the ENERGY lab

PROJECT FACTS

Carbon Sequestration

In-Situ MVA of CO_2 Sequestration Using Smart Field Technology

Description

Through its core research and development program administered by the National Energy Technology Laboratory (NETL), the U.S. Department of Energy (DOE) emphasizes monitoring, verification, and accounting (MVA), as well as computer simulation, of possible carbon dioxide (CO_2) leakage at CO_2 sequestration sites, along with risk assessment of those sites. MVA efforts focus on the development and deployment of technologies that can provide an accurate accounting of stored CO_2, with a high level of confidence that the CO_2 will remain permanently sequestered. Effective application of these MVA technologies will ensure the safety of sequestration projects with respect to both human health and the environment, and provide the basis for establishing carbon credit trading markets for sequestered CO_2. Risk assessment research focuses on identifying and quantifying potential risks to humans and the environment associated with CO_2 sequestration, and helping to ensure that these risks remain low.

In this three-year project—performed by the West Virginia University Research Corporation with support from CONSOL Energy, Advanced Resources International, Battelle, and Schlumberger—the Principal Investigator (PI) will develop a software package capable of recognizing patterns from real-time data transmitted by multiple permanent downhole gauges (PDGs) and then estimating the location and amount of any CO_2 leakage causing a pressure change in the reservoir. The software will be developed by simulating PDGs in a carbon storage reservoir formation where CO_2 is being sequestered. Results of this project are expected to be broadly applicable to a variety of sequestration technologies and projects seeking to model potential CO_2 leakage from geologic formations.

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PARTNERS

CONSOL Energy
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Battelle
Schlumberger

COST

Total Project Value
$1,681,126

DOE/Non-DOE Share
$1,344,618 / $336,508

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U.S. DEPARTMENT OF ENERGY

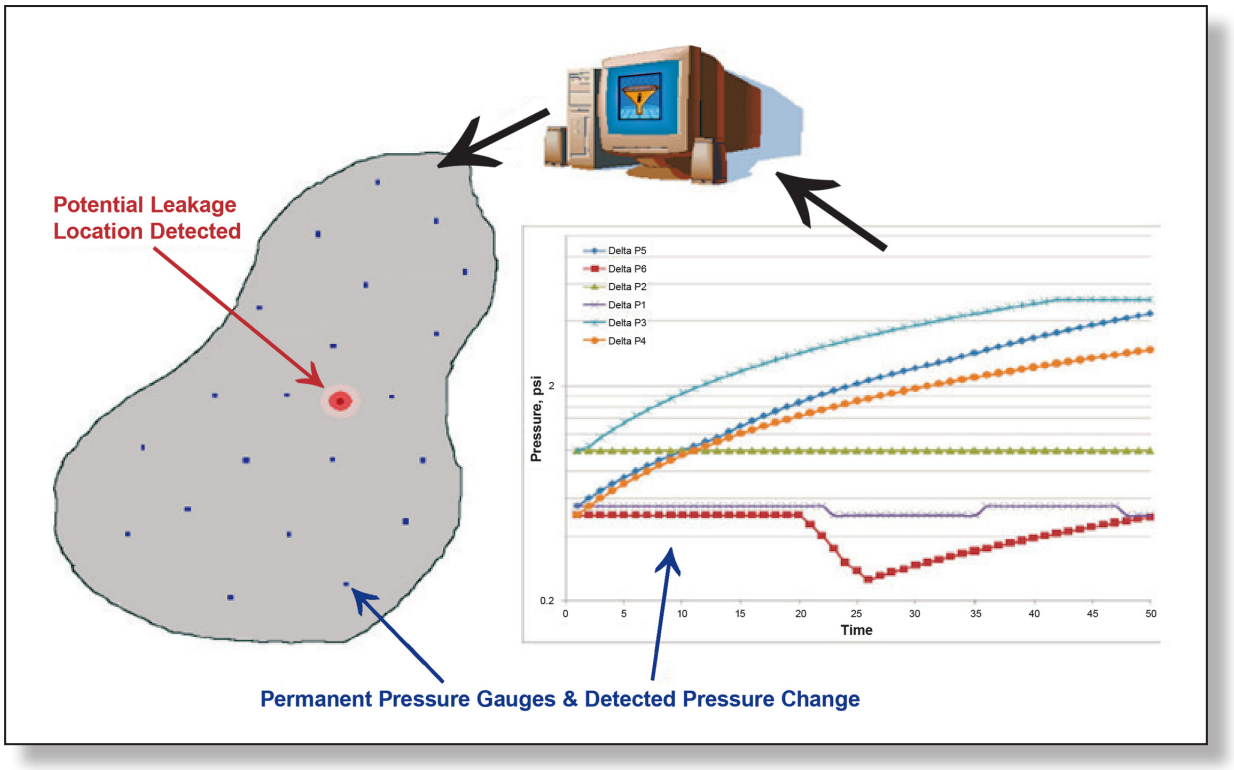

Figure 1: By performing intelligent pattern recognition on pressure changes as a function of time, the new technology will be able to approximate the location and amount of CO_2 leakage in a sequestration project. In the above plot (right), the changes in pressure (Δp) that have been detected by different PDGs are shown in different colors. The new technology will analyze and interpret these changes in real time and provide an approximate location of the potential leakages as shown on the left.

The new technology is based on the concept of "smart fields," which is rapidly gaining support and popularity in the oil and gas industry. Smart fields integrate digital information technology with the latest monitoring techniques to provide continuous knowledge and control of reservoir operations and processes. Under this concept, hundreds of millions of dollars have been invested to successfully develop highly sensitive PDGs that are capable of operating in harsh environments for long periods. The PDGs collect and transmit high-frequency data streams in real time to remote control centers to be analyzed and used for reservoir management.

Primary Project Goal

The main objective of this project is to develop the next generation of intelligent software that is able to take maximum advantage of the data collected by PDGs to continuously and autonomously monitor and verify CO_2 sequestration in geologic formations. Further, the project team will investigate the feasibility of using this technology to monitor the growth and advancement of the CO_2 plume during the injection process.

Planned Activities

To accomplish the above objectives, the project team will use the pattern recognition power of state-of-the-art Artificial Intelligence and Data Mining (AI&DM) technology to develop a methodology, residing in a computer program, to recognize patterns from simulated realistic pressure data acquired from PDGs located within the reservoir model. This software will be capable of, but not limited to, locating point sources within a reservoir from which CO_2 is leaking based on changes in pressure data. The methodology will autonomously cleanse and summarize raw data collected from in-situ pressure gauges, to prepare the data for processing and analysis. Upon completion, the methodology will be validated by its ability to accurately identify the location of simulated leakage points in a model of an existing heterogeneous reservoir. Once the approximate location of potential CO_2 leakage is identified, the information will be communicated via e-mails, text messages, or other means to those performing "at" or "near" surface monitoring locations for more precise detection and analysis.

Benefits

Successful performance of this project will improve the understanding of factors affecting CO_2 storage permanence and capacity, and increase confidence that CO_2 placed in geologic formations is accurately tracked and that any leakage is detected and quickly treated. Results of the project are expected to be broadly applicable to a variety of sequestration technologies and projects seeking to model potential CO_2 leakage from geologic formations.