SECOND GENERATION ADVANCED REBURNING FOR HIGH EFFICIENCY NO_x CONTROL

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Prepared by:

Vladimir Zamansky

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GE Energy and Environmental Research Corporation

18 Mason, Irvine, CA 92618

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Abstract

This project is designed to develop a family of novel NO_x control technologies, called Second Generation Advanced Reburning (SGAR) which has the potential to achieve 90+ NO_x control in coal-fired boilers at a significantly lower cost than SCR. The eleventh reporting period in Phase II (April 1 – June 30, 2000) included design validation AR-Lean tests (Task 2.6) in the 10×10^6 Btu/hr Tower Furnace. The objective of tests was to determine the efficiency of AR-Lean at higher than optimum OFA/N-Agent injection temperatures in large pilot-scale combustion facility. Tests demonstrated that co-injection of urea with overfire air resulted in NO_x reduction. However, observed NO_x reduction was smaller than that under optimum conditions.

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Executive Summary

This project is designed to develop a family of novel NO_x control technologies, called Second Generation Advanced Reburning (SGAR) which has the potential to achieve 90+ NO_x control in coal-fired boilers at a significantly lower cost than SCR. The eleventh reporting period in Phase II (April 1 – June 30, 2000) included design validation AR-Lean tests (Task 2.6) in the 10×10^6 Btu/hr Tower Furnace. The objective of tests was to determine the efficiency of AR-Lean at higher than optimum OFA/N-Agent injection temperatures in large pilot-scale combustion facility.

The test approach was to parametrically vary key process parameters in order to characterize sensitivity and optimize performance. Test variables included: urea atomization pressure, urea nitrogen stoichiometric ratio, urea solution strength, OFA/Urea port configuration, nitrogen agent type, OFA/Urea injection temperature, and injector position. Each of these conditions was evaluated as reburning heat input was varied from 10% to 20%. For comparison, a series of basic SNCR tests was also performed. Urea, aqueous ammonia and ammonium sulfate were used as N-agents. The best performance was provided by urea. Performance increased as atomizing pressure and nitrogen stoichiometric ratio increased and OFA injection temperature decreased. Performance was also better when urea was injected axially co-current to the furnace gas flow. This configuration provided better urea mixing with flue gas.

Tests demonstrated that moderate NO_x control can be achieved by installing AR-Lean in boilers with existing systems for OFA injection even if temperatures of the OFA injection are too high for the gaseous N-agent to be effective. This can be achieved by injection of N-agent in the form of an aqueous solution. CFD modeling explains test results and predicts better performance at full scale.

A report summarizing test results has been prepared and will be submitted to a GE component that provided cofunding for this part of the program. After their review, the results will be included in the next quarterly report.

Future Work

Future activities will include Tower Furnace tests on advanced coal reburning. All Tower Furnace results in conjunction with the process models will be used for to estimating process performance in a full-scale boiler.