Certification Boulevard

Roy Pelletier

Test Your Knowledge Of Operational Topics

Thanks to Neil R. Kirkland and Michael Martin, operator trainees from the Marion Correctional Institution Wastewater Treatment Facility in Lowell, Florida, for providing these questions and answers. — Roy

1. What is the FIRST warning that trouble is starting in an anaerobic digester?
   A. Increase in carbon dioxide
   B. Increase in pH
   C. Increase in sludge volume
   D. Increase in volatile acid/alkalinity relationship

2. What is the MAXIMUM recommended holding time for a sample to be tested for CBOD?
   A. No holding time   B. 28 hours
   C. 48 hours   D. 72 hours

3. What is the oxygen concentration in the atmosphere?
   A. 15.2 percent   B. 19.5 percent
   C. 20.9 percent   D. 23.5 percent

4. Which of the following is a harmful physical agent?
   A. Hydrochloric acid   B. Methane
   C. Solvents   D. Temperature

5. How long should an RBC unit be rotated when superchlorinating the unit for snail removal?
   A. 2 to 3 hours   B. 8 to 12 hours
   C. 2 to 3 days   D. 5 to 7 days

6. What safety precaution should be taken when starting a positive displacement pump?
   A. The discharge valve should be closed.
   B. The inlet valve must be grounded.
   C. The discharge valve must be opened.
   D. There should be no people near the pump.

7. Most activated sludge mixed-liquor suspended solids fall into a range of what percent volatile content for municipal waste when the process is operating properly?
   A. 5 to 15 percent
   B. 30 to 40 percent
   C. 50 to 70 percent
   D. 70 to 80 percent

8. What may be the FIRST corrective action taken to resolve floating sludge conditions in a secondary clarifier, given these observations:
   • SVI is 132
   • Microscopic exam reveals abundance of filamentous organisms
   A. Decrease the D.O.
   B. Increase the D.O.
   C. Increase the WAS rate
   D. Reduce the RAS rate

9. A spray field has a total of 80 acres and is divided into four equal zones. Only one zone may be operated at a time and the permit states that no more than 4 inches of water can be applied to the zone. How long can a zone be operated at a rate of 0.7 mgd before it must be rotated to another zone?
   A. 48 hours   B. 3.1 days
   C. 4.2 days   D. 144 hours

10. What may be the PROBABLE CAUSE for low chlorine gas pressure at a chlorinator?
    A. Chlorine cylinders are full
    B. Low injector vacuum
    C. Insufficient number of cylinders connected to the system
    D. Plugged diffusers

ANSWERS ON PAGE 53.

A Question Revisited…
By Roy Pelletier

I would like to acknowledge **James Bess** from HypoChlor Inc. for his comments regarding a question in the March 2005 "Certification Boulevard" column. Question No.2 was stated and answered as follows:

2. Given the following data, what will be the January budget for sodium hypochlorite at this water plant?
   • Finished water flow is 1.2 mgd
   • Chlorine dosage is 10 mg/L
   • Sodium Hypochlorite solution strength is 12.5%
   • Bulk density of solution is 9.7 lbs/gal
   • Cost per bulk liquid gallon is $0.40

   a. $12,051   b. $2,240
   c. $1,023   d. $3,396

Lbs/day of solution = lbs/day chlorine used ÷ solution strength
Gals/day solution = lbs/day solution ÷ density of solution

(1.2 mgd x 10 mg/L x 8.34 lbs/gal) ÷ 0.125 = 800.6 lbs/day solution
800.6 lbs/day solution ÷ 9.7 lbs/gal = 82.54 gpd x 31 days/month = 2,558.7 gal/month
2,558.7 gal/month x $0.40 per gallon =

$1,023.49 January Budget

Jim identified another way of considering this calculation, which alters the given answer. He wrote the following:

Dear Mr. Pelletier,

I believe the person submitting No. 2 exercise would under budget for disinfection.

Bleach at 12.5% trade strength contains 125 grams Cl_2 per liter; therefore, you have 473.125 grams Cl_2 per gallon.

1 gram per cubic meter = 1 milligram per liter

(1,200,000 gallons per day) ÷ (264.2 gallons per cubic meter) X (10 grams per cubic meter) X (31 days per month) = 1,408,024.22 grams per month.

(1,408,024.22 grams per month) ÷ (473.125 grams per gallon) = 2976.01 gallons per month

(2976.01 gallons per month) X ($0.40 dollars per gallon) = $1190.40 per month of January

$1190.40 - $1023.49 (answer given) = ($166.91)

Jim also wrote:

I have contacted my sources and looked up references for the industry standard concerning bleach strength in the marketplace. The industry standard when referring to bleach strength is to use Trade Percent (volume percent) rather than weight percent. The method used to define chlorine usage for most problems assumes trade percentage (volume percent) chlorine content values will be applied, not weight percentage.

Referring to George Clifford White's Handbook of Chlorination and Alternative Disinfectants, Fourth Edition, pages 107 - 109 explain bleach available chlorine in table 2.2 as "Trade % Available Chlorine grams per liter"; specific gravity is not used to determine dosage requirements. Were specific gravity used, then you likely also would have to account for the variations in the treated stream, the associated problems with bleach caustic levels and bleach degradation. I will be happy to discuss this issue further if you wish.

Best Regards,
Jim Bess
HypoChlor Inc.
Estero, Florida

Thank you, Jim. — Roy

Certification Boulevard Answer Key

From page 30

1. What is the FIRST warning that trouble is starting in an anaerobic digester?
   D. Increase in volatile acid/alkalinity relationship
   Because the alkalinity is so high in an anaerobic digester, the pH is slow changing and the digester will basically go "sour" before the pH begins to drop. This is why the acid/alkalinity ratio is the best process tool to use to monitor the performance efficiency of anaerobic digestion.

2. What is the MAXIMUM recommended holding time for a sample to be tested for $CBOD_5$?
   C. 48 hours

3. What is the oxygen concentration in the atmosphere?
   C. 20.9 percent

4. Which of the following is a harmful physical agent to microbiology?
   D. Temperature
   These other agents can certainly be harmful to microbiology; however, they are chemical and not physical agents.

5. How long should an RBC unit be rotated when super-chlorinating the unit for snail removal?
   A. 2 to 3 hours

6. What safety precaution should be taken when starting a positive displacement pump?
   C. The discharge valve must be opened
   If a positive displacement pump is started with the discharge valve closed, severe damage can occur within the pump and discharge piping. This can be a very dangerous condition, as pieces of the pump, pipe or devices on the pipe (like pressure gauges) can become projectiles.

7. Most activated sludge mixed liquor suspended solids fall into a range of what percent volatile content for municipal waste when the process is operating properly?
   D. 70 to 80 percent
   Younger sludge will generally have a higher volatile content, while older sludge will have a lower volatile fraction of the mixed liquor total suspended solids.

8. What may be the FIRST corrective action taken to resolve floating sludge conditions in a secondary clarifier, given these observations:
   • SVI is 132
   • Microscopic exam reveals abundance of filamentous organisms
   B. Increase the D.O.

9. A spray field has a total of 80 acres and is divided into four equal zones. Only one zone may be operated at a time and the permit states that no more than 4 inches of water can be applied to the zone. How long can a zone be operated at a rate of 0.7 mgd before it must be rotated to another zone?
   B. 3.1 days
   Step 1: 80 acres ÷ 4 zones = 20 acres per zone
   1 acre = 43,560 ft^2
   Step 2: 4 inches ÷ 12 inches per foot
   = 0.333 feet of water applied
   Step 3: 20 acres x 43,560 ft^2 per acre
   = 871,200 ft^2 x 0.333 feet of water applied
   = 290,109.6 ft^3
   Step 4: 290,109.6 ft^3 x 7.48 gals per ft^3
   = 2,170,019.8 gals per zone
   Step 5: 2,170,019.8 gals per zone ÷ 700,000 gals per day flow rate
   = 3.1 days

10. What may be the PROBABLE CAUSE for low chlorine gas pressure at a chlorinator?
    C. Insufficient number of cylinders connected to the system