

# **Kansas Class I - IV Wastewater Operator Need to Know**

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Healthy Kansans living in safe and sustainable environments

The Kansas Department of Health and Environment (KDHE) has compiled the following minimum knowledge expectations for water operators. The intent of this document is to identify those items which individuals are expected to comprehend in order to serve as water operators. This document is not intended to serve solely as a study guide for operator certification examinations. In order to pass a certification examination, an operator must possess knowledge gained through formal education and training as well as on-the-job experience.

# Kansas Class I Wastewater Operator Need to Know

## I. Why Treat Wastewater

- Human Health
  1. Pathogens
  2. Sterilization
  3. Disinfection
- Environment
  1. Dissolved oxygen (D.O.) depletion causes fishkills
  2. Surface and groundwater contamination
- Clean Water Act (CWA) and state permitting requirements

## II. Chemistry

- Characteristics of wastewater
  1. Grit
  2. Organic
  3. Inorganic
- pH
- Biochemical oxygen demand (BOD)
- Solids
- D.O.
- Composite vs grab sampling

## III. Safety

- Confined space
- Lock out/tag out
- General first aid
- Typical hazards encountered
- No job worth losing your life over

## IV. Basic Math

- Surface area
- Volume
- Efficiency
- Loading (mass per volume or area)
- Detention time
- Percentages
- Flow rate ( $Q=VA$ )

## V. Sewers - Collection Systems

- Types
- I/I
- Gravity vs force main
- Slope

## **VI. Basic Operation and Maintenance**

- Pumps
  1. Types
  2. Centrifugal pump components
  3. Valving
  4. General concepts of head, suction, and head loss
- Pump Stations
  1. Alarm conditions
  2. Routine maintenance
  3. Confined space
- General housekeeping

## **VII. Treatment**

- Grit removal
- Primary treatment
  1. Bar screen
  2. Comminutor
  3. Clarification
- Treatment
  1. Definition
  2. Ponds
    - a. Biology
    - b. Facultative vs aerated ponds
    - c. Series vs parallel operation
    - d. Pest control
    - e. Vegetation control
    - f. Sludge build up and removal
  3. Trickling filter basics
    - a. Media
    - b. Distribution
    - c. Common problems
  4. Sludge handling
    - a. Aerobic/anaerobic digestion basics
    - b. Drying beds
    - c. Land application

## **VIII. Disinfection**

- Chlorination
- Dechlorination
- Ultraviolet disinfection

# Kansas Class II Wastewater Operator Need to Know

## **I. All Need to Know for Class I**

### **II. Chemistry**

- D.O. saturation
- Factors controlling rates of reaction
- Potential hazardous lab chemicals that might be encountered
- Biochemical oxygen demand (BOD) test procedure
- Total suspended solids (TSS) test procedure

### **III. Safety**

- Confined space ventilation
- Backflow/cross connection basics

### **IV. Basic Math**

- Conversion of concentration – flow to pounds or pounds/day
- Utilize multiple concepts in the same problem

### **V. Sewers**

- Hazardous gasses
- I/I correction

### **VI. Basic Operation and Maintenance**

- Pumps
  1. Maintenance
  2. Start up
- Pump Stations
  1. Controls
  2. Routine maintenance
- Basin dewatering and repair
- Record keeping basics

### **VII. Treatment**

- Grit removal
  1. Types of materials removed
  2. Operational controls
- Primary treatment
  1. Bar screen
    - a. Advantages/disadvantages
    - b. Solids disposal
  2. Communitor
    - a. Advantages/disadvantages
    - b. Problems encountered
  3. Clarification
    - a. Designs

- b. Visual indicators
- Treatment
  1. Ponds
    - a. Diurnal fluctuations
    - b. Correction of problems
      - i. Nuisances
      - ii. Overloading
    - c. Aerated ponds
      - i. Controls
      - ii. Configurations
  2. Trickling filter basics
    - a. Advantages/disadvantages
    - b. Media
    - c. Distribution
    - d. Underdrains
    - e. Recirculation
    - f. Relationship to secondary clarifier
  3. Rotating biological contactors (RBCs)
    - a. General knowledge of process
    - b. Biology
  4. Activated Sludge
    - a. General knowledge of process
    - b. Concept of sludge age
    - c. Visual indicators
  5. Sludge handling
    - a. Aerobic/anaerobic digestion basics
      - i. Biology
      - ii. Gas production
      - iii. Operational controls/parameters
    - b. Dewatering
      - i. Drying beds
      - ii. Vacuum filtration
      - iii. Belt filter press
    - d. Disposal

### **VIII. Disinfection**

- Chlorination
- Dechlorination
- Ultraviolet disinfection

# Kansas Class III Wastewater Operator Need to Know

## **I. All Need to Know for Classes I and II**

### **II. Chemistry/Biology**

- Important parameters and the general laboratory procedures
  1. pH
  2. Solids
  3. Chemical oxygen demand (COD)
  4. D.O.
  5. Ammonia
  6. Composite vs grab sampling
- Define aerobic, anaerobic, septic, anoxic
- Problems with industrial wastes
- Concept of concentration
- Oxygen solubility in water
- Specific gravity

### **III. Safety**

- Hazardous gasses encountered
- Chlorine
- Backflow/cross connection
  1. Typical devices
  2. Low/high hazards
- Immunizations

### **IV. Basic Math**

- Multiply/divide exponents
- % vs other expressions of concentration
- BOD calculations
- Slope
- Appropriate use of conversion factors
  1. Concentration at certain flow to mass/time
  2. °F to °C
  3. MGD to gpm, cubic ft/s, gpm, ect.
- Flow rate, velocity, area relationships ( $Q=VA$ )

### **V. Management**

- Importance of good communication
- Importance of establishing safety plans
- Scheduling of work

### **VI. Basic Operation and Maintenance**

- Pumps
  1. Types
  2. Troubleshooting centrifugal pumps

- Pump Stations
  1. Operational control
  2. Troubleshooting
- Power
  1. 110 vs 220 volt power
  2. Poly vs single phase motors
  3. Power draw at various operating conditions
- Bypassing – when and proper reporting protocols
- Valves
  1. Types
  2. Where used

## VII. Treatment

- Primary treatment
  1. Comminutor
    - a. Troubleshooting
    - b. Routine maintenance
  2. Clarification
    - a. Basic design criteria
    - b. Sludge withdrawal
- Treatment
  1. Definition
  2. Ponds
    - a. Aerated vs non-aerated
    - b. Operational controls
  3. Trickling filters
    - a. Troubleshooting
    - b. Treatment capabilities
  4. Rotating biological contactors (RBCs)
    - a. Biology
    - b. Visual indicators
    - c. Troubleshooting
  5. Activated Sludge
    - a. Variations in the process
    - b. Biology
    - c. Operational controls
    - d. Troubleshooting
    - e. Terminology
      - i. MLSS
      - ii. MLVSS
      - iii. RAS
      - iv. WAS
  6. Nitrogen reduction and phosphorus reduction
  7. Secondary clarifier
    - a. Settling
    - b. Weirs
    - c. Recycling

- d. Wasting
- e. Visual indicators
- f. Troubleshooting
- g. Routine maintenance
8. Sludge handling
  - a. Aerobic/anaerobic digester operations
    - i. Chemistry
    - ii. Supernatant
    - iii. Troubleshooting
  - b. Filters and presses - how they work and basic troubleshooting
    - i. Belt presses
    - ii. Vacuum filters
    - iii. Baggers
  - c. Land application

### **VIII. Disinfection**

- Chlorination
- Dechlorination
- Ultraviolet disinfection

# Kansas Class IV Wastewater Operators Need to Know

## **I. All Need to Know for Classes I, II, and III**

### **II. Chemistry/Biology**

- Visual indicators of stream pollution
- Instrument maintenance

### **III. Safety**

- Hazardous atmospheres
  1. Types
  2. Gas concentrations
- Fire suppression

### **IV. Basic Math**

- Solids calculations
- Relation of solids content to moisture content

### **V. Management**

- Elements of a safety program
- Record keeping
  1. Manual
  2. Computerized
- Handling emergency situations
- Using past trends to predict future
- Public relations
- Telemetry and supervisory control and data acquisition (SCADA) systems

### **VI. Basic Operation and Maintenance**

- Pumps
  1. Routine maintenance programs
  2. Multiple pump applications
- Lubrication
  1. Appropriate lubricants
  2. Schedules
- Advanced electrical
  1. Power Factors
  2. Demand rates
  3. Energy efficiency

### **VII. Treatment**

- Pretreatment
- Flow measurement
- Secondary treatment
  1. Trickling filters
    - a. Nitrification

- b. Optimizing treatment
2. Rotating biological contactors (RBCs)
  - a. Nitrification
  - b. Routine maintenance items
3. Activated Sludge
  - a. Nitrification/denitrification
  - b. Aeration basin/clarifier relationship
  - c. Filament control
  - d. Environmental effects on performance
4. Nitrogen reduction and phosphorus reduction
5. Secondary clarified
  - a. Denitrification
  - b. Baffling
6. Sludge handling
  - a. Treatment for pathogen control
  - b. Land application
    - i. Health concerns
    - ii. Environmental concerns

#### **VIII. Disinfection**

- Chlorination
- Dechlorination
- Ultraviolet disinfection