Water Quality

Course Overview

This course is designed to provide an overview of water quality regulations, methods of compliance, instrumentation used to monitor and ensure water quality, and the analysis required to supply clean and safe drinking water to the public. Course material consists of reading assignments, video lectures, review questions, study problems and lesson quizzes.

Course completion requires that the student successfully complete each component of each individual lesson. Review questions and written assignments must be submitted either online or uploaded in a Word document for the professor's review. Lesson quizzes have a minimum passing score of 70%.

Upon successful completion of the course requirements, students will receive a certificate of completion for the *Water Quality* course, which is applicable toward a Certificate in Water Treatment Technology from American Water College.

Water Quality (4.1 CEUs)

- Public Water Supply Regulations
- Water Quality Monitoring
- Laboratory Equipment and Instruments
- Microbiological Contaminants
- Physical and Aggregate Properties of Water
- Inorganic Chemicals
- Organic Contaminants
- Radiological Contaminants
- Customer Complaint Investigations

Required Texts

Textbook: Water Distribution Operator Training Handbook
Edition: Fourth Edition
Authors: William C. Lauer
ISBN: 978-1-58321-954-6

Textbook: Water Treatment Operator Training Handbook
Edition: Third Edition
Authors: Nicholas Pizzi and William C. Lauer
ISBN: 978-1-58321-861-7

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Educational Objectives

- To provide an overview of state and federal water quality regulations
- To acquaint students with the instrumentation utilized in maintaining water quality
- To acquaint students with tests and methods of compliance
- To provide an overview of analysis and data monitoring
- To demonstrate the public's reliance on operators to provide clean and safe drinking water

Evaluation

Students will be graded on their performance on each lesson quiz, and their course participation. Unless each unit is completed, the student will not be permitted to advance to the next lesson, and the student will not be awarded credit for completion until all assignments, quizzes and lectures are completed. Please contact our office with any questions.

Support

Students can contact our student support staff with any course-related, content-related, or technology-related inquiries. Our office hours are Monday-Thursday, 9-5 CT, and Friday 9-12 CT.

Contact Info:

Phone Number: (661) 874-1655
Email Inquiries: Info@americanwatercollege.org

Additionally, students are encouraged to contact their professor directly with any questions or comments.

Water Quality

Lesson 1 – Public Water Supply Regulations

Summary of This Lesson

There are both state and federal regulations that govern water quality standards and methods of treatment. The Safe Drinking Water Act is the most widespread and overarching regulation in effect today. This lesson takes a detailed look at the SDWA, other regulations, and the contaminants that are regulated, with their maximum allowable levels.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain why the Safe Drinking Water Act was passed by Congress
- Explain why amendments to the SDWA were passed
- Identify the classes of public water systems covered by the act
- Explain the principle requirements of the act
- Explain special regulation requirements that have been enacted by USEPA

Assignments for This Lesson

- Read Chapter 1 in *Water Treatment Operator Training Handbook*
- Read Chapter 1 in *Water Distribution Operator Training Handbook*
- Watch the video lecture for Lesson 1
- Answer Review Questions
- Complete the quiz for Lesson 1

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Lesson 2 – Water Quality Monitoring

Summary of This Lesson

All water systems must monitor their water quality to some extent; a surface water treatment plant may need more monitoring, while a groundwater system may require less. It is important to monitor water for contaminants and to ensure that the treatment process is both effective and economical.

This lesson covers sampling and monitoring, data and records, and sample preservation and transportation.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the importance of representative sampling
- Explain the way in which grab, and composite samples are collected, and under what circumstances each method is used
- Explain the selection of proper sample volumes
- Identify and explain methods of establishing representative sampling points
- Explain the importance and limitations of sample preservation
- Explain the importance of proper sample labeling and record keeping

Assignments for This Lesson

- Read Chapter 1 (pages 5-10) in *Water Distribution Operator Training Handbook*
- Watch the video lecture for Lesson 2
- Answer Review Questions
- Complete the quiz for Lesson 2

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Lesson 3 – Water Laboratory Equipment and Instruments

Summary of This Lesson

In our last lesson, we covered the importance of monitoring water quality. In this lesson, we will cover the labware and instruments that allow operators to perform monitoring analyses. These analyses are important in identifying, correcting or preventing potential water quality issues, and all operators should understand the lab procedures for those reasons.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify general labware and laboratory equipment
- Identify analytical instruments commonly used in a laboratory
- Identify and explain basic labware and instruments necessary to conduct routine process control tests

Assignments for This Lesson

- No reading assignment for this lesson
- Watch the video lecture for Lesson 3
- Answer Review Questions
- Complete the quiz for Lesson 3

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Lesson 4 – Microbiological Contaminants

Summary of This Lesson

From bacteria and viruses to protozoa, water is prone to pathogenic (disease-causing) organisms. These microbiological pathogens can cause illness, or in some cases death. It's crucial to be aware of the different contaminants, their effect, and the method of treating or removing these contaminants.

This lesson covers the different types of microbiological contaminants, and the common methods of monitoring and removal.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the significance of pathogens in drinking water
- Explain why coliform bacteria are used as an indicator of pathogenic organisms
- Identify and explain the general procedures involved in the commonly used microbiological tests of drinking water
- Explain the important new concepts in the Total Coliform Rule

Assignments for This Lesson

- Read Chapter 12 in *Water Treatment Operator Training Handbook*
- Watch the video lecture for Lesson 4
- Answer Review Questions
- Complete the quiz for Lesson 4

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Lesson 5 – Physical and Aggregate Properties of Water

Summary of This Lesson

The physical makeup of water can affect the treatment process, making chemical or biological contaminants harder to treat. This lesson covers the physical properties of water and how to sample and test the physical characteristics of water.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the significance of the more common physical tests required for public water system operation
- Identify and explain the methods of sampling for physical tests of water
- Identify and explain the methods of performing physical tests of water

Assignments for This Lesson

- Read Chapter 12 in *Water Treatment Operator Training Handbook*
- Watch the video lecture for Lesson 5
- Answer Review Questions
- Complete the quiz for Lesson 5

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Lesson 6 – Inorganic Chemicals

Summary of This Lesson

The USEPA regulates several inorganic compounds in water, including: antimony, asbestos, barium, beryllium, cadmium, chromium, copper, cyanide, fluoride, lead, mercury, nitrate, nitrite, selenium, thallium, arsenic, and others. In this lesson, we will explore the different inorganic contaminants, the significance of its presence in water, and the method of sampling or testing for these contaminants.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the significance of the more important inorganic chemicals of concern in drinking water treatment
- Identify and explain methods of sampling for inorganic chemicals
- Identify and explain methods of analysis for inorganic chemicals

Assignments for This Lesson

- Read Chapter 12 in *Water Treatment Operator Training Handbook*
- Watch the video lecture for Lesson 6
- Answer Review Questions
- Complete the quiz for Lesson 6

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Lesson 7 – Organic Contaminants

Summary of This Lesson

Organic contaminants most often occur in surface water sources as the result of plants or algae growth, and human activities. Organic compounds can also occur as a result of water treatment and transmission. These contaminants can cause treatment issues and serious health problems if not treated properly. This lesson will cover the sources and solutions for organic contaminants.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Identify the basic properties of organic chemicals
- Identify the principal sources of natural and synthetic organic substances in water
- Explain the adverse health effects of organic chemicals
- Explain the methods of measuring the concentration of organic chemicals in water
- Explain the methods of controlling organic chemicals in drinking water

Assignments for This Lesson

- Read Chapter 12 in *Water Treatment Operator Training Handbook*
- Watch the video lecture for Lesson 7
- Answer Review Questions
- Complete the quiz for Lesson 7

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Lesson 8 – Radiological Contaminants

Summary of This Lesson

Our final lesson on contaminants for this course focuses on radiological contamination issues. Natural radioactivity can contaminate water, or it can be the result of industrial or medical sources. The health risks are widespread and potentially life-threatening. This lesson takes an in-depth look at the structure of radioactive particles, the health hazards, and the methods of treating water for radioactivity removal.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the basic theory of radioactive materials
- Identify the radioactive materials of principal concern in drinking water
- Explain the adverse health effects of radioactivity in drinking water
- Explain radionuclide monitoring requirements
- Explain methods of treating water for radioactivity removal

Assignments for This Lesson

- Read Chapter 12 in *Water Treatment Operator Training Handbook*
- Watch the video lecture for Lesson 8
- Answer Review Questions
- Complete the quiz for Lesson 8

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Lesson 9 – Customer Complaint Investigations

Summary of This Lesson

It is important for any water treatment operator to respond to a customer's inquiries or complaints about their water quality. Not only is this an important step in building the public confidence in their water supply, responding to a customer complaint may be an early warning sign of a contaminant issue or water quality problem.

This lesson will explain the differences between taste-and-odor investigations, physical appearance investigations, a laundry and fixture staining investigation, and investigating an alleged illness as a result of poor water quality.

Lesson Objectives

Upon completion of this lesson, students will be able to:

- Explain the general principles of conducting an investigation in response to a customer complaint on water quality
- Explain the general principles of conducting a taste-and-odor complaint investigation
- Explain the general principles of conducting a physical appearance complaint investigation
- Explain the general principles of conducting an investigation of staining on laundry and plumbing fixtures complaint
- Explain the general principles of conducting an alleged illness complaint investigation

Assignments for This Lesson

- Read Chapter 20 – "Public Relations" (pages 329-331) in *Water Distribution Operator Training Handbook*
- Watch the video lecture for Lesson 9
- Answer Review Questions
- Complete the quiz for Lesson 9