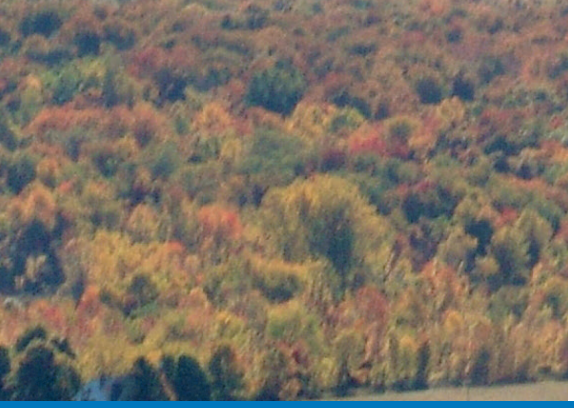

Constellation Energy Nuclear Group (CENG) uses condenser cleanliness program to reduce oxidant concentrations and increase capacity

OMNI™ Condenser Performance

NALCO Water
An Ecolab Company

CASE STUDY – POWER

CH-1053

SITUATION

Over the past several years, Constellation Energy Nuclear Group (CENG) has taken steps to improve condenser performance. A clean condenser helps a power plant reach its maximum generating capacity. That means, when demand and prices are highest, the plant maximizes revenue.

In 2008, CENG Nine Mile Point in Scriba, NY evaluated a condenser cleanliness program. The success of that program – documented in the December 2009 issue of *Nuclear Power International* – resulted in a production increase of 20 MW and an economic recovery of $1.05 million.[1]

After seeing the results obtained at Nine Mile Point, the staff at another Constellation nuclear plant, R.E. Ginna in Ontario, NY, decided to evaluate a similar program for their plant.[2]

Changes to the plant's discharge limits in 2008 were another reason to look for new ways to maintain condenser cleanliness. Historically, the plant had applied bleach to maintain condenser cleanliness. New requirements from the New York State Department of Environmental Conservation reduced the allowable total residual oxidant (TRO) in the plant's discharge from 0.2 ppm to 0.1 ppm. To maintain condenser cleanliness and comply with the new discharge rules required a new approach.

SOLUTION

Prior to the change in discharge allowances, the plant chlorinated for two hours every day. Daily chlorination was supplemented with an annual, thirty-day chlorination period. Applying the high oxidant – 0.2 ppm TRO – the plant achieved good results. The plant's new challenge: achieve the same or better results, but with half the applied oxidant.

ENVIRONMENTAL RESULTS	eROI℠	ECONOMIC RESULTS
Increased energy capacity by 9MW	ENERGY	$600,000 per year

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.

[1]Cicero, et.al., "Cleanliness Program Improved Condenser Performance," Nuclear Power International, Volume 2, Issue 4, December 2009.
[2]R.E. Ginna started commercial operations in 1970. This 581 MW Pressurized Water Reactor (PWR) is one of the oldest nuclear reactors operating in the United States.

Bromine chemistry did not, at first, appear to be a workable solution. Bromine is a liquid at normal pressures and temperatures. Handling it is difficult. The production of HOBr by adding bromine gas (Br_2) to water is not a viable option. And concentrated sodium hypobromite solutions are not stable. NaOBr decomposes quickly to form the biocidally inactive bromate ion, as shown in the equation below.

$3OBr^- \rightarrow 2Br^- + BrO_3^-$

The workable solution combined the existing sodium hypochlorite system with sodium bromide: the Nalco Water ACTI-BROM® program, a condenser cleanliness program that is part of the comprehensive OMNI Condenser Performance program. Sodium bromide is safe, stable and delivers more biocidal activity per pound of oxidant applied than hypochlorite. The reaction – shown below – is very fast, so minimal contact time between the chlorine and bromide is needed to produce the biocidal HOBr.

HOCl + NaBr → HOBr + NaCl

In 2009, the plant started using ACTI-BROM and bleach for its two-hour chlorinations. The change increased the effectiveness of each biocide application without increasing TRO.

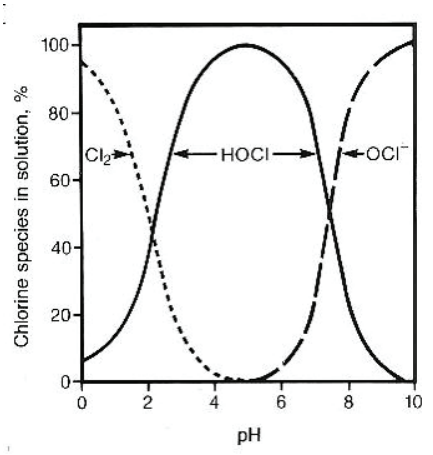

Figure 1 – *At elevated pH, sodium hypochlorite is a poor biocide because little of the free chlorine is in the biocidal HOCl form.*

RESULTS

In the spring of 2010, a plan was developed to use ACTI-BROM during the 30-day chlorination. TRO never exceeded 0.1 ppm.

Figure 3 shows the condenser efficiency for 2009 and 2010. In July 2009, bleach was used exclusively. Condenser efficiencies were brought back to 98%, as measured by Condenser Cleanliness Factor. In 2010, ACTI-BROM was used. Condenser efficiencies increased to 99.5% using the same performance metric.

A 1.5% improvement in condenser cleanliness factor delivers a capacity increase of about 9 MW, an improvement that represents a $600,000 annual economic recovery. The plant was able to achieve these financial results while reducing total residual oxidant discharges to Lake Ontario by 50% and meet its newer, more restrictive discharge limits.

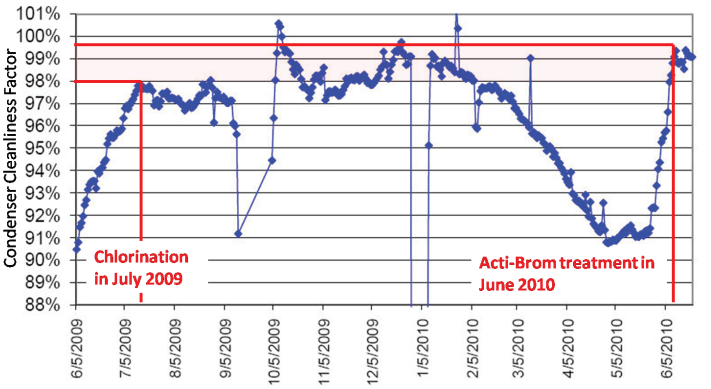

Figure 2 – *The 2009 condenser chlorination program returned the condenser to 98% cleanliness factor. In 2010, using ACTI-BROM, condenser cleanliness factor reached 99.5%. The improvement delivered $600,00 in annual economic recovery.*

Nalco Water reports Environmental Return on Investment (eROI) values to customers to account for contributions in delivering both environmental performance and financial payback.

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