Certification Boulevard

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Test Your Knowledge of Wastewater Treatment

1. Given the following data, what is the solids loading rate on the secondary clarifiers?
   - *Plant influent flow is 15.5 mgd*
   - *The RAS rate is 70 percent of Q*
   - *There are three (3) 120-foot diameter secondary clarifiers*
   - *The aeration MLSS is 2,400 mg/L*

   A. 9.1 lbs/day/ft^2 B. 8.6 lbs/day/ft^2
   C. 18.9 lbs/day/ft^2 D. 15.5 lbs/day/ft^2

2. What is the best adjustment to make (from the list of possible answers) if solids are rising in the secondary clarifier, accompanied by small, pinpoint gas bubbles?
   A. Increase aeration D.O.
   B. Decrease the RAS rate
   C. Decrease the WAS rate
   D. Decrease aeration D.O.

3. Is a high-rate aeration process typically overloaded or underloaded by design?
   A. Overloaded B. Underloaded
   C. Low MLSS D. High F/M ratio

4. Which process adjustment will typically decrease the contact time in an aeration tank?
   A. Raising the weir
   B. Decreasing the air supply rate
   C. Increasing the RAS rate
   D. Increasing the WAS rate

5. Which condition may produce the poorest denitrification efficiency in an aeration tank?
   A. Low air supply
   B. High aeration D.O.
   C. Low aeration D.O.
   D. High RAS rate

6. Given the following data, calculate the OUR:
   - *Beginning D.O. is 7.1 mg/L*
   - *Ending D.O. is 1.9 mg/L*
   - *Test time is 4.2 minutes*

   A. 74.3 mg/L/hr B. 192.7 mg/L/hr
   C. 24.5 mg/L/hr D. 58.4 mg/L/hr

7. Given an OUR test result of about 75 mg/l/hr, and given that this is a healthy and properly operated activated sludge process, which location of the aeration tank did this sample come from?
   A. End of the aeration tank
   B. Entering the secondary clarifier
   C. Beginning of the aeration tank
   D. Not enough data to identify the location

8. Given the following data, calculate the SRT of this activated sludge facility.
   - *Plant flow is 15.5 mgd*
   - *Aeration capacity is 6.4 mg*
   - *MLSS concentration is 2,500 mg/L*
   - *Mixed liquor is 76 percent volatile*
   - *WAS concentration is 7,500 mg/L*
   - *QWAS is 249,750 gpd*
   - *Final effluent TSS is 1.5 mg/L*

   A. 12.6 days B. 4.8 days
   C. 6.2 days D. 8.4 days

9. Given the following data, what is the total volume of this secondary clarifier (including the cone volume)?
   - *50 ft. diameter*
   - *12 ft. SWD*
   - *3 ft. sludge blanket depth*
   - *4 ft. cone depth*

   A. 176,154 gals B. 19,578 gals
   C. 324,578 gals D. 195,727 gals

10. Given the following data, what is the TSS concentration?
    - *50 ml of sample*
    - *Tare weight of filter is 11.8873 grams*
    - *Final weight of filter after drying is 12.2255 grams*

    A. 2,624 mg/l B. 13,012 mg/l
    C. 6,764 mg/l D. 1,312 mg/l

ANSWERS ON PAGE 70

SEND US YOUR QUESTIONS FOR CERTIFICATION BOULEVARD

Do you have a question or an exercise you would like to feature in "Certification Boulevard?" We'll be glad to publish it. Just send your question (with the answer) or your exercise (with the solution) to:

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There is no limit to the number of questions or exercises you may submit. Please include your name, city, and organization or company so we can give you credit.

Certification Boulevard Answer Key

From page 26

1. **D. 15.5 lbs/day/ft²**
   Total lbs/day Entering the Secondary Clarifiers ÷ Total Clarifiers Surface Area
   = 527,422 lbs/day ÷ 33,912 ft²
   = 15.55 lbs/day/ft²
   Total lbs/day Entering the Secondary Clarifiers
   = (15.5 mgd + 10.85 mgd) x 2,400 mg/L x 8.34 lbs/gal
   = 527,422 lbs/day
   Total Clarifiers Surface Area
   = 3.14 x (60 ft x 60 ft) x 3 Clarifiers
   = 33,912 ft²

2. **D. Decrease aeration D.O.**
   This condition is most likely the result of denitrification in the clarifier sludge blanket. Reducing the aeration tank D.O. will improve the biological denitrification process in the aeration system and decrease the denitrification in the secondary clarifier. Also, increasing the RAS rate may improve the condition.

3. **A. Overloaded**
   Aeration loading refers to the $CBOD_5$ entering the system. The high-rate aeration process typically has a high F/M ratio and a low SRT and is considered an overloaded process.

4. **C. Increasing the RAS rate**
   Increasing the RAS rate increases the total flow entering the aeration tank, thereby decreasing the contact time in the aeration tank.

5. **B. High aeration D.O.**
   Because denitrification is an anoxic reaction, high dissolved oxygen levels in the aeration tank will typically result in poor denitrification efficiency.

6. **A. 74.3 mg/L/hr**
   OUR, mg/L/hr
   = (Start D.O., mg/L – Ending D.O., mg/L) ÷ Test Time, mins x 60 mins/hr
   = (7.1 mg/L – 1.9 mg/L) ÷ 4.2 mins x 60 mins/hr
   = 74.3 mg/L/hr OUR

7. **C. Beginning of the aeration tank**
   The beginning of a healthy, properly operated aeration tank should have an OUR reading between 50 to 100 mg/L/hr. The end of that same aeration tank should have an OUR reading of about 20 to 30 mg/L/hr.

8. **D. 8.4 days**
   SRT, Days
   = Lbs Aeration MLSS ÷ (Lbs/day WAS TSS + Lbs/day Final Eff TSS)
   Lbs MLSS Inventory
   = Aeration capacity, mg x MLSS conc., mg/L x 8.34 lbs/gal
   = 6.4 mg x 2,500 mg/L x 8.34 lbs/gal
   = 133,440 lbs MLSS
   Lbs/Day WAS TSS
   = QWAS, mgd x WAS TSS, mg/L x 8.34
   = 0.24975 mgd x 7,500 mg/L x 8.34 lbs/gal
   = 15,622 Lbs/Day
   Lbs/Day Eff TSS = Q, mgd x Final Eff TSS, mg/L x 8.34
   = 15.5 mgd x 1.5 mg/L x 8.34 lbs/gal
   = 193.9 Lbs/Day
   SRT, Days
   = 133,440 Lbs MLSS ÷ (15,622 Lbs/day WAS TSS + 194 Lbs/day Final Eff TSS)
   = 8.4 Days

9. **D. 195,727 gals**
   Total tank volume
   = tank volume in gallons at SWD + volume in gallons in the cone
   Tank volume, gals
   = πr^2 x side water depth, ft. x 7.48 gals per cubic foot
   = 3.14 x 25 ft. x 25 ft. x 12 ft. x 7.48 gal/ft³
   = 176,154 gallons at SWD
   Cone volume, gals
   = πr^2 x cone depth, ft. x 7.48 gals per cubic foot
   = (3.14 x 25 ft. x 25 ft. x 4 ft. x 7.48 gal/ft³) ÷ 3
   = 19,573 gallons in cone
   Total Volume in Tank
   = 176,154 gals at SWD + 19,573 gals in cone
   = 195,727 gallons

10. **C. 6,764 mg/l**
    TSS, ppm
    = weight of suspended solids in grams x (1,000,000 ÷ ml of sample)
    Weight of TSS
    = Final Wt. - Paper Tare Wt.
    = 12.2255 gm - 11.8873 gm
    = 0.3382 gm
    TSS, ppm
    = 0.3382 gm x 1,000,000 ÷ 50 ml sample
    = 6,764 mg/l (ppm)