



**OCT WATER QUALITY ACADEMY**  
**A US Government Funded Education Contractor**  
**An ANSI/IACET Accredited School Nationwide**  
**Class Description Submittal to OESAC**

Title: **Water Treatment Operations**

**New Class**, or  **Class Renewal**

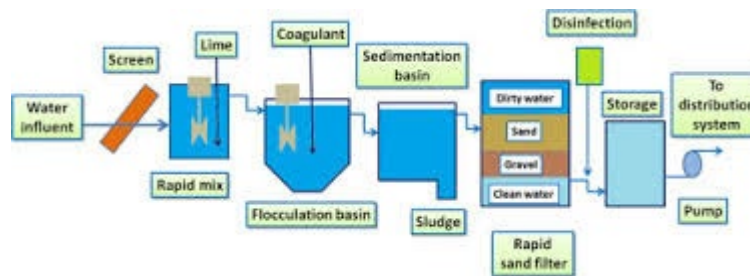
CEU Award requested: **0.7 CEUs**

**OVERVIEW:**

This one (1) -day foundation class is a must attend session for all water treatment operators, **especially entry level operators**. All component plant processes and functions are clearly identified, then described from raw water intake to finished water clear well storage. Surface treatment processes are reviewed beginning with the general vocabulary of the treatment industry, water chemistry, and the various techniques of water treatment.

**CLASS DESCRIPTION:**

This session is designed to provide a basic knowledge foundation about the processes utilized to treat raw water and prepare attendees for the questions and problems they will encounter at work and in a water plant operator certification exam.



**Fig 1. Conventional Water Treatment Plant.**

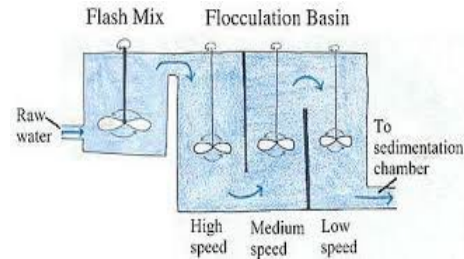
**OUTLINE:**

**Surface Water Plant Operation**

1. **Introduction and Overview:**
  - Goals
  - Groundwater vs. Surface Water
  - Water Treatment Decision Tree
  - Storage

2. **Conventional Surface Water Treatment:**  
 Plant Configuration  
 Surface Water Plant Flow Sheet  
 Application Points for Chemicals  
 Conventional, Direct and Alternative  
 Filtration Configurations.

3. **Flash Mixing of Coagulants:**  
 Clarifying Equipment Components  
 Chemical Oxidants  
 Flash Mixing - Propeller / Motionless  
 Liquid Chemical Feed Pumps  
 Dry Feeders - Gravimetric /Volumetric  
 Color and Turbidity Removal  
 Primary Coagulants  
 Factors Influencing Coagulation  
 Alkalinity Factors  
 Coagulant Dosage - pH Domains



**Fig 2. Plant components.**

4. **Flocculation:**  
 Process Monitoring  
 Guideline and Sampling  
 Proper Floc  
 Floc Identification -  
 Influencing Factors  
 Typical Flocculator Equipment  
 Jar Testing  
 Charged Particles (Cations and Anions)  
 Quiz - Coagulation and Flocculation

5. **Sedimentation:**  
 Theory of Sedimentation  
 Settling Zones  
 Ideal Sedimentation Basins  
 Sedimentation Patterns  
 Overflow Rates  
 Floc Carryover  
 Type of Clarifiers  
 Operational Problems  
 Design Criteria (Alum Floc)  
 Surface Settling Rate  
 Detention Time  
 Weir Overflow Rate  
 Horizontal Velocity  
 Tube Settlers  
 Quiz - Sedimentation



**Fig 3. Sedimentation Tank**

6.

**Filtration:**

- Conventional Surface Water Turbidity Removal Filtration System
- Effluent Turbidity Standards
- Gravity Filter System Components
- Surface Wash Units
- Filtration Theory
- Rapid Sand / Mixed Media Filters
- Filter Media Configurations
- Service Run Vs. Headloss
- Declining Rate Vs. Constant Rate Filtration
- Mixed Media Backwash Rates
- Filtration Rates
- Backwash Rates
- Filter Operation Records
- Filter Problems and Corrective Measures
- Iron and Manganese Removal
- Slow Sand Filters
- Sand Pressure Filters
- Diatomaceous Filters
- Quiz - Filtration



**Fig 3. Filtration Gallery**

7.

**Water Softening:**

- Ion Exchange
- Lime - Soda Ash Softening

**Membrane filtration:**

- Quiz – Membranes



**Fig 4. Water Softening.**

8. **Chemicals.**  
 Aluminum sulphate  
 Polyaluminium Chloride  
 Chlorines

**Appendix:**

Public Water System Definitions  
 Chemical Formulas

**DETAILED SUPPORTING DESCRIPTION:**

The *primary function* of water treatment is to provide drinking water that is Safe from contamination and will not cause waterborne disease. A water supply that is considered safe to drink is called POTABLE.

WATER TREATMENT CHEMICALS	
Chemical	Purpose
Chlorine	Disinfection agent
Sodium Hypochlorite	pH increaser (caustic soda)
Calcium Hypochlorite	pH increaser
Alum (Aluminum Sulfate)	pH control (acidic)
Ferric Chloride	Coagulant & flocculant
Poly Aluminum Chloride (PAC)	Advanced coagulant
Sodium Hydroxide	pH increaser
Hydrochloric Acid	Protect roe acidic
Antisctad Carbon	Removes Organic compounds
Antiscalants (e.g. Polyacrylamides)	Aid in solid-liquid separation

**Fig 5. Wt. Treatment Chemicals.**

A *secondary reason* that water is treated is to remove objectionable materials or possibly change the characteristics of the water source to make it more acceptable to the consumer. Drinking water that “tastes good” and is acceptable to the consumer is called PALATABLE. The major objectives of water treatment are to produce a water supply that is both **potable** and **palatable**.

**Three (3) Basic Characteristics.**

These characteristics of the water source can be broken down into three (3) basic categories: *physical, chemical and biological characteristics*.

**Physical Characteristics:**

The physical characteristics of water include TURBIDITY, color, temperature, taste and odor. These characteristics may not cause the water source to be unsafe to drink, but might still be objectionable to the consumer. Physical characteristics relate to the sensory qualities of water.

**Chemical Characteristics:**

Chemical differences between two (2) water sources include mineral content and the presence or absence of chemical compounds such as calcium, magnesium, iron, fluoride and other naturally occurring compounds. Man-made chemical contaminants including industrial chemicals, pesticides, and other organic chemical must also be removed.

The chemical stability of the water may also need to be controlled. The measure of the BASE or ACID characteristic of water is called pH. ALKALINITY is the naturally occurring buffering capacity of the source water. In Oregon, natural water characteristics or chemical treatment may require pH adjustment to insure a pH neutral or stable product water that will flocculate.

**Biological Characteristics:**

The presence of organisms such as BACTERIA, VIRUS, PROTOZOANS, ALGAE, and others, make up biological characteristics of water. One of the operator's most important roles in water treatment is to deliver water that is free from disease-causing or PATHOGENIC organisms. Adequate chemical treatment and filtration will remove these organisms. Other organisms and their by-products may play a role in modifying both the physical and chemical characteristics of the water.

**A Fourth (4th) Characteristic:**

Radiological factors may have to be considered because there is the possibility that the water may have encountered radioactive substances. This is a somewhat new area for the water treatment process. Maximum permissible concentrations of radioactivity are measured in terms of *alpha and beta particle* activity.

**OBJECTIVES:**

- Students will learn the history of municipal water filtration, key terminology terms, and the multiple step process needed to turn raw water into potable water.
- Students will gain a fundamental knowledge of all the topics listed in the outline above.
- Students will have the opportunity to interact with an experienced instructor to clarify information on municipal filtration where they lack knowledge and understanding.
- Students will be prepared for state operator examinations to increase licensure in their state of residence.

**TIME PRESENTATION OUTLINE:**

<b>Start Time</b>	<b>End Time</b>	<b>Instructional Time</b>	<b>Allotted Break Time</b>	<b>Chapter/Discussion/Quiz</b>
8:00am	8:50am	50 minutes	8:50am–9:00am	Introduction, Water Filtration. Physical, Chemical and Biological characteristics.
9:00am	9:50am	50 minutes	9:50am–10:00am	Conventional Surface Water Plant Configuration.
10:00am	10:50am	50 minutes	10:50am-11:00am	Flash Mixing of Coagulants.
11:00am	12:00pm	60 minutes	12:00pm-12:30pm	Flocculation.
12:30pm	1:20pm	50 minutes	1:20pm-1:30pm	Sedimentation.
1:30pm	2:20pm	50 minutes	2:20pm-2:30pm	Filtration.
2:30pm	3:20pm	50 minutes	3:20pm-3:30pm	Water softening and Membrane Filters.
3:30pm	4:30pm	60 minutes		Chemical formulas.
		<b>420 minutes</b>		

6 sessions of 50 minutes of instruction and 2 sessions of 60 minutes of instruction equals 420 minutes. 420 minutes equates to 7 hours of instruction divided by 10 which is 0.7 CEUs.

END