

Calculation of the Cycles of Concentration

$$N = CR/CM \text{ -----(1)}$$

$$CM \times M = CR \times (B + W) \text{ -----(2)}$$

$$N = CR/CM = M/(B + W) \text{ -----(3)}$$

$$M = E + B + W \text{ -----(4)}$$

$$N = (E + B + W)/(B + W) \text{ -----(5)}$$

$$E = (DT/5.8) \times (R/100) \text{ -----(6)}$$

where

N : cycles of concentration

CR, CM : dissolved solid concentrations of circulating water and make-up water (mg/l)

M : make-p water quantity (m³/h)

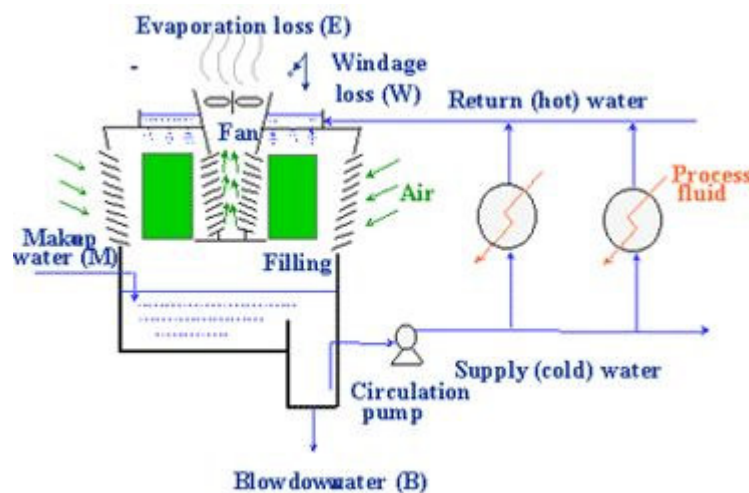
B : blowdown water (m³/h)

W : windage loss (m³/h)

E : evaporation loss (m³/h)

DT : water temperature drop across cooling tower (oC)

R : circulation water quantity (m³/h)



CHEMICAL INJECTION: ANTISCALANT CWT940 (broad spectrum)

Given recirculation flowrate, estimate Windage + Evaporation

Normally, $2\% < \text{Windage} + \text{Evaporation} < 3\% R$

Blowdown = Evaporation / (cycles - 1)

Next step: estimate Blowdown

Makeup = Evaporation + Blowdown

- Software results indicate recommended antiscalant dosage, as ppm of makeup stream