Case Study

By B.K. Jha

Control of Algae and Bio-film in Water at Panipat Refinery

The Problem

Panipat Refinery operates several large cooling towers round the clock for bringing down the temperature of the water and recalculates the water in the refinery. To ensure the quality of the circulating water and to keep it free from bacteria and algae, chlorine, chlorine dioxide and host of other chemicals are regularly added, to maintain the residual chlorine level at about 0.2-0.5 in the circulating water. One of these cooling towers, with a capacity of 15,000 to 20,000 cubic meter/hour, was facing the problem to maintain the residual chlorine level. As a consequence, it was necessary to increase the dose of chlorine to prohibitive levels. Such abnormal rise in chlorine consumption could be due to the leakage of oily materials or, high algae and bacteria pick up by the water during circulation. The water in the cooling water sump was having floating matters which are likely to deposit on the cooling tower surface. The problem was excessive build up of algae and bio mass in the circulating water.

The Options

The obvious solution was to replace the contaminated water with fresh water, clean all the contacting surfaces of the cooling tower circuit, replace damaged sections and fix all the possible points from where oil could get mixed with the water. This was carried out during

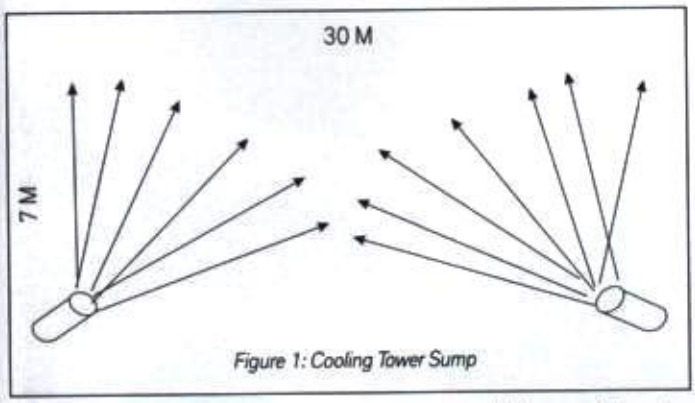

Figure 1: Cooling Tower Sump

the shutdown and the cooling towers were restarted. However, it is not a permanent solution. It will prevent the oil ingress, may be permanently and algae and bio film growth for a shorter time. At the same time it was decided to install Ultrasound devices in the cooling tower sump, to restrict the growth of Algae and Bio films. It was expected that the reduction in growth of Algae and Bio film will reflect in improved water quality, with lower chlorine consumption.

The Solution

We contacted Managing Innovation, who is active in promoting use of Ultrasound based devices Manufactured by Thomas Electronic, of Belgium. Considering the low residence time of water and very high turbulence in the sump, it was decided to install two units of Ultrasound Transducers at two different corners as shown in Figure 1, to avoid chance of interference between the units as far as possible. Accordingly, two units of Ultrasonic NT 4.1 from M/S Thomas Electronics was installed and the chlorine and chlorine dioxide consumption was monitored on monthly basis. Before the

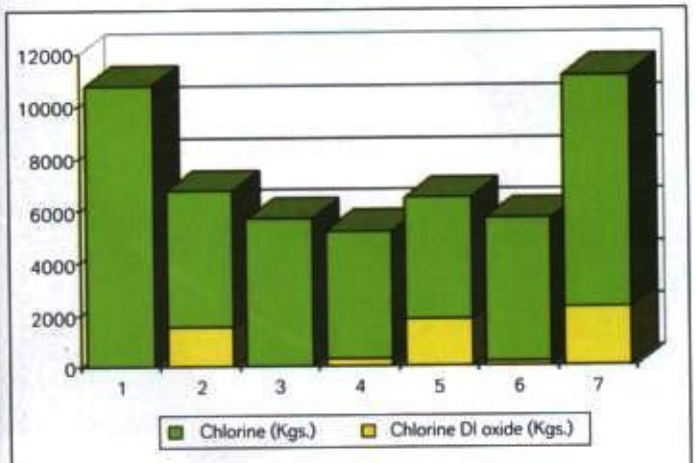

Figure 2: The Ultrasonic Devices were Installed During the Period (From 17th November 2001 to 16th February, 2010) - 3 to 5 in the X axis. Monthly Consumptions in KGs: 1) Before Shut down September 2009, 2) During September 2009 - just after shut down and cleaning, 3) During 17 November - 16 December 2009, 4) During 17 December 2009 - 16 January 2010, 5) During 17 January 2010 - 16 February 2010, 6) During 17 February 2010 - 16 March 2010, and 7) During 17 March, 2010 - 16 April 2010.

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installation, the cooling tower was cleaned and the entire water was replaced after shutdown. The ultrasonic devices were installed during the middle of November, 2009 and were withdrawn on 17th February, 2010, to establish the performance of the Ultrasound devices. ☞ www.iocl.com

The Result

The Ultrasonic devices were installed on 17th November 2009 and was removed on 16th February, 2010. It was decided to observe the chlorine consumption for several months after the units are removed. The following observations were made during the trial period:

- The surface of the sump water was found clean.
- During first two months after installation, the chlorine consumption was substantially lower and there was no difficulty in maintaining residual chlorine level in circulating water. Although the consumption of chlorine and chlorine dioxide was marginally high during January to February, 2010, it was again at lower level during February to March, 2010.
- Subsequently, the data for two months after the devices were removed was compiled and the entire data is plotted in the figure below. It could be clearly seen that the consumption during March to April, 2010 was almost at the level prevailing before the shutdown.

It could be appreciated that there are several factors other than algae and bacteria formation, which could influence the chlorine consumption. The leakage in exchanger leads to oil ingress in the cooling tower circulating water, which significantly influence the chlorine consumption as well as the makeup water quality. Therefore, it is very difficult to draw any accurate quantitative conclusion on the reduction of chlorine consumption, based on a trial for such a short period.

About the Author

The author is the Senior Process and Utility Manager of Panipat Refinery of Indian Oil Corporation. He has more than 15 years of experience in maintaining the utility supplies for large refineries. Referred as one of India's most modern refineries, Panipat Refinery was built using global technologies from IFP France; Haldor-Topsoe, Denmark; UNOCAL/UOP, USA; and Stone &Webster, USA. It processes a wide range of both indigenous and imported grades of crude oil. Panipat Refinery has doubled its refining capacity from 6 MMT/yr to 12 MMT/yr with the commissioning of its Expansion Project. Panipat Refinery is the seventh refinery of Indian Oil. It is located in the historic district of Panipat in the state of Haryana and is about 23 km from Panipat City. The original refinery with 6 MMTPA capacity was built and commissioned in 1998 at a cost of Rs. 3868 crore. The Refinery caters to the high-consumption demand centres in North-Western India including the States of Haryana, Punjab, J &K, Himachal, Chandigarh, Uttaranchal, as well as parts of Rajasthan and Delhi.

We look forward to your feedback on this case study. To know more about the author, you can write to us at content@eawater.com