



## WASTEWATER TECHNOLOGY TRAINERS

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

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### Problem of the Day 2014.Nov.22

#### Discussion

The Water Environment Federation is the trade organization for water professionals, including wastewater treatment operations professionals (<http://wefcom.wef.org/home>). Individual states, or groups of states, sponsor local chapters. On October 29, 2014, I gave a 6-hour Math for Operators Workshop at the annual conference of the Pacific Northwest Clean Water Association (PNCWA). PNCWA represents Idaho, Oregon and Washington (<http://www.pncwa.org/>). All operators should seriously consider joining their local association. In California it is the California Water Environment Association (<http://www.cwea.org/>).

Long story short: I randomly covered a series of math problems in the PNCWA workshop, and I have been requested by several attendees to send them the problems. Instead, I am going to post them here (starting with the 2014.Nov.04 Problem of the Day). They are good practice for all visitors to WWTT's Problem of the Day.

For those of you who may be new to WWTT's Problem of the Day, we insert a page break after the problem statement so you can print it without looking at the solution: see what you can do to solve the problem **before** looking at the solution.

We are changing the focus with today's Problem of the Day and looking at volatile solids (VS) loading to anaerobic digesters. Keep in mind there are at least two reasons we care about the VS loading to anaerobic digesters:

1. The process objective of anaerobic digesters is volatile solids destruction (or reduction)
2. When volatile solids are destroyed in an anaerobic digester, the carbon in those solids is converted to methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ). The methane can be used as an energy source.

### Problem of the Day

Given the following information, calculate the pounds of VS per day in the primary sludge going to the anaerobic digesters.

- Primary sludge flow = 150,000 gal sldg/d
- TS concentration = 5.6%
- VS concentration = 75%
- **Calculate: lb VS/d** in the primary sludge to the anaerobic digesters.

## Solution

As always, WWTT is very particular about how things are labeled when we're doing problems, as indicated in the following list of information. Notice that "gal sldg" and "lb sldg" show up in the first two bullets below. These units are a reminder that the density of the sludge is needed even though it was not provided in the problem statement. We use density in many problems to go back and forth between gallons and pounds.

**Problem of the Day:** Given the following information, calculate the pounds of VS per day in the primary sludge going to the anaerobic digesters.

- Primary sludge flow = 150,000 gal sldg/d
- TS concentration = 5.6% = 5.6 lb TS/100 lb sldg
- VS concentration = 75% = 75 lb VS/100 lb TS
- Primary sludge density = 8.34 lb sldg/gal sldg (assumed since not given)
- **Calculate: lb VS/d** in the primary sludge to the anaerobic digesters.

<b>lb VS</b>	=	75 lb VS	5.6 lb TS	8.34 lb sldg	150,000 gal sldg
<b>d</b>		100 lb TS	100 lb sldg	gal sldg	<b>d</b>

All the units have canceled except those needed in the answer, **lb VS/d**. The arithmetic gives the answer:

$$75 \times 5.6 \times 8.34 \times 150,000 \div 100 \div 100 = \mathbf{52,542 \text{ lb VS/d}}$$

Happy calculating!