PROCESS SIMULATIONS LTD

Solving Industrial Problems through Process Modeling

Optimizing Bark Boilers

PSL offers a comprehensive analysis and optimization of your boiler that will:

- Reduce operational costs
- Increase the efficiency of boiler
- Minimize carryover and flue gas emissions
- Reduce NOx, CO and carbon particulate

Bark Boiler Problems

Bark boilers (Figure 1) are used in pulp and paper mills to burn bark and other waste fuel and to produce process steam and electrical power. Most of the problems associated with bark boilers are related to inadequate mixing between the combustible gases and air. Many existing bark boilers require more than 8%-10% of exit O_2 in the flue gas to compensate for the poor mixing conditions, and to maintain acceptable levels of CO at the boiler exit. An optimized air system should not have more than about 4% of exit O_2. The increased flue gas flow requires higher capacity induced and forced draft fans, and results in higher upward flow velocities. The upward flow of the flue gas entrains airborne particulate and carries it into the upper sections of a boiler. This particulate carryover accumulates in the economizer hopper from which it has to be removed and disposed.

In The Past

Boiler designs and modifications were based on experience and simple physical modeling. Because of the complexity of the turbulent gas flow and combustion in a boiler, such an approach is frequently insufficient and has not produced desired effects. Many pulp and paper companies have spent hundreds of thousands of dollars on modifications that have not fulfilled their expectations or the contractor's promises.

Now

The advent of high-speed, cost effective computing has produced a new and powerful analysis tool: *process modeling*. We can simulate and predict in advance the outcome of any boiler modification, supporting the mill managers decisions concerning boiler operations and air/fuel delivery system retrofits.

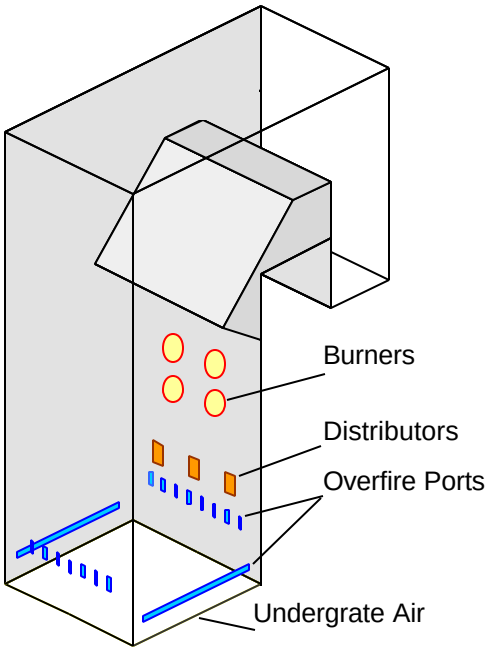

Figure 1: Schematic of bark boiler

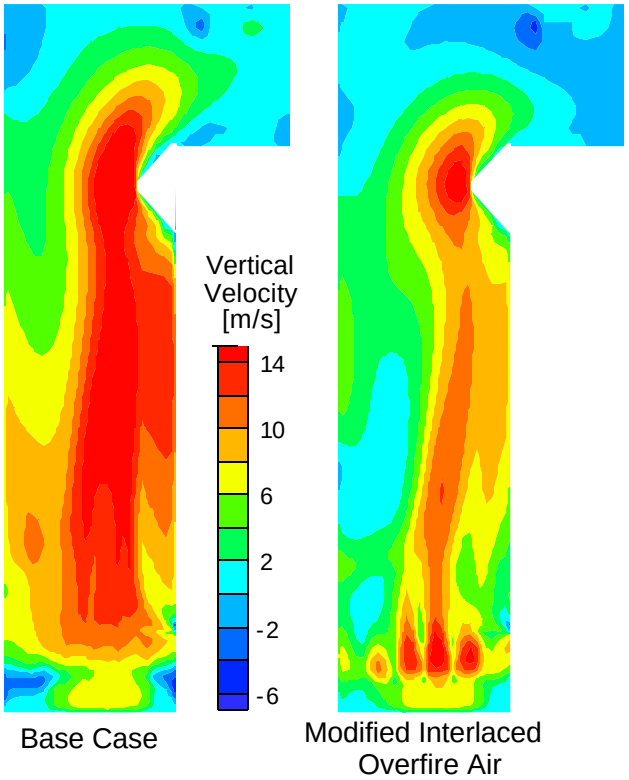

Figure 2: Vertical gas velocity distributions

WHAT WE CAN DO FOR YOUR BOILER

- Analyze the existing air and fuel system
- Improve gas mixing and combustion effectiveness
- Lower excess air necessary for complete combustion
- Minimize particulate carryover
- Minimize unburned char
- Minimize emission of CO_2, CO, NO_x
- Increase the range of operational conditions
- Improve overall thermal efficiency
- Optimize firing strategies for different loads/fuels
- Increase the capacity of the boiler
- Improve controllability of the boiler
- Minimize danger of blackouts
- Minimize danger of waterwall tubes failure
- Analyze the possibility of air and fuel system upgrade

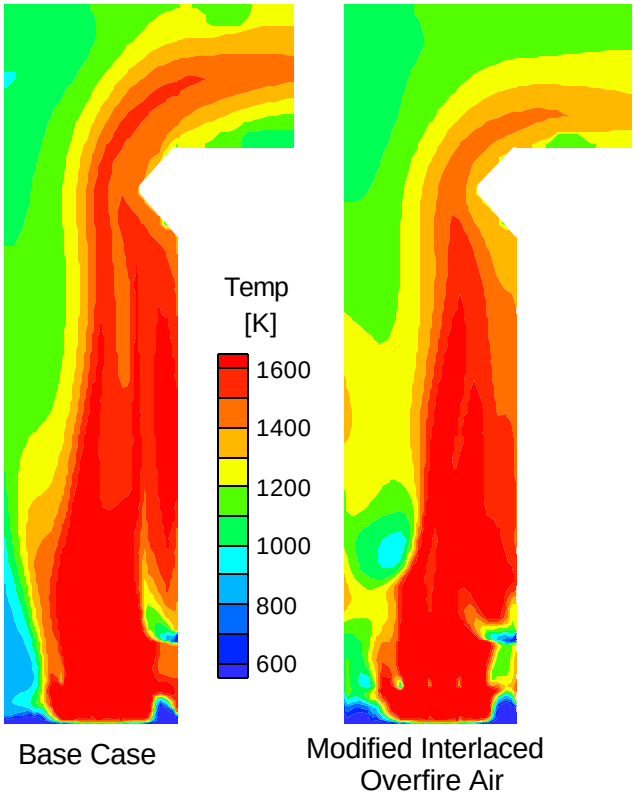

Figure 3: Temperature distributions

HOW WE DO IT

We work closely with the boiler operators to collect the information necessary to set up and run the bark boiler model. When all the necessary data is collected the model is set up and a baseline case is computed. PSL uses our own process modeling software to simulate gas flow and gas phase combustion. The results of the computer simulation are presented as graphs showing flow fields (Figure 2), gas temperature (Figure 3), fuel and carryover trajectories (Figure 4), fuel distribution on the floor/grate, and other relevant information. Computer animations of the flow field and carryover may also be included.

Simulation results allow for a thorough understanding of the boiler operation, and provide the basis for optimization of the existing air and fuel system. In some cases it may be sufficient to improve the boiler's operating practices, in other cases, it may be beneficial to retrofit the boiler with a modern overfire air system. The decision depends on the severity of the operational problems and the budget available for the boiler upgrade. Any of these changes can be *evaluated in advance* by our model, helping to minimize risks in the decision making process.

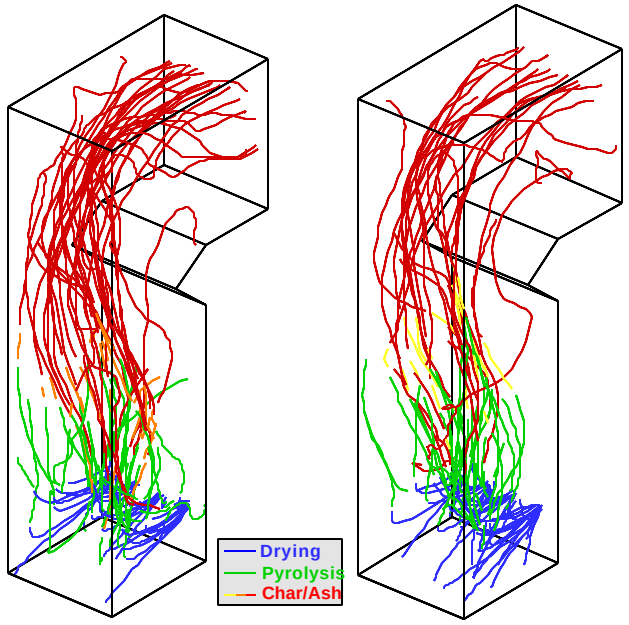

Figure 4: Carryover particulate trajectories

PROCESS SIMULATIONS LIMITED

Consulting engineers specializing in the modeling and analysis of industrial process equipment including:

- **Recovery Boilers**
- **Biomass/Utility Boilers**
- **Headboxes**
- **Digesters**
- **Lime Kilns**
- **Wood Kilns**
- **Hydrocylones**
- **Air Ports, Nozzles, Ducts**

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