

# Cooling Towers and Environmental Sustainability

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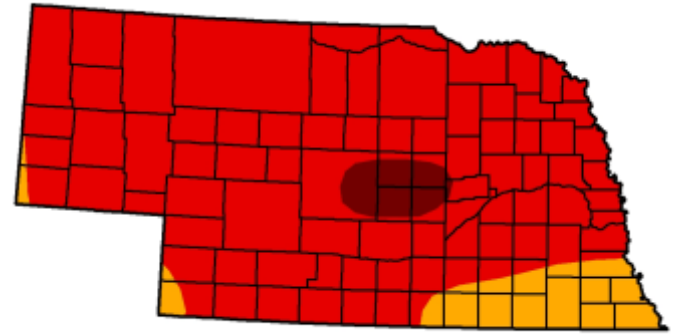
# Striking an environmental balance

- ▲ 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

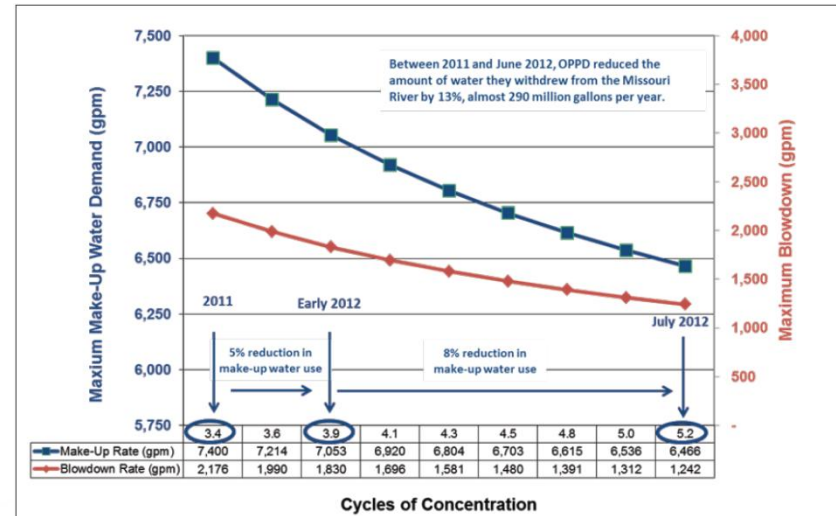


# Technology provides the solution

## ▲ 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.



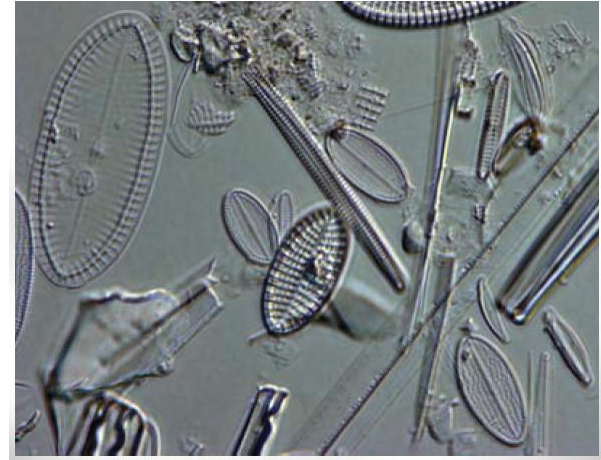
# A sustainable solution

- ▲ 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.



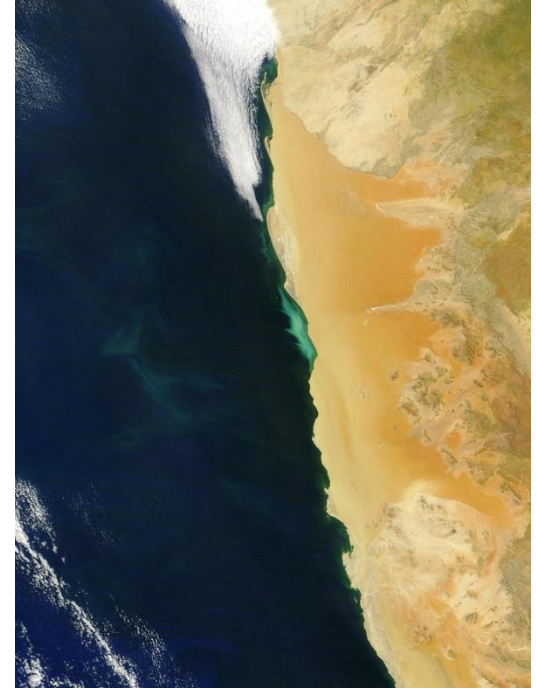
# Impact on the local community

- ▲ 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 ( $H_2S$ ) gas smells like rotten eggs.



Huge algae bloom off the coast of Namibia.  $H_2S$  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

## ▲ 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



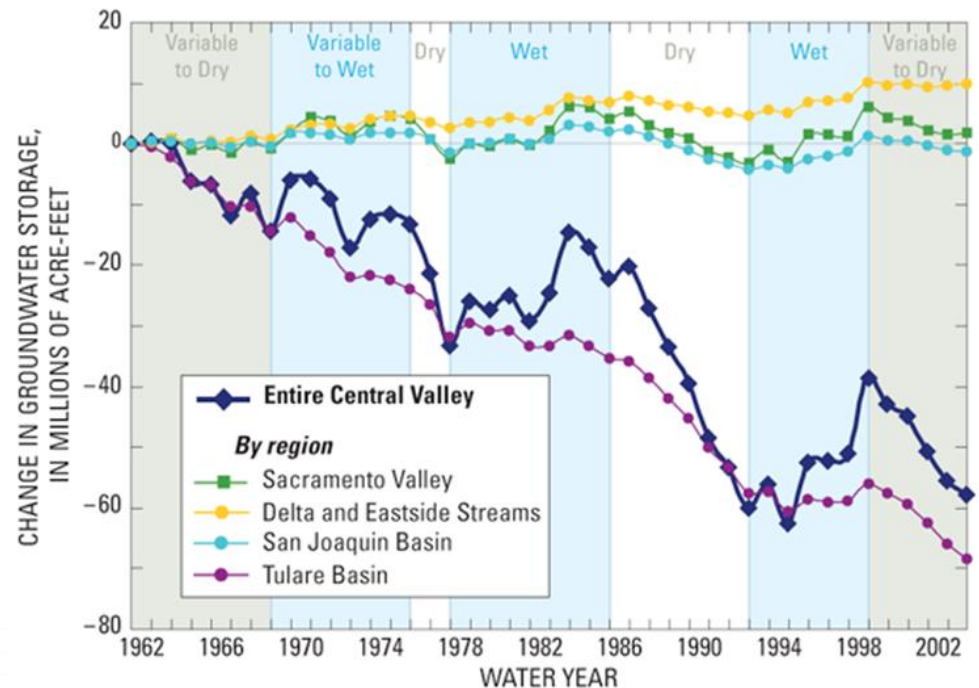


# A sustainable solution

- ▲ 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.