JANSEN

Boiler News

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OUR MISSION

Our Company provides combustion, boiler, and energy technologies, products, and services.

We are dedicated to working with our clients to help define and achieve their productivity, reliability, efficiency, safety, and environmental goals.

We accomplish by:

- *Listening and understanding.*
- *Providing a flexible approach to problem solving.*
- *Developing creative and innovative solutions.*
- *Partnering with clients to implement these solutions.*

We commit ourselves to creating a challenging and supportive work environment that fosters opportunity for professional growth and fulfillment.

Our team is dedicated to the highest standards of professional ethics and integrity.

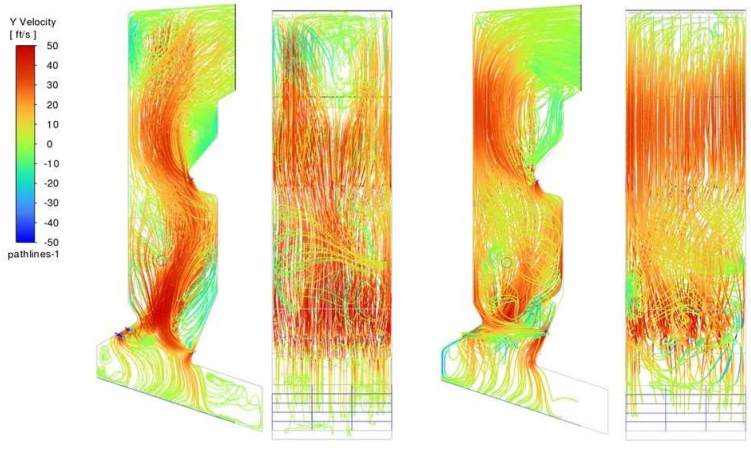
INSIDE THIS ISSUE:

Optimizing Emissions Control in MSW-Fired Boilers

Which type of fuel is the most difficult to burn? Municipal solid waste (MSW) is certainly high on the list! Jansen has recently implemented multiple engineering evaluations to help clients address the challenges of adhering to tightening nitrogen oxides (NO_X) emission requirements while maintaining optimal carbon monoxide (CO) emissions. In one example, Jansen combined optimization tuning, an engineering evaluation, and computational fluid dynamics (CFD) modeling to support our client in the northeast United States in optimizing the selective non-catalytic reduction (SNCR) system on their MSW-fired power boiler.

In the first step, Jansen implemented optimization tuning to identify shortcomings in boiler operations or combustion air system that could reduce the effectiveness of the combustion and SNCR systems. Our tuning efforts revealed that the combustion air system was effective in controlling emissions only within a narrow operating range. Fluctuations out of this range resulted in elevated levels of either CO or NO_X. In addition, pathways to change the air delivery in response to these fluctuations were limited due to the older design and arrangement of the combustion air system.

Jansen then conducted an engineering evaluation to quantify the boiler's performance using data collected during tuning. This allowed for an assessment of the existing fan capacity margins as the unit's steam generation rate tends to be around 10%-15% higher than the original design condition. The evaluation also provided inputs for CFD modeling to consider



Existing OFA arrangement **Upgraded OFA arrangement**

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current and alternate air system performance. Results from the CFD model revealed a well-defined channel of high-velocity gases exiting the lower furnace arches. The air jets produced by the existing overfire air (OFA) system lacked sufficient momentum to effectively penetrate the updraft. Temperature distributions also showed that the elevation of the urea injection ports was too high in the furnace for the SNCR system to optimally reduce NO_X.

CFD model results for a Jansen high energy OFA system on the boiler front and rear walls showed stronger air jet penetration and increased turbulence patterns in the lower furnace, which disrupted the high-velocity channeling through the center of the furnace. The turbulent mixing also produced larger chemical reaction zones for urea injection and increased residence times for SNCR reactions. These conditions are expected to decrease chemical usage and the potential for ammonia slip. In addition, the design of the Jansen air system would provide increased fan operating margin and robust air system control over a wider variety of operating conditions. The results of the evaluation have provided our client with the necessary information to plan for changes and upgrades in the SNCR and the OFA system to optimize their operations.

This project showcased how Jansen's diverse skillset can be leveraged to help identify combustion performance problems and develop world-class solutions for our clients.

Feasibility Evaluations for NCG Incineration Within Boilers

Kraft paper mills produce Non-Condensable Gases (NCGs) in the pulping process. Cluster rule environmental regulations require the collection and incineration of both Dilute NCGs (DNCGs) and Concentrated NCGs (CNCGs). When the ruling was first promulgated, many mills installed dedicated incinerators for NCG removal. However, these units can accrue considerable maintenance costs as they approach their end of life. Therefore, there has been an industrywide trend of decommissioning these incinerators and instead destroying NCGs within existing power boilers or recovery boilers.

Burning NCGs in a boiler furnace eliminates the maintenance and operating costs of dedicated incineration units and increases the mill's overall heat recovery. Recovery boilers can also recover sulfur from the Total Reduced Sulfur (TRS) gases contained within the NCGs. Before NCGs can be incinerated in a boiler, however, the boiler's suitability to serve as an incineration site must be evaluated. This includes determining the adequacy of the boiler furnace to satisfy the residence time and temperature criteria for incineration. In addition, because NCGs introduce increased levels of sulfur dioxide (SO_2) in the flue gas, the potential for acid dewpoint corrosion in the boiler's back end equipment should be examined.

Jansen recently evaluated the feasibility of CNCG and Stripper Off-Gas (SOG) incineration in a biomass-fired power boiler for a mill in the Midwest United States whose CNCG/SOG incinerator was approaching end of life. Jansen constructed a heat and mass balance model of the boiler to predict the impact from CNCG and SOG firing for a variety of potential operating scenarios and determine the upgrades needed to meet the client's NCG incineration goals.

NCG Pipe Feeding Fluidized Bed Boiler

Continued on Page 3

These scenarios included boiler operation at a variety of steaming rates and while firing the various fuel blends that are supplied to the boiler during normal operation.

Jansen's evaluation concluded that the boiler furnace was adequate to safely destroy the CNCG and SOG streams via a new burner, which would replace an existing decommissioned oil burner. However, the injection of CNCG and SOG was shown to introduce approximately 10 times more SO_2 into the flue gas. To maintain the boiler equipment safely above the acid dew point temperature, Jansen identified modifications to the air ducting arrangement within the tubular air heater and recommended adding a steam coil air heater to mitigate corrosion while incinerating the CNCG and SOG streams.

These results provided a basis for developing boiler upgrade scopes to meet the client's needs. Jansen is currently in the design phase of the engineering work for this client. Contact Jansen for more information on how our engineering capabilities can enable NCG incineration within your boilers.

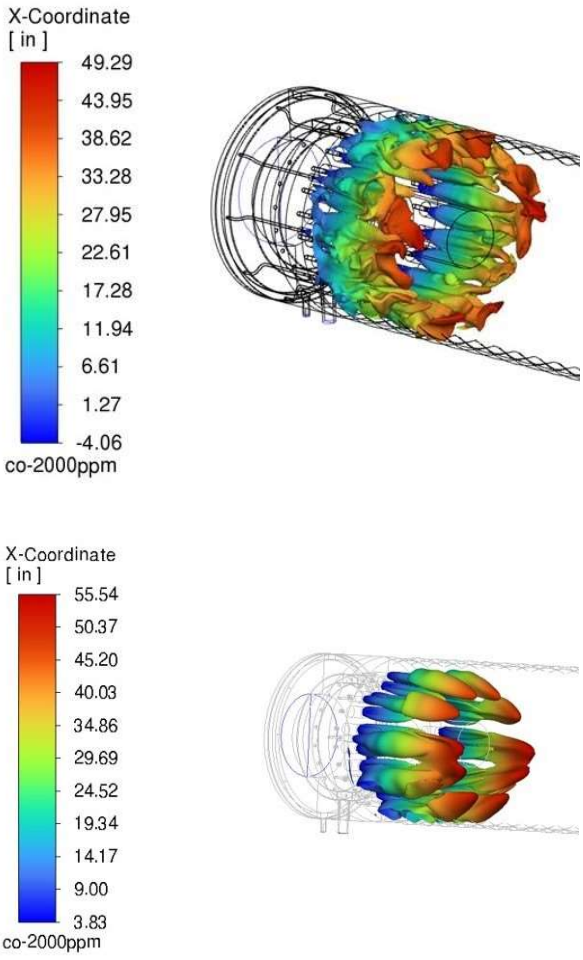
CFD Modeling of Natural Gas Burner Instability

Jansen's CFD modeling capabilities are well established, particularly in furnace combustion processes for waste-to-energy boilers, biomass boilers, and recovery boilers. This year, Jansen conducted modeling to determine possible solutions for unstable combustion in a natural gas-fired Glycol heater.

The subject heater fires natural gas up to a maximum heat input of 83 million Btu/hr. Combustion is generally reliable but will occasionally become highly unsteady. In these instances, the burner flame will periodically detach and reattach, creating within the combustion chamber pressure fluctuations strong enough to pop open access doors on the heater. The heater operators are forced to reduce the firing rate until stable conditions have resumed.

Jansen engineers visited the plant to collect data and information for CFD modeling. Heater operations were stable at most loads but exhibited instability at a load of 70% on a heat input basis. Jansen's modeling and analysis therefore focused on operations at 70% load. To reproduce the site visit conditions, a case analyzing transient combustion conditions for the existing burner was set up. The results for this case showed a pressure fluctuation that did not diminish but rather continued with time, and at a frequency similar to that observed during the site visit. The model also showed irregular flame shapes, again similar to observations. These results indicated that the model was a good representation of the actual combustion instabilities.

A second case included the addition of a perforated plate just downstream of the natural gas injection ports, based on consultation between Jansen and a burner manufacturer.



CFD Modeling Results of Flame Shapes for Existing (top) and Modified (bottom) Burner

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The perforated plate was intended to be a simple representation of a burner modification to improve fuel and air mixing. Modeling results with this modification showed that after introducing the perturbation, the pressure fluctuation diminished with time, meaning that any instability would not persist, unlike in actual operations. Further, flame shapes were longer and smoother, and the oxygen distribution around the burners was much more uniform illustrating the dominant role that combustion air distribution plays in impacting combustion phenomena. As such, a burner modification to improve mixing was found to be a promising solution to eliminate this facility's combustion issues.

This project highlights Jansen's versatility in tackling unusual CFD applications. Jansen provided cost estimates for burner upgrades with the study, and the client is currently in touch with a burner manufacturer about potential upgrades.

AF&PA to Update Recovery Boiler Manual

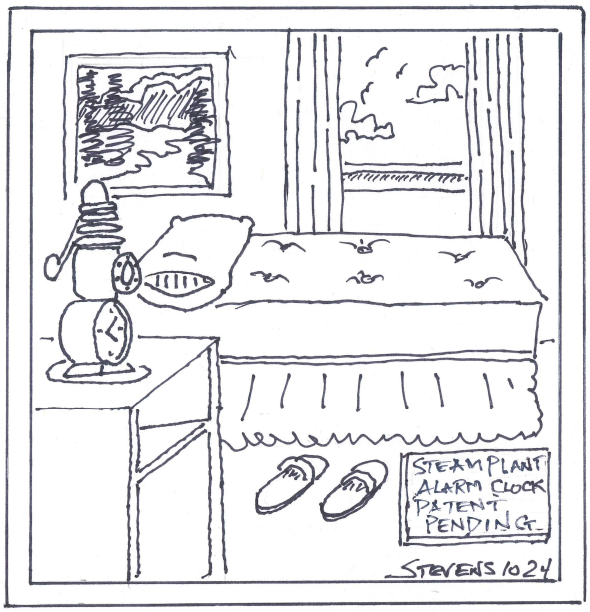
Back in 1979, the J.H. Jansen Company was contracted by the American Paper Institute (API) to write the first volume of the Recovery Boiler Reference Manual. Jansen then produced Volume II in 1983 and Volume III in 1984. Now, the American Forest & Paper Association (AF&PA, the successor to API) is updating the manual and has enlisted Jansen's help in revising and editing, along with assistance from others in the pulp and paper industry.

The Recovery Boiler Reference Manual is an indispensable resource for boiler owners and operators, and Jansen is honored to continue our company's legacy through this important work. Publication of the revised manual is expected in early 2026.

News Briefs

Jansen's experience in the pulp & paper, forest products, agricultural, and waste-to-energy industries and with independent power producers is extensive. Services recently provided to our customers include the following, many of which are in progress:

- Engineering evaluations of biomass, recovery, waste-to-energy, and coal-fired boilers.
- Recovery boiler capacity and condition assessments.
- Combustion air system upgrades.
- Economizer and superheater upgrades.
- Boiler steam/water-side circulation studies.
- CFD modeling of biomass, recovery, and waste-to-energy boilers.
- Emissions control evaluations.
- Boiler operational tuning and optimization support.
- Boiler MACT compliance review and tune-ups.



A collection of boiler house cartoons by Gordon Stevens shown previously in our newsletter can be viewed on our website: www.jansenboiler.com.

For further information on Jansen's projects and capabilities, contact Mark McCabe at 425.736.9758 or by e-mail at mark.mccabe@jansenboiler.com. Additional information and specific project references can be found on our website at www.jansenboiler.com.

Fall 2024 Biomass Boiler Workshop

Gulfport, Mississippi October 30-31, 2024

Since Jansen's workshops began in 2000, they have been attended by over 1,000 engineers, operators, and managers from numerous plants in the pulp & paper, forest products, energy-from-waste, independent power, and food processing industries.

The workshops consist of presentations about new technological developments and results of upgrades to improve the operating performance, burning capacity, thermal efficiency, and fuel economy of biomass- and other solid fuel-fired boilers. In addition, the program will include opportunities for troubleshooting and problem-solving discussions. Participants will benefit by:

- Learning from experts in the industry about the latest retrofit technology for biomass and other solid fuel fired boilers and associated equipment.
- Seeing how other boiler owners solve their boiler problems.
- Discussing potential solutions for their specific issues.

For sign-up and to receive a detailed program of the technical presentations, workshop location, and hotel information, please contact **Cathy Thomas**
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The Biomass Boiler Workshop is presented and co-sponsored by:

JANSEN Combustion & Boiler Technologies, Inc.

ProcessBarron

CleanAir.

Heat Management

Detroit Stoker Company "Our Opportunities Are Always Growing"™

LDX SOLUTIONS

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Boiler News is published regularly by Jansen Combustion and Boiler Technologies, Inc. to provide information to Owners and Operators of boilers.

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