the ENERGY lab

PROJECT FACTS

Carbon Sequestration

Training Toward Advanced 3-D Seismic Methods for CO_2 Monitoring, Verification, and Accounting

Background

Increased attention is being placed on research into technologies that capture and store carbon dioxide (CO_2). Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and, in turn, mitigating global climate change without adversely influencing energy use or hindering economic growth.

Deploying these technologies in commercial-scale applications requires a significantly expanded workforce trained in various CCS specialties that are currently underrepresented in the United States. Education and training activities are needed to develop a future generation of geologists, scientists, and engineers who possess the skills required for implementing and deploying CCS technologies.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory(NETL) has selected 43 projects to receive more than $12.7 million in funding, the majority of which is provided by the American Recovery and Reinvestment Act (ARRA) of 2009, to conduct geologic sequestration training and support fundamental research projects for graduate and undergraduate students throughout the United States. These projects will include such critical topics as simulation and risk assessment; monitoring, verification, and accounting (MVA); geological related analytical tools; methods to interpret geophysical models; well completion and integrity for long-term CO_2 storage; and CO_2 capture.

Project Description

NETL will be partnering with the University of Houston to provide advanced three-dimensional (3-D) seismic methods training for CO_2 MVA. The training is based on the numerical simulation of improved seismic technology that addresses key challenges to monitoring movement and containment of CO_2 in the reservoir, specifically, better quantification and sensitivity mapping of caprock integrity and potential leakage pathways. This will be accomplished by elastic wavefield simulation based on a previous DOE-funded CO_2 sequestration study site in Ness County, Kansas (Figure 1). Elastic simulation typically employs Primary (P) and Secondary (S) wave velocities as well as density for the simulation of a full seismic wavefield.

Seismic elastic wavefield simulation for the selected project site will be completed by developing earth models, generating seismic simulations, and completing analyses of these data. Sonic and density logs in the Dickman field, Ness County, Kansas, will be used to build an elastic earth model. Using this model, simulation of an elastic common midpoint gather (a collection of seismic traces) will be completed to aid in identification of wave types and P-S converter beds. Information from this work may lead to changes in the survey design. The study will then focus on the simulation of a new 3-D seismic survey. The 3-D survey design will be populated with

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PARTNERS

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PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2011

COST

Total Project Value
$331,842

DOE/Non-DOE Share
$299,342/$32,500

Government funding for this project is provided in whole or in part through the American Recovery and Reinvestment Act.

traces from the simulated gather for later processing. Estimates will be made about relative efficiency of single versus simultaneous sources. Analysis of shear and mode-converted data, and migration to create P, S, and possibly mode-converted image volumes will be performed. Finally, interpretation of the data set will be completed, including generation and mapping of horizon slices in the simulation migrated data volumes. From this study, a comprehensive work-flow will be built for simulation of simultaneous source seismic data for CO_2 sequestration.

Goals/Objectives

The overall goal of this project is to provide a numerical simulation of improved seismic technology that will address key challenges, such as:

- Monitoring the movement and containment of CO_2.
- Quantification and sensitivity for mapping of caprock integrity and potential leakage pathways.
- Fundamental research aimed at low cost, high density, full azimuth, vector seismic data.

Benefits

The project will lead to the development of an elastic earth model of the Dickman field, Kansas which will allow for new seismic interpretations. These simulated seismic interpretations will provide for the generation of a new suite of attributes of the study site leading to an improved image of CO_2 migrated volumes and prepare trainees to take on new challenges in seismic modeling for carbon sequestration.

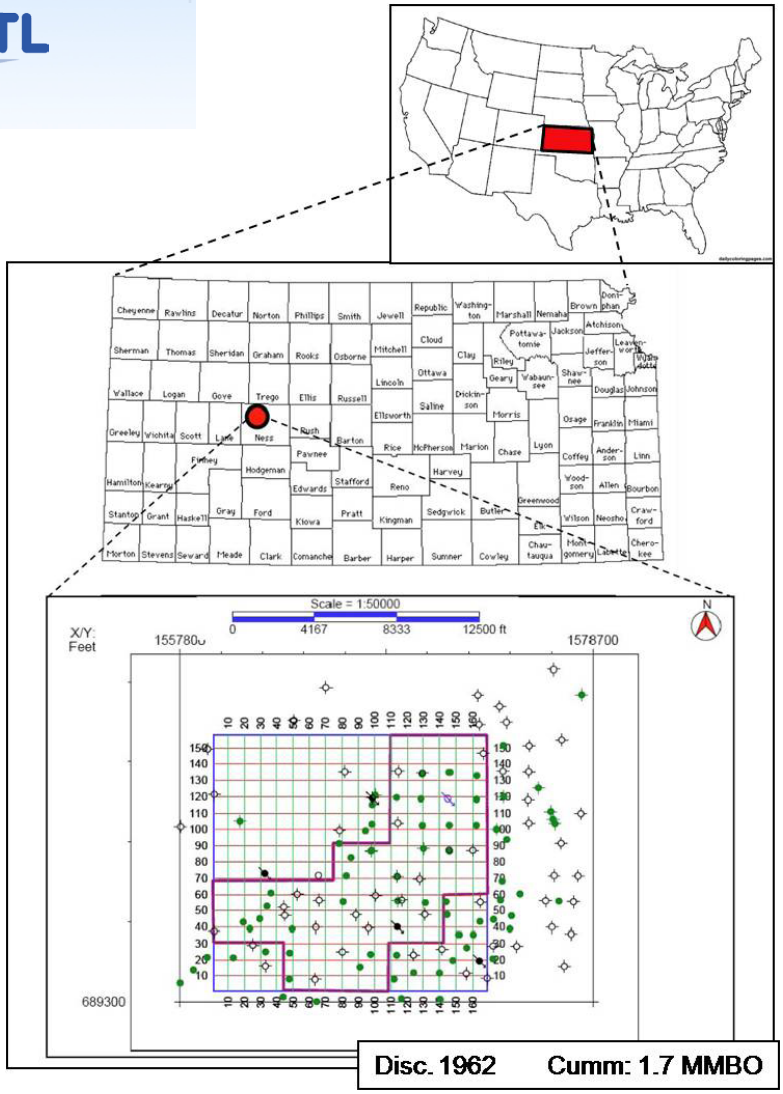

Figure 1. Simplified map depicting the location of the study site, Dickman field, Ness County, Kansas.