Optimisation chlorination strategy cooling water system Verve Energy's Cockburn and Kwinana power plants

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Abstract

In 2006, Verve Energy had, through the asset management department of Kwinana Power Station, contracted KEMA for advice on their antifouling methodology for its cooling water system. This has been done by optimizing its chlorination procedure by means of implementation of the Pulse-Chlorination® principle. Onset for the project was the commissioning of station Cockburn Stage 1 (CKB Stage 1). To implement Pulse-Chlorination, a series of tests needed to be conducted on site. The main purpose of these tests was to determine the most effective chlorine dosing intervals and concentration to mitigate mussel fouling.

The advised Pulse-Chlorination regime had been implemented by Verve Energy during spring 2006. During the first year of implementation, several inspections of the cooling water system have been carried out by divers. From the observations by the divers and the results of the inspection of the condensers in August 2007, it could be concluded that the advised Pulse-Chlorination regime was effective against macro fouling at Kwinana Stage C and CKB Stage 1. These results were confirmed by the results gained from the KEMA Biofouling Monitors which monitored the efficacy of the chlorination throughout this period.

During the inspections of the cooling water intake channels, some growth of mussels was noticed at the first part of the channels and the rest of the cooling system was clean. It was found that this was the result of inadequate mixing of hypochlorite with sea water that enters the cooling water intake channels. To improve the effectiveness of hypochlorite dosing, a new chlorine dosing

structure is being redesigned and optimised by applying Computational Fluid Dynamics (CFD) modelling of the injection interface to ensure optimal mixing.
It can be concluded that Pulse-Chlorination resulted in a reliable and very effective dosing strategy for both Kwinana and Cockburn power plants. This paper provides a concise overview of the main results and observations made during the project.

Key words: Cooling water, Fouling, Mussels, Antifouling substances, Optimisation, Pulse-Chlorination, Chlorination byproducts (CBPs), Environmental impact, IPPC, Best Available Technique

Introduction

Chlorination is still regarded world wide as a reliable and cost effective method in mitigating biofouling in cooling water systems. This is due to its proven efficacy, wide experience, moderate costs and opportunities to optimise the chlorination procedure, as well as the fact that low-level chlorination has not proven to have a major ecological impact [2] [3] [4]. The method we describe here is called Pulse-Chlorination®, a chlorination procedure that has been declared as a Best Available Technique (BAT) under the terms of the EU Integrated Pollution Prevention and Control (IPPC) for macrofouling mitigation in once-through cooling water systems using chlorine [1].

Pulse-Chlorination is based on the principle that, in general, bivalves (mussels, oysters and clams) have a recovery period after exposure to a chlorination period before they open fully and restart filtration for oxygen and nutrition. The Pulse-Chlorination procedure takes advantage of this recovery time by applying short successive periods of chlorine dosing, i.e. alternating periods with and without chlorine (Figure 1).