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Date prepared: October 2013
C&GE Approved: March 10, 2014
Board Approved: April 9, 2014
Semester Effective: Fall 2014
Text Update: June 12, 2014

Water Technology (WTER) 1610 - Introductory Water Treatment (3)

Advisory: Eligibility for Math 1060 and English 1500 strongly recommended

Total Hours: 48 hours lecture

Catalog Description: This course provides a comprehensive introduction to water and related treatment systems for water treatment operators at treatment plant operator apprenticeship levels and those desiring to secure employment as a water treatment operator. This course also covers key concepts and terms in topic areas including treatment processes, sources of supply, pre-treatment, water treatment math, disinfection, filtration, coagulation and flocculation, basic chemistry, pumps, meters, and instrumentation. The essentials of water mathematics are introduced throughout the course to increase skills necessary for using formulas and conversion factors on the job. Field trips will be required.

This course enhances professional development and reviews the necessary range-of-knowledge subjects tested by the California Department of Public Health Grades T1 and T2 exams for water treatment.

Type of Class/Course: Degree Credit

Text: Kerri, Kenneth. *Water Treatment Plant Operation, Vol 1*. 6th ed. Sacramento: Sacramento University Enterprises, 2008. Print.

Recommended Reading: trade journals

Course Objectives:

By the end of the course a successful student will be able to:

1. Demonstrate knowledge of basic competencies for water treatment operation at the apprenticeship level.
 - a. Describe the end-to-end water treatment process.
 - b. Outline major tasks at the apprenticeship level in the water treatment process.
 - c. Explain the roles and responsibilities of a water treatment operator.
2. Define key water terminology as they relate to all major topic areas covered.
3. Demonstrate competence in basic level water mathematics.

Course Scope and Content:

Unit I Introduction, Public Water Systems, and Sources of Supply

- A. Classification and Types of Public Water Systems
- B. Groundwater vs. Surface Water
 - a. Characteristics
 - b. Pros and Cons
 - c. Regulatory Compliance Issues
 - d. Availability
 - e. Treatment Requirements
 - f. Geologic Formations
 - g. Stratification Effects
 - h. Well Construction
 - i. Wellhead Treatment
 - j. Terms
 - k. Iron and Manganese Issues
 - l. Hardness
 - m. Eutrophication
- C. Hydrologic Cycle
- D. Reservoir Management
- E. Watershed Management
 - a. Watershed Sanitary Surveys (WSS)
 - b. Source Water Assessment Program (SWAP)
 - c. Sources of Pollution

Unit II Basic Chemistry

- A. Water Measurements
- B. The Water Molecule
- C. Elements and Compounds
- D. Laboratory Glassware
- E. Determining Molecular Weight
- F. Potable vs. Palatable
- G. Odors and Threshold Odor Number (T.O.N.)
- H. Adsorption
- I. Color
- J. Ion Exchange (IX)
- K. pH and Alkalinity
- L. Significance of Changes in pH and Alkalinity
- M. Inorganic and Organic Compounds
- N. Solution, Concentrations, and Precipitation

Unit III Pre-treatment, Coagulation, Flocculation, and Sedimentation

- A. Screens
- B. Aeration and Pre-oxidation
- C. Coagulation Process
- D. Common Coagulants and Coagulant Aids
- E. Common Basin Design and Configurations
- F. Feed Facilities

- G. Flocculation Process
- H. Sedimentation Process
- I. Weir Overflow Rate
- J. Turbidity
- K. Operations and Maintenance
- L. Safety
- M. Jar Tests
- N. Water Math

Unit IV Disinfection and Filtration

- A. Purpose and Types
- B. Characteristics of Chlorine and Alternative Disinfectants
- C. Chlorine Demand, Storage, and Feeding
- D. Chloramines
- E. Safety Requirements
- F. Detection of Chlorine Leaks
- G. Pre-Chlorination
- H. Breakpoint
- I. Residual Measurement Methods and Reagents
- J. Regulations Requiring the Application of Disinfectants
- K. Filtration Processes
- L. Filter Load Rates
- M. Filter Backwash Rates
- N. Granular Bed Operation and Optimization
- O. Head Loss
- P. Backwash

Unit V Water Quality, Sampling, Laboratory Analyses, and Instrumentation

- A. Regulations and Regulatory History
 - a. Federal and State
 - b. US/EPA Safe Drinking Water Act
 - c. CDPH/DWP Title 22
- A. Parameters:
 - a. Microbiological
 - b. Inorganic
 - c. Organic
 - d. Radiological
 - e. General Mineral
 - f. General Physical
- B. Sample Collection
- C. Waterborne Diseases
- D. Coliform Group
- E. Oxygen Starvation
- F. Bacteria, Viruses, and Protozoan
- G. Methods of Measuring Microbiological Quality
- H. Process Control Equipment

Unit VI Pumps, System Operation, and Storage Facilities

- A. Pump Types and Characteristics
- B. Static and Dynamic Head
- C. Metering Pump Calibrations
- D. Pumps and Water Pressure
- E. Distribution Pipe Systems
- F. Water Storage Facilities
- G. Hazards Including Cross Connections

Unit VII Membrane Systems, Softening, Adsorption, and Miscellaneous Processes

- A. Types of Membrane Filters and their Applications
- B. Nitrate, Iron, and Manganese Removal
- C. Corrosion Control
- D. Taste and Odors
- E. Water Softening
- F. Activated Carbon and Adsorption Processes
- G. Fluoridation
- H. Safety Precautions
- I. Reverse Osmosis

Unit VIII Regulatory Requirements and Safety

- A. Record Keeping and Reporting
- B. Safety Regulations
- C. OSHA, First Aid, Confined Space
- D. Laboratory Safety and General Safety

Unit IX Meters, Cross Connection Control (CCC), and Corrosion

- A. Classification and Types of Meters
- B. Applications and Uses of Various Meters
- C. Advantages and Disadvantages of Various Meters
- D. Theory of Operation
- E. Definition of CCC and Backflow (B/F)
- F. Devices and Applications to Protect Against B/F
- G. Legal Requirements
- H. Types of Corrosion
- I. Galvanic Series of Metals
- J. Causes and Remedies
- K. System Issues
- L. Scenario Observations

Unit X Math

- A. Review Basic Principles, Fundamentals, and Mechanics of Math
- B. Common Constants and Conversions
- C. Scientific Notation
- D. Groundwater Depth
- E. Well Yield
- F. Specific Gravity
- G. Detention Time
- H. Flow
- I. Velocity
- J. Surface Area
- K. Volume

- L. Chemical Application
- M. Dosage and Concentration
- N. Chlorine Demand
- O. Pressure and Head
- P. Temperature Conversion (Scales)
- Q. Solution Math
- R. T.O.N. Math
- S. Sludge and Mudball Production
- T. Hardness in mg/L into Grains per Gallon
- U. Hardness as Non-carbonate vs. Carbonate
- V. Running Annual Quarterly Disinfection By-product (TTHM) Average
- W. Determining Jar Testing Reagent Stock Dilutions
- X. Surface Overflow Rate
- Y. Filter Loading Rate
- Z. Filter Backwash Rate

Methods of Instruction:

1. Lecture and discussions
2. Demonstrations
3. Field trip(s)

Methods of Evaluation:

1. Quizzes
2. Exams
3. Written Assignments/Projects
4. Class Participation