Global aircraft manufacturer achieves water reduction and system performance goals with 3D TRASAR™ Water Saver Technology

SITUATION
In all regions of the world, there has been a rapidly increasing focus placed upon the minimization of water consumption. This has been especially true in the manufacturing sector where most global corporations have been working to brand their products and processes as being more sustainable in response to the expectations of consumers as well as the reality of growing water scarcity.

Recently, an innovative global manufacturer of commercial aircraft developed an initiative to reduce their water and chemical consumption by 25% over the next 5 years. Since 2007, they had been able to document a decrease in water consumption of 9%, but were now challenged to find additional opportunities for savings in order to meet their goal. In addition, unprecedented production demands were driving increased water usage.

In their manufacturing plants, the largest consumers of water were cooling tower systems. These systems were studied, and they determined that the current level of treatment and automation had minimized water usage to the greatest extent possible. In order to achieve any additional reductions, new innovation would have to be integrated into the system.

BACKGROUND AND CHALLENGES
A 1,500 ton (5,000 gallon) HVAC loop with three independent cells was selected to be a trial site for any new technology that could offer additional water reduction capabilities. The concern for the plant was that additional water reduction could only be achieved through higher cycling of the tower. At these unprecedented higher cycles of concentration there was fear that the system integrity or performance would be compromised. As with most cooling systems, there are several key operational results to manage effectively. These include prevention of:

---

### Customer Impact

- Water savings of 1,161,795 gallons per year

### Economic Results

- $12,174 per year

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.
• **SCALE FORMATION**, which acts as an insulator that prevents efficient heat transfer resulting in higher energy usage and under deposit corrosion.

• **CORROSION**, which creates a loss of system integrity that ultimately leads to higher maintenance costs. In addition, corrosion byproducts can foul system heat exchangers, driving up energy consumption.

• **MICROBIAL ACTIVITY**, which presents both potential health risk and operational concerns associated with uncontrolled bacteria growth. Excessive MB growth will lead to fouled heat exchangers and accelerated corrosion rates which ultimately force higher energy costs and a loss of asset reliability.

The challenge was to achieve water reduction through cycles increase without creating an increase in scale, corrosion, or microbial activity beyond established limits.

**HEAD TO HEAD TRIAL**

The plant wanted to evaluate the Nalco solution against one of the leading technologies available in the market. The competitive solution aimed to increase cooling tower cycles by reducing scale-forming ions in the water makeup to the tower through an advanced softening approach. Additionally, the competitor offered the softening approach as a “chemical-free” system and stopped the feed of all scale and corrosion inhibitors as well as any biocides.

Nalco chose to offer a more comprehensive and innovative solution to the challenge.

**PROGRAM**

Nalco provided a more reliable, efficient, and environmentally sustainable alternative for the water reduction challenge. The new 3D TRASAR Water Saver program has been developed by combining 3D TRASAR technology and electrochemical precipitation (EP), a combination that adds a “scale removal” dimension to the existing 3D TRASAR scale prevention plat-
form. 3D TRASAR Water Saver technology gradually cycles up the cooling tower while the EP component removes saturating scale and stores it in reactors. As the tower cycles increase, water loss is minimized from the reduction in blowdown, which achieves water savings. At the same time, the 3D TRASAR technology works effectively to monitor and control all critical system operating parameters to ensure system reliability and the achievement of key performance metrics.

HEAD TO HEAD TRIAL RESULTS

Competitive Solution Results

The competitive solution developed around a softening strategy was able to achieve higher cycles in the cooling tower, which reduced blowdown loss. However, it failed to achieve the water reduction goals anticipated due to the need to frequently regenerate the softener. This required additional water consumption that had not been previously accounted for. Additional concerns included:

- Significantly elevated corrosion – Mild Steel corrosion accelerated to 20 mpy
- No mechanism for microbial control
- Excessive operating costs estimated at more than $50,000 annually for consumables, utilities, manpower and royalties
- Lack of protection during an equipment failure, or softener breakthrough, which would leave the cooling system in a “high scale environment”
- No monitoring, control, or alarming capabilities to notify operators of problematic operation
- No failsafe capability provided during high stress operating conditions

RESULTS

During the first four months of operation the cooling tower was gradually cycled up until “zero discharge” was achieved. This effectively allowed the plant to operate the tower with zero blowdown, thereby maximizing the water reduction capability of the system. After 6 months of operation, the system was drained and inspected. There was no evidence of scale formation or microbiological growth deposition in the tower basins. After 1 year of operation, Chiller #1 was taken off line and inspected. Again, there was no evidence of scale or microbiological deposition found on the chiller tubes or on the tube sheet. This confirmed the effectiveness of the Water Saver program as a water reduction strategy that still provides scale prevention and microbiological control, both ensuring system operating efficiency.

In addition to this outstanding performance in scale prevention, Nalco monitored all key performance indicators in the system throughout the trial and documented the following results.

The net achievement was a blowdown reduction of 100%, allowing the plant to achieve zero liquid discharge from the cooling tower system. This translates into a water savings of 1,161,795 gallons per year or $12,174.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycles of Concentration</td>
<td>12</td>
<td>40+</td>
</tr>
<tr>
<td>Blowdown Water (gpd)</td>
<td>1,853</td>
<td>0</td>
</tr>
<tr>
<td>Mild Steel Corrosion (mpy)</td>
<td>0.8 – 1.8</td>
<td>1.0 – 1.8</td>
</tr>
<tr>
<td>Yellow Metal Corrosion (mpy)</td>
<td>0.0 – 0.2</td>
<td>0.0 – 0.1</td>
</tr>
<tr>
<td>Microbial Activity (cfu/mL)</td>
<td>&lt; 10⁴</td>
<td>&lt; 10⁴</td>
</tr>
</tbody>
</table>
CONCLUSION

3D TRASAR Water Saver Technology significantly out-performed the competitive offering while also achieving the water reduction goals and performance expectations of the manufacturing plant at an improved overall total cost of operation.

- The water reduction goal was not only met, but exceeded
- Scale formation was prevented
- Corrosion levels were maintained below industry standards
- Microbial activity was maintained below industry standards
- Reliability and peace of mind were provided through 3D TRASAR advanced monitoring, control and communications

3D TRASAR Water Saver technology pushed cooling tower cycles to zero blowdown while maintaining excellent corrosion control in the system.

The competitive technology achieved high cycles in the cooling tower, but created an excessive amount of corrosion in the process.