



**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.Jul.23**

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The chief plant operator has calculated that he must waste 18,600 lb of solids today to maintain his target SRT that gives excellent sludge and effluent quality, 7 days. Based on a TSS concentration in the WAS of 6,200 mg/L, what should be the gallons-per-minute setpoint on the WAS pump?

## Introduction

Different from the MCRT, the SRT calculation does not include the solids in the secondary clarifier. This is fine as long as the strategy is to maintain a minimum sludge blanket in the secondary clarifier, which should be the objective of all activated sludge wastewater treatment plant operators. It is important to realize that the operator in today's problem has already figured out how many pounds need to be wasted, so whether we're talking about MCRT or SRT, it doesn't matter.

## Solution

The list of "givens" expressed in the units used by WWTT:

1. Pounds to be wasted = 18,600 lb TSS/d
2. WASTSS concentration = 6,200 mg TSS/L
3. SRT target = 7 d (irrelevant to the problem)

This is another "reverse pounds calculation." Slightly different than yesterday's problem, we are given pounds and concentration and we need to calculate flow rate. The units required in the answer, gal/min, are put between heavy vertical lines, as always, followed by the equals sign and the blank solution bridge.

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gal	=			
min				

The units min are a unit of time. The only unit of time given is d in No. 1 of the list. Time, whether min or d, has to be in the denominator, so No. 1 is entered on the solution bridge.

gal	=	18,600 lb TSS		
min		d		

Since the units min rather than d is required in the answer, the well known conversion factor is entered to get cancel d and get min in the denominator of the solution bridge.

gal	=	18,600 lb TSS	d		
min		d	1,440 min		

The unit lb in the numerator is canceled by entering the density of water "upside down."

gal	=	18,600 <del>lb</del> TSS	d	gal		
min		d	1,440 min	8.34 <del>lb</del>		

The unit TSS in the numerator is canceled by entering the TSS<sub>WAS</sub> concentration in the denominator.

gal	=	18,600 <del>lb</del> TSS	d	gal	L	
min		d	1,440 min	8.34 <del>lb</del>	6,200 mg TSS	

Whenever mg/L are entered on the solution bridge (unless you're solving for mg/L), they are canceled using M-mg/L entered so mg and L cancel.

gal	=	18,600 lb TSS	d	gal	£	M·mg
min		d	1,440 min	8.34 lb	6,200 mg TSS	£

In the numerator of the solution bridge are the units Mgal, but we only need gal. This is resolved by converting Mgal to gal.

gal	=	18,600 lb TSS	d	gal	£	M·mg	10 <sup>6</sup> gal
min		d	1,440 min	8.34 lb	6,200 mg TSS	£	Mgal

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

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gal	=	18,600 lb TSS	d	gal	£	M·mg	10 <sup>6</sup> gal
min		d	1,440 min	8.34 lb	6,200 mg TSS	£	Mgal

$$18,600 \times 1,000,000 \div 1,440 \div 8.34 \div 6,200 = \mathbf{250 \text{ gal/min.}}$$

### Discussion

Readers of Problem of the Day have no doubt noticed I do not identify the individual problems as being appropriate for any specific grade exam. This is on purpose. While I know this drives many of you crazy, my reasoning is that the solution bridge is a process for solving problems. Being able to apply that process to any problem is what makes you a professional. As I often say in our Operator Certification and Math Review classes, do not memorize problems but understand the process. That process is the same no matter what grade of certification exam you may be taking. The complexity of the problem doesn't matter if you know the process.

**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.**