

SUBSURFACE EXPERIMENTAL LABORATORY

AUTOCLAVE AND CORE FLOW TEST FACILITIES



NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

DESCRIPTION

Researchers at the National Energy Technology Laboratory (NETL) study subsurface systems to better characterize and understand gas-fluid-rock and material interactions that impact environmental and resource issues related to oil, gas, and CO₂ storage development. However, studying the wide variety of subsurface environments related to hydrocarbon and CO₂ systems requires costly and technically challenging tools and techniques. As a result, NETL's Experimental Laboratory encompasses multi-functional, state-of-the-art facilities that perform a wide spectrum of geological studies. This provides an experimental basis for modeling of various subsurface phenomena and processes. This includes, but is not limited to, the following: long term exposure of geological samples to specific conditions such as CO₂ saturation at elevated pressure and temperature; the study of geomechanical properties and behavior of fluids; and fluid-solid and fluid-fluid physical and chemical interactions. The laboratory has a wide range of tools and instrumentation to ensure a complete cycle of scientific studies. This begins with preparation of representative samples, moves through the preliminary measurements of basic properties, and culminates in the advanced investigation of the processes of interest under simulated subsurface conditions.

CAPABILITIES

The High Pressure Immersion and Reactive Transport Facility utilizes autoclave reactors that can be equipped with various gases. The reactors have a pressure rating of 5,000 pound-force per square inch (psig) at temperatures up to 482 °F. The lab also contains a set of autoclaves for experiments at 10,000 psig and temperatures up to 662 °F in CO₂ / brine environments. Test reactors are ideally suited to investigate gas/liquid or gas/slurry interactions.

The Geological Sequestration Core Flow Facility includes two flow-through test systems with the ability to measure permeability, CO₂-enhanced oil recovery, and CO₂-water-rock interaction of core samples under CO₂ sequestration conditions. Water-rock flow-through systems allow for measurement of relative permeability of various fluids to study fluid displacement in reservoir rocks under high pressure (up to 5000 psi) and temperature (up to 150 °C) conditions. These units can also be used to study flow-through fractured seal materials such as well-bore cements and caprocks.

GOALS AND OBJECTIVES

Research aimed at monitoring the long-term storage stability and integrity of CO₂ sequestered in geologic formations is one of the most pressing areas that needs to be understood if geologic sequestration is to become a significant factor in reducing greenhouse gas emissions. The most promising geologic formations under consideration for CO₂ sequestration are active and depleted oil and gas formations, brine formations, and deep, unmineable carbon ore seams. Unfortunately, the long-term CO₂ storage capabilities of these formations are not well understood.



Figure 1. Six fixed-head autoclave system with PC interface.

The laboratory's goal is to better simulate the conditions found in major potential geological sequestration sites. Information obtained from laboratory testing of various rock types under a variety of controlled conditions and environments will provide information on the geotechnical effects and chemical interactions that occur when CO₂ is injected into natural rock. This information will also be used to predict potential problems that might be encountered in field-scale investigations.

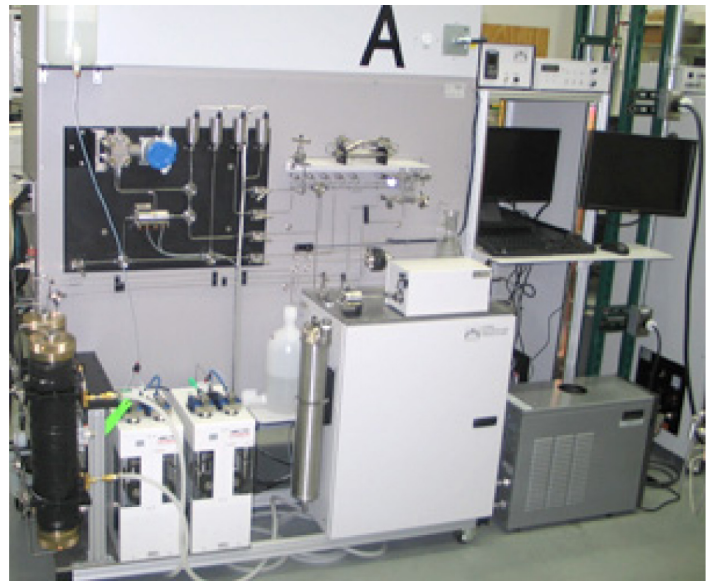


Figure 2. CFS-839Z water-rock flow-through system.

BENEFITS

To help meet a national strategic commitment to clean power generation, NETL is developing a technology base for tomorrow's highly efficient, near-zero-emissions power plants. Environmental and geosciences researchers perform laboratory-scale studies of solid, liquid, and gaseous flows and their interactions. These studies are aimed at understanding the suitability of flue gases for capture and storage in industrial wastes after release from coal-fired power plants. Utilization and sequestration of greenhouse gases, such as CO₂, to mitigate global warming is a primary focus of NETL's research initiatives. The Autoclave and Geological Sequestration Core Flow Test Facilities will be instrumental in accessing the realistic potential of CO₂ geologic sequestration, as well as coalbed methane (CBM) production. Activities conducted at these test facilities will be instrumental in linking laboratory, field, and modeling activities, to ensure accurate test results while optimizing resources to achieve program goals.

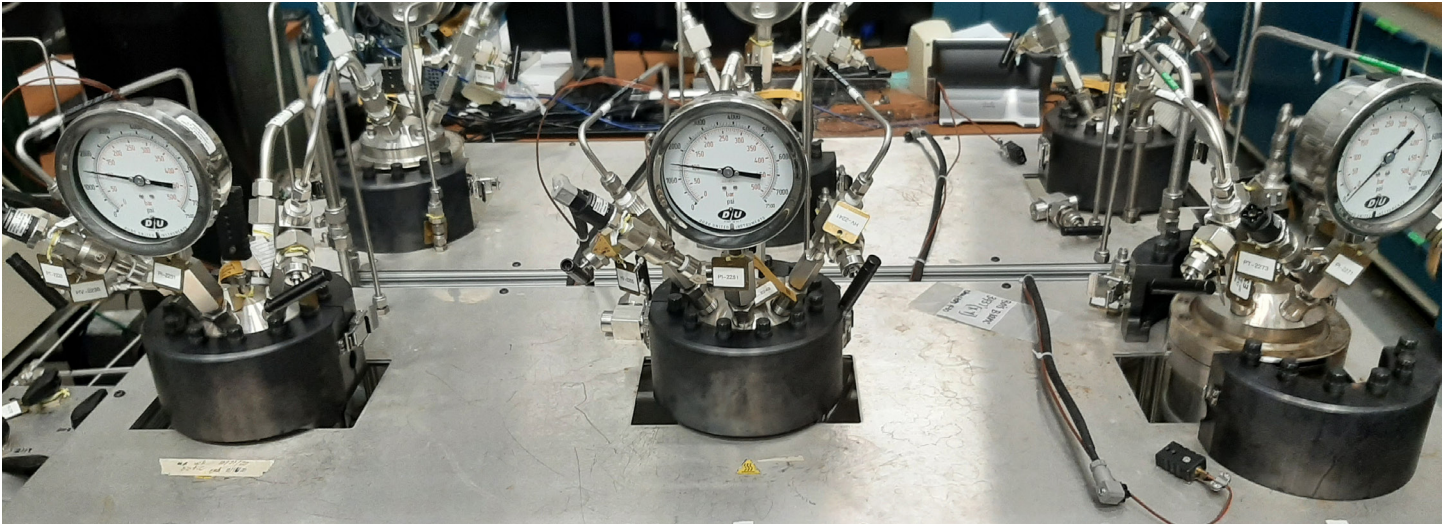


Figure 3. Flow-through unit for studying CO₂-enhanced oil recovery.

NETL is a U.S. Department of Energy national laboratory that drives innovation and delivers technological solutions for an environmentally sustainable and prosperous energy future. Through its world-class scientists, engineers and research facilities, NETL is ensuring affordable, abundant and reliable energy that drives a robust economy and national security, while developing technologies to manage carbon across the full life cycle, enabling environmental sustainability for all Americans, advancing environmental justice and revitalizing the economies of disadvantaged communities.

Leveraging the power of workforce inclusivity and diversity, highly skilled innovators at NETL's research laboratories in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania conduct a broad range of research activities that support DOE's mission to ensure America's security and prosperity by addressing its energy and environmental challenges through transformative science and technology solutions.

NETL lends its expertise toward achieving a carbon-free power sector by 2035 and a net-zero economy by 2050 while catalyzing economic revitalization, creating good-paying jobs and supporting workers in energy communities, especially hard-hit coal, oil and gas, and power plant communities, across the country. One of the most rewarding aspects of NETL's research is that our innovations and our technologies have the potential to improve people's lives in meaningful ways.



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