Module 1:
Introduction to Wastewater Treatment
Answer Key

What are some examples of different interest's various audiences may have?

Ans: Officials of regulatory agencies or other operators would want to be provided with detailed information on the operation of the plant. School classes would want to know only very basic information. Public tours or tours of the news media may be interested in water quality, which will help contribute to acceptance and support.

What are some typical safety issues in a plant?

Ans: Some typical safety issues include:

- Chlorine Safety (potentially toxic atmosphere)
- Confined space entry – Most common cause of death from an on-the job accident for collection system operators is through asphyxiation.
- Explosions hazards – anaerobic digester producing methane gas
- Fall hazards
- Electrical Hazards

Unit 1 Exercise:

1. **True** or False: Treatment plant operators are required to complete continuing education.

2. A process control decision is any action to maintain or change the **quality or quantity** of water being treated.

3. Which one of the following is a treatment plant operator NOT responsible for?

    a. Plant tours
    b. Process control decisions
    c. Upgrading the electrical service panel
    d. Collecting samples

What are some examples of organic impurities from industrial contributors?

Ans: Examples of organic impurities include:

- Chloroform from leather tanning operations and pharmaceuticals manufacturing

- Trichloroethylene from textile mills and adhesive manufacturing
- Phenols from pesticide manufacturing and from iron and steel manufacturing
- BOD and fats, oils, and greases from food processing industries

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A stream used for trout stocking is one example of a thermal sensitive stream where the stream temperature needs to be regulated. Can anyone think of any other reasons to regulate the temperature of discharges to the receiving stream?

Ans: Additional reasons to regulate the temperature of discharges are:

- To prevent loss of dissolved oxygen (DO)—the amount of DO that can be dissolved into water decreases as the temperature of the water increases, and
- To control undesirable aquatic growth such as algae, which grow faster at higher temperatures.

What are some communicable diseases that could be transmitted via untreated wastewater?

Ans: Typhoid, cholera, dysentery, polio, hepatitis.

Unit 2 Exercise

1. Contaminants found in untreated wastewater may include: (Circle all that apply):
   - **a. Pathogens**
   - b. Ozone
   - **c. Organic contaminants**
   - **d. Inorganic contaminants**

2. A type of contaminant that always contains carbon and is derived from animals, plants or may be a manufactured chemical compound is an**:**
   - a. Inorganic contaminant
   - b. Salt contaminant
   - **c. Organic contaminant**
   - d. Pathogen

3. Organic contaminants exert an oxygen demand, which is measured as: **BOD**
4. Typical influent BOD to a wastewater plant is approximately:
   - a. 20 to 30 mg/L
   - b. 100 to 125 mg/L
   - **c. 200 to 250 mg/L**
   - d. 500 to 600 mg/L

5. Typical influent (untreated) total nitrogen concentration is approximately:
    a. 0 to 5 mg/L
    b. 30 to 50 mg/L
    c. 100 to 125 mg/L
    d. 300 to 350 mg/L
6. **True** or False: Total solids consist of dissolved solids and suspended solids.
7. Influent wastewater flow and temperature can increase suddenly due to which of the following**:**
    a. Infiltration
    b. Increased return activated sludge
    c. Industrial waste discharges
    d. Increased solids removal
8. Untreated wastewater discharge can create which of the following?
    a. High chlorine levels in the receiving stream
    b. Oxygen depletion in the receiving stream
    c. Sludge and scum accumulations
    d. Low odor production in the stream
9. Eutrophication can be defined as:
    a. Lack of nutrients in a receiving stream due to chemical discharges
    b. Excessive nutrient availability that results in overgrowth of aquatic plants and algae
    c. Excessive growth of fish
    d. Pleasing taste and odor in drinking water
10. **Stabilization** is the process of converting a waste to a form that resists change.
11. Dissolved oxygen in water is dependent on temperature. **True** or False: An increase in wastewater temperature results in a decreased ability to retain dissolved oxygen.
12. Important nutrients have natural "Nutrient Cycles" in the receiving stream and within the wastewater treatment plant. Name at least 3 of these nutrients:

    Carbon

    Hydrogen

    Oxygen

    Sulfur

    Nitrogen

    Phosphorous

Why should the operator be familiar with the wastewater collection and conveyance network?

Ans: The operator should know the origin of wastes reaching the plant, the time it takes, and how the wastes are transported (flow by gravity or by gravity and pumped). Such knowledge will help you spot troubles and take corrective action.

What is typically done with grit once it is removed from wastewater?

Ans: Grit is usually taken to an approved sanitary landfill.

Why is the Parshall Flume widely used for measuring wastewater flow? Why is the Weir not used very frequently to measure influent?

Ans: The parshall flume is widely used for measuring untreated wastewater flow because it creates no obstructions to the flow of wastewater, which minimizes the chance for blockages or accumulations that might affect the depth of flow and subsequently, the measured flow rate.

The weir is not used as frequently because solids may collect behind the weir, which could result in inaccurate flow measurements. This collection of solids could also cause odors.

Why is a secondary clarifier needed after a trickling filter, rotating biological contractor, or aeration tank?

Ans: To allow organisms in treated wastewater to be removed by settling.

Unit 3 Exercise

Ans: 1. What are the three major components of a Wastewater System?

1. Collection and Conveyance
2. Treatment
3. Disposal

2. Name the three types of collection systems and briefly describe.

1. Sanitary Sewer- collects commercial and household wastes.
2. Storm Sewer- Collects runoff from streets, land and roofs.
3. Combined Sewer- Collects sanitary and storm water.

3. Match the Treatment Processes with the correct description.

1. C
2. F
3. D and/or B
4. A
5. B
6. G
7. E

4. Gravity sewer system are used when the slope is sufficient to produce _____.
   a. 1 ft/sec
   b. 2 ft/sec
   c. 3 ft/sec
   d. 4 ft/sec

5. **Septic** wastewater has a characteristic black color and is brought on by the action of anaerobic bacteria.

6. **True** or False: In preliminary treatment, grit channel cleaning results in a flow velocity decrease through the channel and an increase in removal efficiency.

7. Which of following are flow control devices:
   a. Weir
   b. Serial Rod
   c. Parshall Flume
   d. Kennison Nozzle

8. In a clarifier, the sludge that forms at the bottom may be referred to as the:
   a. Sludge cover
   b. Sludge level
   c. Sludge blanket
   d. Waste sludge

9. What type of settling tank typically follows the biological treatment step?
   a. Primary clarifier
   b. Secondary clarifier
   c. Trickling filter
   d. Equalization tank

10. **True** or False: During clarification, large amounts of sludge rising to the surface may indicate that not enough sludge is being "wasted".

11. Advanced (tertiary treatment) is primarily intended remove which two inorganic contaminants:
    a. Nitrogen
    b. Phosphorous

12. Describe two methods of effluent disposal.
    1. Stream discharge
    2. Land disposal

What are examples of conditions that cause violations?

Ans: Conditions that cause violations:

- Overloading conditions that can lead to overflows, by-passes, or process upsets
- Mechanical equipment deficiencies
- Inadequate budget for maintenance or operation of the plant

What are examples of tasks that would be candidates for a Standard Operating Procedure?

Ans: Examples of tasks would be:

- Field measurement of pH or DO
- Calibrating field montoring instrumentation
- Rotation of duplicate pumping equipment to equalize wear, without changing pumping rates