

Paper mill improves steam system efficiency by addressing boiler carryover

CASE STUDY | Pulp & Paper

WATER TECHNOLOGIES



| Challenge

A North American paper mill was suffering from the adverse effect of boiler carryover. Boiler water carryover can occur due to either mechanical or chemical factors. In this case, it was both.

One of their boilers was undersized relative to the steam demand of the plant, and there was no steam separation equipment on that unit to prevent the entrainment of water droplets and foam. Whenever steam demand would spike, drum water would splash out and contaminate the steam.

Carryover can also occur when a foam layer builds due to excessive concentration of dissolved solids (i.e., alkalinity and conductivity). The industry has recommended limits on boiler water conductivity to prevent foam build-up and carryover. Operating above that threshold, which is set based on operating pressure and other factors, puts the steam system at risk of corrosion and deposition from the contaminants. Blowdown must then be applied to control “cycles of concentration.”

The presence of foam and water droplets in the steam causes many issues:

- “Wet” steam contains less energy, so more is required to heat up the process. This implies higher fuel usage.
- Boiler water contamination in the steam causes corrosion and deposition, increasing maintenance cost on piping and heat transfer equipment.
- When in direct contact with finished paper products, the contaminated steam caused staining, increasing rejects due to quality specifications.
- Returned condensates contaminated with carryover imparted higher conductivity to the feedwater. This creates a vicious cycle as more dissolved solids lead to more carryover.



Total savings
\$458,000/yr



Water savings
1.9 MMUSG/yr



Boiler efficiency
↑5%



Greenhouse gas emissions
reduction **5,200 tons**
CO₂

The incumbent water treatment company was recommending operating the boilers above the industry conductivity guidelines on the premise that this would reduce fuel and water usage.

Faced with the increasing cost from carryover related to repairs and finished product defects, Veolia was offered the opportunity to implement its solution.

| Solution

Veolia recommended several changes regarding operational and chemical parameters. The boiler internal treatment was converted to Solus* AP, an exclusive all-polymer program. Solus' all-polymer chemistry imparts minimal conductivity, helping to prevent carryover. The new program was also comprised of catalyzed sulfite and neutralizing amines.

Operational changes recommended included:

- Respecting industry guidelines for boiler water conductivity to prevent carryover and condensate/feedwater contamination.
- Gradual increase of boiler water cycles of concentration.
- Controlled low-rate venting of the condensate system non-condensable gases.

| Results

Soon after Veolia's treatment program was applied, we observed a decrease in steam condensate conductivity (see Figure 1), indicating that carryover was mitigated at the current conditions.

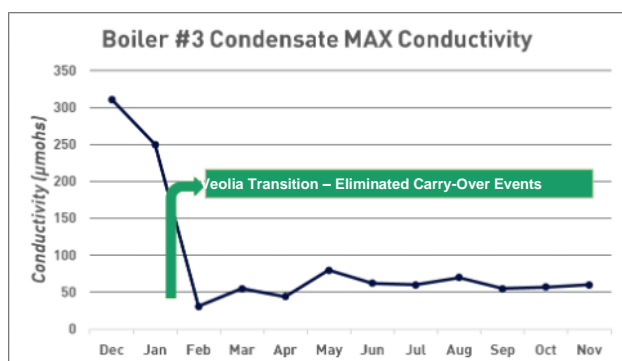


Figure 1: Steam condensate conductivity before and after Veolia treatment implementation

The increase in steam quality allowed for the proposed gradual increase in boiler cycles, passing from 19 to 27 cycles of concentration. As boiler cycles are increased, less hot water is being blown down the drain, reducing water and fuel consumption. It is important to note that the

increase in cycles did not create any carryover events, unlike the previous competitor treatment.

As carryover was controlled and non-condensable gases were vented appropriately, reduced contaminants and improved condensate treatment prevented wear on steam equipment. Knuckle joints of the dryers' steam inlet and steam traps, in general, stopped plugging. The maintenance department also observed that perimeter heating equipment did not require as many repairs. Monitoring of corrosion products in the condensate with Millipore filters showed a clear improvement (Figure 2).

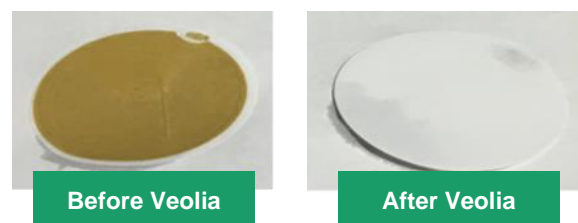


Figure 2: Condensate corrosion level improvement

Throughout the full year that Veolia's treatment was applied, and control parameters were optimized, the plant monitored boiler system performance. Natural gas usage was tracked to determine boiler efficiency, which increased from 75.8% to an average of 81.1% due to steam quality and boiler cycles improvements. This translated into savings of \$311,510 per year in fuel and water reduction (Figure 3).

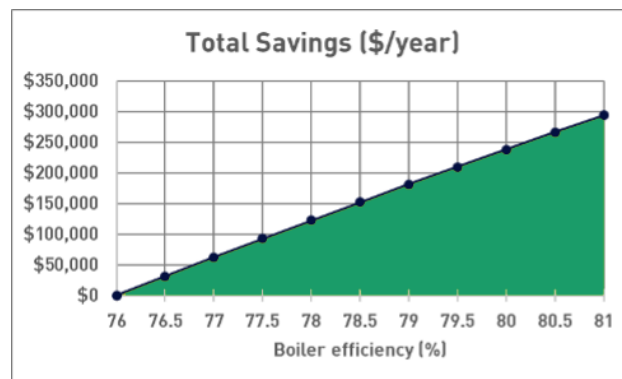


Figure 3: Fuel and water cost savings associated with increased boiler efficiency

Eliminating carryover and improving boiler efficiency reduced the plant's environmental footprint by saving ~1.9 MMUSG/year of fresh water and ~5,200 tons of CO₂. Cost savings totalizing \$458,000 were associated with the project, including the fact that the new Veolia treatment was 50% lower cost than the incumbent chemistry.

Finally, finished paper quality stopped being affected by staining, reducing reject rates and improving productivity, but this value could not be quantified.