THE EFFECT OF COOLING TOWER MAINTENANCE ON THE SUCCESS OF A WATER TEATMENT PROGRAMME

Much has been written on open cooling tower water treatment and the subject is often discussed in very technical jargon but here we intend to simplify that down to an easy to understand language. While maintaining the desired water chemistry is critical to achieving good corrosion and biological control it alone cannot overcome the burden of improper system controls. The best possible chemistry cannot reduce corrosion or biological fouling if the treated water cannot contact the metal surfaces that are hidden beneath deposits or when systems are allowed to bleed unnecessarily or there is excessive water losses or insufficient amounts of treatment added.

Water treatment programmes are generally monitored by measuring chemical and biological parameters and corrosion results. These measurements only indicate the condition of the bulk water and not the condition of the pipe wall and heat transfer surfaces. Corrosion coupons are generally subjected to flow of about 0.6 m/sec to 1.8 m/sec in a corrosion coupon rack fabricated from 22.5mm pipe. This flow rate, while consistent with industry standards for measuring corrosion does not simulate the low flow scenario that encourages deposits and biological growth.

Furthermore, typical biological monitoring is limited to the use of bioassay slides that only indicate planktonic (floating) bacteria levels in the circulating water. Sessile (surface) bacteria can be far more dangerous to system metallurgy by accelerating localised, pitting type corrosion. Deposits generally form at areas subject to low or intermittent flow such as cooling tower basins, cooling tower equalisation lines, horizontal pipe runs and in dead legs. Dead legs are any area in a piping system where water can become stagnant and where water is not exchanged during flushing. Bacteria in dead end pipe lengths and crevices are protected from flushing and sanitation procedures and can re-contaminate the piping system. The deposits harbour bacteria that can add a burden to the biocide programme and ultimately undermine the corrosion control programme.

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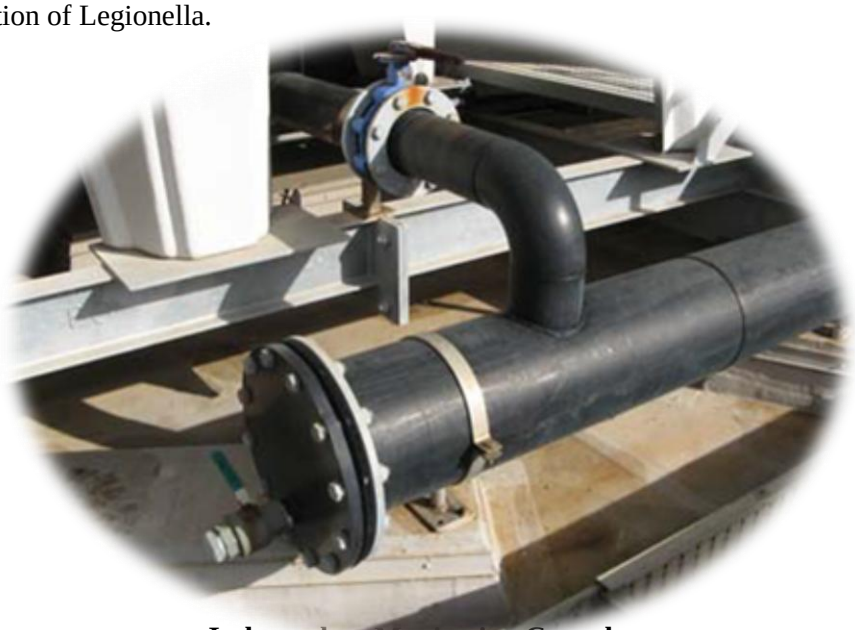
Given the potential problems caused by deposits, the following steps should be considered to reduce the potential for system deposits and corrosion.

Cooling System Maintenance Tips

- Consult the cooling tower operations manual provided by the manufacturer for maintenance instructions for the tower design in use.
- Consult your water treatment supplier and have him prepare a comprehensive plan detailing the types of chemicals used, the amounts of chemicals required to be added and their frequency, full details of the dosing system used and his recommendations to provide a satisfactory level of inhibition to metal surfaces, to control bacterial growths and Legionella, and the recommended number of cycles of concentration to run your system efficiently and maintain a satisfactory and economical cooling system.
- If possible, install side-stream sand filtration typically sized for 2-5% of the circulation rate. Filters should be of the high efficiency type capable of removing sub-micron particles.
- Blowdown all low flow or no flow pipe runs including dirt legs, risers, equalisation lines and condenser heads. Remove dead legs where possible.
- Limit the cooling tower water from exposure to direct or indirect sunlight by covering distribution decks, and ensure that the tower is fitted with a suitable drift eliminator.
- Redirect any building exhausts and vents away from the cooling tower.
- Install walkways around the cooling tower if necessary to facilitate inspection and cleaning of the tower basin.
- Clean the tower as regulated by Authorities, and document all system inspections with full photographic recording on any openings of heat exchanger equipment or pipe inspections.
- Inspect the cooling tower basin at least weekly for unnecessary build-up of dirt, sludge and algae. Be aware of any nearby construction taking place in close proximity to the tower and during seasonal changes when wind, rain or weather conditions can increase debri levels or cause substantial overflow and water loss.
- Be observant to any changes that can influence or cause problems in your water system.
- Ensure that the water treatment supplier performs a full and comprehensive inspection at the time of his regular services, records all changes to dosages, or documents when and why he altered anything, including biocide changes and bleed-off, and that the system is running a satisfactory level of cycles to minimise water loss and use of chemicals. Discuss with your supplier following each service visit how his programme is working compared to expectations to maintain a satisfactory level of corrosion protection and biological control.

Maintaining clean system surfaces and a satisfactory level of water treatment is a major step in extending the life of critical plant equipment, improving heat transfer and in reducing the potential for the amplification of Legionella.



It is also important to understand the role of cycles of concentration in a cooling water system and their effect on managing the process of metal protection and effective biological control. If the cycles of concentration are too low then it is difficult to maintain adequate levels of corrosion inhibitor in the system water to effectively protect the system metallurgy and you are wasting both water and chemical.

Cooling Tower Cycles of Concentration

As pure water is evaporated, minerals are left behind in the recirculating water. As evaporation continues, the water becomes more concentrated than the original make up water. This eventually can lead to saturated conditions. The term cycles of concentration compares the level of solids of the recirculating cooling tower to the level of solids of the original raw make up water. If the circulating water has four times the solids concentration than that of the makeup water, then the cycles are 4.

Bleed off is the process of removing a portion of concentrated recirculating water, which is obviously replaced with fresh make up water. By specifying a certain amount of bleed-off we limit the cycles of concentration the system can operate at, thus controlling scale formation. Various treatments will let us operate at various cycles depending on the makeup water analysis and heat loading of the tower. Bleed off is critical to a successful treatment program. The preferred method of bleed off control is with the use of automated bleed off control and the incorporation of a bleed lock out device when the biocide is added.

The impact on biological control is the same. For best bacterial control it is important that you maintain maximum dosage in the system for sufficient time. In other words strong enough for long enough. All biocides must be in contact with the bacteria at a level sufficient to obtain a "kill" for a period of time to effect that "kill". In the case of chlorine you require 1part per million of free chlorine in the system for a minimum time of 1 hour to produce an effective control. With other bactericides the amount and time can vary considerably, so you need to understand from your treatment supplier what type of biocide is used and what the appropriate contact time is. And why cycles of concentration is important in both instances is that low cycles will continually dilute the amounts of chemicals through excessive bleed or water loss making them ineffective and this in many cases is why some properties have difficulty in maintaining satisfactory control over Total Bacteria Counts and Legionella.

Benefits from an effective cooling water treatment program

- Longer retention of biocide results in better protection against Legionella contamination
- Potential cost savings from reduced cooling tower cleaning requirements*
- Reduced treatment chemical cost due to higher concentration cycles
- Savings from reduced tower blowdowns may include water and sewer charges plus trade waste charges - **www.sydneywater.com.au**