JANSEN

Boiler News

Number 58 I Fall 2025

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:

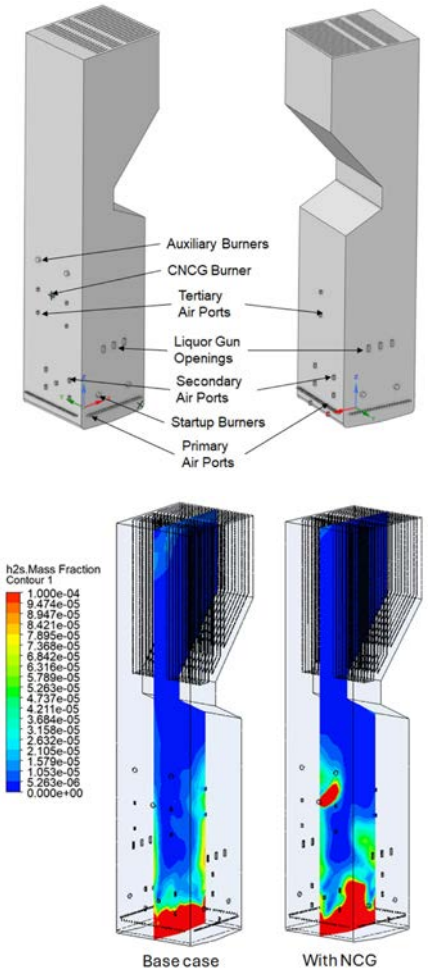
Analysis of CNCG Incineration in Recovery Boilers

Jansen recently supported a client in South America with their desire to incinerate concentrated noncondensable gas (CNCG) in their recovery boiler. Our efforts used computational fluid dynamic (CFD) modeling to evaluate potential impacts on furnace combustion conditions. Of specific interest to the client was how incinerating CNCGs would alter carbon monoxide (CO), nitrogen oxides (NO_X), and total reduced sulfur (TRS) emissions.

For this purpose, we conducted a full engineering evaluation of the boiler, including building a custom thermodynamic model of the boiler. This model quantified the boiler's performance, liquor firing rates, air flows, and flue gas flow and temperature profiles.

Outputs from the heat and mass balance model then served as inputs for a CFD model of the furnace. Jansen simulated CFD cases to optimize the location of the CNCG burner so that it did not negatively impact furnace combustion conditions, taking into consideration species destruction criteria, corrosion concerns, and the impact on emissions. The modeling results show that TRS levels did not increase significantly following introduction of NCG.

Additionally, Jansen used the CFD model data to develop a post-process algorithm for evaluating residence time criteria. Specifically, modeling data is used to track temperature profiles along stream and/or path lines as a function of time. This information confirms the time for which NCG species are maintained above incineration temperatures.



CNCG Model Geometry (top) and Results (bottom)

Continued on page 2

There has been a recent change of opinion and a readiness in North America to consider delivering and incinerating CNCGs in recovery boilers. Though motivations differ, the benefit of incinerating the NCG in a recovery boiler is the capture and return of the sulfur contained in these streams back into the pulping process.

The merger of Lundberg and Jansen into Lundberg Jansen Technologies seamlessly merges Jansen expertise in combustion with Lundberg expertise in the design of NCG collection, transport, and treatment systems. Our solutions exceed the Black Liquor Recovery Boiler Advisory Committee (BLRBAC) recommended good practices for delivering and burning NCG in recovery boilers. Our systems provide additional interlocks and safety measures that prevent moisture from reaching the boiler, while ensuring the gases are thoroughly destroyed without negatively impacting combustion.

This project is an excellent example of how the Lundberg and Jansen teams combine our skills to provide complete project solutions from start to finish.

CFD Modeling for Auxiliary Equipment Design

Jansen is an expert in computational fluid dynamics (CFD) modeling for boiler applications. While well-known for modeling combustion processes within boiler furnaces, Jansen also has the capability to model any auxiliary boiler equipment that features the flow of process fluids. Jansen recently used CFD modeling for the conceptual engineering of new combustion air ducting to support modifications to the grate and dilute non-condensable gases (DNCG) delivery system on a biomass-fired power boiler.

Jansen was contracted to redesign the combustion air supply arrangement downstream of the boiler's tubular air heater (TAH) to accommodate a new segmented undergrate air (UGA) plenum as part of the boiler's grate upgrade. In addition, the client wished to relocate the boiler's two DNCG stream tie-in locations to bypass the TAH. Therefore, Jansen used CFD modeling to compare two conceptual designs, shown in Figures 1 and 2. Design 1 features a narrower OFA duct, while Design 2 features a wider OFA duct

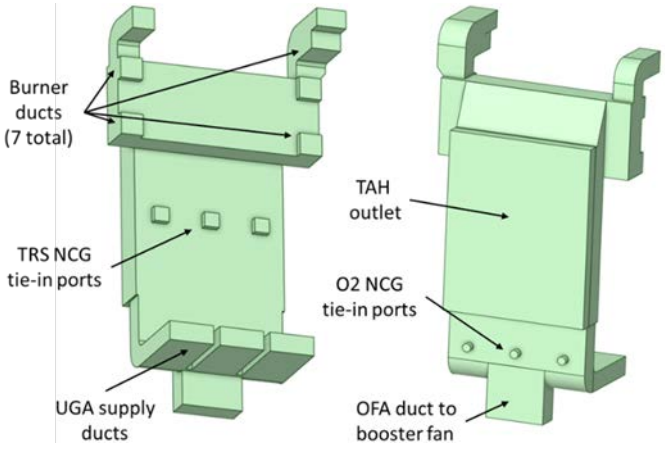


Figure 1. CFD Geometry for Design 1

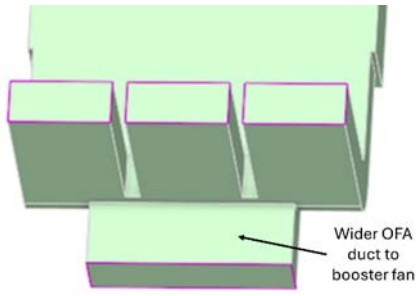


Figure 2. CFD Geometry for Design 2

The two designs were evaluated in terms of mixing profiles, temperature distributions, and flow uniformity across the three new UGA ducts. In addition, the models also evaluated Jansen's proposed DNCG tie-in locations to promote mixing between the UGA, OFA, and DNCG streams while minimizing DNCG flow to the burner windboxes.

Jansen's proprietary CFD modeling program modeled the velocity and temperature distributions of the combustion air. Figures 3 and 4 depict the velocity distributions at the outlet planes of the three UGA supply ducts and the OFA duct. As indicated by the model outputs, the narrower OFA duct introduces a flow disturbance that disproportionately affects the center UGA duct, while the wider OFA duct alleviates this effect. The design with the wider OFA supply duct thus promotes the most uniform flow profiles across the three UGA ducts.

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The CFD models also tracked the DNCG particles from their injection points into the air supply ducting to the model outlet planes. As indicated by Figures 5 and 6, the proposed tie-in locations result in DNCG streams that exclusively feed into the UGA and OFA ducts without affecting the burner air level.

This case study is a prime example of Jansen's expertise in utilizing CFD models for a diverse range of boiler modifications. Please contact Jansen for inquiries about how we can design upgrades for your boiler with our CFD modeling services.

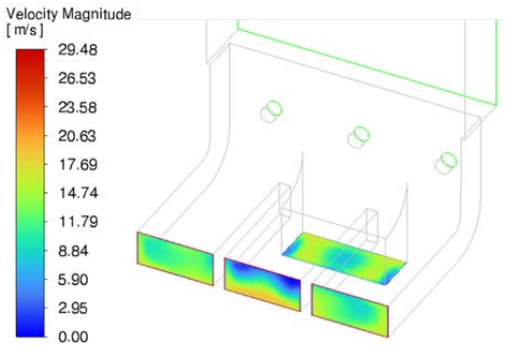

Figure 3. Design 1 Velocity Distribution

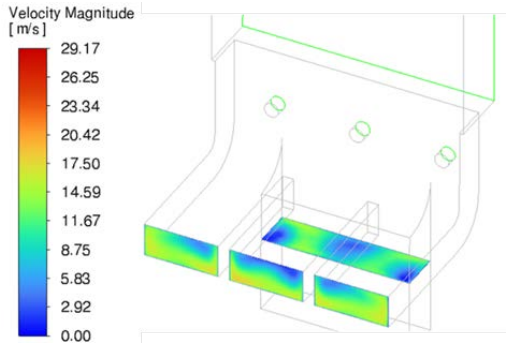

Figure 4. Design 2 Velocity Distribution

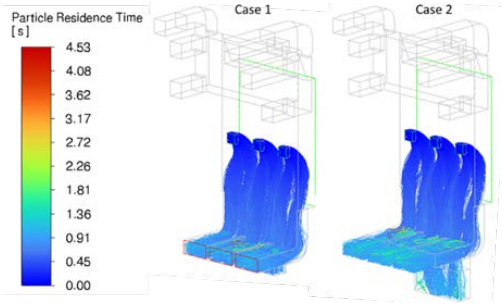

Figure 4. TRS DNCG Streamlines

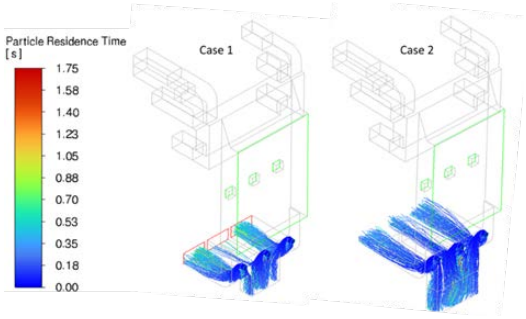

Figure 6. O_2 DNCG Streamlines

Mitigating High Intermediate Superheater Steam Temperatures

Superheater corrosion is a well-known issue in boilers, particularly recovery boilers. Although the composition of the ash impacting the superheater is a primary cause of corrosion, the temperature of the steam in the superheater also plays a role. Typically, secondary superheaters are better protected from excessive steam temperatures by attemperation that occurs between the primary and secondary sections. Primary superheaters, however, do not have this luxury and can also be susceptible to tube overheating and corrosion. Jansen has studied the causes and impacts of excessive intermediate steam temperatures and has designed boiler modifications to avoid this issue.

High steam temperatures leaving the primary superheater and entering the secondary superheater can be caused by numerous factors. Perhaps the superheater was oversized by design in order to provide operating margins, or the attemperator lacks capacity to achieve sufficient temperature reduction. These concerns illustrate the difficulty of sizing a superheater. The superheater design must consider the flue gas temperature and flow rate leaving the furnace, geometric factors such as the furnace nose arch, and probable tube fouling rates.

Even with good initial design, however, steam temperature issues can arise later due to changes in boiler operation or fuels. Sometimes these issues can be addressed by optimizing furnace combustion conditions or upgrading the attemperator. Other times, more complex design solutions might be required.

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Jansen Welcomes…

Dannika Liddell

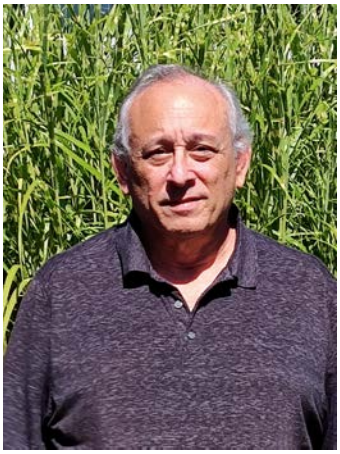
Process Engineer

Dannika Liddell joins Jansen with an interest in thermal and fluids engineering and a background in quality engineering. She graduated Magna Cum Laude from the University of California San Diego in 2023 with a degree in chemical engineering. During her time at the university and previous work experience, Dannika also worked on projects related to process improvement, optimization, evaluating heat transfer, and even designing an acetone production plant.

Dannika and her fiancé have been residents of Seattle since 2023. She enjoys spending time with her fiancé and their dog and can often be found taking classes at her aerial studio or rebinding books at home. Dannika also enjoys traveling, reading, and outdoor sports such as skiing and kayaking when the weather permits it.

John Rosenberg

Chief Financial Officer



John brings over 30 years of experience in finance and accounting working in both public and private firms. He started his career as a staff accountant working at a CPA firm performing audits, reviews, and consulting work for clients in a diverse array of industries. Most recently, he has held senior finance positions in a water ski company, a specialty producer and retailer of hand-blown glass votives as well as a provider of telecommunications service and repair and a political consulting and public relations firm.

John grew up in the LA area but has been living in North Seattle for the past 32 years. He enjoys running Green Lake and photography. He has a passion for aviation and built a 737 flight simulator in his basement. John's latest interest is watch making, which he is just learning as it is never too old to do something new.

James Varesio

Quality Control / ISO Coordinator

James Varesio joins Jansen with more than a decade of experience in operations, logistics, and quality management. His previous roles include Operations Manager, Business Consultant, and SQF (Safe Quality Food) Practitioner with the common theme being a dedication to process improvement, efficiency, and compliance with industry standards. James earned a Bachelor of Science in Psychology with a focus on Industrial Psychology from the University of Oregon.

James has returned to the Pacific Northwest after living in Pennsylvania for several years. He enjoys flying planes, exercise, obstacle courses, the outdoors, and spending time with his corgis.

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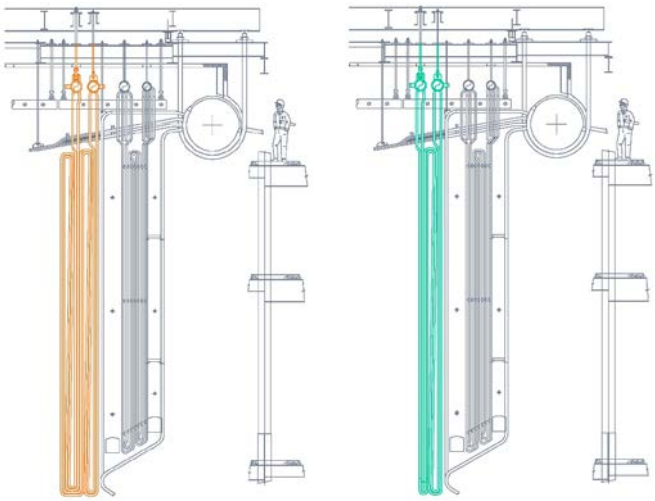
Jansen recently completed two boiler modification projects that included features designed to avoid high intermediate steam temperatures. In the first, Jansen supplied a new, larger economizer to a biomass-fueled power boiler. The new economizer by itself would significantly increase boiler thermal efficiency but would also provide hotter feedwater to the boiler's sweetwater condenser, which would reduce its condensing capacity and negatively impact steam temperature control. To prevent this, Jansen's design for the economizer system included rerouting the feedwater piping such that the condenser received feedwater before the upgraded economizer, thus ensuring cooler feedwater to the condenser and hence greater attemperation capacity.

In the second project, Jansen had supplied a new superheater to a power boiler fired on biomass and fuel oil. Ten years later, the mill replaced the oil burners with natural gas burners. The less radiative natural gas flame would create hotter flue gas temperatures entering the superheater, leading to insufficient attemperator spray capacity, steam temperatures near saturation entering the secondary superheater, and increased risk of tube overheating and corrosion. Jansen analyzed the boiler and determined that removing about one third of the secondary superheater (the first section in the flue gas path) would alleviate high steam temperatures. Following superheater tube removal (shown in the figures), steam temperatures are in a manageable range and consistent steam temperature control can be achieved.



Superheater As Supplied (left) and Following Tube Removal (right)

Jansen uses our analytical and design capabilities to get to the root cause of boiler operating issues and define solutions to achieve improved performance. Contact Jansen today to learn how we can put our strengths to work for you.

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 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 boiler processes.
- 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@lundbergjansen.com. Additional information and specific project references can be found on our website at www.jansenboiler.com.

Fall 2025 Biomass Boiler Workshop

October 22 and 23 | Savannah, Georgia

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, waste-to-energy, independent power, and food processing industries.

This unique meeting comprises presentations on the latest technologies and best practices to improve performance, fuel firing capacity, reliability, and operational flexibility of boiler systems. Participants will benefit by:

- Learning about the latest retrofit technologies for biomass and other solid, liquid, and gaseous fuel fired boilers and associated equipment.
- Exploring how other plants solve their boiler area challenges.
- Engaging in discussion on specific plant goals and potential solutions.

The workshop is FREE OF CHARGE, but space fills quickly. For sign-up and to receive a detailed program of the technical presentations, workshop location, and hotel information, please contact **Cathy Thomas: cathy.thomas@lundbergjansen.com, +1 425.952.2835**

The Biomass Boiler Workshop is presented and co-sponsored by:

JANSEN Combustion & Boiler Technologies, Inc.

FORNAX SERVICES

ProcessBarron

CleanAir.

Heat Management

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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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