

**Module 6:**  
**Solids Handling and Disposal**  
**Answer Key**



Can someone tell us why primary sludges are not as well suited for dissolved air flotation thickeners?

Ans: Primary sludges are heavier and tend to settle.

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**Exercise for Unit 1 – Solids Handling**

**Matching – Match the gravity thickener parts (A-E) with their proper description (1-5):**

C 1. Collects and removes effluent or thickener overflow.

D 2. Slowly rotates to move the settled solids to the middle of the tank.

A 3. Introduces the sludge into the thickener.

B 4. Collects and removes floating debris.

E 5. Provides gentle stirring or flocculation of the settled sludge and releases trapped gas to prevent rising sludge.

- A. Inlet and distribution assembly
- B. Scum removal equipment
- C. Effluent/Overflow weir
- D. Sludge rake to move the sludge to a hopper
- E. Pickets or vertical steel members

Multiple Choice – Choose the best answer unless otherwise noted:

6. Which of the following are advantages of sludge thickening? (*Choose all that apply*)
- Cost savings in the construction of new digestion facilities
  - Increased anaerobic digestion heating requirements, since more water has to be heated.
  - Improved digester performance due to a lower volume of sludge
7. The type of sludge that is commonly thickened using a centrifugal thickener is: (*Choose one*)
- primary sludge
  - secondary sludge
  - tertiary sludge
8. Sludge that is to be thickened using a gravity belt thickener is first preconditioned, typically using what? (*Choose one*)
- chlorine
  - lime
  - polymer
  - soda ash
9. The sludge thickener diagrams that were viewed in this unit include which of the following? (*Choose all that apply*)
- air floatation thickener
  - scroll centrifuge thickener
  - gravity belt thickener
  - basket centrifuge thickener



So how does digestion reduce the volume of solids in the sludge?

Ans: The answer is on the next page of the workbook.



How many have a gas system?  
*[(Note: everyone with an anaerobic digester should have a gas system.)]*



How many use the gas for heat?  
*[(Note: everyone with an anaerobic digester should use the gas for heat.)]*



What kinds of problems do you have with your gas systems?

Ans: *[Expect moisture problems, clogs, low methane content, leaks, corrosion, etc.]*

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What type of meters do people in the class use?

**Ans:** *[These responses could be brands (Trident, Neptune, Ford, WT, Watts) or working types (displacement, turbine, propeller).]*



Which types of meters have worked the best?

**Ans:** *[It is common for the ones that have worked the best to be the ones that were installed with the proper upstream protections. Expect responses of blockage and corrosion to be the items that downgraded the performance of the meters.]*

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How do you check your waste gas burners?

**Ans:** Visual observation from the ground is probably the most common method of checking the burner. A better way is close visual observation of the burner. Once you are close you can also see if fasteners are loose, material is being eaten away, the auxiliary flame source is still lit, or obstructions are developing in the airways.



Does anyone have any tips for checking waste gas burners?

**Ans:** Access is a big concern. Therefore, methods of getting to the burner, ladders, platforms, mirrors, closed circuit TV, are important.

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Considering all the waste streams arriving at the digester, which one gives your plant the most problems in transport and why?

**Ans:** Scum is probably on the top of the list because the grease and oils foul the pipes. It is also the most difficult to pump. Hopefully, most of the grit and stringy material has been removed from the flow stream. The sludges may have gas entrained in them that hinders efficient pumping, but the gas is less of a problem than plugged piping.

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What types of tests should be conducted before entering a digester that has been taken off-line?

**Ans:** Since this may be a confined space, the required tests for confined space entry should be completed: oxygen, explosive gases, hydrogen sulfide, carbon monoxide.

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## Exercise for Unit 2 – Anaerobic Digestion

Multiple Choice – Choose the best answer unless otherwise noted:

- Anaerobic digestion reduces pathogens by what percentage?
  - 50-65%
  - 70-84%
  - 85-99%**
- Psychrophilic bacteria would be used in which kind of digester?
  - Cold digester**
  - Warm digester
  - Hot digester
- A sour digester occurs when:
  - The gas produced by the acid formers gets caught in surfactant
  - Acid formers grow faster than methane formers**
  - Soap and detergent reduce the surface tension of liquids
- Which V.A./ALK (volatile acids/alkalinity) ratios are within problem levels?  
(Choose all that apply):
  - 0.08
  - 0.1
  - 0.8**
  - 1.0**
- An acidic (low pH) digester can be cured by adding alkalinity to the digester. Which one of the following compounds is the most cost effective in curing an acidic digester?
  - Sodium Bicarbonate
  - Anhydrous Ammonia
  - Lime (Ca(OH)<sub>2</sub>)**
  - Sulfuric Acid

Fill in the blank with a correct response:

- A material is considered **dewaterable** if water will readily drain from it.
- An anaerobic digester will produce twelve to eighteen cubic feet of gas for every **pound** of volatile matter destroyed.
- Normally a digester should be fed often. This can be anywhere from two to **twenty** times per day.
- Anaerobic digesters produce methane gas and carbon dioxide gas. If the amount of CO<sub>2</sub> reaches **45** % or more, the gas mixture will not be burnable.

10. When a digester's working volume reaches 60 % or less of its design volume, it is time to shut down and clean the digester.
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### Exercise for Unit 3 – Aerobic Digestion

- The target level of dissolved oxygen in an aerobic digestion tank is:
    - 6 mg/L
    - 1 mg/L
    - 0 mg/L
  - Sludge is usually kept in the aerobic digestion tank for:
    - 1 day
    - 5 days
    - 10 days
    - 20 days
  - Aerobic digestion creates a waste that is better for disposal or beneficial use (reduced volume through dewatering, reduced pathogens and a more stabilized product through the reduction of volatile solids).
    - True
    - False
  - Scum is typically the biggest problem when using aerobic digesters.
    - True
    - False
  - Odors are not generally a problem with aerobic digesters. If odors occur, what are two remedies that may correct the odor problem?
    - Ensure that proper mixing is occurring in the tank.
    - Ensure that proper dissolved oxygen levels are being maintained.
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Do you think there is a fire risk when anaerobic digested sludge is applied on a drying bed?

Ans: Yes (see next question).



Why is anaerobic more dangerous than aerobic sludge?

Ans: Anaerobic sludge contains methane gas. Aerobic sludge should not contain methane gas.



For those drying beds not equipped with vehicle treads, what can be used to facilitate the use of wheelbarrows on the drying bed?

Ans: Planks, grating, plywood.

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#### Exercise for Unit 4 – Solids Management Planning

1. In a drying bed the typical sludge thickness is ten to twelve inches.
2. A drying bed requires about 14 to 20 days of drying time.
3. Reed beds can last up to 10 years.
4. Most sewage sludges are classified as:
  - a. hazardous waste
  - b. non-hazardous waste
  - c. radioactive waste
  - d. none of the above
5. Sludge dewatering methods include drying beds, reed beds, lagoons and mechanical dewatering systems.
  - a. True
  - b. False