

Willamette Water Supply System (WWSS) Advanced Waterworks Long School: Transmission Pipeline and Appurtenances

Courses:

- No. 1 - Advanced Air Valve Systems in Water Transmission
- No. 2 - Advanced Large Diameter Butterfly Valve Systems in Water Transmission
- No. 3 - Advanced Blowoff Systems in Water Transmission
- No. 4 - Advanced Management of Steel and Ductile Iron Pipelines in Water Transmission
- No. 5 - Advanced Fundamentals and Applications of Cathodic Protection Systems in Water Transmission

Duration:

- Minimum 20 hours of instruction for Minimum 2.0 CEUs

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Course No. 1 - Advanced Air Valve Systems in Water Transmission

Training Goals:

- Gain an in-depth understanding of fluid and air mechanics relevant to water transmission systems.
- Master the operational principles, maintenance, and construction techniques of air valve systems to optimize water transmission efficiency and reliability.
- Develop skills in instrumentation and control for comprehensive monitoring and troubleshooting of air valve systems across various transmission scenarios.

Course Outline:

Module 1: Principles of Air Valve Systems

- Introduction to air valve systems in water transmission.
- Fluid and air mechanics: States and compressibility, energy dynamics, hydraulic grade line, and momentum.
- Training Goal: Establish foundational knowledge on how air valve systems function within water transmission networks.

Module 2: Air Valve Operations

- Deep dive into the technology behind air valves and their critical functions (air release, fill, vacuum, and surge).
- Analyzing the relationship of air valves to pipeline hydraulics, including surge protection and air lock prevention.
- Specific considerations for finished water pumped systems versus raw water and gravity transmission systems.
- Training Goal: Equip participants with operational expertise for optimizing water system efficiency through proper air valve management.

Module 3: Maintenance Practices for Air Valve Systems

- Comprehensive overview of materials, tools, and standard operating procedures for maintaining air valves.
- Manufacturer recommendations, troubleshooting techniques, and financial considerations for maintenance planning.
- Training Goal: Prepare participants to effectively maintain air valve systems, ensuring longevity and reliability.

Module 4: Construction Techniques for Air Valve Installations

- Detailed examination of materials and construction techniques specific to air valve assemblies.
- Focus on corrosion protection, access vault planning, and ensuring structural integrity through various construction elements.
- Training Goal: Provide the knowledge and skills necessary for the construction of durable, efficient air valve installations.

Module 5: Instrumentation and Control in Air Valve Systems

- Leveraging instrumentation for monitoring potential air impacts within the system.
- Strategies for troubleshooting surge and air lock events and ensuring optimal system performance.
- Application in finished water pump stations, terminal reservoirs, and raw water transmission contexts.
- Training Goal: Use instrumentation and control techniques for comprehensive air system management.

Course No. 2 – Advanced Large Diameter Butterfly Valve Systems in Water Transmission

Training Goals:

- Understand the principles of fluid mechanics and cavitation as they relate to Large Diameter Butterfly Valve Systems.
- Acquire skills in the operation, maintenance, and construction of Large Diameter Butterfly Valve Systems across different water transmission contexts.
- Master the use of instrumentation and control in managing these systems efficiently.

Course Outline:

Module 1: Introduction to Inline Butterfly Valve Systems

- Overview of Large Diameter Butterfly Valve Systems in water supply.
- Training Goal: Introduce participants to the significance of butterfly valves in water management.

Module 2: Fluid and Cavitation Mechanics

- **Submodule 2.1: Using Hydraulic Grade Line**
- **Submodule 2.2: Cavitation Mechanics**
 - Understanding the causes and impacts of cavitation in butterfly valves.
 - Training Goal: Equip participants with knowledge to minimize cavitation and optimize valve performance.

Module 3: Operation of Inline Butterfly Valves

- **Submodule 3.1: Manual Operation**
 - Technology behind butterfly valves, their functions including throttling flow and isolation.
- **Submodule 3.2: Motorized Operation**
 - Actuating versus modulating operations, focusing on functions such as throttling flow, isolation, and seismic responses.
- **Submodule 3.3: Relationship to Pipeline Hydraulics and Water Pump Stations**
 - Analyzing the impact of butterfly valves on pipeline filling, draining, and surge protection.
 - Training Goal: Enable participants to operate and understand the strategic placement and function of butterfly valves in water systems.

Module 4: Maintenance and Construction

- **Submodule 4.1: Maintenance**
 - Detailed guidance on materials, construction techniques, standard operating procedures, and troubleshooting.
- **Submodule 4.2: Construction**
 - Insights into the selection of materials, valve installation, and corrosion protection strategies.
 - Training Goal: Prepare participants for effective maintenance and construction of butterfly valve installations to ensure longevity and efficiency.

Module 5: Instrumentation and Control

- Focusing on the monitoring and troubleshooting of valve issues in the system, specifically seismic considerations.
- Application in different water supply scenarios: Finished Water Pumpstation, Terminal Reservoir, and others.
- Training Goal: Use control systems to monitor and manage Seismic Butterfly Valve Systems effectively.

Module 6: Special Topics in Water Transmission Systems

- **Submodule 6.1: Willamette River Raw Water System**
 - Differences in operation, maintenance, and control in raw water systems.

- **Submodule 6.2: Finished Water Gravity Transmission System**
 - Understanding manual and motorized functions, seismic considerations, and the relationship to pipeline hydraulics.
 - Training Goal: Address specific challenges and strategies in managing butterfly valves in various water transmission systems.

Course No. 3 - Advanced Blowoff Systems in Water Transmission

Training Goals:

- Understand the principles of fluid mechanics and cavitation in relation to blowoff systems.
- Acquire the ability to operate, maintain, and construct blowoff systems effectively.
- Develop the capability to navigate the complexities of permitting, environmental considerations, and inter-jurisdictional coordination for blowoff activities.

Course Outline:

Module 1: Introduction to Blowoff Systems

- Overview of blowoff systems in water transmission.
- Training Goal: Provide an understanding of the role and importance of blowoff systems in maintaining water quality and system integrity.

Module 2: Fluid and Cavitation Mechanics

- **Submodule 2.1: Using Hydraulic Grade Line**
 - Understanding discharges above grade, sumps, and the influence of receiving bodies on hydraulics.
- **Submodule 2.2: Cavitation Mechanics**
 - Examination of pipe static pressure drops to atmospheric conditions.
 - Training Goal: Equip participants with knowledge to prevent cavitation and optimize hydraulic performance in blowoff operations.

Module 3: Operation of Blowoff Systems

- **Submodule 3.1: Draining and Filling Pipe Segments**
 - Techniques for draining including minor and major blowoffs, and considerations for filling, flushing, and de-chlorination.
- **Submodule 3.2: Hydraulics and Valves**
 - Understanding the roles of gravity, sump pumps, and valves in blowoff systems.
- **Submodule 3.3: Permitting and Environmental Considerations**
 - Navigating jurisdictional, environmental, and seasonal considerations for blowoff discharges.
 - Training Goal: Prepare participants for efficient operation and environmental compliance of blowoff systems.

Module 4: Maintenance and Construction

- **Submodule 4.1: Maintenance**
 - Guidelines on materials, construction techniques, and standard operating procedures for effective maintenance.
- **Submodule 4.2: Construction**
 - Insights into the selection of materials, installation techniques, and corrosion protection for blowoff systems.
 - Training Goal: Ensure participants can maintain and construct durable, efficient blowoff systems.

Module 5: Special Considerations for Raw Water Systems

- **Submodule 6.1: Operation and Environmental Compliance**
 - Specific operational strategies for raw water systems and compliance with environmental regulations.
 - Training Goal: Address the unique challenges of managing blowoff systems in raw water transmission.

Course No. 4 – Advanced Management of Steel and Ductile Iron Pipelines in Water Transmission

Training Goals:

- Understand the critical role of lifeline pipes in water transmission and how to set and achieve level of service goals.
- Develop an understanding of the relationship between pipeline materials and seismic resiliency, operational pressures, maintenance needs, and corrosion prevention.
- Gain expertise in the construction techniques specific to steel and ductile iron pipelines, ensuring durability and efficiency.

Course Outline:

Module 1: Introduction to Steel and Ductile Iron Pipeline Systems

- Overview of the use of steel and ductile iron in water transmission.
- Training Goal: Establish a foundational understanding of the materials' properties and their importance in water systems.

Module 2: Lifeline Pipe and Level of Service Goals

- Discussion on defining lifeline pipes and establishing realistic, attainable service goals.
- Training Goal: Equip participants with the ability to set and pursue objectives that enhance system reliability and service quality.

Module 3: Relationships Impacting Pipeline Performance

- **Submodule 3.1: Seismic Resiliency**
 - Strategies for enhancing the seismic resilience of pipeline systems.
- **Submodule 3.2: Pipe Pressures**
 - Understanding operational pressures and their impact on pipeline integrity.
- **Submodule 3.3: Maintenance and Corrosion**
 - Best practices in maintenance and corrosion prevention to extend pipeline lifespan.
 - Training Goal: Develop a comprehensive understanding of the factors affecting pipeline performance and longevity.

Module 4: Construction Techniques for Pipeline Systems

- Detailed exploration of materials and construction techniques, including flexible pipe trench configurations and joint types.
- Training Goal: Provide thorough knowledge on constructing durable and efficient steel and ductile iron pipeline systems.
 - **Flexible Pipe Trench Techniques**
 - Differences between Type I and Type II trenches and their applications.
 - Trench Foundations and Cutoff Walls
 - Shoring and Compaction
 - **Joint Construction and Protection**
 - Overview of lap joint, butt strap joint, and their variations.
 - Shop and field coating and lining practices for joint protection.
 - Welding techniques and materials and considerations
 - **Locating and Monitoring**
 - Strategies for locate station placement and spacing for effective monitoring and maintenance.

Course No. 5 - Advanced Fundamentals and Applications of Cathodic Protection Systems in Water Transmission

Training Goals:

- Understand the principles of corrosion and its prevention, specifically within the context of water transmission systems.
- Learn the detailed process of designing, installing, monitoring, and maintaining cathodic protection systems.
- Acquire practical skills for construction, troubleshooting, and optimizing cathodic protection to ensure the longevity and reliability of water infrastructure.

Course Outline:

Module 1: Introduction to Corrosion and Cathodic Protection

- Background on corrosion, its impacts on water systems, and the basics of cathodic protection.
- Training Goal: Lay the foundational knowledge necessary to understand corrosion and the importance of cathodic protection.

Module 2: Understanding Cathodic Protection

- **Submodule 2.1: Basics of Corrosion**
 - Exploration of corrosion, the galvanic series, and corrosion cell elements.
- **Submodule 2.2: Cathodic Protection Mechanisms**
 - How cathodic protection works, including electrical insulating coatings and the synergy with corrosion protection strategies.
 - Training Goal: Develop a thorough understanding of cathodic protection principles and mechanisms.

Module 3: Protection Features and Monitoring

- Detailed study on cathodic protection features including test stations, anode beds, and monitoring provisions.
- Discussion on specific elements like pipe isolation, electrical isolation of flanges, meters, and valves, and mitigating interference from external sources.
- Training Goal: Equip participants with knowledge on designing and implementing comprehensive cathodic protection features and monitoring systems.

Module 4: Construction and Installation of Cathodic Protection Systems

- **Submodule 4.1: Construction Techniques**
 - Overview of materials, general notes, and equipment installation schedules for cathodic protection systems.
- **Submodule 4.2: Detailed Construction Components**
 - In-depth look at various test stations, terminal boards, anodes, corrosion coupons, and reference electrodes.
 - Training Goal: Provide the skills and knowledge necessary for the construction and installation of effective cathodic protection systems.

Module 5: Cathodic Protection Maintenance and Troubleshooting

- Strategies for maintaining cathodic protection systems, including wire splice repairs, testing, and adjusting protection levels.

- Techniques for troubleshooting common issues and ensuring operator safety, especially in areas with high voltage AC interference.
- Training Goal: Ensure participants can effectively maintain and troubleshoot cathodic protection systems to ensure ongoing protection.