Technical Note: Rhodamine WT Dye Worksheet: Amount of Dye and Injection Rate

Unit Conversions:

1 gal/day = 2.63 ml/min
Pure dye = 1,000,000,000 ppb[i] (parts per billion)

Flow Equation: Q = qC/c **Where: Q = flow of the plant**

q = flow of the dye
C = concentration of the dye injected
c = concentration of the dye at the measurement point

Question:

How much dye do I need for a 24-hour study of a 20 MGD (million gallons per day) plant?

Answer:

Given that you can see 100 ppb of dye in the plant water, the flow equation tells us that:

$$q = \frac{100 \text{ ppb} \times 20{,}000{,}000 \text{ gal/day}}{1{,}000{,}000{,}000 \text{ ppb}}$$

$$q = 2 \text{ gallons/day}$$

Question:

What should be my dye injection rate for this application? My pump has a range of 4.8 to 48 ml/min.

Answer:

For a 20 MGD operation, we found that the injection rate was 2 gallons/day. Using the 2.63 ml/min = 1 gal/day relationship, we find that the final injection rate should be 2 x 2.63 or 5.26 ml/min. However, if we want to measure the flow in a 10 MGD operation, we will need to perform a 1:1 dilution of the Rhodamine WT dye and still inject 5.26 ml/min. because the calculated injection rate of 2.63 ml/min. falls outside of the range of the pump.

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[i] Although the concentration of the pure dye is not 100% Rhodamine WT, we can still treat the concentration as 1,000,000,000 ppb because the diluted reading of 100 ppb is relative to the initial dye concentration. That is, any error introduced will be cancelled out. Only the ratio of C/c is important.

[2] Unless the water is extremely turbid, the fluorometer should be able to read 100 ppb of Rhodamine WT. The first thing you should do after setting up the instrument is determine the linear range of dye in the water you are using. Make up a solution of dye at various dye concentrations (see the Turner Designs pamphlet *Preparation of Standards for Dye Studies Using Rhodamine WT* (Part No. 998-5111). Be sure to make up the final dilution using the matrix (sewer/waste or other water) as the final diluting liquid.