

# **LOW NO<sub>x</sub> CONTINUOUS EMISSION MEASUREMENTS FROM GAS TURBINES**

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## I. Introduction

Accurate measurement of low level NO<sub>x</sub> emissions from turbines with and without SCRs that meet stringent agency requirements is possible if the CEM system is designed, operated and maintained properly for this the application. It is also possible to measure ammonia for process control as well as compliance where required, however the system design, operation and maintenance are even more critical. This paper discusses system performance as well as component by component test results. The data demonstrates that system biases are different from those of higher level measurements and the steps to eliminate them are unique in many cases. Specially treated system components, stack mounted NO<sub>2</sub> and NH<sub>3</sub> conversion, NO, analyzers with low water and CO<sub>2</sub> biases, and preventing exposing system components to high concentrations are among the conclusions of our work.

## II. Background

- A. The California Air Resources Board (CARB) spearheaded the effort to identify the problems and solutions for low NO<sub>x</sub> emissions measurements when it formed the Low Emissions Measurement Committee (LEMC). This committee was a unique formation of government bodies, private industry, and consultants. The membership contained a well-represented attendance from all entities. CARB, with funding from the California Energy Commission (CEC) and the Institute of Clean Air Companies (ICAC) commissioned UC Riverside, CE-CERT Laboratories to conduct a Low NO<sub>x</sub> emission study. The study was to determine NO<sub>x</sub> transport through various sample conditioning technologies, in particular, identifying compatible materials of construction for wetted components, gas analyzer uncertainties, and total reporting system uncertainties.
- B. Dow Chemical, Dr. Steve Gluck's group, also published work they completed, investigating the transport of low NO<sub>x</sub>, dry, extractive.
- C. GE-EER, Glenn England and Steve Lanier, investigated the uncertainties of chemiluminescent NO<sub>x</sub> analyzers.
- D. Horiba, Jim Downey, published a paper on certification problems for CEMS for low level (<15 ppm NO<sub>x</sub>) in the field.

- E. US EPA is about to publish in the Federal Register, revisions to Method 7E to accommodate changes to the method and parameters for testing low NO<sub>x</sub>.
- F. Baldwin Environmental has published a number of papers concerning our findings for low NO<sub>x</sub> transport through thermo-electric sample chillers.

III. What Are the Issues?

- A. Can a CEMS measure NO<sub>x</sub> at 1-10ppmV in the real world, and in the presence of Ammonia?
- B. Can a CEMS measure NH<sub>3</sub> with sufficient accuracy for compliance or control?
- C. What must change in the system design?
- D. What must change in the O&M to make the accuracy sustainable?
- E. What must change in Reference Methodology and stack testing procedures to support low NO<sub>x</sub>?
- F. What must change in monitoring equipment to enable low NO<sub>x</sub> (and NH<sub>3</sub> measurements)?

This paper approaches the issues involved in low NO<sub>x</sub> emissions measurements using dry, extractive sample conditioning technique. This study addresses the above issues, with conclusions drawn from the data in answer to the aforementioned questions for Low NO<sub>x</sub> measurements in stack gases. The testing performed by Al Budd in Baldwin's analytical laboratory.

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