

Clean cooling boosts efficiency and protects environment

Snapshot

Client

Connah's Quay CCGT plant

Challenge

A build-up of microbial films and silt on cooling system surfaces was reducing efficiency and compromising cooling tower integrity. An improved approach was needed.

Solution

We proposed chlorine dioxide as a biocide, supported laboratory tests and plant trials, and modeled the environmental impact to demonstrate that use was consistent with the application of Best Available Techniques (BAT) for the site and gain Environmental Regulator approval.

Benefits

Effective removal of biofilms and deposits resulted in improvements in cooling system and power plant efficiency, and reduced environmental risk. Estimated total savings are in excess of €1m a year.

When Connah's Quay CCGT plant's conventional biocide dosing method did not satisfactorily control biofouling in its cooling system, we used our combined expertise to put forward a new system. We demonstrated that chlorine dioxide was an environmentally acceptable alternative which could deliver significant efficiency savings to the plant.

Conventional approach failed

Sodium hypochlorite is commonly used as a biocide in UK power plant cooling systems. But in the hybrid cooling towers of the 1420 MW plant, its use was limited by environmental restrictions resulting in microbial slimes being formed on heat transfer surfaces and silt being deposited, reducing efficiency and compromising the cooling system. The plant's key objective was to remove established biofilms and maintain clean heat exchanger surfaces.

Our effective alternative

From our research and development and industry experience, we identified chlorine dioxide as a potential alternative biocide. We supported pilot trials on-site which compared the performance of two cooling towers, treated with chlorine dioxide and untreated. Biological monitoring demonstrated the new system's efficacy in cooling water disinfection and its ability to remove biofilms from fouled surfaces.

We then supported Connah's Quay in obtaining an environmental permit variation to use chlorine dioxide for the whole plant by carrying out a Best Available Techniques (BAT) assessment which included assessment of the environmental impact. Modeling of the discharge into river water formed part of our assessment work.



€1m+

potential annual saving through use of the new biocide

Multi-discipline approach

The broad range of in-house skills we can offer our clients was a key factor in our successful solution to this challenge.

Working closely with the plant's own teams, we were able to provide:

- Water technology know-how
- Advice on technology choice, using information from technology tracking and industry contacts
- Environmental permitting knowledge, supported by first-hand experience with regulators
- Environmental modeling capabilities.



Our innovative solution reduces fouling within the cooling system, delivers plant efficiencies, saves on costs and maintains environmental protection.

How performance improved

On-site trials showed significant improvements to performance after chlorine dioxide was used to remove biofilms and deposits:

- A decrease of 0.9°C in pond temperature and 0.5 -1.5°C in condenser cooling water temperature.
- A 6% reduction in cooling water pump pressure, increasing the circulating cooling water by around 1,000 tonnes/hour relative to a normal flow of 7,000 - 9,000 tonnes/hour.
- At least 10 - 15 mbar improvement in condenser vacuum pressure.
- Potential increase in overall unit efficiency of at least 0.11%.

Importance of modeling

The need for a site-specific environmental assessment for using chlorine dioxide as a biocide at Connah's Quay meant that our modeling work was important to the plant gaining an environmental permit variation to use the new system.

We analyzed experimental data from site test work to estimate decay rates for chlorite, the main by-product from chlorine dioxide which could affect river water, then modeled its flow and dispersion in the estuary. This demonstrated that there would be no significant environmental impact.

Our successful solution to use chlorine dioxide to improve biofouling control was one of the first times to be used in the UK.

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