2016 **Title:** **Port Townsend Paper's Boiler MACT Success Story – Part I: Combustion System Upgrade**

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ABSTRACT:

Port Townsend Paper Corporation (PTPC) operates a biomass-fired boiler called the No. 10 Hog Fuel Boiler (HFB) at its paper mill in Port Townsend, Washington. The boiler was designed to generate up to 250,000 lb/hr of steam while firing biomass derived fuels on a traveling grate. In addition to biomass, the boiler can also fire reprocessed fuel oil.

The unit is operated as the mill's swing boiler and fires a mixture of hog fuel, OCC rejects, urban wood debris, and separated char on the grate along with reprocessed fuel oil (when required) through auxiliary burners to respond to pressure swings in the mill's main steam header. The unit has been successful in consistently achieving the state mandated nitrogen oxides (NOx) emissions limits. Prior to the implementation of the Industrial, Commercial, and Institutional Boiler Maximum Allowable Control Technology (Boiler MACT) ruling, the unit did not have a carbon monoxide (CO) emissions limit. Operating data showed that typical CO emissions during normal boiler operation were more than 40% higher than required by the Boiler MACT mandated limit. PTPC's goal was to meet the Boiler MACT compliance requirements for CO emissions without significantly increasing the NOx emissions above historical levels.

The mill first contracted Jansen Combustion and Boiler Technologies, Inc. (Jansen) to evaluate boiler operation and to develop design concepts to meet these emissions targets. The project was initiated by a thorough engineering evaluation, including a site visit where boiler operating data was collected to establish a baseline of boiler operation.

Computational Fluid Dynamics (CFD) modeling (conducted in-house by Jansen personnel) was utilized to identify pathways to improve CO burnout without significantly increasing NOx emissions. The modeling showed that the root cause of poor CO emissions was inadequate overfire air (OFA) penetration and mixing

coupled with non-uniform fuel delivery profiles caused primarily by mechanical 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 modern pneumatic fuel distributors at a lower elevation on the boiler front wall was shown to significantly improve CO burnout and allow operation at lower excess air levels to keep NOx emissions under control.

In October 2015, the unit was upgraded with the new combustion system. Subsequent testing has shown that CO levels have been lowered by more than 60% and are now well below the Boiler MACT limit. Even with the significant lowering of CO levels, NOx emissions remain not only well below the permit limit, but also close to historical operating levels.

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