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PARTICULATE KNOWLEDGE

Case History Success Story

Neundorfer Helps Paper Mill Gain Operational Flexibility Through Cost-Effective Emission Reductions

Overview

When a good solution is not good enough, but cost is a barrier to the most obvious solution, what do you do?

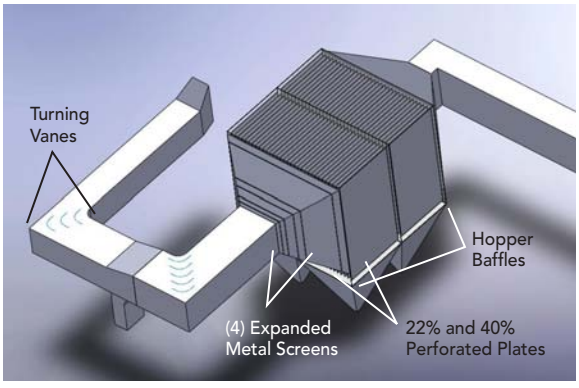
As part of its process to optimize boiler performance, a Wisconsin paper mill consulted with Neundorfer to affordably reduce emission levels. The situation was the result of a fuel change, which had led to more ash load and higher carbon content in the ash. With Neundorfer's help, the company found a way to effectively handle the extra ash, keep stack emissions low and avoid spending an arm and a leg on upgrades.

Before bringing in Neundorfer, the mill was contemplating making expensive ESP modifications, since coal boiler operations and fuel mix were already optimized. As it turned out, however, there was a more affordable way to reach the same end.

Finding a Solution

Neundorfer started the process by creating a 3-D model of the unit, and then used Computational Fluid Dynamics (CFD) analysis and a quantitative performance prediction model to identify areas where gas-flow patterns needed to be improved.

Results of the CFD/performance prediction model suggested three problems. First, the inlet ductwork's shape seemed to be creating uneven velocity and air distribution. Second, velocities across the outlet face suffered from significant variations. Third, during rapping there was an unfavorably high level of dust and ash re-entrainment.



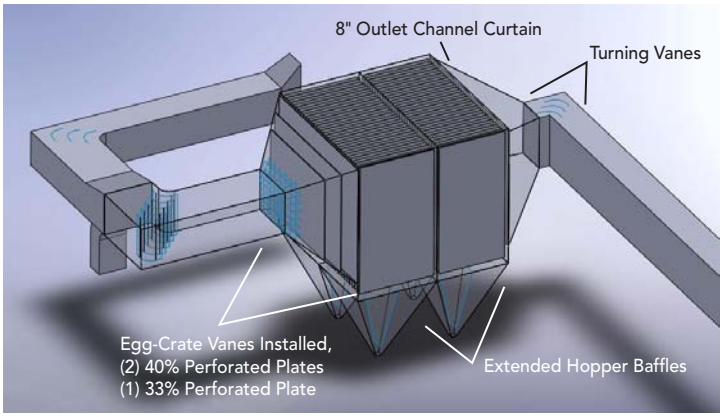
Original Unit Configuration

Options

All three problems pointed to gas-flow as the culprit for why the mill was experiencing undesirable opacity levels and an inefficient unit. By optimizing gas-flow distribution, Neundorfer predicted the mill could reduce its emissions, drop its system pressure, improve precipitator efficiency and eliminate ash re-entrainment.

To determine how best to resolve the problem from a gas-flow distribution standpoint, Neundorfer analyzed CFD results using a computer performance model used to quantitatively predict the effectiveness of different solutions. After running 29 tests, Neundorfer recommended seven improvements:

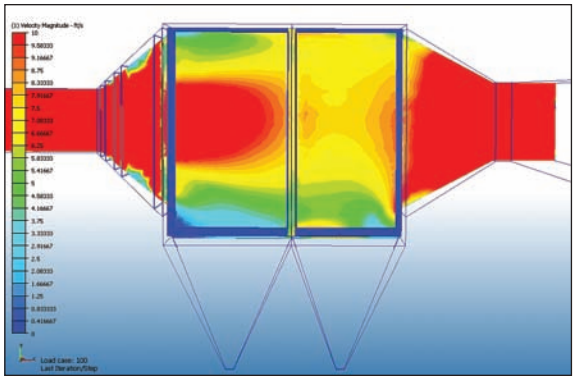
1. **Add inlet nozzle egg-crate vanes** in order to distribute the air evenly across the face of the precipitator and perforated plates, helping to reduce re-entrainment from rapping.
2. **Add inlet perforated plates** and change the porosity to direct and distribute the air across the inlet face more uniformly.
3. **Lengthen the hopper baffles** from 3'-6" to 14'-1.5" to help prevent ash re-entrainment and clogging in the hoppers.
4. **Install a perforated plate** on the outlet face to create a higher average velocity toward the bottom of the duct and eliminate the variation in velocities across the plane.
5. **Add turning vanes in the outlet ductwork** to disperse the air more evenly and reduce pressure drop as it exits the precipitator.
6. **Upgrade the transformer/rectifier control system** to further reduce emissions.



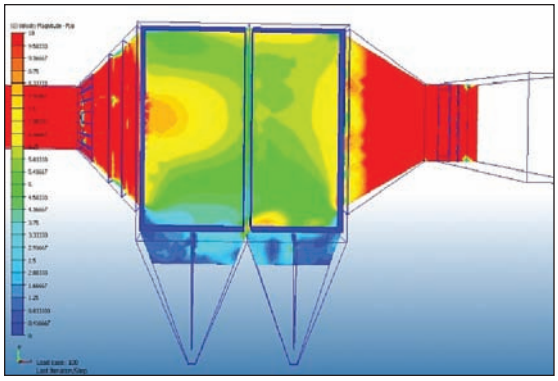
Highlighted blue shows the recommended solution

Results

Neundorfer helped the paper company decide which of the recommended modifications would best fit into its planned outage schedule and budget. The unit's outlet was modified with new turning vanes and 27% perforated plate. Also, four expanded metal screens were removed from the inlet nozzle and replaced with egg-crate vanes.

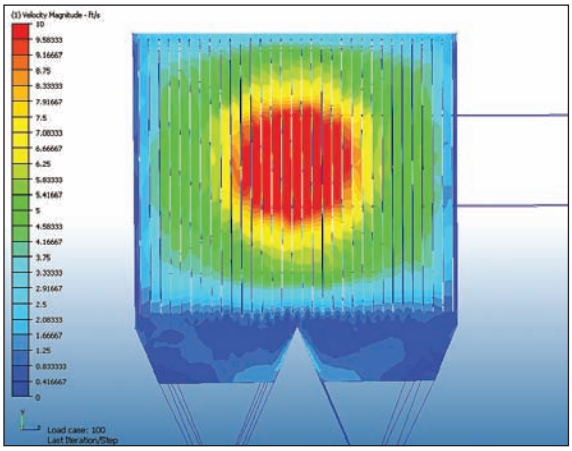


Baseline elevation view velocity profile

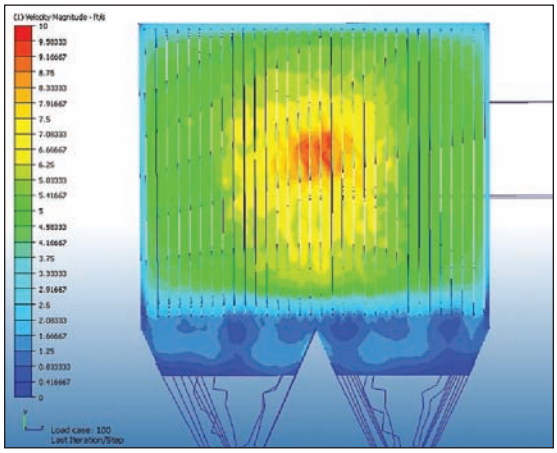


Improved elevation velocity profile after recommended solution

Neundorfer predicted that, just by making these three changes, the mill would reduce stack emissions by 22%. Initial results were very positive: fuel ash content increased, as did carbon levels in the precipitator ash, but *stack emissions didn't rise.*



Baseline inlet face velocity distribution



Improved inlet face velocity distribution after recommended improvements.

Continued Support

Even after the modifications were installed, Neundorfer continued working with the paper company to make sure unit issues were resolved. Neundorfer's support continues as planning continues for future improvements.

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