



## RECOVERY BOILER ANALYSIS

PSL offers a comprehensive analysis and optimization of recovery boilers that will:

- Increase the load and efficiency of the boiler
- Minimize carryover and flue gas emissions
- Reduce operational costs
- Significantly reduce decision making risks
- Provide valuable information for operator training

### RECOVERY BOILER ISSUES

In times of high demand, recovery boilers (Figure 1) are often a bottleneck for mill production. Operating a boiler above the design load often leads to problems such as excess carryover, high combustion gas emissions, elevated thermal stresses, and fuel bed instabilities.

Boiler designs and modifications were based on experience and simple physical modeling. The complex nature of the turbulent gas flow and combustion in the boiler limits this type of approach, often leading to unsatisfactory results. Many pulp and paper companies have spent millions of dollars on modifications that have not fulfilled their expectations or the contractor's promises.

### A NEW SOLUTION

The advent of high-speed, cost effective computing has produced a new and powerful analysis tool: process modeling. PSL and research partners have invested millions of dollars in the development of a sophisticated recovery boiler analysis tool that can simulate the complex details of an operating recovery boiler. This tool can also be used to predict, in advance, the outcome of any boiler modification, including combustion air and fuel flow changes, or even a complete retrofit of the air and fuel delivery systems. Process modeling is an effective tool to help mill managers decide on proposals from recovery boiler manufacturers and retrofit contractors.

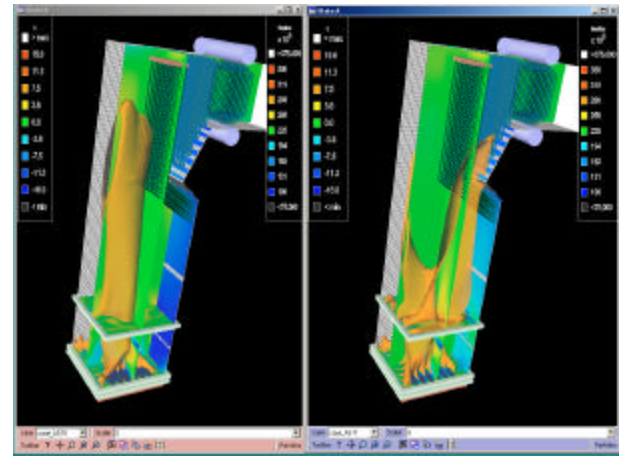


Figure 1: Recovery Boiler Analysis

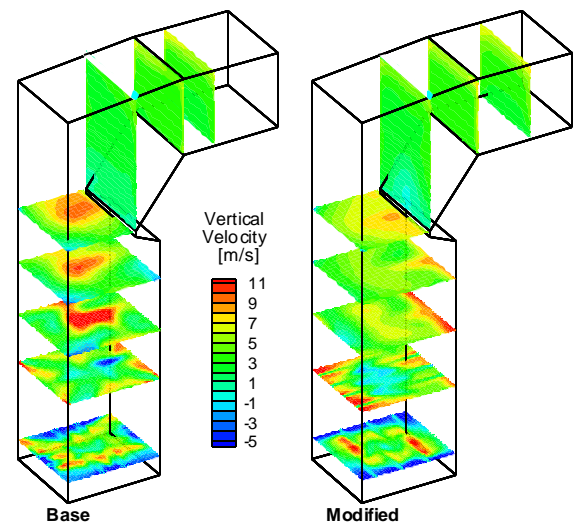


Figure 2: Gas Velocity Distributions

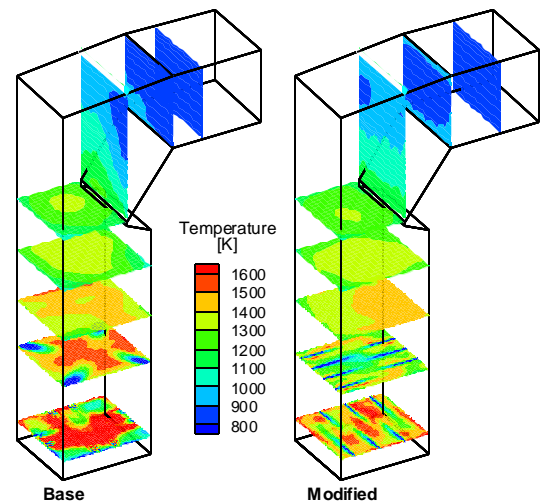


Figure 3: Temperature Distributions

## WHAT PSL 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 and unburned char
- Minimize emissions of CO<sub>2</sub>, CO, TSR, and NO<sub>x</sub>
- Increase the range of operational conditions
- Improve overall thermal efficiency
- Optimize firing strategies for different loads/fuels
- Increase the capacity of the boiler
- Improve the stability of the boiler
- Minimize the danger of bed blackouts
- Minimize the danger of waterwall tube failure
- Analyze and recommend choices of air and fuel system upgrades
- Provide valuable operational information for mill personnel

## HOW WE DO IT

PSL works closely with mill personnel to collect information necessary to set up and run the recovery boiler model. We then set up and run a baseline and one or more modified cases (Figure 1). Detailed results of the simulation are presented in the form of graphs showing gas flow velocities (Figure 2), gas temperatures (Figure 3), combustion gas species distributions (Figures 4 & 5), fuel and carryover distributions (Figure 6), wall heat transfer distributions, and a host of other relevant information. Computer animations of the gas flow and fuel particulate may also be included for operational training.

Simulation results allow for a thorough understanding of the boiler operation, and provide the basis for optimizing 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 new air or fuel delivery 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 recovery boiler analysis tool, helping to minimize risks in the decision making process.

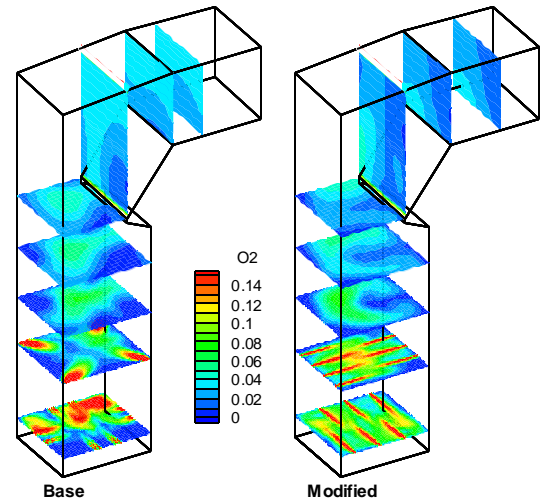


Figure 4: Oxygen Distributions

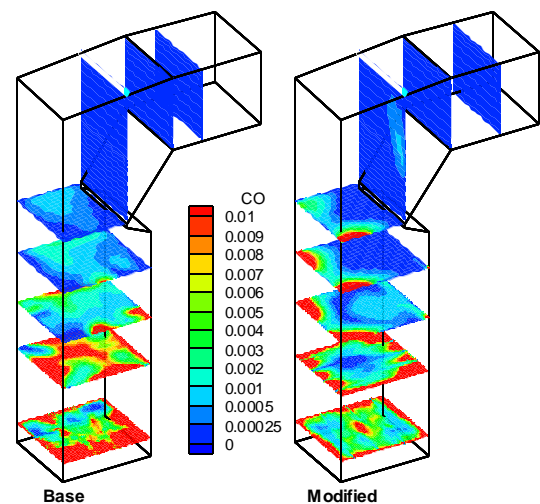


Figure 5: Carbon Monoxide Distributions

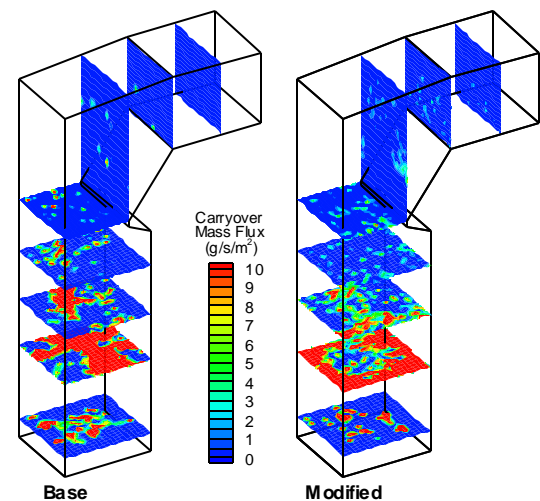


Figure 6: Fuel Mass Flux Distributions

## 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
- Hydrocyclones
- Air Ports, Nozzles, Ducts

204 - 2386 East Mall, Vancouver, BC, Canada V6T 1Z3

Tel: (604) 822-1490, Fax: (604) 822-1934, Email: info@psl.bc.ca, Web: www.psl.bc.ca

