

## Test Your Knowledge of Wastewater Treatment Topics



QUESTION WAY  
ANSWER ST

**Roy Pelletier**

- What is a typical return activated sludge (RAS) to Q ratio for a contact stabilization activated sludge process?
  - 50 percent to 75 percent
  - 20 percent to 50 percent
  - 1 percent to 2 percent
  - 75 percent to 150 percent
- Given the following data, what is the solids loading rate on the secondary clarifiers?
  - Plant influent flow is 23.75 mgd
  - RAS rate is 70 percent of Q
  - There are six 100-ft diameter secondary clarifiers
  - Aeration mixed liquor suspended solids (MLSS) is 2,250 mg/L
  - 21.5 lbs/day/ft<sup>2</sup>
  - 16.1 lbs/day/ft<sup>2</sup>
  - 2.8 lbs/day/ft<sup>2</sup>
  - 96.5 lbs/day/ft<sup>2</sup>
- Given the following Ortho P data for inlet and outlet of a biological nutrient removal (BNR) fermentation tank, does this appear to be a problem?
  - Fermentation inlet Ortho P is 7.0 mg/L
  - Fermentation outlet Ortho P is 4.0 mg/L
  - Yes, the Ortho P is too low in the fermentation tank outlet.
  - Yes, the fermentation outlet Ortho P should be two to three times the concentration of the inlet.
  - No, the fermentation tank is designed to remove phosphorus directly.
  - Both a and b.
- Given the following data, what is the food to microorganism (F/M) ratio of this activated sludge process?
  - Plant influent flow is 23.75 mgd
  - Influent CBOD<sub>5</sub> is 220 mg/L
  - Primary clarifier removes 26 percent of the Influent CBOD<sub>5</sub>
  - Mixed liquor volatile suspended solids (MLVSS) is 75 percent of MLSS
  - Aeration MLSS is 2,250 mg/L
  - Eight aeration tanks, each 220 ft long, 45 ft wide and 15 ft deep
  - 0.42
  - 0.13
  - 0.26
  - 0.11
- What is the best adjustment (from the list of possible answers) to make if solids are rising in the secondary clarifier accompanied by large gas bubbles and strong odors?
  - Increase aeration dissolved oxygen (DO).
  - Decrease the RAS rate.
  - Decrease the waste activated sludge (WAS) rate.
  - Decrease aeration DO.
- Which process adjustment typically increases the contact time in the aeration tank?
  - Lowering the weir.
  - Increasing the air supply rate.
  - Decreasing the RAS rate.
  - Decreasing the WAS rate.
- Given the following data, calculate the respiration rate (RR)?
  - Beginning oxygen uptake rate (OUR) test DO is 7.8 mg/L
  - Ending OUR test DO is 2.2 mg/L
  - Test time is 10 min
  - MLVSS is 1,688 mg/L
  - 0.019 mg/hr/gm
  - 19.9 mg/hr/gm
  - 33.6 mg/hr/gm
  - 56.7 mg/hr/gm
- Given the following data, calculate the daily volume of WAS to be removed from this activated sludge process.
  - Aeration volume: 2.25 mg
  - MLSS: 2,750 mg/L
  - MLVSS: 2,100 mg/L
  - Desired sludge retention time (SRT): seven days
  - WAS concentration: 6,500 mg/L
  - 13,600 gpd
  - 1.36 mgd
  - 0.104 mgd
  - 0.136 mgd
- What problems can grit cause in downstream treatment processes if it is not removed from the influent flow?
  - Erode valve seats.
  - Take up valuable space in tanks.
  - Erode pipes and elbows.
  - Damage pump impellers.
  - All of the above.
- Which adjustment will typically improve denitrification in an aeration tank?
  - Increase the air supply.
  - Increase the DO.
  - Decrease the DO.
  - Shut off the RAS.

Answers on page 66

### 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 through the year 2000 are available on the Florida Water Environment Association's website 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.

### 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 email 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  
407-716-2971

# Certification Boulevard Answer Key

From page 52

- D) 75 percent to 150 percent**
- B) 16.1 lbs/day/ft<sup>2</sup>**

**Total lbs/day Entering the Secondary Clarifiers**  
=  $(23.75 \text{ mgd} + 16.62 \text{ mgd}) \times 2,250 \text{ mg/L} \times 8.34 \text{ lbs/gal}$   
= 757,637 lbs/day

**Total Clarifiers Surface Area**  
=  $3.14 \times (50 \text{ ft} \times 50 \text{ ft}) \times 6 \text{ Clarifiers}$   
= 47,100 ft<sup>2</sup>

**Total lbs/day Entering the Secondary Clarifiers**  
= 757,637 lbs/day = 16.09 lbs/day/ft<sup>2</sup>

**Total Clarifiers Surface Area**  
= 47,100 ft<sup>2</sup>
- D) Both a and b.**
- C) 0.26**

**F/M/ Ratio**  
= lbs/day CBOD<sub>5</sub> Entering Aeration divided by lbs MLVSS in Aeration

**Lbs/day CBOD<sub>5</sub> Entering Aeration**  
=  $23.75 \text{ mgd} \times 162.8 \text{ mg/L} \times 8.34 \text{ lbs/gal}$   
= 32,247 lbs/day CBOD<sub>5</sub>

**Lbs MLVSS in Aeration**  
=  $(220 \text{ ft} \times 45 \text{ ft} \times 15 \text{ ft} \times 7.48 \text{ gal/ft}^3 \div 1,000,000) \times 8 \text{ Aeration Tanks} \times 1,688 \text{ mg/L} \times 8.34 \text{ lbs/gal}$   
= 125,100 lbs MLVSS  
=  $32,247 \text{ lbs/day CBOD}_5 \div 125,100 \text{ lbs MLVSS}$   
= 0.258 F/M
- A) Increase aeration DO.**

*This septic condition requires an increased aerobic environment in the MLSS.*
- C) Decreasing the RAS rate.**

*Decreasing the RAS rate reduces the overall flow entering the aeration tank, which provides an increased contact time in the aeration tank.*
- B) 19.9 mg/hr/gm**

**RR, mg/hr/gm**  
= OUR, mg/L/hr  $\div$  MLVSS, gm/L

**OUR, mg/L/hr**  
=  $(\text{Start DO, mg/L} - \text{Ending DO, mg/L}) \div \text{Test Time, mins} \times 60 \text{ mins/hr}$   
=  $(7.8 \text{ mg/L} - 2.2 \text{ mg/L}) \div 10 \text{ mins} \times 60 \text{ mins/hr}$   
= 33.6 mg/L/hr OUR

**RR, mg/hr/gm**  
=  $33.6 \text{ mg/L/hr} \div (1,688 \text{ mg/L} \div 1,000)$   
= 19.9 mg/hr/gm
- D) 0.136 mgd**

**MLSS Inventory**  
= Aeration Tank Volume, mg  $\times$  MLSS, mg/L  $\times$  8.34 lbs/gal  
=  $2.25 \text{ mg} \times 2,750 \text{ mg/L} \times 8.34 \text{ lbs/gal}$   
= 51,604 lbs Aeration MLSS

**Lbs/day WAS to Remove**  
= Aeration Inventory, lbs MLSS  $\div$  Desired SRT, days  
=  $51,604 \text{ lbs MLSS} \div 7 \text{ days}$   
= 7,372 lbs/day WAS to Remove

**Gallons WAS to Remove**  
= Lbs/day WAS  $\div$  (WAS Concentration  $\times$  8.34 lbs/gal)  
=  $7,372 \text{ lbs/day} \div (6,500 \text{ mg/L} \times 8.34 \text{ lbs/gal})$   
= 0.1359896 mgd or 135,990 gpd
- E) All of the above.**
- C) Decrease the DO.**

*Denitrification is an anoxic reaction and reducing the aeration system DO will improve the denitrification rate in the activated sludge process.*