AQUARIUS
TECHNOLOGIES PTY LTD
WATER QUALITY CONTROL

Quality System

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Aquarius Technical Bulletin - No. 30

Improve your Bacterial Kill rates with Pre-bleed and Bleed Lockout functions

Maintaining low levels of bacteria in comfort cooling systems is essential in preventing Legionnaires Disease; preventing biofouling and maintaining the efficiency of heat transfer; and in the prevention of microbiological induced corrosion.

The “killing” rate from any of the non oxidising biocides is a function of the concentration of biocide added to the system and the time period that the biocide is allowed to remain in the system - commonly referred to as the **CT factor.** e.g.

100 mg/l of Biocide retained for 4 hours equals
200 mg/l of Biocide retained for 2 hours, equals
400 mg/l of Biocide retained for 1 hour, equals
800 mg/l of Biocide retained for 0.5 hours.

Each of the examples above can be expected to give the same level of bacterial “kill”, so it is essential to know the time period that the biocide will be retained in the system.

Depletion or washout of biocide is a function of the system volume and the bleed off rate, - which in turn is a function of (a) water quality and the maximum concentrations that can be maintained in the system and (b) the actual load on the plant.

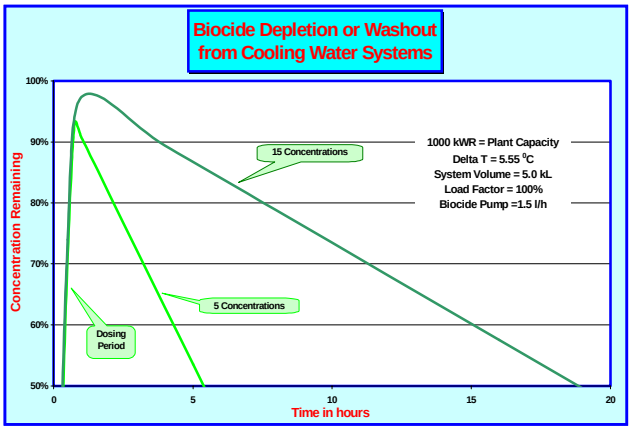
A common formula for estimating the half - life or when the biocide level has been depleted or washed out to 50% of initial amount dosed is also called the Holding Time Index.

HTI 50% hrs. = (Volume(lts) x 0.6925)/Bleed Rate(hrs)

A more exacting formula for the calculation of the rate of depletion from a cooling system is as follows :-

Biocide mg/l remaining in the system =
10^ Log (initial mg/l) - {(Bleed x Time)/(2.303 x Volume)}

Graph No. 1 shows the depletion of biocide from a typical cooling system at 5 concentrations and at 15 concentrations due to bleed off to waste, and demonstrates how T or Time in the CT formula is a function of bleed rate. The graph also shows that biocide is being lost even during the initial 1 hour dosing period.



To improve the biocide kill efficiency and reduce biocide losses, Bleed Lockout is a function built into a number of cooling tower controllers for many years, but simple Bleed Lockout suffers from a number of problems namely -

(a) With Bleed Off locked out, the conductivity may increase up into the scaling region before bleed off is again activated.

(b) The time available for Bleed Lockout, (without increasing up into the dangerous scaling region) may not provide sufficient retention time to warrant a satisfactory bacterial kill.

Since the advent of microprocessor control Aquarius Technologies P/L has added two major features to their range of cooling water controllers namely,

(a) **Pre-bleed** - where the cooling system is allowed to bleed down to 87.5% of set point conductivity value prior to commencement of biocide dosage, and

(b) **Bleed Lockout** activated on start of biocide dosing prevents any bleed off whilst the conductivity increases from 87.5% up to 112.5% of the set point conductivity, and even then the bleed rate is at reduced rates until the end of the Bleed Lockout period.

The combination of Pre-bleed and Bleed Lockout effectively doubles the amount of time available for Bleed Lockout, which greatly improves biocide retention, whilst the automatic over rides prevent wastage of water during Pre-bleed, and on Bleed Lockout, prevent conductivity increasing up to the scaling region.

For a schematic and further explanation see the graph ***Effect of AQUARIUS Pre-bleed & Bleed Lockout*** on the following page.

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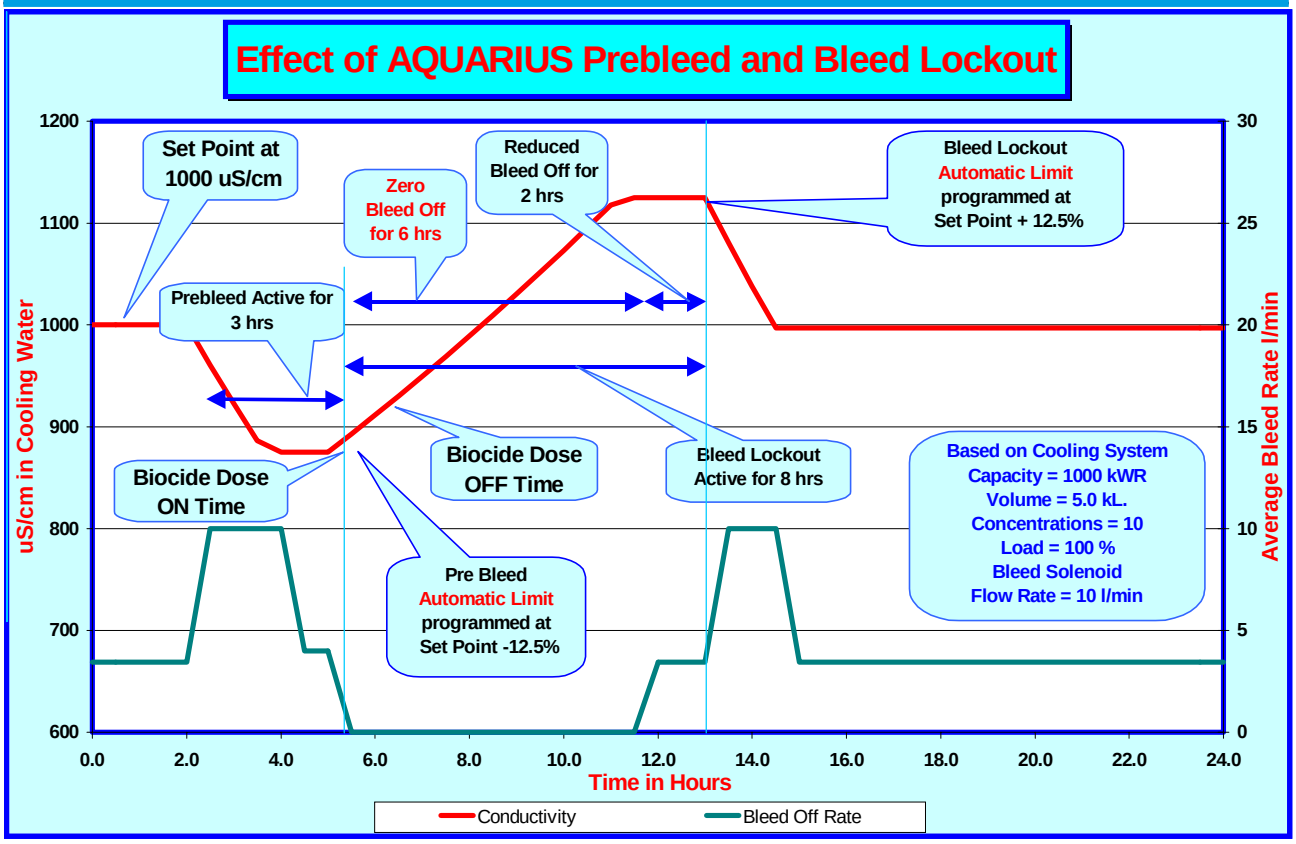

In the latest controllers a biocide dose ON time and OFF time is selected. The hours duration for Pre-bleed and Bleed Lockout are separately entered. The ON & OFF times should be selected in a period of minimum load on the system to provide the longest possible biocide retention period. The Biocide OFF time determines the actual dose in litres delivered to the system, to meet the desired mg/l of dose.

The microprocessor computes the time to commence Pre-bleed and automatically change the set point value to 87.5% of the normal set point. Bleed off commences and bleeds down to 87.5% value and awaits biocide ON time, where biocide dosage is activated and the Bleed Lockout routine is instigated.

The conductivity set point is now automatically changed to 112.5% of set point, and no bleed off will occur until either the evaporation rate increases the conductivity to the 112.5% value, or the end of the Bleed Lockout period whichever occurs first, whereupon the set point is automatically changed back to the original set point conductivity value.

From a spreadsheet set up to calculate the graphs displayed we can also calculate the increase in 50% Holding Time or a 50% CT index as displayed at the bottom of the page.

The spreadsheet calculations show more than a 60% increase in the CT 50% or HTI 50% at 15 concentrations and increasing to an 80% improvement at 3 concentrations.

A 1000 kWR system with an operating volume of 5.0 kL, at 10 cycles or concentrations, and being dosed 3 times per week at 308 ppm without bleed lockout would equate to 200 ppm dosed 3 times per week with Pre-bleed and Bleed Lockout.

Savings = 0.5 lts x 3 x 52 x $8.00 = $640.00 per annum or over the 10 year + life of a controller, about $7500 in total savings with inflation. !!!!

Author

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