**Evaluation of Rocket Research Company's
Plasma Torch for NO_x Reduction Studies
CRADA PC93-001, Final Report**

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FINAL REPORT

Rocket Research Company /Federal Energy Technology Center CRADA NO 93-001

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Combustion and Environmental Research Facility (CERF) formerly known as The Fuel Evaluation Facility was used from March 29 to April 17, 1993 for the sole purpose of evaluating the Rocket Research (RR) plasma torch and testing its effectiveness in reducing NO_x emissions from coal flames. Two spare facility convective sections were modified to accept the torch and to allow for effective mixing in the convective section chambers. The torch was placed into the fourth convective section and a 1-inch fused silica bluff body was placed immediately upstream of the torch to further enhance the mixing at the torch injection location. The gases anticipated for use during testing included ammonia (NH₃), hydrogen (H₂), carbon monoxide (CO), and methane (CH₄). Ammonia and hydrogen were planned as the gases which would be introduced through the torch directly while CO and CH₄ would be used only in the torch secondary injection ring. The intent was to minimize any potential fouling problems with the carbon containing gases. Actual test conditions did not allow evaluation of the CO or the CH₄ due to continued intermittent operation of the Rocket Research plasma torch. The torch had not been previously tested under conditions similar to the high temperature condition of the CERF and consequently it was found that the torch would not operate effectively under the test conditions. The torch using NH₃ and H₂ as primary and secondary gases has evaluated for short periods of time.

The CERF was to operate under slightly different parameters than usual. The intent was to drive the convective section temperatures down to a point where data could be compared to the earlier radical injection studies using TAFE plasma torch. The anticipated convective section temperatures were in the 1400°F to 1500°F range. Actual test conditions were within the planned range. The fuel was to be natural gas (20 lbs/hr) during the first week of testing and coal (30 lbs/hr) was to be fed during the second and third test weeks. Nitric Oxide (NO) was introduced in the last combustor section to spike the flue gas and create simulated coal fired conditions. Torch problems did not allow coal tests and natural gas was the only fuel used over the entire test period.

Carbon monoxide and CH₄ were not injected during the course of the testing due to the limited testing time. It was determined that the use of these gases and subsequent data would not be as beneficial as looking at the potential parameters posed with NH₃ and H₂. It was established that the only significant NO_x reduction was achieved with the use of NH₃ in both the primary and secondary injection locations. Hydrogen in combination with NH₃ did not produce any significant results.