ANNUAL PROJECT REPORT
AS OF DECEMBER 1992

1. PROJECT SPONSOR:

ABB Combustion Engineering
100 Prospect Hill Road
Windsor, CT 06095

2. PROJECT MANAGER:

Mr. Richard Borio
Executive Consulting Engineer

TELEPHONE: (203) 285-2229

3. OCDO GRANT NO#: D-87-21

4. PROJECT: Final Report

5. PROJECT TITLE: Natural Gas Reburning On A Cyclone Fired Boiler

6. PROJECT TERM: FROM March 1990 **TO** July 1993

7. PROJECT	**NAME**	**COST-SHARE**
CO-SPONSORS:	OCDO	$ 1,200
	ABB CE	850 (pending Ohio Ed. final cost share)
	EPA & DOE	3,691
	GRI	2,000
	EPRI	2,000
	Ohio Edison	1,033 (pending final approval by Ohio Ed.)
	East Ohio Gas	507
TOTAL PROJECT COST:		$11,281

I. ABSTRACT

8. OBJECTIVES

The objective of the program is to achieve 50% NO_X reduction at full load on a cyclone type coal-fired utility boiler using natural gas reburning technology; this reduction is to be achieved while not adversely impacting boiler operation or component life. Reburn technology represents one of the few in-furnace NO_X reduction technologies that can be used for cyclone type furnaces. Ohio coals are well suited to use in a cyclone type furnace from the standpoint of their favorable ash fusibility properties; a slagging combustor, such as the cyclone, requires that a molten layer of slag be developed in the combustor to protect the boiler tubes, to capture crushed coal particles to facilitate their burnout, and to be sufficiently liquid to allow successful slag tapping (removal) from the combustor. Reburning technology can be successfully applied to Ohio coals and due to the use of about 18% natural gas some SO_2 reduction is obtained. Importantly the reburn process is also compatible with any number of SO_2 schemes. When the Clean Air Act establishes targets for NO_X for cyclone fired boilers reburn technology will provide a cost effective way to comply with expected

new targets for cyclone combustors while using Ohio coal.

9. WORK DONE AND CONCLUSIONS:

A modified reburn system was installed and long term testing was completed. The modified reburn system resulted in a less expensive system requiring less space which, significantly, also eliminated the need for the flue gas recirculation fan, a relatively high maintenance item. Long term testing has shown NO_X reduction to achieve 50% at full boiler load, but with a decreasing percent reduction at lower boiler load, the NO_X leaving the stack remains relatively unchanged from that obtained during the full load tests. A significant restraint to even further NO_X reduction is the level of CO; as the reburn zone is operated under more fuel-rich conditions the NO_X continues to decrease, but the CO begins to markedly increase. Control over CO could be significantly improved with an updated air/fuel monitoring and control system. There is a load below which the reburn system must be turned off to maintain satisfactory slag tapping; for the subject Niles boiler this load was 75MW, or about 65% of full load. In terms of boiler thermal performance the elimination of recirculated flue gas has virtually eliminated the need for increasing attemperator sprays (compared to the base case) to control steam temperatures going to the turbine. Results of a comprehensive boiler tube thickness monitoring program have shown no significant change in tube wastage during either parametric reburn testing or long term reburn testing phases of the program when compared with results from baseline testing.

10. PLANS FOR COMING YEAR:

A final report will be written summarizing results from the entire reburn program. A technical paper will be written and presented at the EPRI/EPA Joint Symposium on Stationary a Combustion NO_X Control, May 23 - 27, 1993 in Miami Beach Florida.

II. HIGHLIGHTS/ACCOMPLISHMENTS

11. The reburn system was redesigned and successfully eliminated the heavy ash deposits which occurred with the original system. The redesigned system was less expensive, required less space, and eliminated a potentially high maintenance item, namely the flue gas recirculation fan. Long term test results showed 50% NO_X reduction at full load without significantly affecting boiler thermal performance. Boiler tube wastage did not significantly change when the reburn system was operated. Improvements in the air/fuel monitoring/control system would permit even further NO_X reductions by better controlling CO emissions and thereby permitting more fuel rich conditions in the reburn zone which would directly benefit NO_X reduction. ABB Combustion Engineering is ready to market natural gas reburn systems and offer commercial guarantees on same.

III. ARTICLES/PRESENTATIONS

12. "Long Term NO_X Emissions Results with Natural Gas Reburning on a Cyclone Fired Boiler," R. Borio, R. Lewis, S. Durrani, A. Lookman, 1992 International Joint Power Generation Conference, Atlanta, Georgia, October 18 - 22, 1992.