



Biofilm Removal and Prevention Boosts Power Output at a Cost 50% Lower than Bulk Hypo. MIOX's on-demand generated chemistry boosts production of one of the major Puerto Rico power plants by 7%, achieving annual savings of more than \$3.4 million.

POWER PRODUCTION BOOSTED

7%

LOCATION

PREPA Palo Seco Power Plant (590 MW)
San Juan, Puerto Rico, USA

CONTACT

Eugenio Vives, NTS, (787) 649-0678

EQUIPMENT

Dual MIOX oX Cells
30 lbs/day Free Available Chlorine

PREVIOUS DISINFECTION

Sodium Hypochlorite 12.5%

PROBLEM

In 2010, one of the **Power Plants of Puerto Rico Electric Power Authority** (PREPA) faced a crisis due to biological growth in their power plant's cooling tower. The plant was using straight hypochlorite, which was not effective at controlling biological growth. Consequently, plant heat exchangers were plugged and temperature rose above manufacturers specifications due to biofouling of the condenser tube sheets which inhibited effective heat transfer. Due to the biofouling, the units were operating above their limit at 5 or 6 grades over manufacturers specifications even with the valves fully open. The heat exchangers were incapable of removing all the heat, which resulted in a drop in the plant's energy output.

MIOX'S SOLUTION

Instead of using an expensive proprietary biocide, MIOX's Puerto Rico channel partner, New Technology Systems, Inc. (NTS), installed a MIOX chemical generator at the site and started treating the water with Mixed Oxidant Solution (MOS) chemistry. PREPA witnessed an immediate improvement in temperature and the energy load of the plant started to increase. After installing the MIOX system, the temperature decreased, and all the generating capacity lost due to biofouling was gained back because the exchanger was cooling effectively. It resulted in 40 megawatts of additional capacity in just one month.

In total, the power authority's chief chemist estimates that the switch to MOS chemistry returns an overall savings over **\$3.4 million** per year.

Due to the success experienced at the Palo Seco Power Plant, NTS installed similar treatment systems at all of PREPA's nine power plants on the island of Puerto Rico.



The heat transfer efficiencies gained at the Palo Seco plant alone resulted in overall savings of roughly \$3.4 million a year.



Pedro Polanco, Chief Chemist at PREPA



RESULTS

Since the MIOX Dual oX Cell system's installation in 2010, the PREPA Palo Seco Power Plant has realized millions in annual savings due to:

\$3.4 MILLION

Boosted power plant production by 7% due to improved efficiencies after biofilm and scaling removal translating to \$3.4 million in additional capacity.

\$1.4 MILLION

57% reduction in operation and maintenance (O&M) costs. When the heat exchangers would plug, the temperature would cause them to break. Prior to utilizing MIOX systems in their cooling towers, PREPA's O&M costs were approximately \$2.5 million a year. After the system was running on all units, O&M costs fell to \$1.1 million; nearly a 57% reduction.

31,000

Reduction of 31,000 pounds of delivered chemicals per year, in addition to the savings for shipping, handling, storage, training and documentation for those chemicals.

56%

56% reduction in water consumption from 72 million gallons per year to 32 million gallons per year.

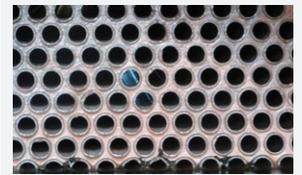
\$300,000

\$300,000 in energy consumption per idled pump. The solution from MIOX allowed PREPA to shut down one of the cooling tower's two 400-horsepower pumps required to push water through the previously biofouled system—each of which uses about 4.8 million kilowatts per hour at a cost of \$300,000 a year in energy consumption.

50%

50% biofilm reduction at a cost 50% lower than bulk hypo.

PALO SECO POWER PLANT 590 MW	BEFORE	AFTER
Energy Output	550 MW	590 MW
Net Energy Output Increase	None	+ 40 MW
Net Output Increase in USD	None	+ \$3.4 million / year
Biocide Program	12.5% Bulk Hypochlorite	Mixed Oxidant Solution (MOS)
Bacteria Count	1,000,000 CFU/ml	100 CFU/ml
Safety	31,000 gallons of hypochlorite per year transported, handled, stored 12.5% hypochlorite required HAZOP training and documentation	No hazardous chemicals used, transported, or stored MOS generated onsite using salt, water, and electricity Solution concentration is <1% No HAZOP required
Operation & Maintenance Cost	\$2.5 million / year	\$1.1 million / year
Water Consumption	72 million gallons / year	32 million gallons / year
Energy Consumption	Two (2) 400-horsepower pumps running 9.6 million kW /hr usage \$600k / year energy consumption	One (1) 400-horsepower pump running 4.8 million kW /hr usage \$300k / year energy consumption



PALO SECO UNIT #3 (210 MW) – ONE OF THE TWO TOWERS TOTALING 590 MW
GENERATOR H₂ TEMP VS. LOAD

