2012 **Title:** **Carbon Monoxide Emission Improvements from Combustion System Upgrades at the Wheelabrator Portsmouth Refuse Derived Fuel Plant**

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ABSTRACT:

Wheelabrator Technologies Inc. (WTI) operates a waste-to-energy facility in Portsmouth, Virginia. At full capacity, a total of 2,000 tons/day of refuse derived fuel (RDF) can be fired in four identical boilers to generate a total of 600,000 lb/hr of steam and 60 MW of electricity. The boilers were originally designed to co-fire RDF and coal; however, coal burning capability was removed a few years after commissioning. The plant provides all of the process/heating steam and the majority of the electrical power to the nearby Norfolk Naval Shipyard.

Historically, the boilers had not been able to reliably achieve carbon monoxide (CO) emissions compliance. CO emissions experienced during normal boiler operation would be more than twice the mandated emission limit. WTI's goal was to improve the boilers' CO emissions performance while achieving sustained boiler operation at higher steam generation and RDF firing rates.

WTI contracted Jansen Combustion and Boiler Technologies, Inc. (JANSEN) to evaluate the operation of the boilers, to assess the overall feasibility of meeting WTI's goals, and to develop design concepts to overcome boiler limitations. The project was initiated by an engineering site visit where boiler operating data was collected and evaluated to develop a baseline of boiler operation.

Current and new combustion system arrangements were evaluated with Computational Fluid Dynamics (CFD) modeling. The results confirmed that the root cause of the poor CO emissions performance was the inadequate penetration and mixing of the original overfire air (OFA) system (comprised of multiple rows of small ports on the front and rear furnace walls). CFD modeling also showed increased CO emissions to result from non-uniform RDF delivery profiles generated by the original fuel distributors that were installed at a high

elevation over the grate. Modeling of the furnace with larger and fewer OFA nozzles placed on the side walls in an interlaced pattern, and the installation of “new-style” RDF distributors at a lower elevation where the boiler’s original coal distributors formerly were located was shown to significantly improve CO burnout.

From December 2010 to May 2011, the new combustion systems were installed on all four boilers. Subsequent testing has shown that CO levels have been lowered by more than 70% and boiler availability has been significantly improved. Nitrogen oxides (NO_x) emissions, although slightly higher following the upgrade, are still within the NO_x compliance limit.

This paper describes the process that led to a successful project, including: data collection and analyses, CFD modeling, equipment design and supply, operator training, and start-up assistance.