



**WASTEWATER TECHNOLOGY  
T R A I N E R S**

*Transforming today's operators into tomorrow's water quality professionals*

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**Problem of the Day  
2015.Jun.29**

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The flow to the plant averaged over a week is 650 gpm. The influent TSS concentration averages 235 mg/L. How many pounds per week of TSS enter the plant?

## Introduction

Obviously this is a pounds-per-day kind of calculation, but flow is given “per minute” and we’re calculating how many pounds of TSS “per week.” A lot of operators are taught to convert all units to MGD. This is a waste of time. To do a problem like today’s, just let the units do the thinking for you.

## Solution

Specifically, the problem states, “[h]ow many pounds per week of TSS enter the plant,” so that’s how we start things off: The units needed in the answer, lb TSS/wk, are entered between heavy vertical lines followed by an equals sign and the blank solution bridge.

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$$\left| \begin{array}{c} \text{lb TSS} \\ \hline \text{wk} \end{array} \right| = \text{_____}$$

The information from the problem statement is summarized here in appropriate units:

1. Flow = 650 gal/min
2. Influent TSS concentration = 235 mg TSS/L

Again, this is just a pounds equation. WWTT likes to start the solution bridge with the pounds of what we are calculating. The units TSS is needed in the answer so is shown in bold on both sides of the equals sign. By the way, if you like starting pounds calculations with 8.34 lb/gal or flow, that’s okay, too.

$$\left| \begin{array}{c} \text{lb TSS} \\ \hline \text{wk} \end{array} \right| = \left| \begin{array}{c} 235 \text{ mg TSS} \\ \hline \text{L} \end{array} \right| \text{_____}$$

WWTT cancels mg/L whenever they are entered unless the problem is solving for mg/L.

$$\left| \begin{array}{c} \text{lb TSS} \\ \hline \text{wk} \end{array} \right| = \left| \begin{array}{c} 235 \text{ mg TSS} \quad \cancel{\text{L}} \\ \hline \quad \quad \quad \cancel{\text{L}} \quad \text{M}\cdot\text{mg} \end{array} \right| \text{_____}$$

The M in the denominator reminds us we need an Mgal to use the pounds formula. We don’t have an Mgal so we use a conversion factor.

$$\left| \begin{array}{c} \text{lb TSS} \\ \hline \text{wk} \end{array} \right| = \left| \begin{array}{c} 235 \text{ mg TSS} \quad \cancel{\text{L}} \quad \text{Mgal} \\ \hline \quad \quad \quad \cancel{\text{L}} \quad \text{M}\cdot\text{mg} \quad 10^6 \text{ gal} \end{array} \right| \text{_____}$$

We are likely tempted to cancel the gal in the solution bridge above, but before we do it, we enter the flow and cancel one of the gal in the numerator with the one in the denominator. It doesn’t matter which one.

$$\left| \begin{array}{c} \text{lb TSS} \\ \hline \text{wk} \end{array} \right| = \left| \begin{array}{c} 235 \text{ mg TSS} \quad \cancel{\text{L}} \quad \text{Mgal} \quad 650 \text{ gal} \\ \hline \quad \quad \quad \cancel{\text{L}} \quad \text{M}\cdot\text{mg} \quad 10^6 \text{ gal} \quad \text{min} \end{array} \right| \text{_____}$$

We need lb in the answer and we still have a gal in the numerator that needs to be canceled. We accomplish both by entering the density of water.

<b>lb TSS</b>	=	235 mg TSS	£	Mgal	650 gal	8.34 lb	
wk		£	Mmg	10 <sup>6</sup> gal	min	gal	

We have min in the denominator, but we need wk. I don't know how many minutes are in a week, but I remember how many minutes are in a day.

<b>lb TSS</b>	=	235 mg TSS	£	Mgal	650 gal	8.34 lb	1,440 min	
wk		£	Mmg	10 <sup>6</sup> gal	min	gal	d	

Now I know there are 7 days per week.

<b>lb TSS</b>	=	235 mg TSS	£	Mgal	650 gal	8.34 lb	1,440 min	7 d
wk		£	Mmg	10 <sup>6</sup> gal	min	gal	d	wk

Since all the units have now canceled except those needed in the answer, we know the solution bridge is complete. The arithmetic gives the answer.

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wk		£	Mmg	10 <sup>6</sup> gal	min	gal	d	wk

$$235 \times 650 \times 8.34 \times 1,440 \times 7 \div 1,000,000 = \underline{\underline{12,841 \text{ lb TSS/wk}}}$$

### Discussion

I tell operators in WWTT classes all the time that they have to believe in themselves and have confidence in what they already know like how many minutes are in a day and how many days are in a week and the density of water and . . . and . . . and . . . You know a lot. If you keep the units straight and make the units work, the calculation has to be correct.

**Happy calculating! Let us know, by leaving a comment, if you want us to do a specific problem, if you see a mistake, or if you have a question on any of the Problems of the Day you are looking at.**