ANNUAL PROJECT REPORT
AS OF DECEMBER 2001

1. PROJECT SPONSORS:

Ohio Coal Development Office
FirstEnergy
Reaction Engineering International

2. PROJECT MANAGERS:

Mr. Scott Vierstra
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3. OCDO GRANT NO. CDO/D-99-12

4. PROJECT UPDATE

5. PROJECT TITLE: *Corrosion Assessment at FirstEnergy Eastlake Station*

6. PROJECT TERM: FROM: APRIL 2001 **TO:** JANUARY 2002

7. BUDGET:

CO-SPONSORS NAME	**COST-SHARE**
OCDO	$ 75,000
FirstEnergy	$100,000
Reaction Engineering International	$ 50,000
SAVvy Engineering, LLC	$ 2,000
TOTAL PROJECT COST:	**$227,000**

I. ABSTRACT

OVERVIEW OF PROJECT AND OBJECTIVES:

This study was to investigate the application of a real-time electrochemical noise corrosion sensor in the radiant section of Unit 5 at the Eastlake Power Station, Eastlake, Ohio. The purpose of the investigation was to demonstrate that corrosion can be accurately measured in real-time and waterwall wastage could be assessed immediately following changes in boiler operation. Project tasks involved an investigation of the role of particulates on corrosion, the performance of the probe in the boiler and an evaluation of the integrity of the hardware in a severe environment. Two boiler elevations on the front wall were selected for the studies. The electrochemical sensor elements were fabricated from low-carbon steel (SA-387) having the same composition as the boiler tubes. The sensor temperature was maintained at 460ºC, to simulate the metal temperature of a supercritical boiler operating at full load.

WORK DONE AND CONCLUSIONS:

The field demonstration has been completed and these tests at Eastlake Power Station provide the first successful demonstration of real-time, high-temperature corrosion assessment in the radiant section of a coal-fired boiler. These tests demonstrated that corrosion can be measured in real-time and an assessment of waterwall wastage can be made daily. Examination of the plant data has revealed that corrosion rate is strongly linked to the boiler load. The higher the boiler load, the higher the corrosion rate. This correlation between corrosion rate and unit load is associated with the corresponding changes in the heat flux and changes in the excess oxygen levels within the furnace. The performance of the probe settled some unresolved technical and economic issues, notably the ability to operate in a particulate laden environment. In addition, during an outage, the probe was not affected by high-pressure water washing of the boiler tubes. Real-time measurements can be integrated into a corrosion management system, which would provide improved operational guidance and control. The direct benefits are the abatement of corrosion by identifying the risk of attack and adjusting either the operational parameters or performing preventative maintenance before any significant waterwall damage is incurred.

PLANS FOR COMING YEAR:

This investigative work efforts associated with the project have recently been completed and the final report is in progress.

II. HIGHLIGHTS/ACCOMPLISHMENTS

1. The corrosion tests at Eastlake Power Station provide the first demonstration of real-time high-temperature corrosion assessment in the radiant section of a coal-fired boiler.
2. These tests demonstrate that corrosion can be measured in real-time and an assessment of waterwall wastage can be made daily.

3. Corrosion rate is strongly linked to the boiler load and heat flux rates. The higher the boiler load or heat flux rate, the higher is the corrosion rate.
4. The probe demonstrated its ability to operate in a particulate laden environment. Also, the probe was not affected by high-pressure water washing of the boiler tubes.
5. Real-time measurements can be integrated into a corrosion management system which would provide improved operational control and abatement of corrosion by identifying the risk of attack before the waterwalls are afflicted by any significant damage

II. ARTICLES/PRESENTATIONS

The following presentations were made based upon this program; OCDO was acknowledged as a sponsor of the program in all cases:

1. K. Davis, G. Green, T. Linjewile, and S. Harding "Evaluation of an on-line technique for corrosion characterization in furnaces," 2001 Joint International Combustion Symposium, AFRC/JFRC/IEA, Kauai, HI, September 2001.

2. T. Linjewile, K. Davis, G. Green, W. Cox, R. Carr, N. Harding, and D. Overacker "On-line Technique for Corrosion Characterization in Utility Boilers," United Engineering Foundation Conference on Power Production in the 21st Century: Impacts of Fuel Quality and Operations, Snowbird, UT, October 2001.

3. Harding, N. S., "High Temperature Corrosion," Invited Graduate Seminar at Brigham Young University Department of Chemical Engineering, Provo, UT, December 2001.

4. K. Davis, M. Bockelie, T. Linjewile, H. Shim, C. Senior, and B. Adams "Unresolved technical challenges to NOx reduction for coal-fired power generation," 27th International Technical Conference on Coal Utilization & Fuel Systems, Clearwater, FL, March 2002.