NO_x Control for Utility Boiler OTR Compliance

Quarterly Technical Report

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Prepared by:

Hamid Farzan
Phone: 330-860-6628
Fax: 330-860-6676
E-mail: HFarzan@babcock.com

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The Babcock & Wilcox Company (B&W)
B&W Research Center
1562 Beeson Street
Alliance, Ohio 44601

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ABSTRACT

Under sponsorship of the Department of Energy's National Energy Technology Laboratory (NETL), the Babcock & Wilcox Company (B&W), and Fuel Tech teamed together to investigate an integrated solution for NO_x control. The system is comprised of B&W's DRB-4Z™ ultra low-NO_x pulverized coal (PC) burner technology and Fuel Tech's NO_xOUT®, a urea-based selective non-catalytic reduction (SNCR) technology.

Development of the low-NO_x burner technology has been a focus in B&W's combustion program. The DRB-4Z™ burner is B&W's newest low-NO_x burner capable of achieving very low NO_x. The burner is designed to reduce NO_x by controlled mixing of the fuel and air. Based on data from several 500 to 600 MW_e boilers firing PRB coal, NO_x emissions levels of 0.15 to 0.20 lb/ 10^6 Btu have been achieved from the DRB-4Z™ burners in combination with overfire air ports. Although NO_x emissions from the DRB-4Z™ burner are nearing the Ozone Transport Rule (OTR) level of 0.15 lb $NO_x/10^6$ Btu, the utility boiler owners can still benefit from the addition of an SNCR and/or SCR system in order to comply with the stringent NO_x emission levels facing them.

Large-scale testing is planned in B&W's 100-million Btu/hr Clean Environment Development Facility (CEDF) that simulates the conditions of large coal-fired utility boilers. The objective of the project is to achieve a NO_x level below 0.15 lb/10^6 Btu (with ammonia slip of less than 5 ppm) in the CEDF using PRB coal and B&W's DRB-4Z™ low-NO_x pulverized coal (PC) burner in combination with dual zone overfire air ports and Fuel Tech's NO_xOUT®.

During this period B&W prepared and submitted the project management plan and hazardous substance plan to DOE. The negotiation of a subcontract for Fuel Tech has been started.

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1 INTRODUCTION

The Babcock & Wilcox Company (B&W), and Fuel Tech are teaming to evaluate an integrated solution for NO_x control comprised of B&W's DRB-4Z™ low-NO_x pulverized coal (PC) burner technology and Fuel Tech's NO_xOUT®, a selective non-catalytic reduction (SNCR) technology, capable of meeting a target emission limit of 0.15 lb $NO_x/10^6$ Btu. Promising results have been obtained from large-scale testing in B&W's 100-million Btu/hr Clean Environment Development Facility (CEDF) that simulates the conditions of large coal-fired utility boilers. Under the most challenging boiler temperatures at full load conditions, NO_x emission of 0.19 lb/10^6 Btu has been achieved firing Powder River Basin coal while controlling ammonia slip to less than 5 ppm. At a 40 million Btu/hr firing rate, NO_x emissions was as low as 0.09 lb/10^6 Btu. Improved performance is possible with injection at full load via a convective pass multiple nozzle lance (MNL) in front of the superheater tubes. Convective pass lances represent the current state-of-the-art in SNCR and should be evaluated in order to assess the full potential of the combined technologies.

Since SNCR performs very well in low load conditions, a hybrid selective catalytic reduction (SCR)/SNCR technology can be developed to take advantage of the strength of both technologies. SCR can achieve over 90% reduction in full load, but there are concerns about catalyst poisoning at low loads due to ammonia bisulfate deposits on the catalyst. By using SNCR in low load and SCR in full load, the hybrid system will use the strength of both technologies.

This proposed project is expected to last 14 months from the start of activity in December 2003 until approval of the final report in January 2005.

The objective of the project is to achieve a NO_x level below 0.15 lb/10^6 Btu (with ammonia slip of less than 5 ppm) in the CEDF using PRB coal and B&W's DRB-4Z™ low-NO_x pulverized coal (PC) burner in combination with dual zone overfire air ports and Fuel Tech's NO_xOUT®. Commercial installations of B&W's low-NO_x burner in

combination with overfire air ports using PRB coal has demonstrated a NO_x level of 0.15 to 0.2 lb/10^6 Btu under staged combustion conditions. The proposed goal of the combustion system (no SNCR) for this project is a NO_x level at 0.15 lb/10^6 Btu. The NO_x reduction goal for SNCR is 25% from the low-NO_x combustion emission levels. Therefore, overall NO_x emissions could approach a level of 0.11 lb/10^6 Btu. In addition, we will evaluate an SCR/SNCR hybrid technology using SCR at full load and SNCR at low load conditions. Since the majority of existing commercial SCR units use ammonia, we will obtain SNCR data with ammonia at low load conditions to allow hybrid SNCR/SCR evaluation with ammonia as a NO_x reducing agent.

2 EXPERIMENTAL

During this period we prepared and submitted the project hazardous substance plan and project management plan. We concluded that no hazardous substance will be generated in the project, and there is no need for treatment of the substance. We will be using urea and ammonia for the SNCR process in the CEDF testing. The remaining aqueous urea solution, with the permission from the city authorities, will be slowly discharged to the sanitary sewer (since it is not a hazardous material). The remaining ammonia will be shipped back to the industrial gas supply company.

Project planning continued by performing management activities. B&W and Fuel Tech discussed the project. We decided to have a site visit during first quarter of 2004 to plan for fabrication of the Multiple Nozzle Lance (MNL) and other site preparation activities such as man-power planning and having Fuel Tech's trailer reserved for testing. Our current plan calls for testing during May. There could be a schedule conflict with Fuel Tech, because they will be starting several commercial SNCR systems just before the ozone season. We are currently thinking about getting the trailer during June and performing the SNCR testing in the June/July timeframe. CEDF general maintenance and instrument calibration will be started in January. The schedule of each task and major milestones is shown in Figure 1.

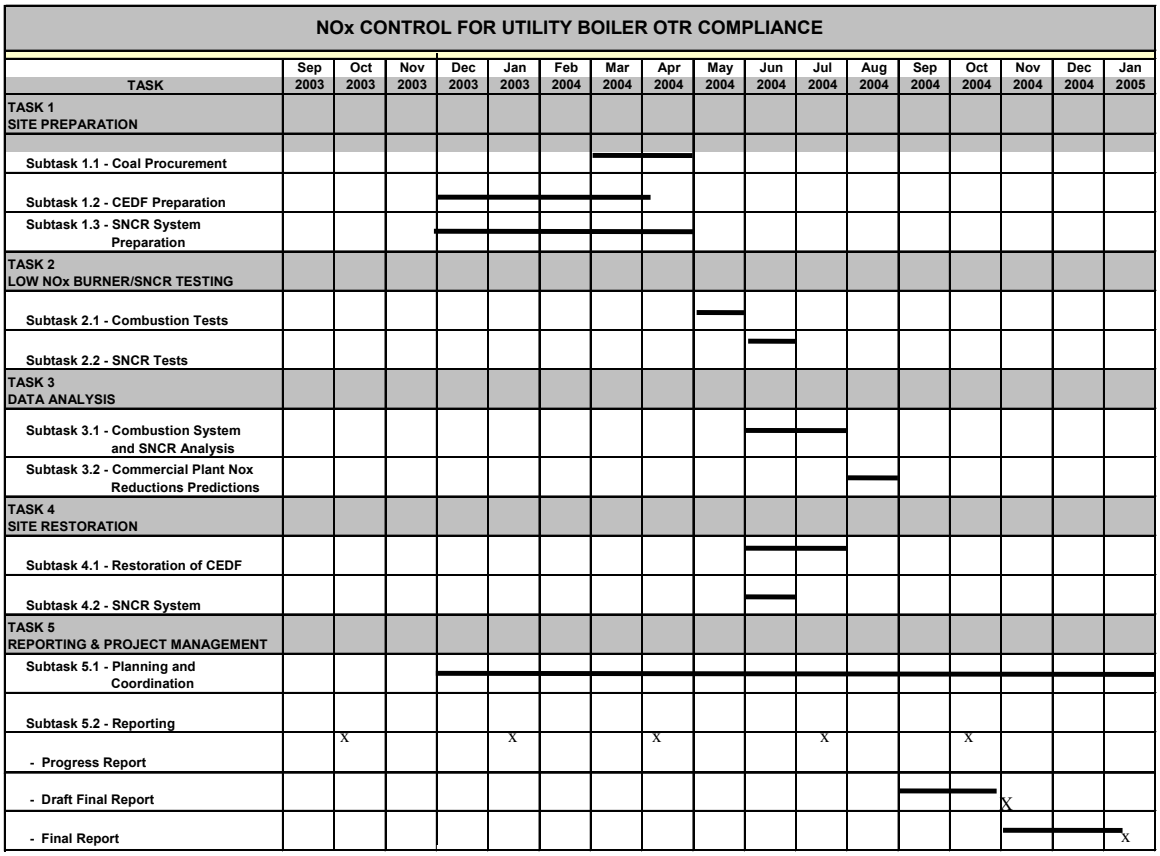

FIGURE 1 - Project Schedule & Milestone Plan

3 RESULTS AND DISCUSSION

No results have been obtained yet.

4 CONCLUSION

No conclusions have been derived.

5 REFERENCES

None.

6 LIST OF ACRONYMS AND ABBREVIATIONS

B&W	The Babcock & Wilcox Company
CEDF	Clean Environment Development Facility
DOE	The United States Department of Energy
MNL	Multiple Nozzle Lance
NETL	National Energy Technology Laboratory
OTR	Ozone Transport Rule
PC	Pulverized Coal
SCR	Selective Catalytic Reduction
SNCR	Selective Non-Catalytic Reduction