

**ANNUAL PROJECT REPORT
As of December 2001**

1. PROJECT SPONSOR

Case Western Reserve Univ.
Mechanical & Aerospace Engg.
University circle
Cleveland, OH 44106

2. PROJECT MANAGER

Dr. Jaikrishnan R. Kadambi
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Co-P.I. Dr. Beverly Z. Saylor,
Assistant Professor, Geological Sciences.

3. OCDO GRANT NO. OCRC3-00-2, C2.15

4. PROJECT: UPDATE

5. PROJECT TITLE: Ohio Coal Research Consortium III, Project OCRC3-00-2C2.15, Multiphase flow characterization in geological formations for CO₂ sequestration

6. PROJECT TERM:

FROM 9-01-01 TO 8-31-02

7. PROJECT	Name	Cost-Share (Year #1)
CO-SPONSORS	OCDO	\$ 69,271
	CWRU	\$ 24,656

I. ABSTRACT

8. OBJECTIVES:

This is a three-year project to characterize the pore geometries of porous geologic formations of Ohio and to investigate experimentally the flow of CO₂ and CO₂ mixtures through the interconnected pores. This will lead to improved understanding of multiphase transport during sequestration of CO₂ in geological formations. The proposed research focuses on the pore-scale flow characteristics of typical coal formations, oil and gas reservoirs, and deep-saline aquifers beneath eastern Ohio. Experimental design includes construction of optically transparent 3-D models of porous rock, and development of new experimental methods using particle image velocimetry and laser Doppler velocimetry to map 3-D microscale flow velocities. These imaging methods are capable of discriminating multiphase liquid-gas, liquid-liquid, and liquid-solid velocities and consequently have applicability to a range of issues related to CO₂ sequestration through coal-bed methane production, enhanced oil and gas recovery, and deep aquifer disposal. Experimental results will be compared with macroscale flow measurements and microscale flow simulations. Year 1 of this effort will focus on developing the experimental techniques. The bulk of the experimental analysis will be accomplished during year 2. Analysis during year 3 will compare results from PIV and LDV characterization with other approaches to characterizing multiphase flow.

9. WORK DONE (2001)

The project was started on September 1, 2001 and involves issues related to multiphase flow in geological formations for CO₂ sequestration. **Literature review regarding** pore characterization methods and Ohio's subsurface formations has been completed. Work is progressing in the area involving the design and construction of simple rock models. The P.I.'s are also interacting with U.S. DOE's National Energy Technology Laboratory personnel regarding the issues related to multiphase flows involved in geological sequestration of carbon. Work on this project is progressing according to the schedule.

10. PLANS FOR COMING YEAR:

The work to develop the experimental technique using laser based optical methods (Particle Image Velocimetry and Laser Doppler Velocimetry) for characterization of the multiphase flow of carbon dioxide in rock formations will be continued in the coming year.

II. HIGHLIGHTS/ACCOMPLISHMENTS

11. A first quarter report providing details of the work performed in the year 2001 was submitted.

III. ARTICLES/PRESENTATIONS

1. "Multiphase Flow Characterization in Geological Formations for CO₂ Sequestration", **J.R. Kadambi**, B. Z. Saylor and B. Zerai , First Quarter Report on project OCRC3-00-2.C2.15 submitted to Ohio Coal Development Office, Columbus, Ohio, Dec,2001.