

BOILER NEWS

Number 38, Spring 2011

OUR MISSION

Our Company provides combustion and boiler technology, products, and services.

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

We accomplish this by:

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

Our team of talented and experienced individuals is committed to the highest standards of professional ethics.

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

Boiler MACT Update – Final Rulings

EPA Posted Final Ruling in February... Now What?

EPA's efforts to establish Hazardous Air Pollutants (HAPs) emissions limits for industrial, commercial, and institutional boilers and process heaters (referred to as Boiler MACT rules) continues on its long and twisted path.

The EPA first promulgated Boiler MACT rules in 2004 in response to requirements in the 1990 Clean Air Act – and owners of industrial boilers and process heaters worked diligently to comply with the ruling within the allotted three years. However, just



before the compliance period culminated in 2007, the US Court of Appeals vacated the ruling on the basis of complaints that portions of the ruling were not stringent enough, not inclusive enough, and required better definition of fuel classifications. After a lengthy data collection period, the EPA put forth a new, more stringent, ruling in April, 2010. Limits were established for filterable particulate matter (PM), carbon monoxide (CO), hydrochloric acid (HCl), mercury, and dioxins/furans. PM, CO, and HCl emissions were to be used as surrogates for heavy metals, volatile organic compounds, and acid gases, respectively. The ruling was to be finalized in January 2011, following a comment period.

Once again, the industry prepared to respond to the more stringent ruling by characterizing the various emissions from their boilers and evaluating necessary upgrades to come into compliance with the new emissions limits. However, after receiving more than 4,800 public comments (including major efforts by the American Forrest & Paper Association (AF&PA),

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Upgrading RDF Boilers – by the ½ Dozen

The Energy-from-Waste (E-f-W) industry consists of facilities that burn municipal solid waste (MSW), refuse derived fuel (RDF), construction debris (CD), and sometimes biomass fuels in order to dispose of these waste materials. Typically, these facilities also convert combustion heat to produce steam and generate electrical power.

Recently, Jansen provided mechanical design and supplied equipment for the combustion system upgrade of six RDF boilers in operation at three different E-f-W facilities in the US.

• **RDF Boilers at Facility "A"**. This E-f-W facility on the mid-Atlantic seaboard operates four identical boilers, originally supplied by Combustion Engineering in 1984 to burn RDF and a small amount of stoker coal. Each unit was designed to generate 180,000 lb/hr of steam at 750°F and 700 psig. Over the years, the coal firing capability was removed from the units.



New OFA Nozzles on Boilers "A"

While firing RDF, the units would typically be operated to generate approximately 150,000 lb/hr of steam. At that rate, the boilers experienced difficulties in consistently maintaining CO emissions below the permit level. In order to maintain a 24-hour CO average emission rate below permit level, the boilers would periodically be shut down. In consequence, this lowered the facility's RDF burning capacity and also increased boiler maintenance costs arising from damage and wear of the boiler equipment due to the frequent shutdowns. The facility's new owner wished to improve operational performance of the units, particularly by lowering CO emissions, such that sustained boiler operation could be achieved without requiring shutdowns for CO compliance. Jansen was first contracted in the summer of 2010 to conduct a Phase I engineering evaluation of the units, including CFD modeling, to make an assessment of the overall feasibility of the owner's goals and develop design concepts on how to proceed.

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Jansen Conference Presentations and Technical Papers

This past year, Jansen personnel have made several technical presentations at national and international conferences and meetings. These presentations were:

- **CO Emissions: Combustion Enhancements to Meet Boiler MACT Limits in Biomass-Fired Boilers;** presented by John La Fond at the Boiler MACT Control Technology Workshops during NCASI's Southern and West Coast Regional Meetings, respectively on June 30 in Charleston, South Carolina, and on September 30 in Vancouver, Washington.

The presentation focuses on controlling CO emissions from wood-fired boilers in the pulp and paper and wood products industries in preparation to meeting the newly published Boiler MACT limits for CO.

- **Biomass Combustion Principles and Boiler Optimization;** presented by Arie Verloop at the annual TAPPI Kraft Recovery Course, January 10-13, St. Petersburg, Florida.

The paper presents an overview of solid biomass combustion in stoker grate-fired boilers. The combustion process is described from fundamentals, performance evaluation, and problem root cause analysis (including CFD modeling), through providing upgrade elements and typical benefits to improve operational performance in a variety of areas.


- **Boiler Upgrades to Increase In-House Power Generation;** presented by Arie Verloop at the Western Regional Boiler Association (WRBA) annual meeting in Eugene, Oregon, March 15-17, 2011.

The paper discusses options for boiler modifications with the purpose to increase electrical power generation in turbine generators by raising steam temperature, operating pressure, and/or boiler steaming rate.

- **An Improved Method for Modeling NO_x Emissions from Biomass Combustion;** by Dr. Allan Walsh at the 9th European Conference on Industrial Furnaces and Boilers (INFUB-9) held near Lisbon, Portugal, April 26-29, 2011.


The paper evaluates several different NO_x modeling mechanisms and their respective complexities in predicting NO_x generation from biomass combustion.

- **Biomass Boiler Optimization to Meet Proposed Boiler MACT CO Limits;** presented by John La Fond at the 2011 Electric Power Conference, May 10-12, Chicago, IL.

This presentation discusses the fundamentals of CO formation and destruction, review the various proposed Boiler MACT, Boiler GACT, and CISWI CO targets, provide examples of CO emissions in typical biomass boilers, review ways to lower CO emissions, discuss the impact of lowering CO on other pollutant emissions (PM and NO_x), and provide a recommended "engineered" approach to CO emission reduction projects. 

If you have an interest in receiving an electronic copy of one or more of these papers or have a specific inquiry, please contact the authors Allan Walsh (425.952.2834), John La Fond (425.952.2832), or Arie Verloop (425.952.2825) or by e-mail at firstname.lastname@jansenboiler.com.

Jansen at Pacific West Biomass Conference & Trade Show

Jansen's booth at the Pacific West Biomass Conference & Trade Show, held January 10-12, 2011 in Seattle, was well visited by friends and people with an interest for our work and making inquiries about our capabilities and experience. The photo shows Jansen's Steve Campbell (l) and Chris Dayton (r) talking to someone who is doing just that! Jansen will also have a booth at the upcoming NAWTEC 19 Waste-to-Energy Conference in Lancaster, PA, May 16-18, 2011. Come visit! 



www.jansenboiler.com

Boiler MACT – How Combustion Improvements Help Meet Requirements


the National Council of Air and Stream Improvement (NCASI), and the Council of Industrial Boiler Owners (CIBO)) about the proposed ruling that identified several errors in data interpretation and shortcomings in the rules, the EPA determined that changes were needed. Because the timing for compliance was court-ordered, the EPA was required to petition the Federal District Court of the District of Columbia for an extension. Additional time was requested to further evaluate the emissions database and re-propose the rules based on the comments and the new information that was received. The new schedule proposed by EPA was to announce revised rules in June 2011, receive and review another round of comments, and to produce the final rules by April 2012. However, the extension request was denied and a "final" ruling was put into place in February 2011. Several significant changes were made to the rulings in comparison to the previous proposal and the EPA has left the door open for possible reconsideration. Boiler and process heater owners are now faced with another three-year compliance period. The question remains - will this be the final version of the rulings?

Some of the key changes in the most recent version of the Boiler MACT rules as applied to biomass-fired stoker boilers include: less stringent limits for PM, HCl, mercury, and dioxins/furans; a reduction in the CO limit from 560 ppm to 490 ppm (at 3% oxygen, dry); a change in solid fuel classification that allows more coal and biomass co-firing; and a change in CO emissions monitoring from a continuous system to annual stack testing.

Over the last year, Jansen has been assisting many clients that burn biomass fuels with Boiler MACT assessments to help identify the boiler and pollution control equipment upgrades necessary to meet the proposed limits, along with budget cost estimates. With an estimated more than 200,000 boilers operating in industrial, commercial and institutional facilities, studying, planning and responding to all the required upgrades will be extremely challenging in the time allotted. The shifting permit limit targets have caused uncertainty across the industry and needed boiler maintenance and upgrades for efficiency and capacity purposes have been postponed until the Boiler MACT rules were finalized.

Jansen will continue to assist biomass-fired boiler owners/operators with determining how the Boiler MACT regulations will impact their operations and provide solutions for units that would exceed the new limits.

How Can Jansen Help?

Jansen assists boiler owners/operators to determine how Boiler MACT (or CISWI) regulations impact their boiler and provide an evaluation of the boiler's combustion characteristics. If operational improvements are not sufficient to meet the new emissions requirements, Jansen can provide combustion system upgrades and team with pollution control equipment providers to help comply with the new regulations. 

For further information and specific inquiries, please contact John La Fond at 425.952.2832 or Arie Verloop at 425.952.2825 or by e-mail at firstname.lastname@jansenboiler.com.

NEWS Briefs

Since our last newsletter (No. 37, Spring 2010), Jansen has conducted the following process and design engineering projects in the Forest Products, Independent Power Producers, Energy-from-Waste, and other industries (many are in progress):

- Combustion system upgrades for biomass boilers.
- Combustion system upgrades for RDF-fueled boilers.
- Superheater and economizer upgrades and/or new supply.
- Biomass and RDF boilers engineering evaluations.
- Chemical recovery boiler performance evaluations and capacity studies.
- Chemical recovery and biomass boiler evaluations to meet power generation upgrades.
- Supply of injection nozzles for DNCG disposal in biomass boilers.
- Boiler circulation studies and UFM data collection.
- CFD modeling of biomass, chemical recovery, MSW, and RDF-fueled boilers.
- Boiler operational fine-tuning and optimization support.
- Boiler MACT and CISWI compliance review.

This work was conducted, or is currently in progress for the following companies:

- | | | |
|--------------------------------|------------------------------------|---------------------------------------|
| • Avista Utilities | • International Paper Company | • ReEnergy Holdings LLC |
| • Brunswick Cellulose Inc. | • Kimberly-Clark | • Rentech Energy Midwest Co. |
| • BTG Slovakia a.s. | • Longview Fibre | • RockTenn |
| • Cariboo Pulp & Paper Company | • Louisiana-Pacific Corporation | • SAPPi North America |
| • Canfor | • MeadWestvaco | • Smurfit-Stone Container Corporation |
| • Catalyst Papers | • Minnesota Power | • Sonoco Products Co. |
| • Clearwater Paper | • Mondi SCP | • SP Newsprint Co. |
| • Covanta Energy | • NewPage Corporation | • Thermal Power Plant Zvolen |
| • Domtar Inc. | • Orange County Container Group | • Tolko Industries |
| • Evergreen Packaging | • Packaging Corporation of America | • Wheelabrator Technologies, Inc. |
| • Georgia-Pacific LLC | • Port Townsend Paper Corporation | • Weyerhaeuser Company |
| • Great River Energy | • Rayonier Performance Fibers LLC | |

For further information on these types of projects, please contact Arie Verloop at 425.952.2825 or by e-mail at arie.verloop@jansenboiler.com. Additional information and specific project references can be found on our website at: www.jansenboiler.com.

Jansen WELCOMES

Mark LeBel We are pleased to announce that Mark LeBel has joined Jansen, starting early March 2011. Mark is working out of the Atlanta area as a Senior Consultant.

Mark has had a long career with Combustion Engineering/ABB/Alstom Power Inc., lastly in the position of Manager, Boiler Engineering Services. He has broad experience in design and operation of Power, Waste-to-Energy, and Chemical Recovery Boilers as well Biomass-fired Circulating and Bubbling Fluidized Bed Boilers.


He holds a B.Sc. in Chemical Engineering, with Minor in Material Science from the University of Connecticut. Most of you may know Mark because of his active participation in BLRBAC, AF&PA, TAPPI, Int. Chemical Recovery Conference, etc., or as an advisor/representative to a variety of industry committees.

Mark can be reached by phone at: (425) 736-9758 or e-mail: mark.lebel@jansenboiler.com. If you know Mark, do drop him a line!



Andrea Striz We are also pleased to announce that Andrea Striz has recently joined Jansen. In 2010, Andrea graduated from the University of Washington with a M.Sc. degree in Mechanical Engineering. Among her skills set, she counts energy conversion, heat transfer, and fluids transport.

On a lighter note: with Andrea's hiring, both Jansen's sailing and Spanish speaking capabilities have been given a big boost, as she is a sailing instructor and competitor and speaks Spanish fluently.

Andrea is working as a Process Engineer in Jansen's Process Engineering department. She can be reached by phone at: (425) 952-2853 or e-mail: andrea.striz@jansenboiler.com. Please join us in welcoming Andrea. 


UPDATE ON Biomass Boiler Combustion System Upgrades

Since the late 1990s, Jansen has designed and supplied combustion system upgrades on over 60 solid biomass and RDF-fueled boilers. Currently, projects are under contract for five additional units, with planned installations between May and November this year.

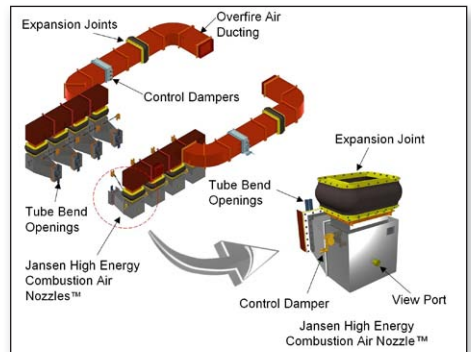
Typically, a combustion system upgrade includes modifications to the biomass fuel and/or air delivery systems, particularly the fuel delivery distributors and overfire air (OFA) supply, as depicted in the sketches on the right and shown in the photos on page 5.

Jansen OFA system upgrades have provided significant reduction in CO emissions (reductions by more than half) thus providing an excellent tool for meeting Boiler MACT requirements.

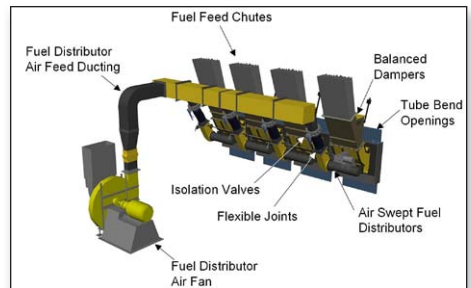
Further detailed information of the Jansen approach and experience in upgrading combustion systems of biomass-fired boilers, including OFA upgrades, can be found on our updated website (www.jansenboiler.com) with detailed project descriptions and past Newsletter articles.

Readers may wish to attend one of Jansen's Biomass Boiler Workshops. As has been a tradition for ten years, again in 2011, biomass boiler workshops will be held in two locations: Charlotte, North Carolina (June 9-10) and Sacramento, California (September 22-23). For sign-up details and further information about these workshops and locations, see the announcement on page 6. 

For specific inquiries and/or references, please contact Arie Verloop at 425.952.2825, or Ned Dye at 425.952.2827 or by e-mail at firstname.lastname@jansenboiler.com.



Elements of Overfire Air Supply Upgrades



Elements of Fuel Distributors Upgrade



Boiler House Cartoons on Jansen Website

A collection of boiler house cartoons can be viewed on our website: www.jansenboiler.com. Over thirty cartoons by Gordon Stevens shown previously in this newsletter are presented on the site. Each cartoon depicts a humorous situation with people and equipment in the boiler house. As you will agree, Gord has the rare insight to find humor in the operation of industrial boilers and we hope you enjoy his cartoons as much as we do.

Upgrading RDF Boilers – by the ½ Dozen

Based on the study findings, Jansen recommended that the existing over-fire air (OFA) delivery systems be replaced with modern high capacity OFA systems located on the boilers' side walls and that the fuel distributors be replaced with "new style" RDF distributors at a lower elevation.

The recommended upgrades, along with other improvements and maintenance work, were installed during separate boiler outages between November 2010 and May 2011.

Initial operation of the units that were upgraded first has demonstrated the following results:

- Boiler steam flows can now be maintained in the 150,000 lb/hr range without requiring shutdowns to lower the average CO emissions.
- CO emissions have been reduced by more than 50%.
- NO_x emissions compliance is also being achieved.
- Sustained boiler operation, no longer requiring shutdowns, has significantly increased the facility's RDF burning capacity.

Based on these four upgrades, the owner has been very pleased with the quality of the design/supply work by Jansen as well as the initial operational performance of the units after the upgrades.



New RDF Fuel Distributors with Air Supply on Boilers "A"



OFA Nozzles on Boiler "B"

Components of OFA Upgrade on Boiler "B" in the Fabrication Shop



• **RDF Boiler at Facility "B"**. Jansen completed a similar project – but with entirely different initial goals – on another RDF boiler in operation in an E-f-W facility in New England. The unit was also supplied by Combustion Engineering (in 1987) for co-firing of RDF and stoker coal and was designed to generate 231,000 lb/hr of steam at 825°F and 880 psig from RDF only. The unit was typically operated below its MCR steam flow to prevent exceeding the daily CO emission limit. Jansen was first contracted to conduct a comprehensive engineering evaluation, including CFD modeling and circulation study, to evaluate the impact of permanently removing the furnace water cooled screen section on the superheater life expectancy since this screen was in need of replacement.

Furnace CFD modeling by Jansen uncovered shortcomings of the existing OFA system. The model showed non-uniform and elevated flue

gas temperatures at the superheater inlet, thereby accelerating corrosion rates in the superheater and emphasizing the need to retain the screen section. Modeling showed that upgrading the OFA delivery system and removing the screen would result in a decrease in peak corrosion rates by over 10%, as compared to an increase by nearly 10% if the screen section were to be removed without modifying the OFA system.

The plant moved forward by following Jansen's recommendations and upgraded OFA delivery system components were installed during the March 2011 boiler outage.

Initial operation of the unit after the OFA system upgrade has been "...a complete success..." as quoted by plant personnel, in part due to the increase in RDF burning rate and decreased CO emission levels. The OFA upgrade also provided improved combustion control, allowing implementation of a CO trim control loop.

Long term operation will reveal if the predicted benefits on corrosion can be quantified and that removal of the screen section is warranted.

• **RDF Boiler at Facility "C"**. The upgrades on the RDF boilers in facilities "A" and "B" came on the heels of an OFA delivery system upgrade that was supplied by Jansen to a RDF-fueled boiler in the upper mid-west three years ago. This Riley Stoker unit had been converted to burn RDF on a traveling grate in 1989 and has a design steaming capacity of 173,600 lb/hr. Prior to the OFA upgrade, at times, natural gas was co-fired with the RDF to control CO emissions. The purpose of the OFA delivery system upgrade was to lower CO emissions, reduce natural gas co-firing, and have the ability to burn additional RDF and generate more steam.

With the OFA upgrade, all of Jansen's performance guarantees were met. Operation with the new OFA system and the implementation of an oxygen trim logic has resulted in the following demonstrated performance improvements:

- A 12% average increase in RDF firing and steam generation rates.
- Ability to operate at lower flue gas oxygen levels while maintaining CO and NO_x compliance.
- Reduced frequency and magnitude of CO emission spikes.
- Reduced need for natural gas co-firing to remain within emissions compliance.



OFA Nozzles on Boiler "C"

For further information on this recent work and specific inquiries about potential future projects, please contact Arie Verloop at 425.952.2825 or by e-mail at arie.verloop@jansenboiler.com.

Attend Our

2011 Biomass Boiler Workshops

- Charlotte, North Carolina, June 9-10, 2011
- Sacramento, California, September 22-23, 2011

Since 2000, these workshops have been attended by some 675 representatives of numerous plants in the Pulp/Forest Products Industries, Independent Power Producers and Energy-from-Waste Industry.

The workshops consist of presentations about new technological developments and results to improve the operating performance, waste fuel burning capacity, efficiency, and fuel economy of biomass-fired boilers (mostly stoker-fired). In addition, the program will include troubleshooting and problem solving discussions of challenges that attendees bring to the workshop. Participants will benefit by: 1) learning about the current retrofit technology for biomass boilers and associated equipment; 2) seeing how other mill operations solve their biomass boiler area problems; and 3) receiving information and solutions to their specific problems. Attendance to the workshop is free of charge; space is limited.



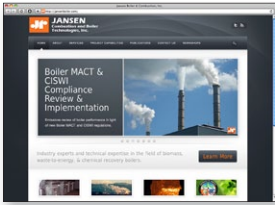
Participants take notes during a past Biomass Boiler Workshop

The workshops are co-sponsored by:



For sign-up and to receive a detailed program of the technical presentations, workshop location, and hotel, etc., please contact Pat Azeltine or Cathy Thomas by phone at 425.952.2843/2835 or by e-mail at firstname.lastname@jansenboiler.com.

Website Update Earlier this year, we incorporated a major upgrade and modernization of our website. Go see: www.jansenboiler.com. Whereas



the design and layout of the old site had served us well for many years, a new look was needed. With this new look, no changes have been made to the in-depth (technical) content of the site, including detailed

capabilities and project descriptions, technical papers, etc., as well as a collection of over thirty boiler house cartoons by Gord Stevens.



Jansen Projects in Canada

In Canada, the department of Natural Resources is implementing the Pulp and Paper Green Transformation Program (GTP); a total of CAD\$ 1 billion is being made available to mills for capital projects that have a positive impact on the environment, energy efficiency, and expanded use of renewable fuels.

This past year, Jansen was awarded several projects that are supported by the GTP in mills in Kamloops, Port Alberni, Prince George, Quesnel (all BC), The Pas (MAN), and Windsor (QUE). Several more are currently under consideration.

RECEIVE OUR Newsletter by E-mail

This Newsletter, No. 38, Spring 2011, is again being sent by e-mail to our contacts for whom we have an e-mail address. It will also be sent via regular postal service. We are continually expanding the electronic distribution list for our bi-annual newsletter. To receive future newsletters, you are given the following choices:

- Prefer receipt by e-mail (no regular mail)
- Prefer receipt by regular mail (no e-mail)
- Prefer both mailings (e-mail and regular mail), If we do not hear from you, we will assume this choice.

To receive this and upcoming Newsletters electronically, please send your e-mail address to editor@jansenboiler.com and you will be included on the list.



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