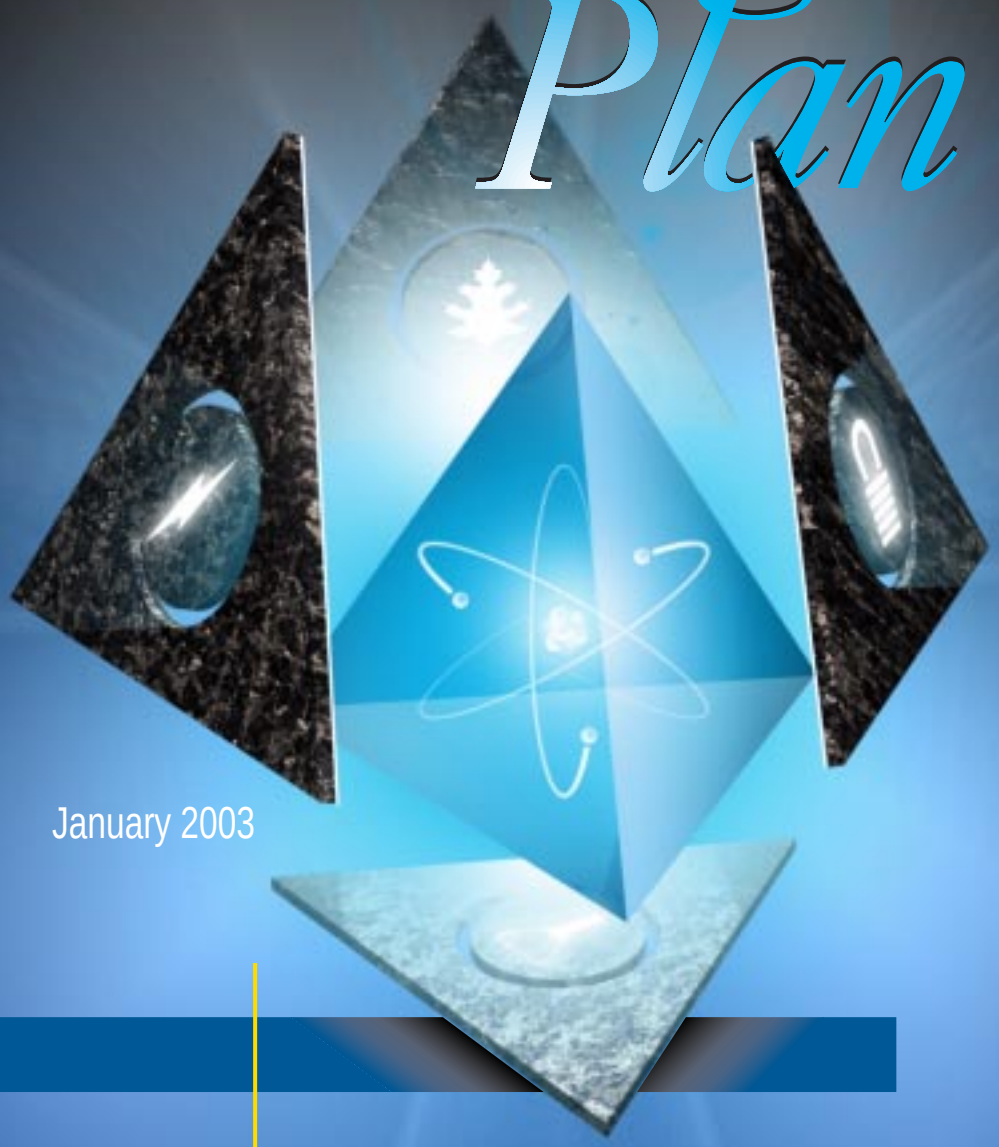
Idaho National Engineering
and Environmental Laboratory

Strategic Plan



January 2003

INEEL
Home of Science
and Engineering Solutions

...launching a new era in the nation's nuclear energy program.

Message from the Director
Nuclear Energy, Science, and Technology

PD03-0010-01

William D. Magwood IV

Director, Nuclear Energy, Science, and Technology

In July 2002, Department of Energy (DOE) Secretary Abraham established the Idaho National Engineering and Environmental Laboratory (INEEL) as the nation's leading center for nuclear energy research and development (R&D). Over the past several months, my office, the Office of Environmental Management, the Idaho Operations Office, and the laboratory have worked diligently to effect a smooth transition of the INEEL. This document, which I am pleased to endorse, represents our first effort to outline a new vision for the INEEL. This realigned vision returns the laboratory to its core mission of nuclear energy R&D, launching a new era in the nation's nuclear energy program.

For more than 50 years, the INEEL has made vital contributions to U.S. national security. These contributions have ranged from building, testing, and demonstrating the country's first nuclear reactors to advancing alternative energies, military equipment, and environmental technologies. The INEEL is a valuable multiprogram national laboratory well positioned to serve our country in the decades ahead.

I look forward to forging a strong working relationship with the INEEL. Through this partnership, we will optimize use of the laboratory's talent and resources to assist DOE and the administration in meeting needs critical for national security.

Message from the INEEL Director

PN02-0253-01-02

Bill D. Shipp

President, General Manager, and Laboratory Director

For the foreseeable future, the INEEL's role will be clearly intertwined with national security. With today's global terrorism concerns, the administration needs the INEEL and other DOE national laboratories to demonstrate how the knowledge and expertise gained through science and engineering can advance our nation's primary security interests. The INEEL is well positioned to do this. The Secretary of Energy's announcement elevating the INEEL as the nation's leading center for nuclear energy R&D recognized and expanded the laboratory's role in national and energy security. Because energy security is so crucial to our nation's well being, the INEEL's rich history of technical and scientific expertise in nuclear energy engineering, research, and analysis will provide DOE a national laboratory leadership platform.

As a multipurpose national laboratory, the INEEL will continue to deliver advances that support DOE's missions in energy, defense, and science. Our efforts will also focus on asset revitalization, continued laboratory restructuring and operational enhancements, and maximization of our R&D capabilities. Another major thrust will be our ongoing collaboration with other national laboratories, government agencies, academia, and private industry. Collaboration and strategic relationships are pivotal to increasing the value of science and technology delivered to DOE.

In partnership with the DOE Office of Nuclear Energy, Science, and Technology, we look forward to taking a leadership role in defining and implementing a new era of nuclear R&D. Our combined efforts will contribute to the nation's security needs and demonstrate that the INEEL is the "home of science and engineering solutions."

SECURING OUR NATION'S ENERGY FUTURE

This strategic plan outlines an exciting new direction for the Idaho National Engineering and Environmental Laboratory (INEEL) as we transition to the Department of Energy's (DOE) Office of Nuclear Energy, Science, and Technology (NE). Our primary focus will be enhancing energy security through leadership in nuclear science, engineering, and technology development. We will also contribute to national security by providing innovative science and engineering solutions to challenges facing our nation's critical infrastructure and homeland security. As a multiprogram national laboratory, we will continue to facilitate DOE's legacy cleanup and stewardship and to conduct research to advance energy-related sciences.

Below is our new vision, mission, key guiding principles to achieve customer satisfaction, and major challenges that we face, together with goals and the strategies for accomplishing them.

PN01-0571-04-34

Vision

The INEEL—the leading U.S. research laboratory in nuclear science and engineering—providing the next generation technology for the United States and the world—recognized for providing solutions to energy, security, and scientific challenges.

INEEL Mission

The INEEL's principal mission is to develop and demonstrate advanced nuclear technologies that provide clean, abundant, affordable, and reliable energy. We also conduct basic and applied research to protect our nation's critical infrastructure and enhance our national security, facilitate DOE's legacy cleanup and stewardship responsibilities, and advance energy-related sciences.

To address DOE and national priorities, the INEEL fills the following critical roles:

- Supports the government's role in leading the revitalization of the nation's nuclear power industry and reestablishing U.S. world leadership in nuclear science and technology.
- Develops, tests, and demonstrates safe, reliable, affordable, environmentally sound, and proliferation-resistant fission and fusion power systems.
- Develops, tests, and demonstrates technologies and systems that enhance the safe transportation, management, and storage of spent nuclear fuel and other nuclear materials.
- Develops, tests, and demonstrates advanced fuel-cycle technologies and provides engineering, design, and operations support to optimize the national repository at Yucca Mountain.

U.S. Secretary of Energy Spencer Abraham announces INEEL's new mission.

- Conducts basic and applied research in subsurface science and engineering to advance the cleanup, monitoring, and stewardship of contaminated sites.
- Uses the broad scientific and engineering capabilities of the laboratory to support DOE's three challenge areas: expanding energy, ensuring defense, and advancing science.

Customer Satisfaction Guiding Principles

At the INEEL, we are dedicated to providing customer satisfaction. We recognize that customer satisfaction means clearly understanding your customer's requirements and satisfying them every time with performance that meets or exceeds their requirements. We also recognize that the taxpayer is our ultimate customer.

To ensure customer satisfaction, the INEEL conducts operations based on the following guiding principles:

Demonstrate Scientific and Technical Leadership

We integrate the best talent, facilities, and equipment to achieve cutting-edge solutions to meet customer needs. We continually enhance our professional, scientific, and technical abilities to enable our future leadership.

Improve and Innovate

We believe that improvement is always possible and that the next great breakthrough is within our grasp. We constantly look for ways to improve our research and business processes, products, and services and freely share lessons learned. We value creativity, curiosity, and learning, and we are open to new ideas and ways of solving problems.

Deliver Quality Solutions on Time

We take pride in providing products and services that meet or exceed customer requirements. We deliver products and services on time and within budget. We perform the job right the first time, avoiding rework.

Demonstrate Integrity in Every Aspect of Our Work

Each employee takes responsibility for maintaining and enhancing the reputation of the INEEL. In their day-to-day work, employees treat customers and colleagues in an honest, responsible, ethical, and law-abiding manner.

Work in a Safe, Secure and Environmentally Sound Manner

Each employee accepts responsibility for ensuring that our work meets safety, security, and environmental requirements. We work smart to avoid injuries, polluting the environment, damaging our facilities, or compromising proprietary, sensitive, or classified information. Employees speak up when encountering unsafe processes, products, or services and share experiences that benefit each other.

Work Cost-Effectively and Efficiently

We maintain a questioning attitude and continually search for ways to reduce redundancy and unnecessary cost. Without compromising the job at hand, we streamline processes by reducing the number of steps and approvals required.

Challenges We Face

To achieve our potential as a national laboratory, we must overcome several challenges. These include:

Maintaining and Developing the Work Force

DOE and INEEL leadership must work together to cultivate an exceptional cadre of next-generation scientists and engineers to meet future needs. Many of our key employees in the science and technical disciplines are nearing retirement age. Therefore, we must recruit, retain, and develop employees in an extremely competitive, increasingly high-tech marketplace. We need to strengthen development and educational advancement opportunities for our employees. In addition, we must support our employees by providing the opportunity to advance our scientific reputation through peer reviews, publication in professional journals, and leadership in scientific and engineering professional organizations.

Restoring Our Infrastructure and Technical and Test Capabilities

Several of the DOE national laboratories have facilities in grave need of upgrading. At the INEEL, deficiencies reside in systems-intensive facilities most integral to our cleanup mission, nuclear operations, and laboratory and processing work. For some time, we have addressed the infrastructure investment need by reducing infrastructure and associated costs to redirect funds for required upgrades at mission-critical facilities. However, not all mission infrastructure requirements can be met through cost reduction alone. A 90-day infrastructure study is being conducted to determine the types of facilities needed to support current and future nuclear energy missions at the laboratory. DOE and the INEEL must work together to see that recommendations from this study are implemented. A significant investment is required to provide cost-effective research facilities and the necessary scientific equipment at the INEEL.

Assuring DOE-Contractor-Stakeholder Commitment to the New Mission

The INEEL's transition to its new nuclear energy mission will be enhanced by a shared DOE-contractor-stakeholder commitment to enable the development of new testing and demonstration facilities necessary for the INEEL to serve as the "command center" for the advanced nuclear energy mission. As a result of this new DOE-contractor-stakeholder commitment, U.S. leadership in nuclear science and technology will be reestablished and significant progress made in expanding nuclear energy as a reliable, affordable, and clean energy source.

Goals, Strategies, and Strategic Indicators

As a multiprogram national laboratory, the INEEL conducts science, technology, engineering, and program operations for DOE and a variety of other customers. Our strategic goals and priorities were last defined in the *FY 2002-2006 INEEL Institutional Plan* issued in February 2002. With the announcement of the laboratory's transition from DOE's Office of Environmental Management (EM) to its Office of Nuclear Energy, Science, and Technology (NE), we began a new round of strategic planning. The result is a plan that strategically focuses our efforts on NE priorities, maintains emphasis in areas of critical importance to DOE and other customers, and facilitates completion of accelerated cleanup at the INEEL. This plan is aligned to DOE's draft Strategic Plan and the President's National Energy Policy. Through technical excellence, we will maximize our value to the taxpayer and continue to be a cost-effective, environmentally responsible resource for the nation. The strategic plan that follows is aligned with our eight strategic goals:

Goal 1 — Assure the nation's energy security by developing advanced energy systems and improving the efficiency, reliability, and safety of current energy technologies

Goal 2 — Develop and demonstrate advanced fuel-cycle systems

Goal 3 — Provide safe and efficient state-of-the-art research capabilities for nuclear fuels, materials, and systems testing and evaluation

Goal 4 — Provide innovative science and engineering solutions to address challenges to our nation's critical infrastructure

Goal 5 — Facilitate completion of DOE's legacy cleanup and stewardship responsibilities

Goal 6 — Conduct science and identify technologies that underpin solutions to DOE's mission (reliable energy, national security, and energy-related science)

Goal 7 — Continue to develop a high-performance, responsible, and accountable multiprogram national laboratory that is responsive to mission needs and demonstrates operational excellence

Goal 8 — Strengthen national and international partnerships to address DOE R&D needs

Definitions

The following pages of this document outline the INEEL's eight goals in terms of strategies and strategic indicators. These categories are defined below.

Goals

What we are seeking to achieve. Six of our goals are directly related to program performance and are the primary responsibility of our line program organizations. Two goals crosscut the entire laboratory.

Strategies

Activities to be performed to accomplish our stated goals. Goals will likely remain consistent over several years, while strategies may change based on national policy, performance assessment, or other factors.

Strategic Indicators

Results, outcomes, activities, or actions that will be achieved if the strategies are successful. They help assess, at a strategic level, whether our work is on the right track to meet established goals. The performance evaluation management plan and detailed work plans contain more detailed, quantifiable measures to assess progress.

GOAL 1

Assure the nation's energy security by developing advanced energy systems and improving the efficiency, reliability, and safety of current energy technologies

"America must have an energy policy that plans for the future, but meets the needs of today. I believe we can develop our natural resources and protect our environment." President George W. Bush in the *National Energy Policy*, May 2001.

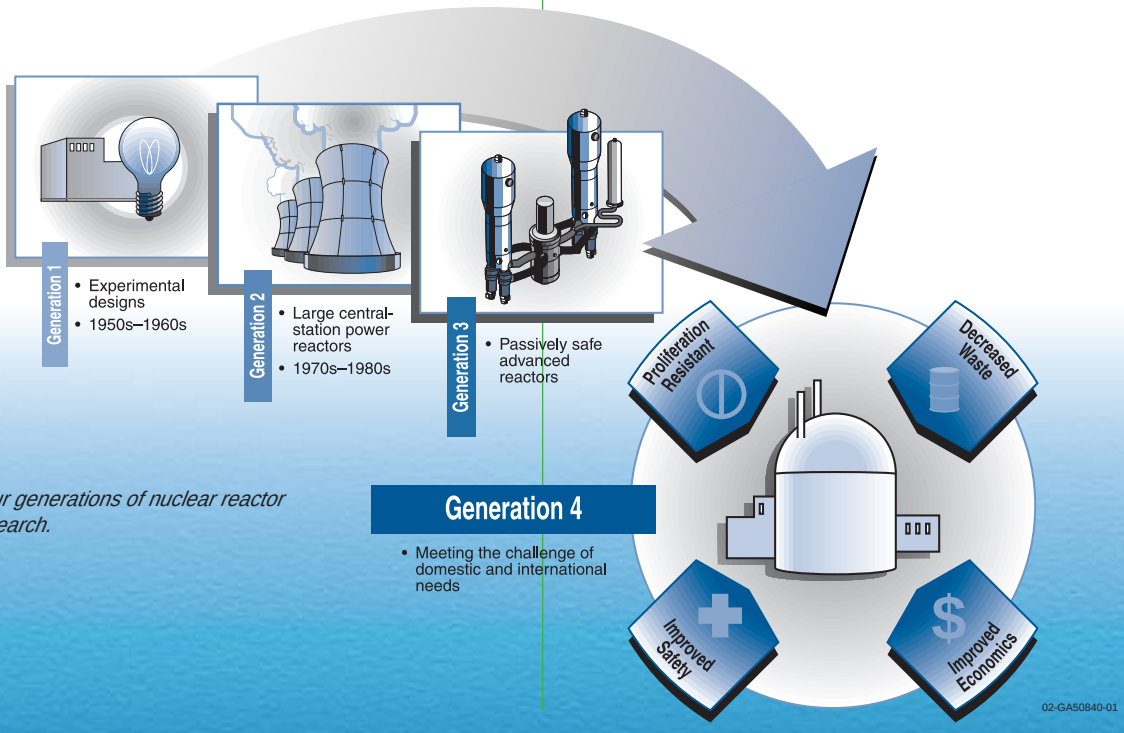
Secretary of Energy Spencer Abraham identified energy security, which is a primary component of national security, as a core DOE mission. In July 2002, Secretary Abraham announced that the INEEL would be the nation's leading center for nuclear energy R&D and *"…the epicenter of our efforts to expand nuclear energy as a reliable, affordable, and clean energy source…."*

To support DOE's energy technology priorities, we will provide leadership, technology, and engineering demonstration support for current operating reactors and advanced nuclear energy systems. We will apply our expertise in nuclear energy systems design and development, nuclear safety, systems integration, and large-scale engineering demonstration for advanced nuclear energy systems, bioenergy, and hydrogen production. Additionally, we will provide critical support to the Nuclear Regulatory Commission (NRC) for efficient licensing and regulation of reactors.

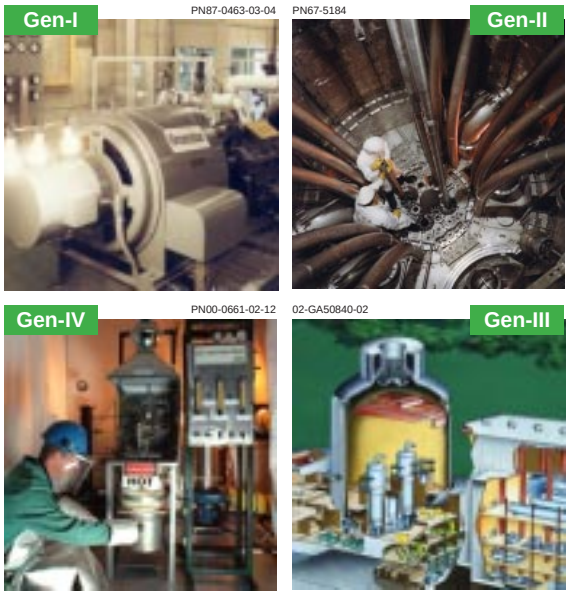
Strategy

Lead key technical, systems integration, and testing activities for DOE's Generation IV advanced nuclear energy systems development in order to reestablish U.S. leadership in the international nuclear community.

The INEEL and Argonne National Laboratory-West, as NE's lead laboratories for nuclear reactor technology, played pivotal roles in the formation of the 10-country Generation IV International Forum. This forum has defined the leading Generation IV advanced reactor systems that can respond to the economic, safety, sustainability, and nonproliferation goals for 21st century deployment, and subsequently prepared a Generation IV Roadmap. The roadmap, completed



Four generations of nuclear reactor research.



Examples of each reactor generation (clockwise from upper left): EBR-I, ATR, AP600, lead-coolant reseach.

in September 2002, is the product of a two-year effort involving more than 100 international experts. This roadmap identifies key technical issues and pathways to enable one or more Generation IV systems to enter the world marketplace before 2030. Each of the 10 Generation IV countries will begin international R&D efforts in 2003. We have been assigned the leadership position for systems analysis and integration for the Generation IV/ Advanced Fuel-Cycle Initiative.

Strategic Indicators

- Continue to provide effective leadership for the integrated Generation IV/Advanced Fuel-Cycle Initiative.
- Finalize agreements for at least three international collaborative Generation IV R&D programs by the end of 2003.
- Staff key technical positions in system design, energy production, materials, fuel development and testing, and spent fuel separations technical teams in 2003.
- Initiate a Generation IV advanced fuel irradiation testing program at the Advanced Test Reactor (ATR) in 2005.

Strategy

Conduct leading edge R&D for supercritical water, high-temperature gas, and liquid-metal-cooled advanced reactor systems and provide technical support for development of nearer-term systems such as the Pebble Bed Modular Reactor, the Advanced Canadian Deuterium Uranium Reactor (ACR 700), and the Simplified Boiling Water Reactor (SWR 1000).

The INEEL has been assigned U.S. leadership for the supercritical water-cooled reactor, gas-cooled fast reactor, and very high-temperature reactor. Our R&D priorities are guided by the Generation IV Roadmap and will be focused primarily on these three systems. We will assemble world-class U.S. and international R&D teams to resolve key viability issues such as fuel performance, high-temperature materials development, analytical methods development, and nuclear data measurement.

Strategic Indicators

- Issue the U.S. Generation IV R&D Plan in March 2003.
- Enter into cooperative agreements with at least two national laboratories to collaborate on Generation IV R&D in 2003.
- Initiate at least one technical support project for a near-term deployable reactor system by 2004.
- Organize international product teams for the supercritical water-cooled reactor, gas-cooled fast reactor, and very high-temperature reactor and begin operation before October 2003.
- Initiate a nuclear science and engineering base technology program including, but not limited to, methods development and nuclear data measurements by 2005.

Strategy

Conduct leading-edge R&D focused on biomass/ whole-crop utilization, hydrogen production and infrastructure, and other energy efficiency, renewable energy, and fossil energy technologies that contribute to improving the nation's energy security and environmental quality.

The INEEL conducts key R&D programs for the DOE Offices of Energy Efficiency & Renewable Energy (EE) and Fossil Energy (FE) in areas as diverse as geothermal energy, hydropower, energy storage testing and infrastructure, oil, gas, clean coal, energy management, and industrial energy efficiency. We are emphasizing bioenergy to produce efficient harvesting technologies for biomass feedstock production and hydrogen

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High-tech multicomponent harvesters are being developed to harvest the previously unusable parts of wheat straw for use as a renewable, clean biofuel.

production from nuclear and other processes and hydrogen infrastructure to support the U.S. FreedomCAR program.

Strategic Indicators

- Complete the DOE roadmap for biomass feedstock harvesting technology and initiate a DOE-funded Center of Excellence at the INEEL in 2004.
- Initiate at least three funded bioenergy R&D programs in collaboration with the Northwest Bioproducts Research Institute by 2005.
- Initiate EE and NE hydrogen production R&D programs in 2003, and organize an integrated EE/NE hydrogen production demonstration program by 2007.

Strategy

Provide key strategic and technical leadership in support of NRC's risk-informed, performance-based regulatory concept.

Effective regulation of U.S. nuclear power plant operations and efficient licensing of advanced Generation III and IV reactors are critical components of the revival and growth of nuclear energy in the U.S. Our core competencies in reactor system demonstration will be critical to conducting prototype/demonstration programs for licensing advanced gas-cooled and Generation IV reactors. We provide key technical support to NRC in the areas of probabilistic risk assessment, performance indicator development and data management, and human factors. We also offer unique, world-class facilities such as ATR, which will provide critical fuels and materials performance data for licensing advanced reactors.

Strategic Indicators

- Continue support as NRC's primary provider of risk-based regulatory and human-factors services by 2005.
- Initiate a joint DOE/NRC gas-cooled-reactor fuels irradiation test program at ATR in 2004.
- Complete development of the INEEL SAPHIRE (Systems Analysis Program for Hands-on Integrated Reliability Evaluation) code by 2007.
- Initiate construction of the Generation IV prototype demonstration reactor by 2010 to support licensing and other system data needs.

Goal 2 — Develop and demonstrate advanced fuel-cycle systems

The *National Energy Policy* directs that *"…in the context of developing advanced nuclear fuel cycles and next generation technologies for nuclear energy, the United States should reexamine its policies to allow for research, development, and deployment of fuel-conditioning methods (such as pyroprocessing) that reduce waste streams and enhance proliferation resistance."*

One of the most important issues facing nuclear power in the United States is the disposal of nuclear waste and spent nuclear fuel. The United States is initiating the Advanced Fuel-Cycle Initiative in 2003 to develop and demonstrate proliferation-resistant spent fuel treatment and transmutation technologies that will enable the U.S. Government to make an informed decision about future fuel-cycle policy and deployment alternatives before 2007.

Several countries, notably France, the United Kingdom, and Japan, are treating nuclear waste and spent nuclear fuel to reduce the quantity, toxicity, and lifetime risk of the waste. Such treatment involves separation and treatment of spent fuel, recycling, and burnup or transmutation of plutonium and minor actinides. The United States has focused on developing a geological repository at Yucca Mountain, Nevada. A treatment approach to waste reduction and disposal has the potential to reduce cost and improve the safety of the geological repository and reduce inventories of plutonium. At the INEEL, we have aqueous-based fuel-processing technologies (and advanced pyroprocessing capabilities at Argonne National Laboratory-West) and state-of-the-art, second-generation facilities for fuel-processing R&D and demonstration and can address this issue in support of the U.S. nuclear energy and waste disposal programs.

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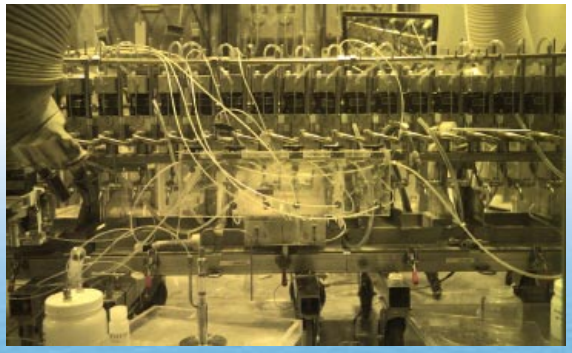

These three photos show scientists researching various types of centrifugal contactors, a central component of the aqueous method of nuclear fuel processing.

Strategy

Conduct key R&D on light-water-reactor (LWR) spent fuel separations processes.

Advanced spent fuel separations will include a combination of UREX+ for uranium separations, special aqueous separations processes to remove particular fission products that require storage, and plutonium and minor actinide separations using proliferation-resistant processes that do not separate pure plutonium. Phase 1 of the Advanced Fuel-Cycle Initiative will develop technology for dealing with current stockpiles of LWR spent fuel. Phase 2 of the initiative will develop the technology for multiple spent fuel recycle in Generation IV fast reactors that can effectively burn up or transmute the majority of the plutonium and other actinides.

Strategic Indicators

- Complete feasibility studies for advanced aqueous separations of LWR fuel components (e.g., uranium, plutonium plus actinides, and fission products) at the radioanalytical laboratories of the INEEL's Idaho Nuclear Technology and Engineering Center in 2005.
- Develop and demonstrate technologies for simultaneous separation of cesium and strontium from dissolved spent fuel raffinates by 2005.

Strategy

Conduct an engineering-scale LWR fuel-processing demonstration program.

Engineering-scale demonstration of spent LWR fuel-separation processes are required before 2007 to form the technical basis for a U.S. fuel-cycle policy decision and as a basis for establishing the approach to operating the Yucca Mountain geological waste repository. The INEEL second-generation fuel-processing facilities at its Idaho Nuclear Technology and Engineering Center (Fuel Storage Area/Fluorinel Dissolution Process Area) are ideally suited to conduct the engineering-scale demonstration.

Strategic Indicators

- Initiate preconceptual design of a 2000-tonne per year spent fuel treatment plant in 2003.
- Complete engineering-scale LWR spent fuel processing demonstration by 2007.

Strategy

Develop advanced nuclear fuels that will enable the proliferation-resistant consumption of plutonium and other actinides in existing and advanced reactors.

Advanced mixed-oxide or other fuels will be required to accomplish demonstration of initial recycle capability for actinide burnup or transmutation. As advanced and Generation IV reactors are designed, advanced mixed-actinide fuels must be developed and tested for effective fuel-cycle closure. Irradiation performance of these fuels will be demonstrated in ATR (see Goal 5).

Strategic Indicators

- Initiate development of a fast-spectrum test zone at ATR in 2003.
- Conduct LWR recycle fuel irradiation test at ATR in 2005.

Strategy

Assist in providing a safe and reliable long-term repository for spent fuel and nuclear waste.

DOE is responsible for safe disposal of the nation's spent nuclear fuel and high-level waste to reduce risk and enhance national security. To achieve these goals, DOE's repository development efforts must incorporate sound, defensible, science-based designs, engineering, and technologies. The INEEL is ideally qualified to support the repository-development mission because of our successful long-term history of designing and operating nuclear facilities and, particularly, remotely operated facilities for handling and managing nuclear fuel.

Strategic Indicators

- Establish a significant collaboration in 2003 between the INEEL and the Repository Development Program that leverages the INEEL's engineering strengths in the following key areas:
  - Engineering and Operations Support.
  - Nuclear Facility Design Support.
  - Robotics Development.
  - Waste Package Closure Equipment Development
  - Subsurface Science.
- Maintain the National Spent Nuclear Fuel Program to be responsive to DOE.

GOAL 3

Goal 3 — *Provide safe and efficient state-of-the-art research capabilities for nuclear fuels, materials, and systems testing and evaluation*

Our nuclear program is responsible for providing NE with safe and efficient capabilities for nuclear fuels testing and evaluation. The nuclear program is also responsible for the safe and reliable operation of ATR and supporting nuclear test and evaluation facilities. We will also conduct R&D in nuclear systems supporting NASA (National Aeronautics and Space Administration) missions.

We performed materials testing, along with significant safety studies, that have been key in the development of commercial and military nuclear power systems. The safe operation of commercial and naval nuclear propulsion systems can be directly traced to work performed at some of the 50-plus nuclear reactors that we constructed and operated.

Top view of ATR vessel internals during construction (right). The Advanced Test Reactor facility is the centerpiece of the planned work for Generation IV and advanced fuel-cycle development. The Advanced Test Reactor is located at the Test Reactor Area (pictured below).

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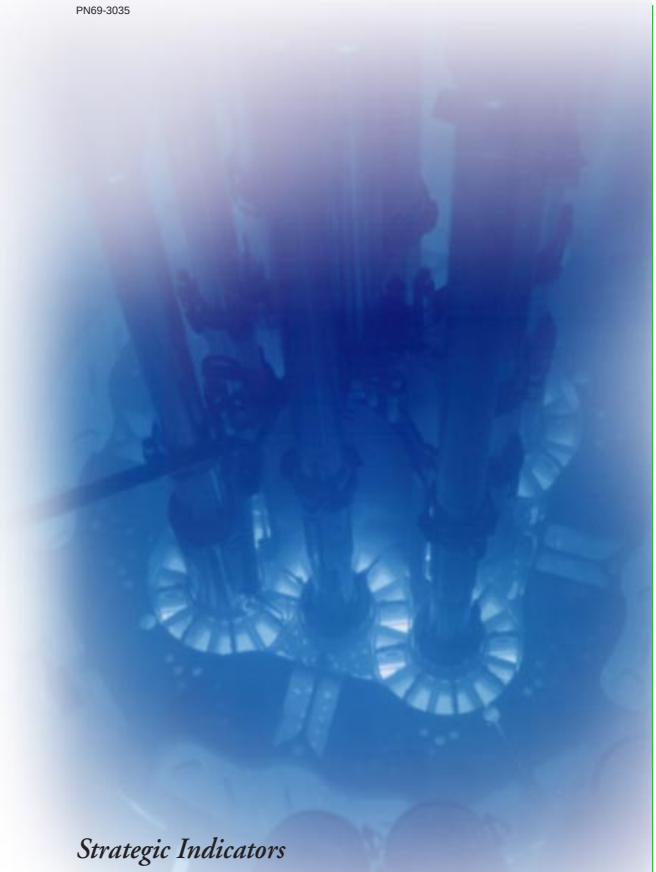
Strategy

Manage operation of ATR and other INEEL nuclear facilities to the highest standards of performance and safety, fully consistent with DOE requirements and best commercial practices, to ensure a highly reliable, available, and cost-effective nuclear testing capability for U.S. and international missions.

Our nuclear success is based on strong technical leadership, design, and operating practices. Our ATR facility is the centerpiece of the planned work for Generation IV and advanced fuel-cycle development. The testing and evaluation performed at ATR, combined with information developed by other national and international partners, will form the basis for the licensing and operation of the next generation reactors and fuels. ATR will continue to support the Naval Nuclear Propulsion Program along with producing isotopes for industrial and medical purposes.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Strategic Indicators

- Maintain a reactor operating efficiency factor of at least 98 percent (as measured by compliance to operating schedule based on the test plan) for ATR.
- Continue to provide materials irradiation capabilities to enable the advancement of Naval Nuclear Propulsion Programs.
- Provide irradiation user facilities to universities and others in the scientific community.
- Provide isotopes as needed for DOE's Isotope Production and Distribution Office.
- Promote use of ATR for materials and fuel testing of advanced reactors including advanced LWRs, gas-cooled reactors, and liquid metal reactors.

Strategy

Strengthen the capabilities at the INEEL Test Reactor Area to support fuels and materials irradiation testing through the addition of new state-of-the-art research instruments and additional R&D staff.

We will upgrade laboratories and hot cells at the Test Reactor Area to more efficiently examine materials irradiated in ATR and will extend our capabilities through collaboration with Argonne National Laboratory-West. We also plan to supplement our existing staff with new personnel trained to conduct state-of-the-art analyses on advanced materials and fuels.

Strategic Indicators

- Provide enhanced hot-cell capabilities that support new materials, new fuel types, and new reactor concepts by 2005.
- Upgrade chemistry, material science, and physics laboratories to meet the needs of new reactor fuels and materials testing by 2010.

Strategy

Construct advanced reactor prototype facilities for testing, demonstration, and regulatory/ licensing missions that support electricity production, high-temperature process heat and hydrogen production, and space power.

As the leader in the national nuclear program, we will construct advanced reactors and prototype facilities to enable materials testing for future nuclear missions, including Generation IV and NASA. The new facilities will provide the necessary data for new fuels and processes that should reduce the need for additional repository space. We will also support testing of space nuclear propulsion systems to support future space programs.

Strategic Indicators

- Develop, promote, and construct advanced reactor prototype facilities to prove and demonstrate state-of-the-art reactor concepts; start up a new fast neutron facility by 2012; operate the very high-temperature reactor test bed prototype by 2017; operate the Generation IV fast reactor prototype by 2025.
- Support the joint NE/NASA Nuclear Space Initiative by providing infrastructure needed for nuclear reactor technology and systems development, testing, and evaluation; operate the space nuclear power system ground test by 2010.

GOAL 4

Goal 4

Provide innovative science and engineering solutions to address challenges to our nation's critical infrastructure

The nation's reliance on its critical infrastructure of communications, power, and transportation is well known. The events of September 11, 2001 revealed the vulnerabilities of this infrastructure, the complexities of which cause further vulnerabilities as the cascading effects of any single system failure may impact interdependencies within the infrastructure.

DOE and Homeland Security will have complementary roles in ensuring the nation's security. As the mission of Homeland Security unfolds, it is crucial that the vulnerabilities of critical infrastructure be made apparent and that a clear path to resolving these vulnerabilities be defined.

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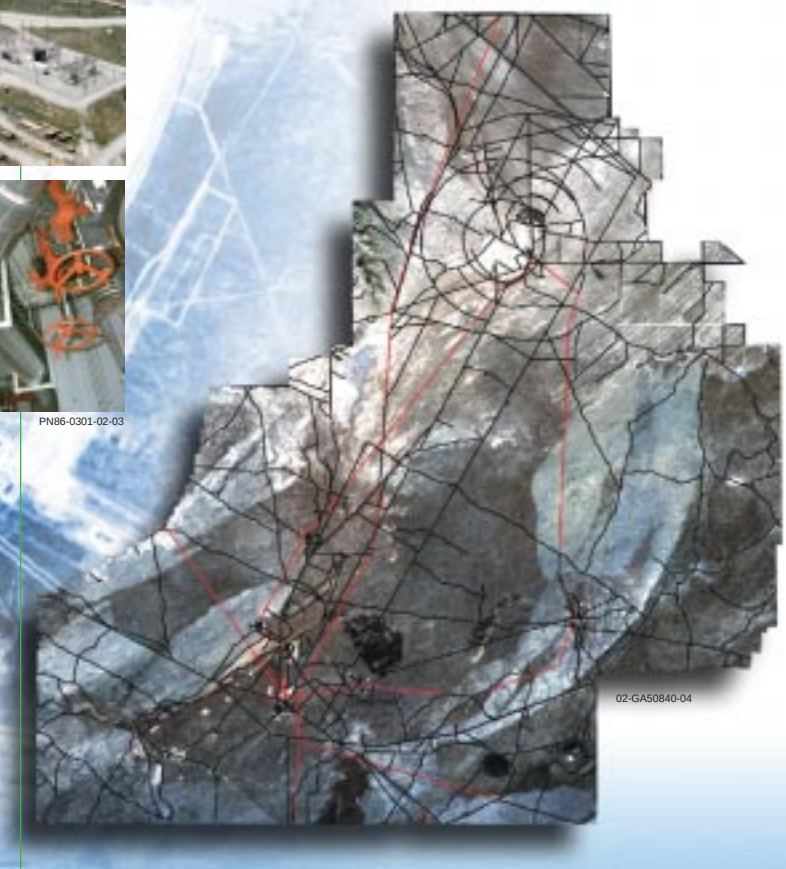

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INEEL's size, remoteness, and variety of self-contained facilities make it an attractive site for testing critical infrastructure. The complex network of utilities within the INEEL boundary can be seen in the satellite image at right.

Strategy

Establish the INEEL as the site of choice for scalable testing and development of critical infrastructure protection systems.

For more than five decades, the INEEL has successfully served as a test range for numerous governmental activities, particularly nuclear and military development and testing. The site's remote location, sophisticated infrastructure, and science and engineering base make it a natural critical infrastructure test bed. Our role is to develop, test, certify, and deploy technologies to protect the nation's critical infrastructure from terrorist threats, aging, and degradation.

Our customer base includes government agencies with missions related to critical infrastructure assurance, homeland security, counterterrorism, and national defense, and industry components responsible for developing and deploying our nation's infrastructure.

Strategic Indicators

- Fully establish, fund, and operate the Critical Infrastructure Test Range, Supervisory Control and Data Acquisition Test Bed, and national physical security, cyber, and wireless test beds by 2005.
- Use Critical Infrastructure Test Range data and analyses to protect and maintain the nation's infrastructure.

Strategy

Conduct a robust research, development, testing, and demonstration program that results in new technologies, methods, and procedures to reduce threats against citizens, infrastructure, and the environment.

We will continue to build upon work currently being conducted for DOE and other federal agencies such as the Department of Defense (DOD) related to securing the nation's energy infrastructure and detecting, deterring, and countering terrorism involving weapons of mass destruction. We will continue to develop improved detection and response technologies and to provide technology development and environmental planning for DOD's chemical weapons destruction program. We will apply our technologies, research capabilities, and expertise to address the national and international challenges related to nonproliferation and environmental security.

Strategic Indicators

- Develop innovative counterterrorism technologies in response to homeland and national security challenges.
- Develop novel technologies that reduce the proliferation of weapons of mass destruction and the materials and technologies used to produce them.
- Build upon core competencies in materials, detection, and response technologies to address customer challenges.
- Expand the INEEL's role in national and international nonproliferation and environmental security relative to the advanced fuel cycle, nuclear materials production and control, international safeguards and security, and transportation and management of spent nuclear fuel.
- Expand the INEEL's involvement with and support of the International Atomic Energy Agency by 2005.

Strategy

Develop a broad critical infrastructure assurance program to address customer needs against threats of terrorism, aging, and degradation, and malicious and inadvertent cyber security disruptions.

Before researchers can develop the technical solutions against threats, we must fully understand the vulnerabilities of critical infrastructure systems and components, and communicate vulnerability risks to customers and stakeholders. We can assist the customer in mitigating these vulnerabilities and prioritizing upgrade investment decisions for existing infrastructures. Our Critical Infrastructure Assurance Program is a comprehensive program that encompasses not only the application of technologies but also policies and processes that protect and strengthen the nation's infrastructure. We have defined a cyclical process in which each phase feeds data to and supports the resolution of the next phase from vulnerability assessment through certification development. We can apply consequence control procedures to existing infrastructure in order to limit damage, reduce recovery time from attacks, and lessen economic impacts. This broad infrastructure assurance program continues with developing standards for new, more robust infrastructures and the certification of systems and components against the new standards.

Strategic Indicators

- Conduct vulnerability assessments for strategic and critical infrastructures, and develop risk-based programs for prioritizing needs.
- Participate in critical infrastructure standards establishment.

- Develop methodologies for and demonstrate benefits of critical infrastructure consequence control.

Strategy

Meet the broader strategic needs of the national defense, intelligence, and homeland security communities by applying the total spectrum of INEEL R&D, operations, and manufacturing capabilities.

Although Homeland Security is in its infancy, its needs and requirements will be defined in the swiftest possible manner. With a history of proven applied engineering and technology development, nuclear operations, and manufacturing capabilities, our laboratory is prepared to respond rapidly to emerging needs. The successful delivery for almost two decades of quality products for demanding military customers has called for technical expertise, skilled workmanship, and outstanding project management. These skills, along with our applied engineering foundation, have resulted in significant, long-term defense programs and advances in defense-related research such as lightweight armor. We are capable of not only developing technologies but also designing applications and fielding results in a rapid and responsive manner.

Strategic Indicators

- Capitalize on Specific Manufacturing Capability know-how to develop and demonstrate lightweight armor products that enhance the nation's national security by 2007.
- Further develop the integrated, engineered systems capability, as applied to munitions assessment and command and control systems, to encompass homeland security needs.
- Establish the INEEL as the lead laboratory for advanced security and hardening/armor systems for spent nuclear fuel and radioactive high-level waste transport, and build upon the INEEL's experience and expertise in:
  - Vulnerability assessments; materials science and developing, designing, and manufacturing ballistic and armor materials for DOD; and systems engineering.
  - Safe management and transportation of spent nuclear fuel.
  - Critical infrastructure protection testing.
  - Terrorism and security threat assessment for DOE and DOD.
- Establish a strategic partnership and integrating role with Homeland Security to provide R&D, applied technology, and operational support by 2005.
- Expand the INEEL role in monitoring and information systems in support of national security.

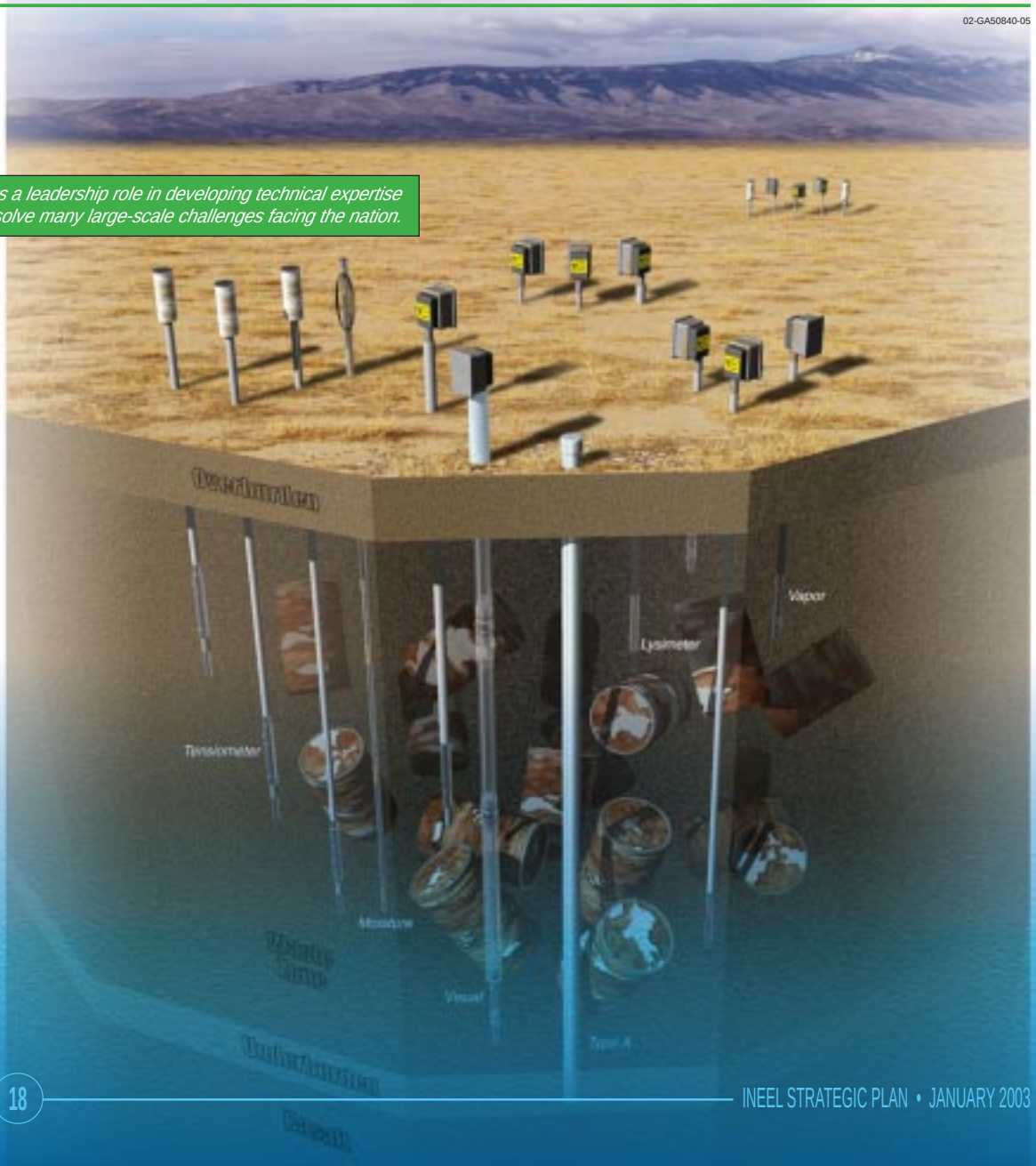
GOAL 5

Goal 5

Facilitate completion of DOE's legacy cleanup and stewardship responsibilities

The legacy of the nuclear weapons complex presents serious national environmental problems. These include buried waste, spent nuclear fuel disposition, high-level waste treatment and tank closure, and future environmental challenges. Successful disposition of nuclear waste and spent nuclear fuel will also address a key issue facing the nuclear power industry and enable future expansion of this energy source in the United States. Target investments in efficient cleanup technology will result in savings that can be reinvested in energy security for the nation.

The EM Top-to-Bottom review, "A Review of the Environmental Management Program," February 2002, concluded that science and technology should support accelerated risk-based cleanup and closure of EM sites. The INEEL has assumed a leadership role in developing forward-looking research plans designed to reduce the risk of environmental issues and to reduce the life-cycle costs of cleanup. We recognize that as cleanup progresses around the DOE complex and elsewhere, resolving emerging issues and intractable problems will require directed science and technology. Successful resolution will require a stewardship approach that includes physical controls, institutions, information, decision-making, and public involvement.



INEEL plays a leadership role in developing technical expertise needed to solve many large-scale challenges facing the nation.

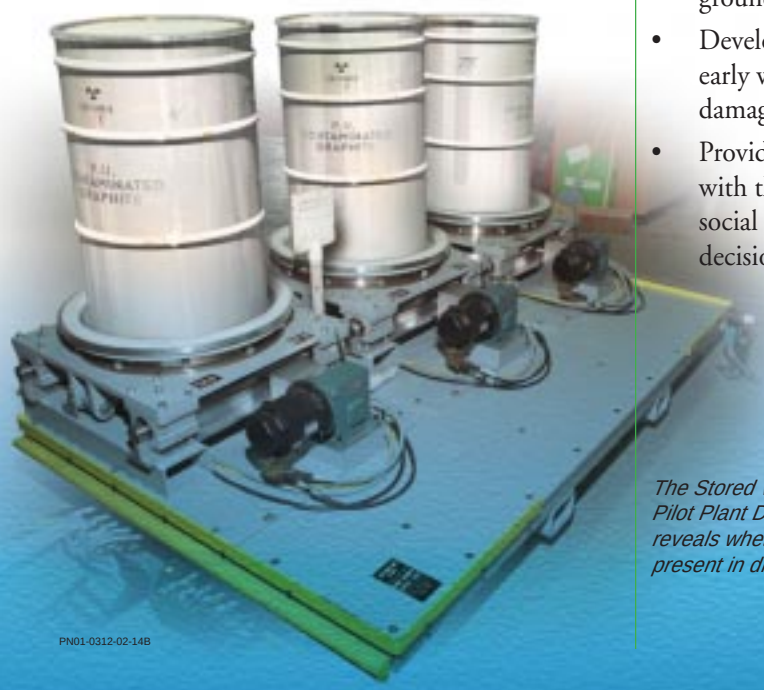
Strategy

Apply science and technology necessary to complete DOE's high-priority cleanup actions and have material placed in safe storage pending repository availability.

The INEEL has successfully managed spent nuclear fuel and high-level wastes for nearly half a century. We have significant applied research, technology, and engineering capability that can be applied to address DOE's environmental-cleanup challenges. The DOE Idaho Operations Office has issued the "Environmental Management Performance Management Plan for Accelerating Cleanup at the Idaho National Engineering and Environmental Laboratory," DOE/ID-1106, July 2002, that describes the approach to accelerating risk reduction at the INEEL by completing cleanup faster and more efficiently. We will continue to lead the development and application of applied science, technology, and engineering solutions necessary to achieve DOE's accelerated cleanup plans.

Strategic Indicators

- Provide enabling technologies to support INEEL tank farm closure by 2012 and calcine removal and spent nuclear fuel disposition by 2035.
- Adapt and apply science and technology developed for INEEL cleanup challenges at other federal and nonfederal sites.



PN01-0312-02-14B

The Stored Waste Examination Pilot Plant Drum Handling System reveals whether liquid waste is present in drums.

Strategy

Develop new R&D capability to resolve the nation's environmental challenges and provide cost-effective, reliable, long-term stewardship options.

Long-term stewardship means planning and safely managing legacy waste for periods ranging from tens to thousands of years. Technical success for long-term stewardship must include site conceptualization and modeling, contamination containment and control, site-monitoring sensors, information preservation and communication, relationships between disposal sites and their communities, long-term stewardship system performance verification and monitoring, and land-use controls that can survive and be effective over many decades. The INEEL will continue to play an active role in conducting and applying the science and technology that has a critical role in successful long-term stewardship.

Strategic Indicators

- Maintain a leadership role in formulating and implementing the science and technology solutions required by the nation's long-term stewardship challenges.
- Develop and validate predictive models to guide programs aimed at preventing or remediating contamination.
- Design and test robust waste containment systems to prevent contaminants from reaching groundwater supplies.
- Develop reliable monitoring systems to provide early warning of problems before extensive damage is done.
- Provide and advocate the use of tools that deal with the complexities of human behavior in social settings to enable successful decision-making in long-term stewardship.

GOAL 6

Goal 6

Conduct science and identify technologies that underpin solutions to DOE's mission (reliable energy, national security, energy-related science)

The discoveries and breakthroughs achieved through DOE's science programs contribute to fundamental scientific knowledge and fuel the applied research and technology programs within DOE. We plan to expand our fundamental science program and apply sound science and engineering principles through multidisciplinary teaming to provide tangible solutions to current and future real-world problems. We are focusing on cleaning and protecting the environment through the use of nature's own tools and on applying the historically strong capabilities of the laboratory in measurement systems to provide critically needed detection tools to combat chemical and biological terrorism. We will address national energy needs by conducting materials research for new nuclear reactors, exploring the use of biological systems for producing fuels, and applying our fundamental knowledge of geological systems to carbon dioxide sequestration and storage of high-level nuclear waste.

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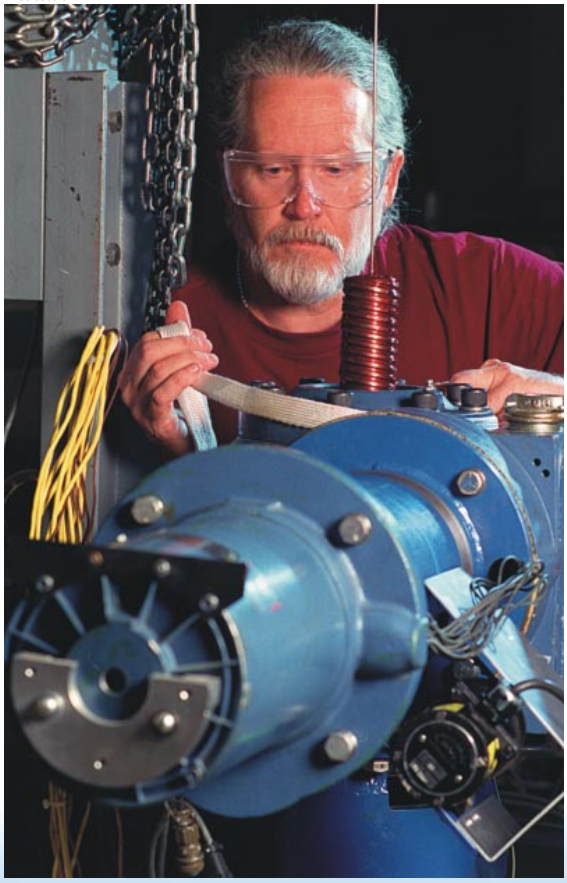

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PN00-0517-06-09

INEEL researchers conduct advanced R&D in multiple scientific and engineering disciplines in support of DOE missions.

Strategy

Conduct fundamental science that provides new knowledge and understanding in areas that directly support DOE missions.

The complex challenges faced by DOE require the assembly of an incredibly diverse set of technical skills and capabilities to address these challenges. Our recent successes in winning funding through the Nuclear Energy Research Initiative and Environmental Management Science Program are evidence that the INEEL is competitive and qualified to work on key DOE problems. However,

we plan to increase the overall number of Ph.D.-level research scientists in selected technical fields. We believe that new staff, coupled with existing staff, will set the stage for our future programs. We are also committed to encouraging and actively support staff participation in the wider scientific community through peer-reviewed publications and participation/leadership activities of technical societies.

Strategic Indicators

- Establish strong research efforts in foundation-building technical disciplines (biology, behavioral science, chemistry and chemical engineering, computational science, earth science, ecology, material science, mathematics, nuclear science and engineering, physics, and mechanical and electrical engineering) that focus on complex problems and interdisciplinary efforts.
- The INEEL programs in chemistry, physics, and materials science are contributing to the field of nanoscience and engineering. INEEL programs in biology, chemistry, earth science, and ecology are contributing to global climate change science and technology programs.

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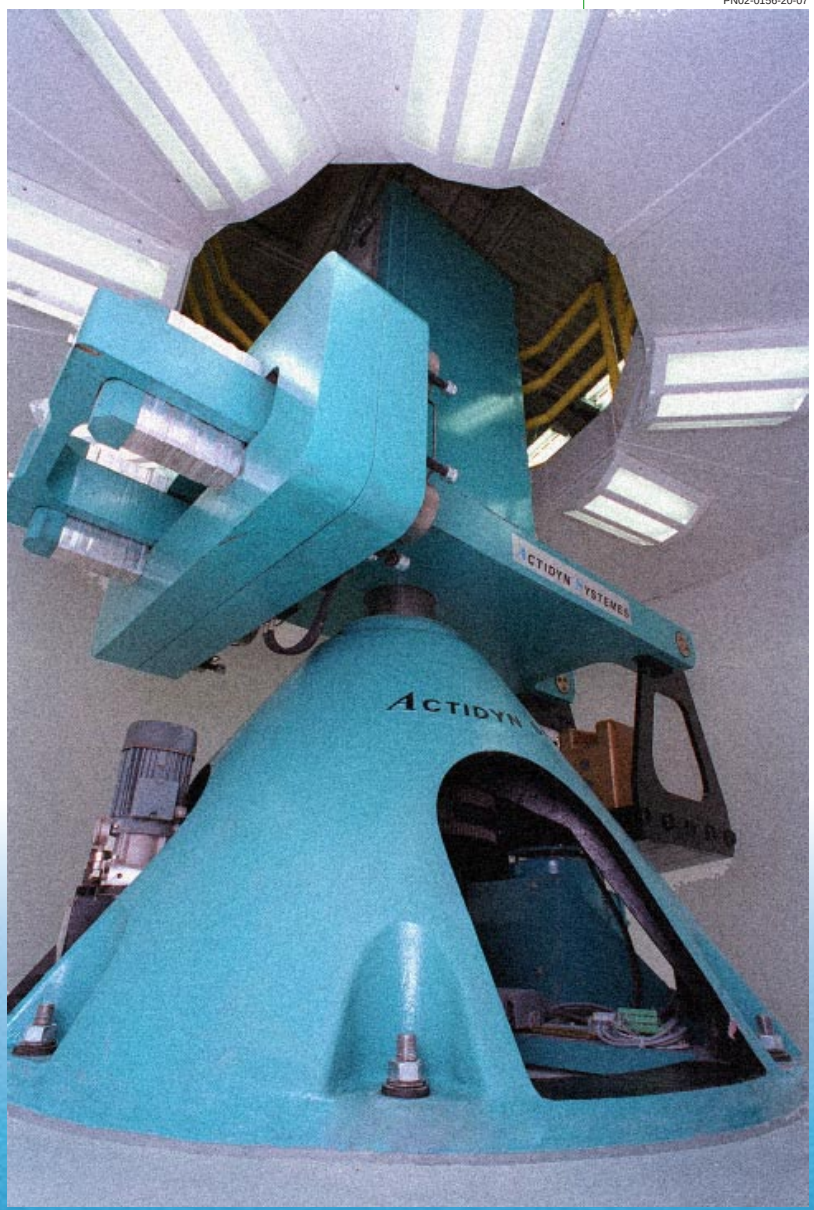

Pictured is a model c-61 geocentrifuge system (50-g tons, 2-m radius) located at the INEEL Geocentrifuge Research Laboratory. INEEL and visiting researchers will use the geocentrifuge to study fluid flow through samples made from soils, rock and other materials.

- Enhance the INEEL's stature in the scientific community through increased publication in first-tier technical journals and leadership in prominent scientific and engineering societies.
- Expand the role of advanced simulation and computing in all disciplines.
- Provide scientific computing support, including the technical knowledge and expertise to solve problems related to data analysis, modeling, simulation, and imaging in scientific computations.

Strategy

Develop new research capabilities and staff that enable application of fundamental science to complex applied problems.

In order to provide new research capabilities in support of DOE missions, we need to improve the physical research infrastructure and assemble top-quality research teams. We have already initiated a program to diversify the capabilities of our technical staff through the addition of new staff. However, it is imperative that we provide our technical staff with cutting-edge research tools and facilities. We are committed to acquiring critical new and replacement research tools through our General Purpose Capital Equipment program as well as alternative means such as cost sharing and corporate investment. We plan to focus on expanding our scientific and engineering computing infrastructure, adding new space for present and future research activities, and developing new capability for exploring the dynamics of coupled environmental processes that control the fate and transport of environmental contaminants.

Collectively, the scientific and engineering community's understanding of subsurface processes is incomplete, and existing tools to characterize and model these processes are inadequate. We have established the Subsurface Science Initiative, an interdisciplinary research program, to address these issues. The Subsurface Science Initiative focuses on broadening our fundamental understanding of subsurface processes so that we can monitor and predict the fate, transport and interactions of contaminants within the earth. Experiments representative of real-world environments such as those found in environmental management problems; long-term containment of radioactive waste and spent fuel; recovery of natural resources such as coal, oil, and natural gas; and potential to use geological repositories for carbon dioxide sequestration require enhanced understanding of subsurface processes. We focus on real-world problems by combining laboratory-scale, mesoscale, and field-scale R&D, and we recognize that environmental challenges present social, behavioral, and economic challenges as well. We also actively pursue collaborations ranging from individual investigators to institutions to effectively address DOE's technical challenges.

Strategic Indicators

- Invest in laboratory-directed R&D to develop diverse new science and technology capabilities in areas such as nanoscience, computing and simulation, and human health.
- Address critical research infrastructure needs to provide state-of-the-art advanced engineering and computing systems.
- Develop new solutions that address currently intractable cleanup problems.
- The INEEL Geocentrifuge Research Laboratory research program is implemented and performing work to test and validate subsurface models and scientific concepts by 2004.
- Review of the SGL by the Office of Biological and Environmental Research and Advisory Committee is completed in 2003.
- Develop collaborations that combine fundamental and applied science with technology demonstration programs that address major DOE needs including reliable energy sources, control of weapons of mass destruction, and long-term stewardship of radioactive materials.

GOAL 7

Goal 7 ***Continue to develop a high-performance, responsible, and accountable multiprogram national laboratory that is responsive to mission needs and demonstrates operational excellence***

We are committed to continuous improvement through highly capable staff, facilities, and tools that support growth and through application of information technology that enhances scientific investigation and system integration. That commitment is also reflected in our determination to deliver the results customers expect—a quality product, on schedule and within budget.

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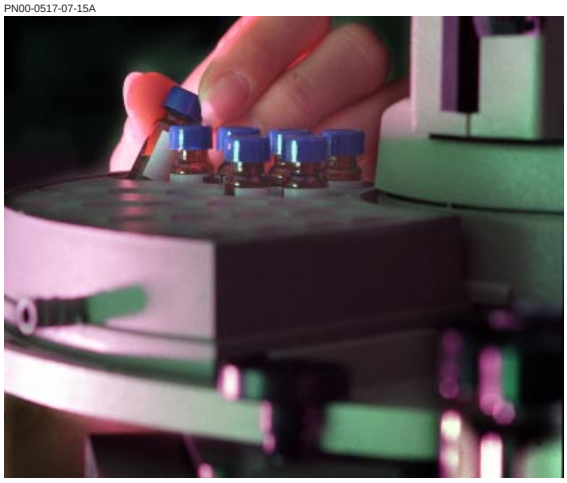

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INEEL is committed to continuous improvement through highly capable staff, facilities, and tools that support DOE missions.

Strategy

Manage our current and future human capital to ensure a staff that is of the highest quality, capable of sustained scientific and engineering excellence.

This strategy emphasizes the importance of continuing to improve our staff's capabilities and technical eminence through aggressive recruiting, compensating based on performance, and challenging the staff to excel.

Strategic Indicators

- Effectively recruit, develop, manage, and retain a high-quality and diverse work force to sustain world-class scientific and engineering programs and enhance laboratory capabilities.
- Support economic development and science and engineering education at the local, state, and regional levels.

Strategy

Provide staff with state-of-the art facilities that are safe and secure as well as the necessary tools to ensure operational excellence.

A national laboratory cannot be successful unless it provides the scientific and technical staff with facilities that meet realistic needs and specific tools needed to accomplish the assigned mission. We also recognize that operational excellence and security are cornerstones of continued success.

Strategic Indicators

- Improve the overall condition of laboratory facilities including new facilities that support increased experimental capabilities at ATR, hydrogen fuel research reactor testing, and nuclear fuels research.
- Address research space needs through the planned Center for Science and Technology located on the joint Idaho Falls campus of the University of Idaho and Idaho State University by 2005.
- Demonstrate continued commitment to the Integrated Safety Management System and the Voluntary Protection Program.
- Demonstrate continued commitment to the Environmental Management System (International Standards Organization 14001).
- Demonstrate commitment to best-in-class physical and cyber security.

Strategy

Aggressively upgrade, integrate, and expand our computing infrastructure, including computational science and high-performance computing capabilities.

Our efforts to upgrade our computing infrastructure cannot wane. It is incumbent upon leadership to provide needed scientific, business, and other computing capabilities that share information, reduce the burden on business processes, and focus on supporting projects and more efficiently accomplishing work.

Strategic Indicators

- Conduct a comprehensive scientific and engineering computing needs assessment in 2003 that projects these needs through 2013.
- Publish a prioritized plan within six months of completion of the needs assessment that addresses meeting the identified scientific and engineering computing needs.

Strategy

Achieve results that exceed customer expectations.

We are employing several best-management practices to continuously improve our performance. These include the Integrated Safety Management System, the Standards-Based Management System, R2A2s, Six Sigma process management improvement tool, our institutional and work planning process, self-assessment program, and our Project Engineering Tool Box. Through the use of these management systems and tools and the outstanding contribution of our staff, we are determined to exceed our customer's expectations and deliver world-class science and technology in an environmentally safe, secure, and efficient laboratory.

Strategic Indicators

- Improve management and accountability at all levels of the organization.
- Use achievement-focused performance indicators.
- Complete implementation of the customer service model.
- Enhance use of the Project Management Tool Box for R&D.

GOAL 8

Goal 8 — *Strengthen national and international partnerships to address DOE R&D needs*

Experience has shown that collaborations between universities, national laboratories, other government agencies, and industry are effective drivers for innovative research, education, and business. We value and cultivate collaborations by providing the leadership and technical expertise needed to solve many large-scale technical challenges facing the nation.

PD03-0008-01

Representatives of the Generation IV International Forum gathered in Seoul, Korea in August 2000 to discuss policy and technical issues related to Generation IV. Subsequent forum meetings have been held in Miami and Rio de Janeiro (pictured below).

PD03-0009-01

Strategy

Strengthen and extend collaborations with other national laboratories in research areas of mutual interest.

The success of our laboratory initiatives in nuclear energy, critical infrastructure protection, subsurface science, and other areas depends in part on the support of strategic partners at other national laboratories. This approach best leverages DOE's investment in science and harnesses the historical strengths of its national laboratories.

Strategic Indicators

- As a part of our joint responsibility as lead laboratories for nuclear reactor technology, the INEEL and Argonne National Laboratory-West plan joint research projects that use the complementary expertise of each organization's personnel and facilities. The two laboratories plan at least one major cooperative program in 2003 and are participating as partners in the development and leadership of the Advanced Fuel-Cycle Initiative.
- Jointly implement a national Supervisory Control and Data Acquisition Test Bed with Sandia National Laboratories to support national energy assurance and homeland security objectives by 2004.
- Advance subsurface science by partnering with other national laboratories (Pacific Northwest National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, Argonne National Laboratory-West, Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, and Lawrence Livermore

National Laboratory and DOE's Grand Junction Office) to address critical environmental challenges.

- Develop the technical basis, in collaboration with other national laboratories and universities, for experimental campaigns to be conducted in the proposed Subsurface Geosciences Laboratory.

Strategy

Strengthen and extend research collaborations with universities in areas of strategic laboratory focus.

Commencing this year, we plan to enhance existing partnerships and establish new partnerships with universities in support of our laboratory initiatives.

For nuclear science and engineering, the INEEL will continue collaborations with the Massachusetts Institute of Technology (MIT) while nurturing new university collaborations within the recently founded Innovations in Nuclear Infrastructure and Education (INIE) program. The INEEL is a member of the INIE Western Nuclear Science Alliance along with Oregon State University, the University of California at Davis and Berkeley, Washington State University, Idaho State University and five national laboratories (Lawrence Livermore National Laboratory, Pacific Northwest National Laboratory, Los Alamos National Laboratory, Argonne National Laboratory, and the Jet Propulsion Laboratory). The INEEL will also collaborate with the other INIE alliance universities to seek focused research opportunities and serve as host to graduate students and faculty.

For other research areas, including national security, subsurface science, biotechnology, and energy we plan to maintain and enhance our collaborations with the eight regional universities of the Inland Northwest Research Alliance (INRA), as well as several other domestic and foreign universities.

Strategic Indicators

- Enhance and expand collaborations with MIT, INIE universities, and other universities in nuclear energy beyond the current MIT Center for Advanced Nuclear Energy Systems.
- Partner, as appropriate, with Idaho State University to form and operate an Institute for Nuclear Science and Engineering with both education and research missions.
- Engage at least three additional major nuclear engineering university departments in formal joint research partnerships within the next three years. These partnerships will combine the talents of the laboratory with university faculty and students to solve problems relevant to DOE's nuclear energy mission as well as support a rebuilding of the country's nuclear engineering education infrastructure.
- Continue joint activities at the Idaho Accelerator Center at Idaho State University to develop active interrogation techniques for detecting both conventional explosives and weapons of mass destruction.
- Enhance the INEEL/INRA relationship by:
  - Increasing the direct involvement of INRA representatives with the laboratory, including joint appointments and personnel exchange.
  - Continuing to collaboratively support the development of educational programs that directly support our mission.
  - Enhancing INEEL/INRA management collaboration.
  - Supporting technical areas of the INRA Subsurface Science Research Institute and the Subsurface Science Symposium.

Strategy

Strengthen collaborations with industry in areas of mutual technical expertise and involvement.

We use a variety of commercial arrangements such as Cooperative R&D Agreements, technology licenses, Work-for-Others agreements, and other business arrangements to establish technology partnerships. In addition, as part of the DOE contract, Bechtel Corporation, BWX Technologies, Inc., and INRA have committed to reinvest a portion of the yearly fee for conducting research at the INEEL. This Corporate-Funded R&D Program is a unique opportunity to enhance research at the INEEL. As we develop the next generation of nuclear reactors, we will build on our strong relationship with the nuclear power industry that dates back more than 50 years. Opportunities for expanded collaboration also exist in the oil and gas,

biotechnology, materials, and alternative energy industries.

Strategic Indicators

- Build on record performance in 2001 by continually increasing licensing income.
- Develop a long-term relationship with NanoSteel Company (an INEEL spinoff company) to develop and deploy super-strength steels and nanopowder production programs focused on materials for the paint and coating industries.
- Strengthen our ties and relationships with the nuclear power industry.
- Develop and deploy a Wireless Communications Test Bed in support of government and industry needs in collaboration with Bechtel Telecommunications by 2003.
- Develop fuel-cell technology for remote and distributed systems in collaboration with BWX Technologies, Inc.
- Develop small-scale natural gas liquefaction systems in collaboration with domestic and foreign industrial companies.

Strategy

Increase and enhance collaborations with U.S. and international governmental agencies that support and augment DOE missions.

Strategic Indicators

- Continue leadership in the Generation IV International Forum and the implementation of the Generation IV Roadmap.
- Assume a leadership role in the integrated Generation IV/Advanced Fuel-Cycle Initiative beginning in 2003.
- Establish partnerships and collaborations to fulfill DOE's nuclear energy objectives, resulting in a minimum of 10 cooperative programs with universities, five cooperative programs with other DOE laboratories, and one cooperative program with an industrial partner by 2005.
- Increase collaborations with regional, national, and international entities in support of specific security needs.

...launching a new era in the nation's nuclear energy program.

The INEEL's new vision focuses on our nuclear roots, while continuing our support to all of the Department of Energy's missions.

The INEEL is a U.S. Department of Energy
National Laboratory Operated by
Bechtel BWXT Idaho, LLC.

02-GA50840