ANNUAL PROJECT REPORT
AS OF DECEMBER 2000

1. PROJECT SPONSOR:

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3. OCDO GRANT NO. C1.9

4. PROJECT UPDATE XXX **OR FINAL REPORT**

4. PROJECT TITLE: **CO_2 Separation and Sequestration Utilizing FGD Scrubber By-Products**

6. PROJECT TERM: FROM: September 1, 2000 **TO:** September 30, 2001

7. PROJECT CO-SPONSORS:	**NAME**	**COST-SHARE**
	OCDO	**$** 76,103
	Univ. of Cincinnati	**$** 25,805
		$
		$
TOTAL PROJECT COSTS		**$** 101,908

I. ABSTRACT

8. OBJECTIVES:

The objectives of this project are to study a process designed to produce a concentrated stream of CO_2 separated from flue gas by scrubbing the flue gas with a slurry containing reclaimed magnesium hydroxide. The project will focus on establishing the mechanisms responsible for controlling the absorption and desorption (recycle) rates which may then be used to scale the technology for pilot-plant demonstration purposes. The first year of the project will establish the proof-of-concept of this method by studying the feasibility of absorption and desorption of CO_2 by solutions containing $Mg(OH)_2$ in a bench-scale bubble column operated under realistic conditions. From this data we can determine the effect of slurry concentrations on performance, and make initial estimates on the amount of energy required for both the absorption and desorption steps.

9. WORK DONE AND CONCLUSIONS:

A. Literature Review

The literature has been reviewed for experimental methods for the study of the carbon dioxide absorption and regeneration with chemical absorption method. The main efforts have been directed toward evaluating CO_2 absorption performance, treating impurities in the flue gas and finding the most efficient integration of the CO_2 recovery system into thermal power plant.

B. Design of CO_2 Regeneration System

During this first quarter of the project, the CO_2 regeneration system has been designed and constructed. The portable pressurized high-temperature reactor size is 32 cm (I.D.) and 26.5 cm in length. The control pressure range of this reactor is from 0 to 30 psi (0-2 kg/cm^2) and control temperature range is from 212 to 274 ^oF.

For the heating of this reactor, a heating plate is used with a temperature control panel. In addition, to condense the saturate water vapor from gas stream, a condenser tube with water-jacket type condenser is used. The length of condenser tube is 58 cm. The cooling water pump circulates the cold water to the condenser tube continually to remove the heat released by the system.

C. Reclaimed Magnesium Analysis

A sample of magnesium hydroxide slurry, reclaimed from an ME-FGD system, was analyzed using a carbon analyzer (RC-412, Multiphase carbon/hydrogen/moisture determinator, Leco Corporation) and TGA (951 Thermogravimetric analyzer, DuPont Instrument). From the results, the carbon concentration of $Mg(OH)_2$ slurry indicated 0.24 %, thus this concentration could be used as base line for CO_2 absorption and regeneration experiments. TGA experimental results of this sample also showed that a small amount of weight change occurred during the decomposition of the $Mg(OH)_2$ slurry.

10. PLANS FOR COMING YEAR:

1. Conduct absorption studies using reclaimed $Mg(OH)_2$.

2. Conduct both low-temperature and high-temperature desorption studies.

II. HIGHLIGHTS/ACCOMPLISHMENTS

11.

The sequestration potential **without recycle** for this process **is ~190,000 tons** of carbon dioxide per year, and **~1,230,000 tons** with recycle for every percent of CO_2 recovered by the regenerable $Mg(OH)_2$ process at those power plants currently using ME-FGD systems. **The costs will be less than $10 per ton of CO_2** separated and concentrated for a regenerable method with a slurry solids concentration ? 20 %.

Absorption studies using simulated flue gas with 12-15% CO_2 concentrations have shown that reclaimed $Mg(OH)_2$ will readily absorb carbon dioxide.

III. ARTICLES/PRESENTATIONS

12.

"Feasibility of CO_2 Abatement by Scrubbing with Reclaimed Magnesium Hydroxide," Vicki C. Whitehead, Tim C. Keener, and Soon-Jai Khang, ***Proceedings of the 93st Annual Meeting & Exhibition of the Air & Waste Management Association***, paper 973, Salt Lake City, Utah, USA, June 18-22, 2000.

"CO_2 Recovery by Scrubbing with Reclaimed Magnesium Hydroxide" by Vicki C. Whitehead, Tim C. Keener, and Soon-Jai Khang, in ***Proceedings of the American Institute of Chemical Engineering Spring National Meeting***, Atlanta, GA March 5-9, 2000.