

This study guide is for wastewater collection system operators seeking certification at advanced skill and knowledge levels. The outlined topics indicate the general subjects which are the basis for examination questions. Operators should be knowledgeable in the subject matter outlined here. Reference materials and sample test questions can be found following the outline of topics.

I. WASTEWATER AND ITS CHARACTERISTICS

- A. Sources (municipal, industrial)
- B. Composition (water, solids, organic compounds, inorganic compounds, organisms)
- C. Production rates (individuals, municipalities, industries)
- D. Physical characteristics (color, odor, etc.)
- E. Units of measurement (gallons per day, population equivalent, etc.)

II. BIOLOGY

- A. Microorganisms present in wastewater
  - 1. Algae (green, blue-green, diatoms)
  - 2. Bacteria (anaerobic, aerobic, facultative, pathogenic, fecal coliform)
  - 3. Viruses
- B. Byproducts of the activity of microorganisms (oxygen, carbon dioxide, hydrogen sulfide, methane, nitrogen, water, etc.)
- C. Biochemical Oxygen Demand (BOD)

III. CHEMISTRY

- A. Chlorination (chlorine demand, chloramines, breakpoint, disinfection, etc.)
- B. Chemicals found in wastewater and their effect on piping and equipment
- C. Gases found in wastewater collection environments (hydrogen sulfide, methane, oxygen, etc.)
- D. Chemicals used for dealing with problems encountered in wastewater collection (chlorine, etc.)
- E. pH and effects

IV. SAMPLES AND TESTS

- A. Procedures for sample collection
- B. Equipment tests

V. DESIGN

- A. Prevention of cross-connections
- B. Pump design sizing, head measurements, flow rates, and velocities for different size

pipe, etc.

VI. CONSTRUCTION AND MAINTENANCE

- A. Buildings and grounds (cleanliness, protection from vandalism, etc.)
- B. Pumps, piping, valves, meters, hydrants, and other equipment (types, spare parts, lubrication, corrosion control, prevention of cross-connections and infiltration or exfiltration)
- C. Line cleaning tools (pig, rodder)
- D. Electrical connections and terms
- E. Equipment parts and functions

VII. POTENTIAL PROBLEMS

- A. Corrosion (causes and locations)
- B. Pump problems (vibrations, decreased delivery, cavitation)
- C. Water hammer in lines
- D. Wastewater becoming septic

VIII. SAFETY

- A. Construction safety (trenching, shoring, traffic, etc.)
- B. Housekeeping
- C. Handling hazardous materials (chlorine, acids)
- D. Poisonous and explosive gases (ventilation in confined spaces, no smoking in same)
- E. First aid

IX. RULES AND REGULATIONS

- A. Requirements of size and separation from wells, potable water lines, etc.
- B. Minimum velocities
- C. Management requirements and responsibilities
- D. Responsibility (lawsuits and fines)
- E. Submission of plans and specifications (required for new facilities, changes in existing systems)

X. RECORDKEEPING

- A. Need for records (some required by state and federal law)
- B. Types of records (equipment operation, maintenance, repairs)
- C. Operation and maintenance manuals

## REFERENCES

1. “Recommended Standards for Wastewater Facilities,” Great Lakes-Upper Mississippi River Board of State Health and Environmental Managers
2. “Data Sheets for Operators of Municipal Utilities,” North Dakota State Department of Health and Consolidated Laboratories
3. “Manual of Instruction for Sewage Treatment Plant Operators,” New York State Department of Environmental Conservation

**TYPICAL EXAMINATION QUESTIONS**  
**Grade III and IV Wastewater Collection System**

1. Which chemical listed would reduce odor problems at a lift station?
  - a. Methane
  - b. Hydrochloric acid
  - c. Sulfuric acid
  - d. Hydrogen sulfide
  - e. Chlorine
  
2. Pumps that have fewer starts and stops:
  - a. Have excessive wear on control circuit relays
  - b. Have excessive wear on motors
  - c. Have a tendency to overheat
  - d. Consume less energy than a motor that often starts and stops
  - e. All of the above
  
3. Vibrations in pumps may be caused by improper motor pump:
  - a. Power factor
  - b. Piping
  - c. Curves
  - d. Alignment
  - e. All of the above
  
4. Name one disadvantage in flushing a collection system.
  - a. A clean sewer line result
  - b. Friction from debris in the line is reduced
  - c. Hydraulic and organic overloads can occur at the wastewater plant or stabilization ponds
  - d. Efficiency of the sewer is increased
  - e. Potential stoppages in the line are eliminated

5. SAMPLE PROBLEM:

A wet well is 10 feet wide by 10 feet long and 20 feet deep. With no pumps running, the level of the wet well is rising 2.5 feet in 5 minutes. What is the rate of flow of wastewater into the wet well?

- a. 40 GPM
- b. 125 GPM
- c. 375 GPM
- d. 650 GPM
- e. 1000 GPM

Study Guide for Grade III and IV  
Wastewater Collection System Operators

$$\begin{aligned} V &= l \times w \times h \\ &= 10 \text{ ft.} \times 10 \text{ ft.} \times 2.5 \text{ ft.} \\ &= 250 \text{ ft.}^3 \end{aligned}$$

$$250 \text{ ft.}^3 \times \frac{7.5 \text{ gal.}}{1 \text{ ft.}^3} = 1875 \text{ gal.}$$

$$\frac{1875 \text{ gal.}}{5 \text{ min.}} = 375 \frac{\text{gal.}}{\text{min.}}$$

ANSWERS:            1. e            2. d            3. d            4. c

PROBLEM ANSWER:

5. c.