PROJECT facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Carbon Sequestration

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New Approach for Long-Term Monitoring of CO_2 Leaks from Geologic Sequestration

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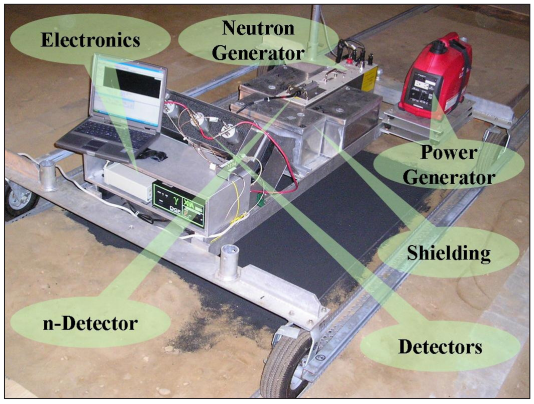
Background

Monitoring, mitigation, and verification (MMV) capabilities are critical in ensuring the long-term viability of carbon capture and storage (CCS) projects. MMV research is generally focused on developing techniques to provide an accurate account that the stored CO_2 will remain safely and permanently stored in suitable geologic formations. Furthermore, assuring human health and safety and preventing damage to the host ecosystem will be essential in obtaining permits for geologic sequestration projects.

Description

Brookhaven National Laboratory (BNL) developed a multi-elemental scanning instrument for determining carbon analysis in soil. The method is based on inelastic neutron scattering (INS), which offers a non-invasive method for continuous monitoring of the soil carbon and other elements in situ over both specific plots and large areas. In the original experiments, BNL researchers were able to effectively monitor underground carbon concentrations with INS and evaluate various strategies for terrestrial carbon sequestration. This new initiative will implement INS over the long term to effectively monitor near-surface carbon buildup resulting from the seepage of CO_2 sequestered in geological formations. This second generation of INS allows for an enhanced level of carbon detection in soil from the current detection limit of .5 percent to .01 percent. The project will also provide a new approach for monitoring changes in soil carbon sequestration for the purpose of trading with carbon credits.



Mobile INS system

Primary Project Goal

The purpose of this project is to test a new approach for the long-term monitoring of near-surface CO_2 buildup. Additionally, this project will enable a new approach for monitoring land remediation of coal mine lands for possible carbon credit trading. This new approach is based on a new INS technology that was tested in field measurements in static and scanning modes. This technology is non-destructive, multi-elemental,

PARTNERS

Brookhaven National Laboratory

PERIOD OF PERFORMANCE

10/01/2007 to 09/30/2008

COST

Total Project Value
$250,000

DOE/Non-DOE Share
$250,000 / $0

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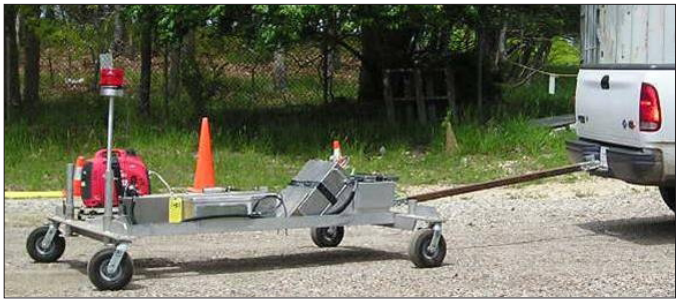
and analyzes large soil masses greater than 300 kg in situ. The INS fills a specific gap in below-ground measurement by scanning large areas and monitoring the cumulative buildup of CO_2, thus increasing the sensitivity for leak detection.



INS system ready for deployment in the field

Objectives

The short-term objectives of this project are to:

- Modify the INS's power generator with a battery setup to eliminate exhaust CO_2 emissions in the field and thus avoid inaccuracies in the experimental data
- Integrate the INS system with the planned experiments at the Zero Emissions Research and Technology (ZERT) facility at Montana State University
- Evaluate the effects of soil moisture and density on the system response
- Evaluate the effect of varying soil carbon profiles on INS calibration
- Perform Monte Carlo simulations and system analysis for soil carbon build-up
- Establish INS baselines at two mine reclamation sites (Ohio and Pennsylvania) with two different land remediation protocols

The long-term objectives are to:

- Complete INS system characterization and deploy it to additional geologic sequestration project sites, such as the Frio Brine Pilot test facility
- Implement the INS system for systematic soil carbon monitoring at CO_2 injection facilities
- Complete follow-up monitoring of mine land reclamation
- Complete calibration of the image pixels from aerial spectral scans with INS scans

INS system in use in a wheat field in Montana

Benefits

The anticipated benefit of such a system is the ability to monitor critical MMV issues associated with CCS projects. DOE's Carbon Sequestration Program is working to develop technologies to promote the cleaner use of coal and for capturing and permanently storing CO_2, a greenhouse gas that can contribute to global climate change. This new adaptation of the INS system will enhance long-term monitoring of CO_2 at geologic sequestration sites by improving the ability to detect the unlikely occurrence of a CO_2 leak.