INEL

Idaho National Engineering Laboratory

INTRODUCTION

The Idaho National Engineering Laboratory (INEL), where electricity was first generated from nuclear energy, is situated on 890 square miles of the southeast Idaho desert. Administered by the U.S. Department of Energy Idaho Operations Office, the INEL is a leading center for nuclear safety research, defense programs, nuclear waste technology, and developing advanced energy concepts.

Established in 1949 as the National Reactor Testing Station, the INEL contains the largest concentration of nuclear reactors in the world. Fifty-two reactors, most of them first-of-a-kind facilities, have been built here. Fourteen of these facilities are operable, the others having been phased out on completion of their research missions.

In 1951 the INEL was the site of one of the most significant scientific accomplishments of the century—the first use of nuclear fission to produce electricity. This took place at Experimental Breeder Reactor No. I (EBR-I), now a national historic landmark open to the public.

The first pressurized water reactor and boiling water reactor prototypes were built and operated at the INEL in the 1950s. One of the latter, BORAX III, was the first to light an American town—Arco, Idaho in 1955. Today, in addition to nuclear fission programs, work is conducted on fusion energy, geothermal energy, low-head hydropower, industrial energy conservation, environmental research, strategic and critical materials, computer code development, materials testing, and advanced instrumentation development.

The principal INEL Site comprises nine program operating areas, valued at more than ***$3.2 billion****. Six buildings in Idaho Falls house administrative and scientific services supporting INEL operations.*

The Site has an average elevation of 4,865 feet, underlain with beds of lava rock. Annual precipitation averages 8.5 inches.

EMPLOYMENT AND ECONOMIC DATA

INEL employment totals about 10,000. Most INEL facilities are operated by government contractors: American Protective Services, Argonne National Laboratory, EG&G Idaho, Westinghouse Electric Corporation, and Westinghouse Idaho Nuclear Company. Construction and design engineering is performed by Catalytic, MK-Ferguson Company, Rockwell-INEL, and the Ralph M. Parsons Company.

More than 1,300 employees hold engineering degrees. About 600 have science degrees, mostly physical science, and more than one employee in three has a college degree.

Approximate INEL payroll during FY 1985 was **$285 million**. During 1985, INEL programs cost about **$593 million**. Total estimated cost for FY 1986 amounts to **$600 million**.

The INEL and its employees significantly influence Idaho's social and economic welfare. INEL employees represent the heaviest concentration of technical professionals in the northern Rocky Mountain region. Many employees are active in civic and community affairs and contribute significantly to the quality of life in the area. Economically, the INEL generates approximately **$612 million** annually in wages and salaries, directly and indirectly, and generates more than **$50 million** in various tax revenues to Idaho.

RADIOLOGICAL AND ENVIRONMENTAL SCIENCES

The Radiological and Environmental Sciences Laboratory (RESL), operated by Department of Energy (DOE) personnel, is renowned for its pioneering work in the fields of radiation monitoring devices, ultrasensitive methods for radiochemical analyses, and radiation safety research and development.

RESL scientists carry on a year-round program for studying and monitoring the underground water supply, food stuffs, soil, vegetation, and air. Data obtained from this work continue to confirm the safety of INEL operations for Site employees and the public.

Working in conjunction with, but independent of, DOE employees are a number of highly trained atmospheric, geologic, and hydrologic experts employed by the U.S. Geological Survey and the National Oceanic and Atmospheric Administration.

WATER REACTOR SAFETY PROGRAMS

Water reactor safety research has been conducted at the INEL since 1955 when the first reactor safety studies were conducted in the Special Power Excursion Reactor Test No. I (SPERT-I) Facility. Early research focused mainly on the so-called "runaway power" accident. Testing in four SPERT reactors led to an understanding of several natural mechanisms that resist runaway power conditions. SPERT tests also led to the development of improved reactor safety control systems.

Other major contributions to water reactor safety research have been made by the Power Burst Facility (PBF) and the Loss-of-Fluid Test (LOFT) Facility. Tests conducted at these facilities have provided information on fuel and systems behavior during various postulated accident scenarios.

EG&G Idaho conducts the INEL's water reactor safety research programs for DOE and the Nuclear Regulatory Commission (NRC). Some programs are funded partially by foreign governments or private institutions.

The purpose of these programs is to study the behavior of nuclear power plants, nuclear fuel, and reactor safety systems during off-normal or accident operating conditions. Equipment, procedures, and operator performance are studied to reduce the possibility of reactor accidents and to reduce the extent of damage.

This research is conducted in accordance with the nation's policy of seeking information to resolve safety issues related to reactor design, licensing, and operation.

MATERIALS TESTING PROGRAM

New fuels and materials that could help improve water-cooled reactor design and operation are tested in the INEL's 250-megawatt Advanced Test Reactor (ATR). These tests determine how fuels and materials—relatively unaffected in more conventional environments—react when bombarded by streams of neutrons and gamma rays. Some materials swell or crack in this reactor environment, whereas others become soft or brittle. The effects of many years of radiation in a commercial reactor can often be obtained in days or months by inserting samples in the ATR.

The largest materials test reactor of its kind, the ATR has a unique serpentine core design. This four-lobed core delivers a wide variation of power levels to nine individual test loop areas. Each test loop has its own pressurizer, pump, heat exchanger, and purification system apart from the reactor's main core, allowing nine individual experiments to be conducted in the ATR simultaneously. Additional test space surrounds the loops, allowing even more experiments to be conducted independently.

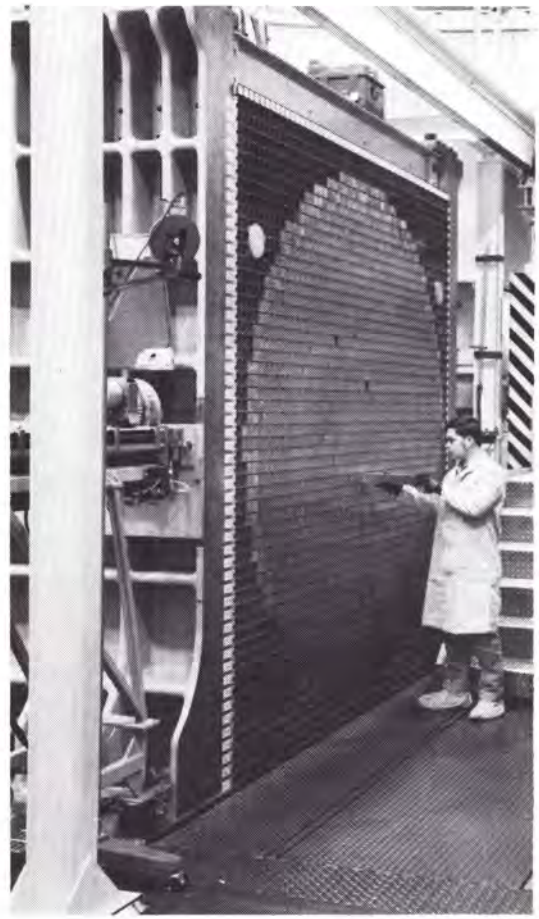
The ATR is upgraded regularly, growing more sophisticated in design to meet the needs of the nuclear industry. It has incorporated advances gained through experience in two, now inactive, INEL materials test facilities, the Materials Testing Reactor and the Engineering Test Reactor.

BREEDER REACTOR RESEARCH

An important INEL responsibility includes assignments for furthering DOE's breeder reactor base research and development program. The program is aimed at power plants that create more new fuel than they burn while generating electrical power. The Argonne National Laboratory-West area is building on the accomplishments of the historic EBR-I, which produced the first usable electrical power from the atom in 1951 and two years later first proved the feasibility of fuel breeding.

Its successor, Experimental Breeder Reactor II (EBR-II), is a 20-megawatt electrical power plant, operating since 1964. The electricity produced by EBR-II is used on the INEL power grid. The plant plays an important role in testing fuels and materials for future breeder reactors.

During the past two years, scientists from Argonne have developed an innovative design for an advanced nuclear power plant, called the Integral Fast Reactor (IFR). The plant appears to be inherently safe and less expensive to build and operate than previous reactors. It also has a closed, self-contained fuel cycle that appears to be economical and highly resistant to diversion.



Other Major Facilities at Argonne-West

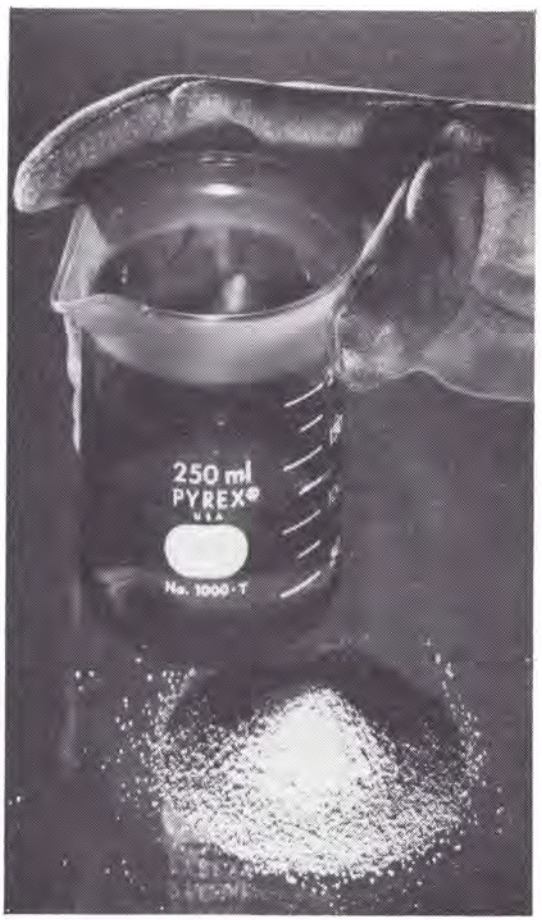
—The Transient Reactor Test (TREAT) Facility produces power bursts for testing breeder fuels at extreme power or temperature levels.

—The Zero Power Plutonium Reactor (ZPPR), the largest fast reactor critical facility in the world, performs low-powered testing physics and design studies.

—The Hot Fuel Examination Facilities/North and South (large, shielded hot cells) each contain an air-atmosphere and an argon-atmosphere cell. They are used for handling and examining radioactive experiments from test reactors both on and off the INEL.

—Two other small reactors at Argonne-West are the Neutron Radiography Facility Reactor, used as a neutron source for testing, and the Argonne Fast Source Reactor, used for developing improved instruments and techniques for fast-neutron measurements.

REACTOR FUELS REPROCESSING



The INEL's Idaho Chemical Processing Plant (ICPP) recovers valuable "unburned" uranium from spent nuclear reactor fuel elements, mostly from government-owned reactors. Since 1953, the ICPP has recovered approximately two-thirds of a billion dollars' worth of Uranium-235.

The highly radioactive by-product liquids from the ICPP operations are first stored in 300,000-gallon stainless steel tanks inside underground concrete vaults. These vaults are monitored at least three times daily for tank leakage although no leak has ever occurred. When properly cooled, the liquids are converted into granular solids and then retrievably stored in large, stainless steel bins inside underground concrete vaults.

A major effort is underway to replace the 20-year-old aging ICPP facilities to increase the plant's efficiency and capabilities.

The new Waste Calcination Facility, a replacement solidification plant brought on-line in 1982, is capable of converting 3,000 gallons of highly radioactive waste to solid form daily.

The new Fluorinel Dissolution and Fuel Storage Facility (FAST) augments and improves existing and aged ICPP operations. The multilevel, 120,000-square-foot facility receives, stores, and dissolves used nuclear fuel from government-owned reactors. The uranium recovery payback is expected to cover the facility's construction costs by the early 1990s.

Another new facility, the Remote Analytical Laboratory (RAL), incorporates the most modern and sophisticated analytical chemistry techniques to support analyses of process operations.

Construction has started on the final facility necessary to bring about a complete upgrade of the ICPP. Excavation for the Fuel Processing Restoration Project began in April of 1986, and completion of construction is now scheduled for late 1992. The Fuel Processing Facility (FPF) will increase uranium recovery by more than a factor of four over present capability. The FPF also will allow increased on-stream availability through remote maintenance and equipment replacement and will permit more positive control of effluent. Rigorous design, safety, and security standards are being incorporated in the design and construction of the FPF.

A new Coal-Fired Steam Generation Facility (CFSGF) is providing the ICPP with steam for heating and processing. Replacing aged oil-fired burners, the CFSGF operates with a fluidized bed combustion design and is equipped with the best available air pollution control technology.

RADIOACTIVE WASTE MANAGEMENT

Nuclear waste research and technology development are major areas of study at the INEL. Various strategies of waste storage and processing are studied and implemented at the Radioactive Waste Management Complex (RWMC) and other INEL locations. RWMC demonstrates that low-level beta-gamma, contact-handled transuranic waste, and intermediate-level transuranic wastes can be handled and stored safely.

Transuranic waste, materials contaminated with small amounts of plutonium and americium, are stored at RWMC. A major goal of the DOE waste management program is to remove all retrievable transuranic waste from the INEL and place it in a federal repository. Starting in 1989, INEL contact-handled transuranic waste will be transported to the federal Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal. Two experimental pilot-plant facilities will prepare INEL contact-handled transuranic waste for transport to WIPP. The Stored Waste Examination Pilot Plant (SWEPP) provides capabilities to nondestructively examine and certify transuranic waste. Containers not certified for WIPP will be sent to the Process Experimental Pilot Plant (PREPP) for processing into a certifiable form.

The RWMC is exploring new techniques for disposing of low-level

waste. This material, generated at the INEL, consists of protective clothing, paper, rags, packing materials, glassware, tubing, and other general-use items. Containers of low-level waste are placed in pits or soil vaults in the RWMC Subsurface Disposal Area. A concerted effort is ongoing at the INEL to identify and apply methods for volume reduction of low-level waste. At the Waste Experimental Reduction Facility (WERF), contaminated metal wastes are melted and cast into ingots, achieving a significant volume reduction. Incineration of combustible low-level waste is also carried out at WERF, achieving a volume reduction of about 100-to-1.

NAVAL REACTORS FACILITY

The Naval Reactors Facility (NRF) today is still adding to its significant accomplishments. These include the feasibility testing of the world's first nuclear submarine engine in the early 1950s, and the subsequent prototype operation of the first nuclear engines for large surface ships. The NRF also serves as a training station for nuclear Navy crews.

NATIONAL ENVIRONMENTAL RESEARCH PARK

The 570,000-acre INEL Site became the nation's second National Environmental Research Park in 1975. Since then, all lands within the INEL boundaries have been a protected outdoor laboratory where scientists from DOE, other federal and state agencies, universities, and private research foundations conduct ecological studies.

DOE IDAHO OPERATIONS OFFICE

The DOE Idaho Operations Office (ID) is located in Idaho Falls about 50 miles east of the INEL Site and houses approximately 225 DOE-ID scientific and administrative employees.

In addition to the INEL, DOE-ID administers work at the damaged Three Mile Island reactor in Pennsylvania; a nuclear fuels reprocessing facility in West Valley, New York; a Magnetohydrodynamics (MHD) Coal-Gasification Components Test Facility in Butte, Montana; the DOE Denver Support Office; and the DOE Grand Junction Area Office in Colorado.

INEL RESEARCH CENTER

The INEL Research Center (IRC), located in Idaho Falls, is a multidisciplinary research center where INEL scientists and engineers conduct research in such disciplines as materials science, chemistry, physical sciences, biotechnology and environmental sciences. The IRC is a cornerstone for present and future government-based technology programs, geared toward achieving energy self-sufficiency and improving industrial productivity and competitiveness for the United States.

NEW DIRECTIONS

The INEL continues to expand its program base and has received new initiatives as industry, other government agencies, and the worldwide scientific community recognize the unique facilities, capabilities, and expertise available here. The uniqueness of the INEL has allowed an expansion of the customer base. Defense and aerospace programs are becoming more important to the INEL as are cooperative research projects with universities and private industry. In addition to DOE and NRC, the INEL has new programs sponsored by the U.S. Department of Defense, the National Aeronautics and Space Administration, the U.S. Department of Interior, and the U.S. Environmental Protection Agency.