



# Certification Boulevard

Roy Pelletier



## Test Your Knowledge of Biosolids Management

- Given the following data, what is the depth of the cone, from the SWD to the bottom of the cone?
  - Gravity Thickener is 50 feet in diameter.
  - Sludge blanket depth is three feet.
  - Floor slope is 2:12.
  - Sludge removed is 50,000 gpd.

A. 2.08 feet  
B. 1.02 feet  
C. 6.14 feet  
D. 4.17 feet
- Given the following data, is this an acceptable cost of polymer usage for a GBT?
  - \$15.10 polymer per dry ton of sludge processed.

A. Yes, it is very reasonable.  
B. No, it is too high.  
C. There is not enough data to calculate this parameter.  
D. This piece of information is not relevant to GBT operation.
- Which adjustment will normally decrease the size of floc particles exiting an in-line venturi mixer of a belt filter press?
 

A. Open the venturi mixer.  
B. Close the venturi mixer.  
C. Place a second venturi mixer into service.  
D. The venturi mixer has nothing to do with floc size.
- Given the following data, what is the solids loading rate of this DAF unit?
  - The DAF tank is 80 feet long, 16 feet wide, and 12 feet deep.
  - The sludge feed rate 55 gpm for 750 mins/day.
  - The sludge feed concentration is 8,000 mg/l.

A. 1.2 lbs/day/ft<sup>2</sup>  
B. 3.6 lbs/day/ft<sup>2</sup>  
C. 0.46 lbs/day/ft<sup>2</sup>  
D. 2.1 lbs/day/ft<sup>2</sup>
- What is the HRT in days of an aerobic digester, given the following data?
  - The tank diameter is 75 feet.
  - The tank is 20 feet deep.
  - The TWAS feed is 15,500 gpd.
  - The tank depth averaged 85 percent full during the calculation period.

A. 62.6 days  
B. 31.3 days  
C. 23.5 days  
D. 36.2 days
- Given the following data, and using the VanKleek formula, what is the percent volatile solids reduction in this anaerobic digester?
  - Feed Sludge Total Solids = 3.4 percent
  - Feed Sludge Volatile Solids = 2.7 percent
  - Digested Sludge Out Total Solids = 2.4 percent
  - Digested Sludge Out Volatile Solids = 1.7 percent

A. 40.1 percent  
B. 37.1 percent  
C. 34.5 percent  
D. 47.1 percent
- Which digester in a two-stage anaerobic digestion process normally is not mixed and/or heated?
 

A. The primary digester  
B. The secondary digester  
C. Neither is normally mixed or heated  
D. Both are normally mixed and heated

- Given the following data, what is the volume of this digester?
  - The digester tank diameter is 75 feet.
  - The digester depth is 24 feet to overflow.
  - The digester sludge feed rate is 125 gpm for 8 hrs/day.

A. 1,125,147 gals  
B. 792,693 gals  
C. 3,170,772 gals  
D. 157,045 gals

- What does the following formula represent?
 
$$(\text{OUR, mg/l/hr}) \div (\text{TS, gm/l}) = \text{mg/hr/gm}$$

A. Oxygen uptake rate  
B. SOUR  
C. SVI  
D. Fecal coliform

- Which process modifications may help resolve a condition of massive white foam and low pH in an aerobic digester?
 

A. Increase the sludge feed rate.  
B. Increase the air supply and increase the D.O.  
C. Decrease the digester SRT.  
D. Decrease the air supply and decrease the D.O.

ANSWERS ON  
PAGE 44

## SEND US YOUR QUESTIONS

Readers are welcome to submit questions or exercises on water or wastewater treatment plant operations for publication in Certification Boulevard. Send your question (with the answer) or your exercise (with the solution) by e-mail to [roy.pelletier@cityoforlando.net](mailto:roy.pelletier@cityoforlando.net), or by mail to:

**Roy Pelletier**  
Wastewater Project Consultant  
City of Orlando  
Public Works Department  
Environmental Services Wastewater Division  
5100 L.B. McLeod Road,  
Orlando, FL 32811

## Looking for Answers? Check the Archives

Are you new to the water and wastewater field? Want to boost your knowledge about topics you'll face each day as a water/wastewater professional? All past editions of Certification Boulevard back through the year 2000 are available on the Florida Water Environment Association's Web site at [www.fwea.org](http://www.fwea.org). Click the "Site Map" button on the home page, then scroll down to the Certification Boulevard Archives, located below the Operations Research Committee.

## Certification Boulevard Answer Key

### From page 24

1. **D. 4.17 feet**

Depth of the cone in this tank, with a diameter of 50 feet and a floor slope of 2:12, is calculated as follows:

$$50 \text{ feet} \div 2 = 25 \text{ foot radius}$$

$$25 \text{ feet} \div 12 \text{ inches/foot} = 2.08 \text{ feet}$$

$$2.08 \text{ feet} \times 2 = 4.167 \text{ feet}$$

(slope of 2:12 ... means that the floor slopes, from the outer wall to the center of the tank, 2 inches for every 12 inches of travel)

2. **A. Yes, it is very reasonable**

It is not uncommon for a GBT to thicken waste activated sludge consuming polymer at a rate of about \$10 to \$20 per dry ton of sludge processed. Polymer usage depends on several variables, including, but not limited to: process SRT, F/M ratio, and SVI of the activated sludge process; sludge feed rate and concentration to the GBT; polymer solution strength; mixing efficiency of the polymer solution and the feed sludge belt speed, and others.

3. **B. Close the venturi mixer.**

An in-line (or in-pipe) venturi mixer is designed to impart energy on the two streams being mixed: sludge feed and polymer solution. As the mixer is closed, more energy is imparted and the size of the resultant floc particles will be smaller.

4. **D. 2.1 lbs/day/ft<sup>2</sup>**

$$\text{DAF solids loading rate} = \text{lbs/day/ft}^2$$

**Lbs/day sludge feed**

$$= \text{sludge feed, mgd} \times \text{feed conc., ppm} \times 8.34 \text{ lbs/gal}$$

$$= \text{gpm} \times \text{mins/day} \div 1,000,000 \times \text{ppm} \times 8.34$$

$$= 55 \text{ gpm} \times 750 \text{ mins/day} \div 1,000,000 \times 8,000 \text{ ppm} \times 8.34$$

$$= 2,752 \text{ lbs/day}$$

**Surface area, ft<sup>2</sup> = length, ft. x width, ft.**

$$= 80 \text{ feet} \times 16 \text{ feet}$$

$$= 1,280 \text{ ft}^2$$

**DAF solids loading rate = lbs/day/ft<sup>2</sup>**

$$= 2,752 \text{ lbs per day} \div 1,280 \text{ ft}^2$$

$$= 2.15 \text{ lbs per day per ft}^2$$

5. **D. 36.2 days**

**Aerobic digester HRT, days**

$$= \text{Volume of tank, gals} \div \text{Feed sludge, gpd}$$

**Volume of tank, gallons**

$$= \pi r^2 \times \text{depth, ft.} \times 7.48 \text{ gal/ft}^3 \times \% \text{ full}$$

$$= 3.14 \times 37.5 \times 37.5 \times 20 \text{ ft} \times 7.48 \text{ gal/ft}^3 \times 0.85$$

$$= 561,490.9 \text{ gallons}$$

**Sludge feed, gpd = 15,500**

**Aerobic digester HRT, days**

$$= 561,491 \text{ gals} \div 15,500 \text{ gpd}$$

$$= 36.2 \text{ days}$$

6. **B. 37.1 percent**

**VanKleek VS Reduction, %**

$$= \text{VS IN} - \text{VS OUT} \div \text{VS IN} - (\text{VS IN} \times \text{VS OUT}) \times 100$$

**VS IN = VSS + TSS**

$$= 2.7\% \div 3.4\%$$

$$= 0.794$$

**VS OUT = VSS + TSS**

$$= 1.7\% \div 2.4\%$$

$$= 0.708$$

**VanKleek VS Reduction, %**

$$= 0.794 - 0.708 \div 0.794 - (0.794 \times 0.708) \times 100$$

$$= 37.09\%$$

7. **B. Secondary digester**

Typically, the secondary digester in a two-stage anaerobic digestion process is not mixed or heated. This tank typically is used as a gas and sludge holding tank.

8. **B. 792,693 gals**

**Tank Capacity, gals =  $\pi r^2 \times \text{depth, ft.} \times 7.48 \text{ gal/ft}^3$**

$$= 3.14 \times 37.5 \text{ ft.} \times 37.5 \text{ ft.} \times 24 \text{ ft.} \times 7.48 \text{ gal/ft}^3$$

$$= 792,693 \text{ gallons}$$

(note: consider  $\pi$  as 3.14)

9. **B. SOUR**

The Specific Oxygen Utilization Rate, or SOUR, is calculated by dividing the Oxygen Uptake Rate (OUR) test results by the total solids content of the sample in grams per liter. The SOUR is used to determine potential for additional volatile solids reduction that is remaining in a sample. Typically, the SOUR results of aerobically digested sludge should be no greater than 1.5 mg/hr/gm TS to meet Class B standards for vector attraction reduction.

10. **D. Decrease the air supply and decrease the D.O.**

Typically, white foam produced in an aerobic digester can be the result of over-aeration. Reducing the air supply, and resultant dissolved oxygen levels, can many times decrease the production of white foam. Shutting off the air altogether for several hours at a time can actually make white foam disappear. This activity (shutting off the air supply) typically will result in increased destruction of volatile solids in the aerobic digester. Also, denitrification (use of nitrate as a source of oxygen) replenishes alkalinity, and usually results in an increased pH value.