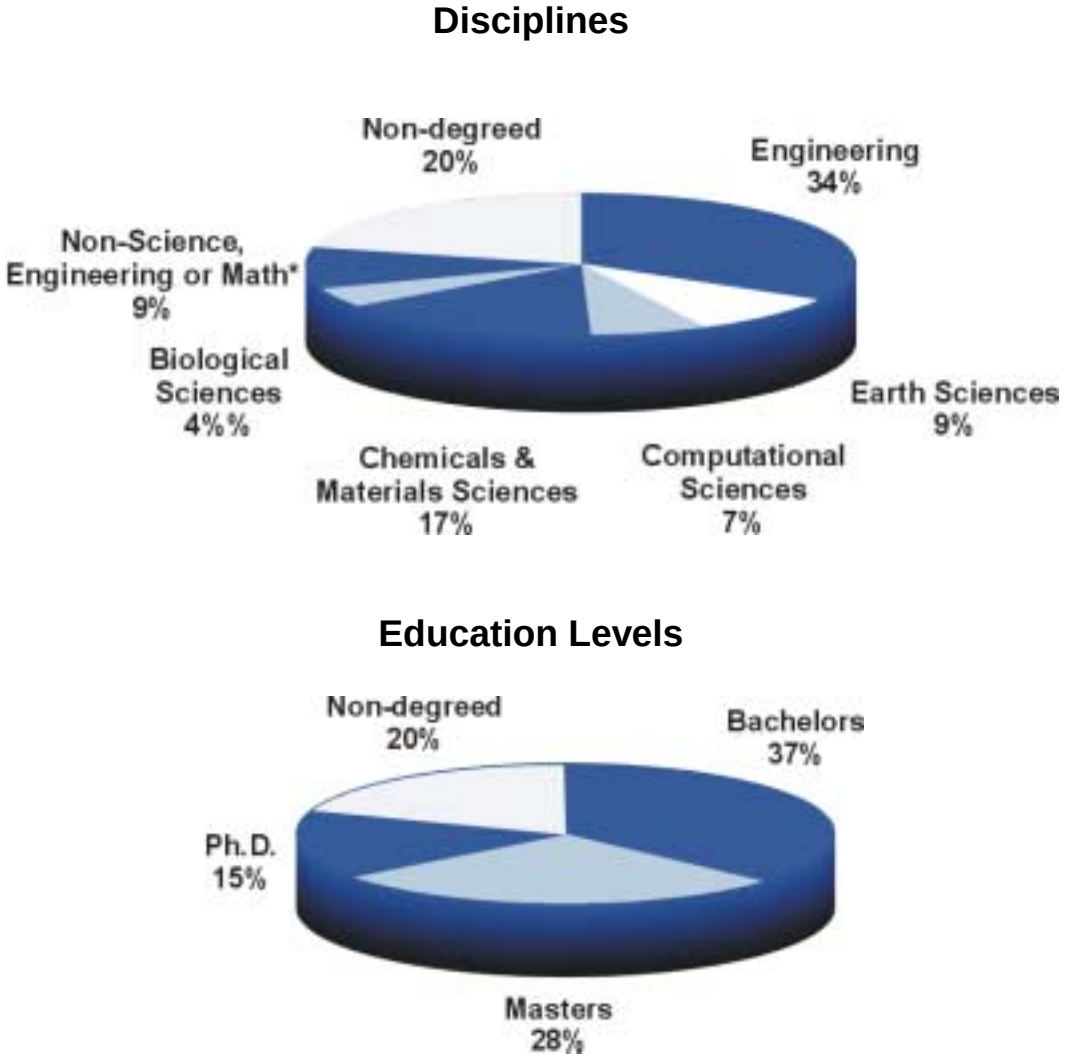

Figure 9. Skill mix and education of R&D staff.

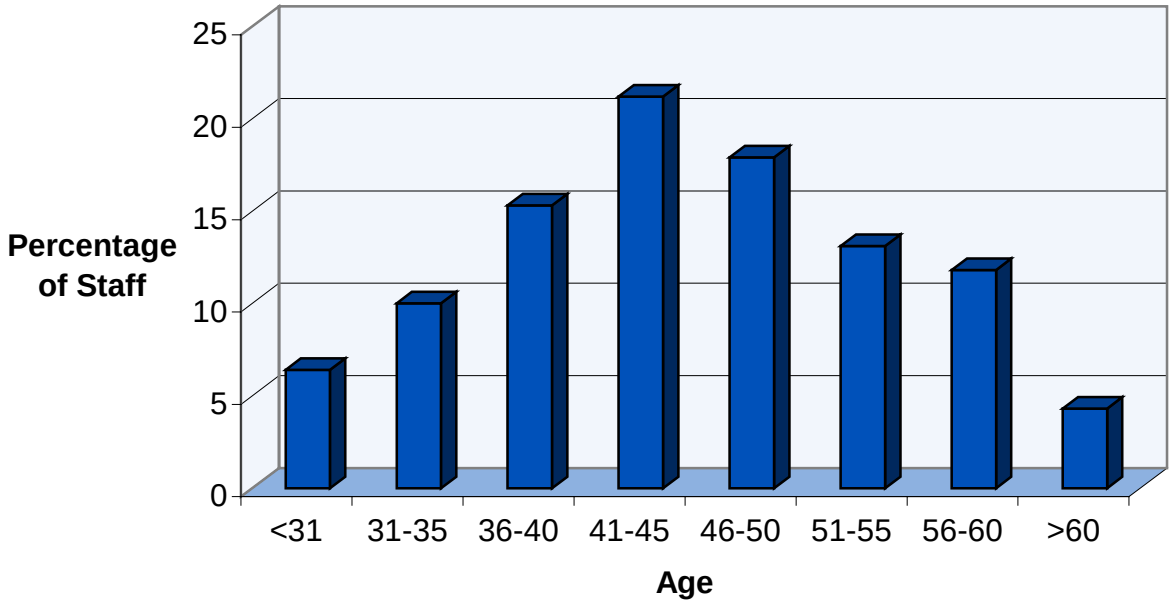

Figure 10. Overall age distribution of INEEL R&D staff.

2.3.2 Staffing Needs for Entire Site

Figure 11 shows results of a near-term staffing gap analysis in strategic areas performed by INEEL. This analysis, *Demographic Analysis of INEEL Scientists and Engineers by Highest Technical Degree, Draft, Revision C, April 29, 1999,* was discussed in general terms with Under Secretary Moniz and EM Assistant Secretary Huntoon. Other technical staffing issues that were discussed include:

- Need to increase level of advanced degrees in strategic INEEL disciplines
- Add 50 new Ph.D.s in the next 3 years and 170 Ph.D.- and 190 Master-level personnel over the next 10 years
- Recruit 5 outstanding scientists in FY 2000 in strategic INEEL disciplines
- Increase number of postdoctoral positions
- Provide 100 postdoctoral positions within 10 years
- Increase postdoctoral positions to 28 (50% increase) in FY 2000, chemistry (8), biology (7), physics (6), and engineering (7).

Analysis identified gaps across the site and over 50% of these positions are for R&D. Numbers of staff may be modified as specific needs of major programs become more definitive. Impacts of funding availability throughout the year may require changes in strategies.

INEEL proposes a systematic effort to strengthen disciplines whose support is needed for ongoing and new programs. The Undersurface Subsurface Environmental (USE) Program is an example where weaknesses exist in disciplines related to USE. A systematic effort would consist of a tiered program to add technical depth at the Ph.D. and support staff levels in associated disciplines. The first tier would comprise disciplines of earth science, biological science, and

computational science, in that order of priority. The second tier would consist of characterization and measurement science (including physics), chemical and material science, and applied engineering, with equal emphasis on the first two and less emphasis on the third. A similar protocol would be developed for other recommended strategies.

Discipline	Ph.D.			M.S.		
	Current Staff	Total Needed	New Hires	Current Staff	Total Needed	New Hires
Biological Sciences	14	37	23	31	41	10
Characterization and Measurement	33	49	16	29	38	9
Chemical and Materials Sciences	80	111	31	117	154	37
Computational Science	9	52	43	55	72	17
Earth Science	13	43	30	75	98	23
Engineering	61	88	27	300	394	94
Total	**210**	**380**	**170**	**607**	**797**	**190**

Figure 11. Entire site staffing needs over the next 10 years: FY 1999 – FY 2009.

2.3.3 Labor Relations

INEEL laboratory employees are represented by a number of unions:

- Paper Allied-Industrial, Chemical, and Energy Workers
- Idaho Building and Construction Trade Council
- United Plant and Guard Workers of America
- Brotherhood of Teamsters
- Amalgamated Transit Workers.

In general, labor relations are cooperative, with exception of issues surrounding the spent fuel program and the crafts involved. DOE-ID is planning a privatization contract for movement of spent nuclear fuel from fuel ponds to dry storage. Currently union workers at the site perform this activity. There is concern by the unions that, on award of the privatization contract, BBWI will not use union labor or will use different unions. There is no indication of when to expect resolution of this issue, which currently rests with DOE's Office of Worker Transition and Community Relations.

2.3.4 Other Workforce Issues

INEEL, as other organizations throughout DOE, is concerned over loss of qualified people through retirement and attrition. It is becoming increasingly difficult to recruit highly qualified or even apprentice scientists in some of INEEL's areas of technical expertise. This problem will become worse as universities discontinue programs that supported Cold War R&D subject areas.

There are existing resources in place at INEEL with which to form a solid basis for expanded research and technology development programs. INEEL needs to take an aggressive approach to growing and sustaining its current assets in strategically determined disciplines. This is essential

to being able to expand capabilities and to correspondingly support the pursuit of large-scale R&D programs and facilities supporting DOE missions.

Maintaining and growing the core competency of the DOE nuclear weapons complex was addressed in the opening statement, and by numerous other speakers, at the annual Energy Facility Contractors Group (EFCOG) Directors meeting, held March 3, 1999. Statistical analysis indicates that 21% of industry workforce is over age 50, whereas in DOE the figure is 34%. At INEEL, 29% of the workforce is over 50, with the average age being 45.5 years.

To address these issues, INEEL conducts an annual site-wide survey of employees to update its skills inventory database. In this database, employees list up to 10 different skill areas in which they have proficiency. These skills may or may not be employed by individuals in their current assignments. Additionally, Human Resources prepares 3-year projections of skill mix requirements quarterly. Comparing information from the database with projections enables INEEL to anticipate changes in skill mix requirements and to plan for retraining, outplacement, or additional recruitment. INEEL is currently looking at modifying the budgeting process to require that labor projections be entered by common occupational classification tie skill requirements to funding sources and reflect monthly variations. This will enable INEEL to feed required data into the DOE complex-wide Work Force Information System.

INEEL has internal systems in place to facilitate employee growth and advancement. The contractor administers an internal job-posting system that offers preference to current employees in applying for positions that are advancement opportunities.

To help INEEL employees prepare for career advancement opportunities, the contractor administers an active educational assistance program whereby current employees may take college-level courses to acquire undergraduate and graduate degrees in many disciplines, including several scientific and engineering fields. Many of these courses are available locally during evening hours. Additionally, full-time employees who meet eligibility criteria and are interested in pursuing their education full-time may participate in a degree program that allows them to retain benefits of full-time employment, working as few as 20 hours per week while they attend classes.

INEEL employees influence engineering and science education by sitting on local, state, and regional executive boards, academic advisory councils, and education steering committees. Several employees teach courses as adjunct professors at local schools and universities.

Advanced management classes from the Massachusetts Institute of Technology (MIT) using advanced distance learning methods, and Harvard teaching onsite, add vital knowledge to the contractor management team. Participation in corporate Management Institute programs contributes to development of management capability within the organization.

Personnel who are transitioning into new areas of technical responsibility or affected by skill mix changes are assisted through the INEEL Transition Center. The center is funded through operating budgets as well as the State of Idaho work force transition council. Where appropriate, employees with jobs not identified as necessary in the INEEL Institutional Plan are individually retrained in new technologies essential for mission work.

In addition to internal efforts, the contractor recruits at 42 colleges and universities nationwide, including several institutions with high minority student representation. The company participates in minority career fairs and advertises position announcements nationally in professional and minority publications.

Based on emerging skill mix requirements, the contractor has developed and implemented a college recruiting at local and regional institutions with academic programs in areas for which the company is seeking candidates. The contractor will continue to participate in high technology career fairs, advertise in professional publications, and use INEEL Internet home page and other automated job listing services. Where necessary, the company contracts with professional search firms to fill positions for which candidates are not readily available.

The contractor's close association with academic institutions, e.g., Historically Black Colleges and Universities/Minority Institutions (HBCU/MI), Hispanic Serving Institutions, and American Indian Serving Institutions supports diversity within the work force. Approximately 400 students annually receive fellowships to perform research and engineering projects at the laboratory. Twenty percent of those are traditionally from minority/female groups, providing a rich pool for future full-time employees. For example, INEEL sponsors several programs that provide support to technical women in the form of continuing education, summer fellowships, and job placement. In addition to HBCU/MI curriculum, these programs include:

- PATH (Provide a Trusting Hand)
- Employee Education Program
- Hispanic Youth Symposium particularly focused on women in engineering.

Appendix A presents INEEL's Equal Opportunity Employment site-wide statistics.

2.4 Operations Oversight

2.4.1 Capital Equipment

Annually, INEEL develops a facilities plan through a process of evaluation and prioritization. This evaluation considers current and future facility needs based on INEEL's critical outcomes and regulatory drivers. Based on this evaluation, INEEL has requested a capital equipment budget of $1.3 million for R&D ($3.88 million site-wide) for FY 2000. In addition, a site-wide request for Program Construction funding of $12.29 million and $28.23 million for General Purpose Facilities (GPF), General Plant Projects (GPP), and General Purpose Equipment (GPE) has been submitted. This requested budget is discussed in detail in Appendix A.

Figure 12 shows the budget request for site-wide capital equipment in outyears. Information on specific items and cost are found in INEEL's *FY 2000-2004 Institutional Plan*, (Draft) November 1999.

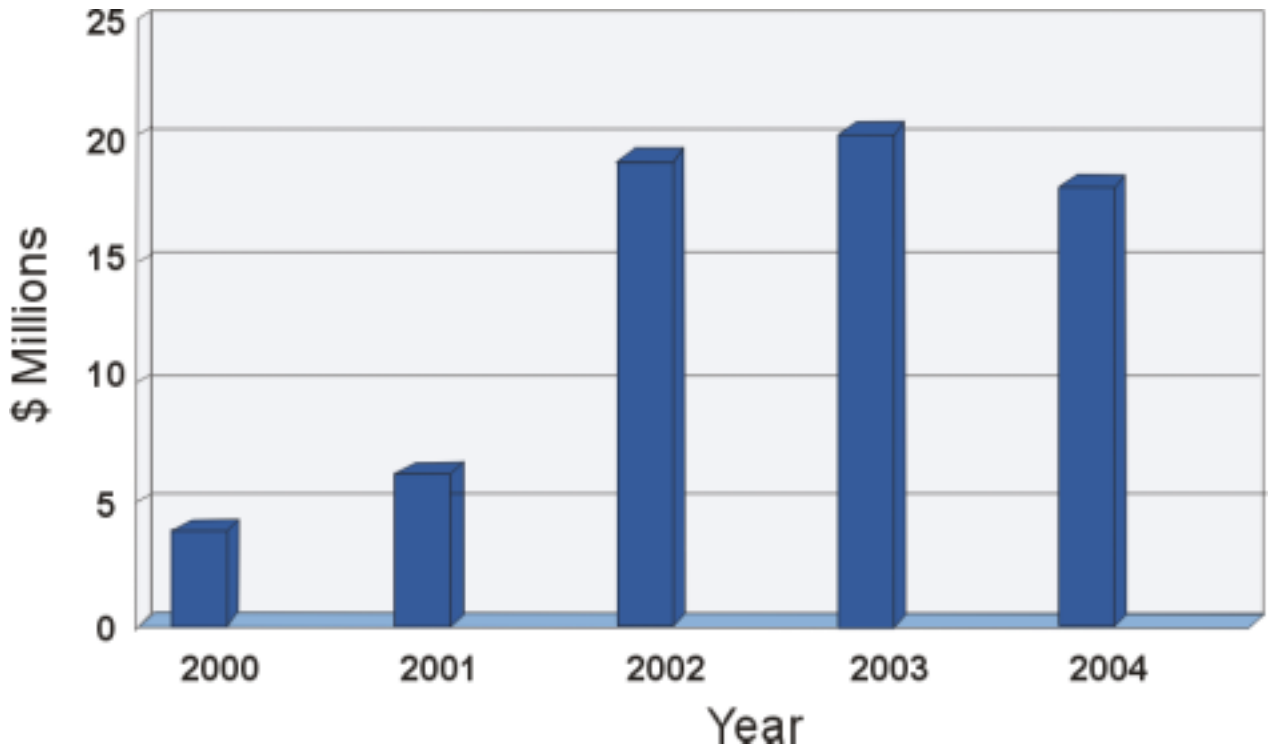

Figure 12. INEEL site-wide capital equipment projections: FY 2000-04.

2.4.2 Infrastructure and Facility Maintenance/Needs

INEEL does not compile data on infrastructure requirements for R&D separately from infrastructure requirements of the entire site. As such, this discussion relates to both INEEL operations and R&D. In recent years, availability of laboratory space has become a chronic problem at INEEL. In 1997, an INEEL Laboratory Utilization Study was conducted to evaluate and verify available laboratory space for current and future research needs. The study identified that there is no available laboratory floor space at INEEL for any additional scientific or engineering research. In essence, there can be no further growth at INEEL in environmental, science, and engineering research programs without additional facilities.

INEEL's present laboratory status is:

- There is insufficient laboratory space to meet current and future needs, both in town and the site
- Average age of buildings containing laboratories is 28 years (see Figure 13)
- 40% of the laboratories are in fair to poor condition (see Figure 14)
- 45% of the buildings will soon reach their expected 40-year life span
- There is only a 2.5% vacancy rate in current laboratory space
- No alternative facilities that could be modified have been identified.

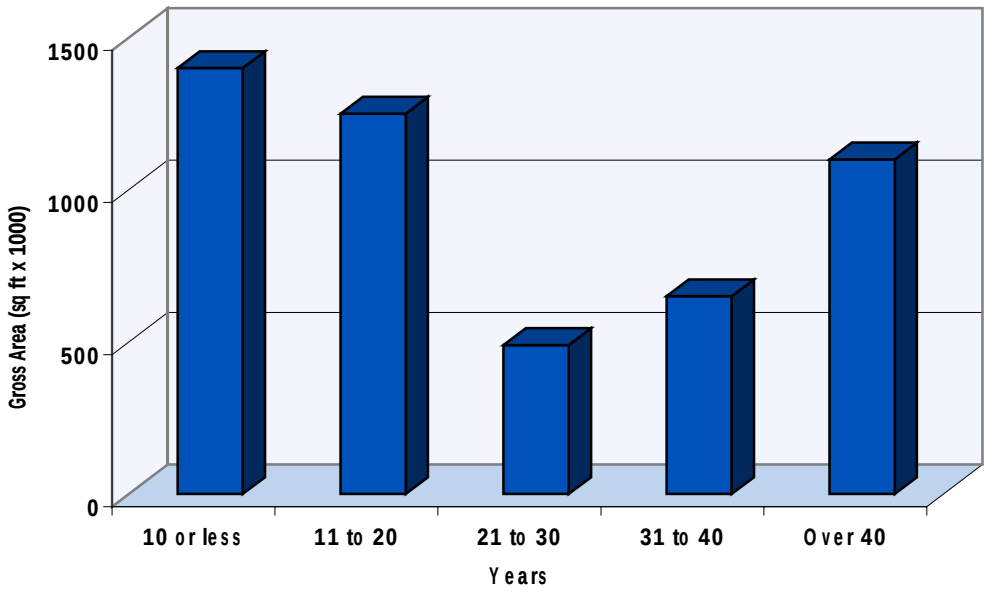

Figure 13. Age of INEEL site-wide laboratory buildings.

INEEL is using five leased laboratory sites in the City of Idaho Falls, which were not designed for science and research. Even if some work was discontinued, space made available is more suited to fitting an immediate need and not conducive to continued use. Buildings were once grocery stores, motorcycle shops, and furniture warehouses. As such, they have deficiencies in electrical power capabilities; electrical receptacles; airdrops; fire sprinkler systems; and heating, ventilation, and air conditioning (HVAC) systems. At the INEEL Research Center (IRC), mechanical and electronic prototyping capability is housed in space planned as mechanical areas that were never designed for continuous occupancy by personnel.

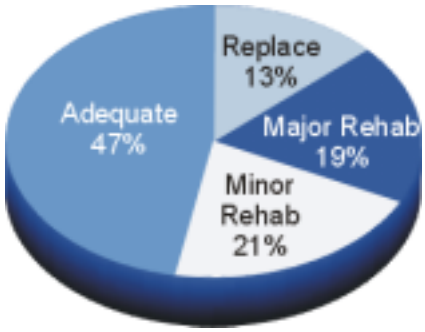

Figure 14. Condition of INEEL site-wide laboratory space.

While laboratory space was the focus of the Laboratory Utilization study, office space is also insufficient. The value of co-locating teams of researchers cannot be emphasized enough. To have members of multidisciplinary teams spread out among many buildings is a clear detriment to INEEL's technical effort. Presently, there are no vacancies at IRC. Some offices hold more

than one researcher. Other researchers have their offices at the Engineering Research Office Building (EROB) and commute to work in the lab.

With no new significant building, General Plant Projects (GPP) projects have been pursued as the only means of achieving space. While, INEEL has obtained GPP monies in the past for expansions, the EM budget for GPP projects continues to be reduced. There are a number of GPP submittals in place; however, only one of these projects has any funding identified as a result of FY 2000 EM budgets reductions.

For FY 2000, INEEL has requested $28.23 million for General Purpose Facilities (GPF), GPP, and General Purpose Equipment (GPE). In addition, a request for Program Construction funding of $12.29 million was submitted. Projects that have been initiated in FY 2000 with these funds include:

- INEEL Road Rehabilitation
- Health Physics Instrument Laboratory
- Site Operations Center
- INTEC Electrical & Utilities Upgrade
- TMI Fuel Storage Facility
- TRA Fire & Life Safety Improvements
- TRA Electrical Utility Upgrade.

Figure 15 shows resource projections for these budget items in outyears. Proposed major projects include the Subsurface Geosciences Laboratory (SGL).

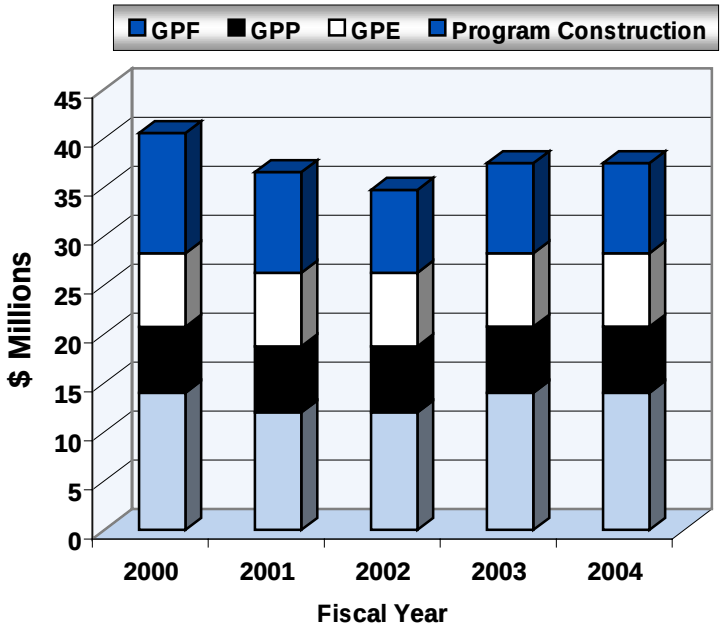

Figure 15. INEEL site-wide facility and equipment resource projections.

2.4.3 Environment, Safety, and Health

INEEL's goal is to be recognized as a leader in exemplary environment, safety, and health (ES&H) performance within the DOE complex by attaining Voluntary Protection Program (VPP) Star status. Full compliance with ES&H requirements is used as the baseline for effective and efficient continuous improvement while striving for ever-increasing standards of excellence. In support of this goal, INEEL has established ES&H objectives and implemented the "Safety and Health Five-Year Plan." This plan helped INEEL better identify ES&H costs and issues, provided a means of prioritizing needed activities, and identified funding to address deficiencies. INEEL is instituting a proactive approach for dealing with ES&H issues through BBWI and DOE self-assessment reviews.

INEEL is integrating ES&H into all aspects of work through employee and management involvement. This integration is being accomplished by maintaining an atmosphere conducive to open communication and participation, especially in ES&H planning, issues management, and concerns. INEEL has increased employee knowledge and awareness through effective employee training, increased facility walkthroughs with ES&H professionals, and regular meetings of professionals in each discipline.

Though case management of occupationally related illnesses and injuries, and increased training and employee commitment, INEEL will reduce accidents and occupational injury and illness. This action will be accomplished using a synergistic occupational health approach that supports line management in recognizing, evaluation, and controlling occupational health hazards. Medical and industrial hygiene is centrally managed and work together to ensure early recognition and prevention of occupational injuries and illnesses. A unified and consistent radiological control program will be developed to be consistent with DOE's realignment of responsibilities for radiological control areas, and implementation of the DOE Radiological Control Manual.

Site-wide improvement will be realized through consolidation and standardization of common ES&H program elements. Additional improvements will be achieved through improvement of current measurement systems used to evaluate progress. These systems will be reviewed and adjusted to ensure appropriate ES&H indicators are identified to track effective and efficient implementation of ES&H programs.

The following efforts have been established to ensure regulatory compliance and INEEL's commitment to ES&H excellence is fulfilled:

- Implement a DOE Voluntary Protection Program (VPP) Star culture
- Integrate safety into all levels of management and work
- Update best practices, risk management systems, ES&H manuals, and procedures, and
- Conduct independent ES&H appraisals and audits of INEEL activities.

2.4.4 Quality Assurance

INEEL's QA program is comprehensive and addresses activities for planning, achieving, verifying, and maintaining quality of items and activities in support of widely diversified programs, projects, and facilities. Flexibility and cost-effective application of the QA program is provided through a graded approach such that the program can be economically applied to small

dollar value projects as well as large-scale nuclear programs and facilities. The graded approach considers factors such as programmatic mission, regulatory requirements, customer specifications, hazards and consequences of failure, importance of data, complexity, and other relevant factors to establish the appropriate rigor to be applied in QA functions.
The program is maintained and directed by the M&O contractor Environment, Health, Safety, and Quality Assurance division, which reports to the BBWI President and General Manager.

Personnel independent of those who performed the work routinely conduct comprehensive inspections, audits, assessments, and workplace surveillance. The QA program is subject to external audits and assessments by the contractor's parent company and DOE to further ensure requirements are being met and QA processes are effective. Item or work process deficiencies, as well as any opportunities for improvement from oversight activities, are evaluated. Actions are taken to correct deficiencies and improve processes.

INEEL success in gaining significant and continuing work process improvement stems from strong top-to-bottom employee commitment. Staff performing the work are most knowledgeable of the process and customer needs. Therefore, their talents and expertise are brought to bear in problem solving and process improvement. Resolution of problems and process improvements may be implemented as the result of a person or a small team effort, or if institutional issues are involved, by a team that represents a crosscut of the company.

2.4.5 Security

At INEEL, threats are mitigated through a variety of programs dedicated to protecting national security and DOE interests. INEEL Operations Security, Counterintelligence, Export Control, Foreign Visitor Control, Technical Security, Classified/Sensitive Unclassified Information Control, Protective Force, and Safeguards Programs routinely work together to form an effective network. INEEL protection strategies are based on the DOE Design Basis Threat Statement, INEEL Local Threat Analysis, and applicable DOE orders. Protection strategies include detection, delay, and response capabilities that permit containment and/or neutralization of adversaries before they complete their objective. Recovery and recapture capabilities are incorporated into the protection strategy. Protection measures are based on a graded approach and multiple-layer strategy. They address a range of concerns from theft and diversion of special nuclear material and theft of classified and sensitive matter as well as protection of property and personnel. Cost-effective protection measures are established in a prioritized manner, with emphasis placed on assets with a higher attractiveness.

Work packages have been developed based on requirements defined in DOE Order, Executive Orders, and internal procedures. Based on the requirements as determined by the scope of these work packages, current funding does not provide the resources required to meet the safeguard and security (S&S) mission. INEEL has requested additional resources.

2.4.6 Information Management

Overall computing and network environment at INEEL is stable. Operations and technical support processes are in place and documented. Configuration management processes are functioning. Business needs drive decisionmaking related to information technology. A periodic, company level tactical planning process for information technology (IT) has been in use

for several years; this tactical planning process feeds into capital and operational budgeting processes. Selection and implementation of an off-the-shelf Enterprise Resource Planning (ERP) application is targeted for the next couple of fiscal years. Mission-critical systems are at current hardware and software levels, with maintenance provided. Business continuity/recovery planning is part of the lifecycle process for essential systems.

Most core business applications run on a single IBM S/390 platform; theses systems include budget planning and tracking, human resources, payroll, inventory, accounting, and property management. Unix servers host other enterprise applications from Hewlett Packard and Sun, and by Windows NT and NetWare running on Intel servers. E-mail and workflow environment is based on electronic work processes for purchase requisitions, travel authorizations, property control, and other software and associated computer platforms. INEEL has an intranet, hosting company level and facility specific documents, ISMS related data, work control and material management applications, training records and content delivery, demographic and occupational health systems, environmental applications, and general communications at the laboratory level and to/from DOE. Essentially all employees have access to the Intranet.

INEEL's sensitive internal network is protected by a firewall based on a commercial product. The network backbone is fiber-based and is in the midst of migrating to ATM. Outside the firewall, a set of servers accessible from the Internet provides an interface for those seeking information about INEEL and for external business partners with established working relationships. INEEL has external connectivity via a commercial ISP and ESNet.

The laboratory has established standard configurations for desktop and mobile hardware and associated application software. Contracts for this standard hardware and software have allowed INEEL to significantly reduce purchase and operational costs for computing. The help desk and field service functions provide effective support via phone and call-out, including factory-certified warranty service for Dell systems. INEEL is in the process of implementing a toolset to better manage those distributed assets, via software distribution, remote assistance, and inventory data collection. A central file back-up/restore service is available on a subscription basis.

LMITCO reduced Information Management (Records/Documents Management not included) costs by 38% between FY 1995 and FY 1997. These reductions were achieved by eliminating low-value-added activities, eliminating operation of a CRAY supercomputer, eliminating the annual computer conference, accepting higher risks (e.g., increasing the dollar cost for formal Acquisition Plan justifications to $50K), reducing support levels, and implementing standards for desktop hardware and office productivity software. These cost reductions were accomplished while increasing network capabilities, i.e., voice mail capabilities, implementing a new messaging system, and providing increased mainframe capacity through addition of the R31 computer.

With respect to INEEL's records/documents management, funding priority was achieved in FY 1999 to replace the 47 year old Records Storage Facility (RSF). The existing facility is inadequate in size, construction, and does not meet federal regulations and national codes for personnel safety and storage or retrieval of records. The new RSF will be capable of storing boxes of records generated over 50 years along with adaptability for future storage needs. It is designed to comply with NARA, NFPA, and NQA-1 codes with single storage capacity for 40,000 to 45,000 boxes. The new facility is scheduled for completion in FY 2001.

2.4.7 Community Relations/Communications

INEEL programs emphasize the importance of communicating openly and interactively with all pertinent internal and external individuals and groups. Within the laboratory community, free interchange of ideas and concerns is fostered through several avenues:

- Operation of an expansive intranet
- Publication of a regular employee newspaper (with frequent health and safety inserts and letters to the editor)
- Distribution of videotaped programs
- Multiple small- and large-group meetings with employees.

Externally, the goal of enhancing communication and trust is addressed through applying consensus-building techniques in all major community outreach efforts such as:

- Hearings and public meetings
- Use of a speakers bureau
- Maintenance of an Internet site (www.inel.gov)
- Publication of press releases, fact sheets, and environmental cleanup reports
- Maintenance of an INEEL satellite office in Boise
- Attendance at regional fairs and business forums
- Operation of reading rooms
- Administration of a tour program that annually brings 4,000 to 5,000 people, including state lawmakers, to the site.

INEEL interacts extensively with its Citizen's Advisory Board (CAB), a federally chartered, nonpartisan, broadly representative organization of 15 independent citizens with concerns related to INEEL activities. It is a Site-Specific Advisory Board (SSAB), part of DOE's national EM-SSAB. The CAB provides informed recommendations and advice to DOE-ID, EPA Region 10, and the State of Idaho regarding the full scope of INEEL issues, including environmental restoration, waste management and economic aspects.

This citizen's board was formed in March 1994 after a lengthy design and selection process. Fifteen Idaho residents were selected by a citizens selection committee from a pool of 150 applicants from 40 Idaho communities. Members rotate through up to three two-year terms.

In addition to 15 Board members, ex-officio members from DOE-ID, EPA Region 10, and the State of Idaho serve as non-voting members of the CAB. Each member of the CAB represents at least one of the following stakeholder perspectives:

- Shoshone-Bannock Tribes
- Site-related workforce
- Affected local governments
- Environmental interests
- Business interests
- Natural resource users
- Educational community

- Health professionals
- General public.

INEEL has accomplished great strides in improving and strengthening relations with State environmental regulators in the last few years. Although relationships are difficult to quantify, INEEL feels they are good based on recent interactions and continually improving.

3 Appendices

Appendix A. INEEL's Institutional Plan
Appendix B. Site-wide Capital Equipment Needs

APPENDIX A

INEEL's Institutional Plan

APPENDIX B

Site-wide Capital Equipment Needs