Cooling Towers and Environmental Sustainability

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Striking an environmental balance

- Good corporate citizen
- Minimal environmental impact
- Low-cost, reliable electric power
Stressed water and power resources

- Missouri River, summer of 2012
  - Record high temperatures
  - Water released from reservoirs in Montana and North Dakota to support irrigation and navigation

- Omaha Public Power District (OPPD) Nebraska City
  - Raw water clarification limitations risked availability and limited capacity
Technology provides the solution

- **3D TRASAR Cooling Water Optimizer**
  - Sophisticated solubility and corrosion modeling software
  - Modeled impact of increasing cycles of concentration from 3.4 to 5.2
  - Water savings: 290 million gallons per year.

- Implementation was complete in July 2012.
A sustainable solution

- Maintained production during peak demand
- Reduced load on the raw water clarifiers
- Reduced clarification costs
- Reduced water withdrawals from the Missouri River, a highly-stressed waterway
- Sustainable. The drought ended, but the solution remains. The benefits to OPPD continue.

NALCO
An Ecolab Company
Impact on the local community

- Western power plant operates as a zero-liquid discharge (ZLD) facility
- Cooling tower blowdown and other streams discharge to an evaporation pond
- Frequent odor complaints from local residents
**Algae Blooms**

- Phytoplankton (algae) reproduce at a rapid rate in the presence of sunlight, nitrogen and phosphate.

- Within a few days, individual organisms die and sink.

- Anaerobic bacteria consume the dead algae, producing hydrogen sulfide gas which bubbles up through the water column.

- Hydrogen sulfide (H$_2$S) gas smells like rotten eggs.

Huge algae bloom off the coast of Namibia. H$_2$S reacts with oxygen, releasing pure sulfur. The yellow sulfur reacts with the blue water to produce a green bloom visible from orbit.
Traditional algae control techniques

- Bleach
- Hydrogen peroxide
- Hydroblasting

This plant had used hydrogen peroxide

Cooling water treatment consisted of:
- Phosphate-based scale inhibitor
- Silica scale inhibitor
- Copper corrosion inhibitor
A sustainable solution

Solution: eliminate a nutrient source and the algae will not reproduce.

Cooling water treatment program was changed to a non-phosphate scale inhibitor, controlled with Nalco’s 3D TRASAR Cooling Water Technology

Algae blooms disappeared

Plant assets were protected

Odor complaints were eliminated

Costs for treating algae and odors were eliminated
Scarce and variable water

- Power plant in an arid area of the western U.S.
- Tertiary treated wastewater available and cheap, but highly variable in quality.
- Tight restrictions on fresh water intake
- Tight environmental restrictions on discharge
- Water demands putting pressure on groundwater supplies
Technology provides a solution

Make-up water could go from corrosive to scale-forming without warning.

3D TRASAR Cooling Technology provided a solution:

- Measures key parameters related to system stress
- Detects changes and upsets
- Takes appropriate, automatic corrective action
- Communicates with users
A sustainable solution

Long-term trends expected to continue:
- Water demands from business and residential users
- Environmental restrictions and governmental mandates
- Supply restriction

Technology allowed the plant to:
- Reduce water use by 40 million gallons per year
- Reduce discharge fees by $12.8 million
- Protect their equipment from scale, corrosion and fouling
- Reduce operating costs by $411,000 per year
Conclusion

Sustainable solutions allow power plants to strike the right balance:

- Be a good corporate citizen of the communities in which they operate
- Minimize the environmental impact of the plant
- Provide low-cost, reliable power

Technology helps achieve those goals

“Sustainable” does not necessarily mean “higher cost.” The best solutions actually reduce total cost of operation, strengthening businesses and protecting the environment.