



Certification Boulevard

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Test Your Knowledge of Residuals 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 gallons per day.

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?
 - \$12.50 polymer per dry ton of sludge processed

A. Yes, 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 increase the size of floc particles exiting an in-line venturi mixer of a belt filter press or GBT?

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.
- What is the fecal coliform limit to meet standards for Class A biosolids?

A. 1,000 #/gram TS
B. 10,000 #/gram TS
C. 1,000,000 #/gram TS
D. 2,000,000 #/gram TS
- What is the HRT in days of an aerobic digester, given the following data?
 - The tank is 75 feet in diameter.
 - The tank is 20 feet deep.
 - TWAS feed is 15,500 gallons per day.
 - 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

Looking for Answers?

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- 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 = 1.65 percent

A. 40.1 percent B. 43.0 percent
C. 34.5 percent D. 47.1 percent
- 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.
- What may be the recommended action to perform if the top belt of a belt filter press is flooded and sludge is leaking off the sides?

A. Increase the sludge feed rate.
B. Decrease the belt speed and decrease the washwater pressure.
C. Decrease the sludge feed rate or increase the belt speed.
D. Adjust the polymer dose rate.
E. Both C & D are correct.
- Given the following data, what is the capacity of this digester?
 - Digester tank diameter is 75 feet.
 - Digester depth is 24 feet to overflow.
 - Digester sludge feed rate is 125 gallons per minute for eight hours per day.

A. 1,125,147 gallons
B. 792,693 gallons
C. 3,170,772 gallons
D. 157,045 gallons
- What does the following formula represent?

$$\frac{\text{OUR, mg/l/hr} \times \text{mg/hr/gm}}{\text{TS, gm/l}}$$

A. Oxygen Uptake Rate
B. SOUR
C. SVI
D. Fecal coliform

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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, or by mail to:

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Certification Boulevard Answer Key

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1. **D. 4.17 feet**

The depth of 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, very reasonable**

YES – polymer usage of \$12.50 per dry ton of sludge processed in a GBT is typically very acceptable. 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. **A. Open 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 opened, less energy is imparted and the size of the resultant floc particles will be larger.

4. **A. 1,000 #/gram TS**

Class A residuals fecal coliform is no more than 1,000 #/gram TS. The fecal coliform limit for Class B residuals is 2,000,000 #/gram TS.

5. **D. 36.2 days**

Aerobic digester HRT, days

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

Volume of tank, gallons

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

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

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

Sludge Feed, gpd = 15,500

Aerobic digester HRT, days

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

$$= 36.2 \text{ days}$$

6. **B. 43.0 percent**

VanKleek VS Reduction, %

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

$$\text{VS IN} = \text{VSS} \div \text{TSS}$$

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

$$= 0.794$$

$$\text{VS OUT} = \text{VSS} \div \text{TSS}$$

$$= 1.65\% \div 2.4\%$$

$$= 0.687$$

VanKleek VS Reduction, %

$$= 0.794 - 0.687 \div 0.794 - (0.794 \times 0.687) \times 100$$

$$= 43.04\%$$

7. **E. Both C and D are correct.**

A flooded top belt indicates at least one or more of the following conditions: 1) the sludge feed rate is too high and should be reduced, 2) the belt speed is too slow and should be increased, 3) the polymer dose rate is improper and should be evaluated for an increased or decreased adjustment, 4) the belt is blinded and the washbox nozzles should be cleaned.

8. **B. 792,693 gallons**

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 π 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. Also, this activity (shutting off the air supply) typically will result in increased destruction of volatile solids in the aerobic digester.