

Advanced Treatment Technology Controls Biofouling in a Large Cooling Water System at a Chemical Production Plant in the Eastern United States



CASE STUDY - CHEMICALS

CH-1551E



BACKGROUND

A large chemical producer in the eastern United States uses chlorine dioxide to control microbiology in the large cooling water system used on site. The successful application and efficacy of the treatment is vital to the efficient operation of the system, minimising the fouling of sensitive process heat exchangers, and controlling microbiological growth in the cooling towers and basin areas. Management at the plant are very focused on safety, minimisation of resource use, and overall production cost-efficiency. To assure this, the company expects the best on-site expertise from its supplier partners, innovation in new technologies, and improved sustainability performance through better water, energy, and waste management. As a result of a new initiative to improve operational efficiencies and to reduce overall costs, management were evaluating a range of new initiatives to provide the best and most cost-effective way to control microbiology within the cooling system.

CURRENT SITUATION

The open recirculating cooling system on site has several cooling towers, providing process cooling for over 100 heat exchangers, and it is vital that maximum heat transfer is maintained at all times, and any downtime avoided, to ensure continuity of production. Flow rates range from 1,000 to 25,000 m³/hour (5,000 to 110,000 gpm). All towers are up-flow, induced draft, multi-cell

units employing splash-type fill. One or more cold wells with vertical lift pumps circulate the cooled water throughout the multiple process units that require cooling water. The units operate continuously for 24 hours per day, 7 days per week. Make-up water quality, process conditions and occasional process leaks promote aggressive biological growth.

Makeup water quality varies, with low to moderate levels of Total Organic Carbon (TOC), and a proportion of makeup comes from treated wastewater effluent. Additional biological loading to the cooling system occurs occasionally when process leaks introduce high levels of organics into the cooling water. In such situations, biofouling increases rapidly and dramatically, if not immediately addressed. Management at the plant decided to seek new options to improve and upgrade the relatively old treatment system and technology in place. Specifically, any new option should improve control of microbiological and macro-fouling, improve overall system reliability and performance, and reduce the associated capital and operational costs.

Chlorine dioxide proved to be the technology of choice. Security and safety in receiving and storing chemicals and in generating chlorine dioxide was of paramount importance to the company. In addition, the equipment should provide a high level of automation that requires minimal operator attention and must be suitable for remote monitoring and control.

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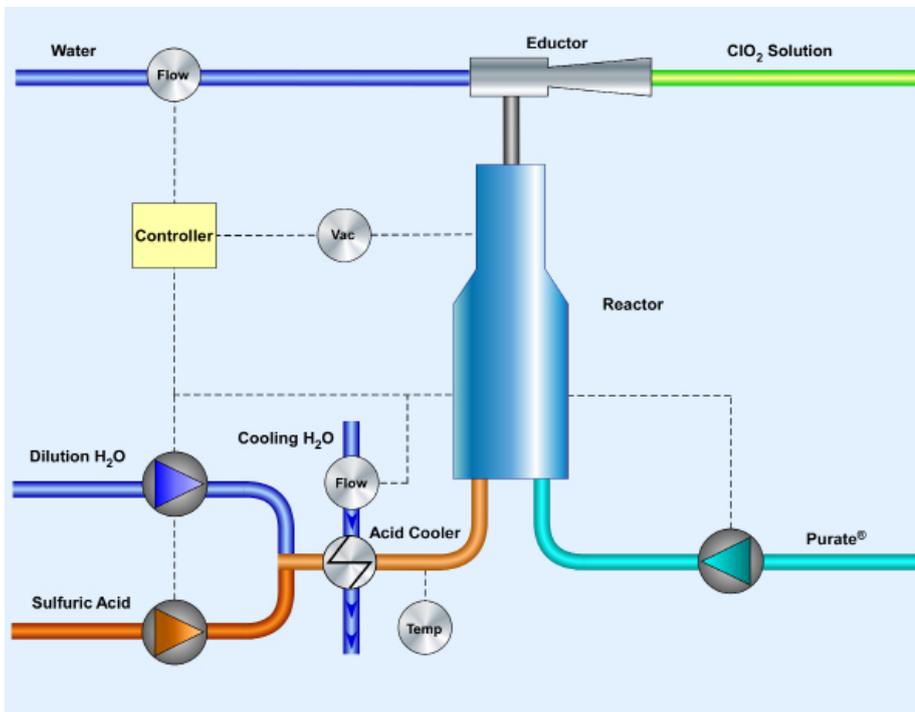


Figure 1 - SVP-Pure chlorine dioxide generator

ACTION PLAN

The distance between the towers was significant, so it was determined that each tower should have a dedicated chlorine dioxide generator. SVP-Pure™ AD and MSA model generators were therefore considered for these applications. The SVP-Pure MSA model generators were eventually selected for the application because they can accept sulphuric acid of any strength, making it easy to coordinate with local acid suppliers. Figure 1 shows the layout of the application.

The SVP-Pure MSA generator features a built-in acid dilution and cooling system that allows for the supply of variable strengths of sulphuric acid. By inputting the acid strength into the generator control system, automatic dilution of the acid is provided. The generator is

fully contained in a rugged industrial cabinet that facilitates installation and provides excellent protection of the equipment and for any personnel in the area. The generator PLC control system provides full local monitoring and control and can be remotely monitored via several types of communication protocols.

The Purate™ storage tanks were each outfitted with a special unloading fitting that mates exclusively with the corresponding fitting of the Purate delivery truck. By taking these safety precautions, a new level of product integrity in unloading and storing chemicals has been provided. The SVP-Pure generators take cooling water from the discharge of the circulation pumps to the generator. In the generator, chlorine dioxide is produced from Purate and sulphuric acid, and is fed into the

cooling water and returned to the cooling tower cold well at the suction side of the recirculation pumps. Thus the impact upon the water balance of the tower is zero. The primary objective of the cooling water treatment programme is to maintain efficient heat transfer in the process equipment.

Chlorine dioxide is the preferred treatment method for biofilm control because of its superior ability to penetrate and remove the biofilm. Control of the biofilm is also a key factor in minimising corrosion of the process equipment, thus minimising down time. The chlorine dioxide is dosed into the cooling water loops such that a 0.1 to 0.2 ppm residual remains in the water when returned to the tower. For this application continuous application of chlorine dioxide has proven most effective in controlling biofilm. The technology is also dosed intermittently to the return water flow during periods of high organic load, or high ambient temperature. This also maintains cleanliness of the tower fill and also in the basin areas.

RESULTS AND CONCLUSION

Dosing of chlorine dioxide to the cooling water system has provided biological control while minimising operating costs. As a result of the installation of the new SVP-Pure generator, using the advanced Purate technology, the overall reliability of the system has been assured. The combination of a strong problem-solving approach, on-site expertise, and the application of new innovative technology, delivered improvements in performance and production continuity. The company is now able to monitor and improve the reliability of key strategic assets while optimising water use and reducing costs.

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