



Water Systems Operations Specialist

Yellow = BSC approved course
Updated 1/4/2021

Water Year 1 Curriculum	
<u>Course Title</u>	<u>Hours</u>
Orientation	3
Introduction to Operator Mathematics	6
EPA/NDDEQ Regulations Review	12
Introduction to the Water Industry	5
Laboratory Basic Procedures and Basic Water Chemistry	10
Chemical, Physical, and Biological Water Impurities	10
Water Equipment Studies	10
Water Plant Collection and Pretreatment Processes	10
Potable Water and Disinfection Processes	10
Maintaining Water Quality in Distribution Systems	6
Security & Emergency Preparation and Source Water Protection	6
Basic Electricity & Electronics	32
CPR/First Aid/AED	5
Valve & Hydrant Maintenance	6
Chemical Feed & Calibration	5
OSHA Safety	32
Total First Year RTI Hours	168
Water Year 2 Curriculum	
<u>Course Title</u>	<u>Hours</u>
Pump and Motor Maintenance	8
Backflow Prevention	5
Line Location and Leak Detection	3
GPS and GIS	8
Non-dissolved Solids Clarification and Filtration Processes	10
Dissolved Solids Chemical Softening and Ion Exchange Processes	10
Instrumentation & Control	10
Water Distribution and Final Treatment Processes	10
Chlorinator Systems & Chemical Handling	10
Corrosion Control Treatment	10
Water Distribution: Distribution Facilities	10
Water Distribution: Disinfection	10
Water Distribution: Operation and Maintenance	10
Water Distribution: Management	10
Small Water System Treatment Plants	10
Utility Management Certification	10
Total Formal Training Hours	144
Total Program RTI	312



Water Systems Operations Specialist

Course Descriptions- Year One Curriculum

Orientation: This session will provide general information to the apprentice about the North Dakota Rural Water Systems Associations Apprenticeship Program including a program overview, what it means to be an apprentice, wage progression, expectations of the apprentice, employment, etc.

Introduction to Operator Mathematics: This session will be an introduction to operator mathematics. The course will start with simple math and is meant to provide a foundation to build greater mathematics understanding.

EPA/NDDEQ Regulations Review: This course is designed to take an entry level water utility employee and introduce them to EPA and NDDEQ drinking water regulations. The Safe Drinking Water Act, the various drinking water rules, MCLs, and other regulations will be covered.

(WATER 200) Introduction to the Water Industry: This course provides an overview of the water treatment program and the water treatment industry. It introduces students to water and wastewater treatment occupations and processes. Students study operator roles, industry requirements, common terminology and basic equipment as well as water use and characteristics.

(WATER 201) Laboratory Basic Procedures and Basic Water Chemistry: Introduction to lab procedures and safety along with the study of chemistry as it applies to the water molecule.

(WATER 202) Chemical, Physical, and Biological Water Impurities: Survey of how the water molecule carries chemical, physical and biological impurities. Measurement, sample collection technique and impurity removal processes are also covered.

(WATER 204) Water Equipment Studies: Introduction to pumps, compressors and auxiliary equipment in plants. Design and operational concepts are covered.

(WATER 206) Water Plant Collection and Pretreatment Processes: This course focuses on groundwater and surface water collection processes including wells and surface collection processes. Pretreatment processes covered include chemical additions, aeration, screening and ponds.

(WATR 212) Potable Water and Disinfection Processes: This course focuses on disinfection processes including all forms of chlorine addition, ozone and ultraviolet light. Potable water regulation and requirements are also covered in depth.

Maintaining Water Quality in Distribution Systems: This course will focus on components of a distribution system, how to monitor and maintain high water quality, how to trouble shoot complaints, identify sources of poor water quality and provide education to customers related to improving water quality in their homes.

Emergency Preparation: This course introduces the National Incident Management System (NIMS) concept. NIMS provides a consistent nationwide template to enable all government, private-sector, and nongovernmental organizations to work together during domestic incidents. This course also introduces Incident Command System (ICS) and provides the foundation for higher level ICS training. It describes the history, features and principles, and organizational structure of the system. This course also explains the relationship between ICS and NIMS.

(MMAT 205) Basic Electricity and Electronics: Covers basic, nonmathematical approach to understanding principles of electricity. Introduces electron theory, static electricity, electrons in motion, and magnetism. Covers basic methods of measuring current, voltage, and resistance.

CPR/First Aid/AED: This course teaches students to take action in a medical emergency and prepares them to respond to choking, breathing and cardiac emergencies. Participants will learn how



NRWA

Water Systems Operations Specialist

to use an automated external defibrillator (AED) in conjunction with CPR. First Aid is taught using a combination of instructor-led lecture, “watch-then-practice” videos, and hands-on training. Topics such as bleeding, burns, poisoning and sudden illness are covered. Course content is applicable for industrial, office, and home settings. Upon completion, receive an Adult 2-year CPR/AED and 2-year First Aid certificate.

Valve & Hydrant Maintenance: The Valve and Hydrant Maintenance course will help operators identify types and locations of valves used in the water/wastewater industry. Included is a brief history of valves and a thorough discussion of different valves and their applications within water and wastewater systems. Types and purposes of hydrants are clearly illustrated with diagrams showing internal and external parts. Hydrant installation, maintenance and operation is well covered. Additional topics include planning and scheduling maintenance work, maintenance budgeting and cost control, installation, location, preventative maintenance, inspection, hand tools, and safety.

Chemical Feed & Calibration: This course will focus on the basics of how to calibrate dry feed chemical hoppers and liquid chemical feed pumps. Participants will also receive free excel spreadsheets that will create actual calibration curves and prediction software that will allow the user to maintain chemical dosages in order to keep the plant running while calibrating a liquid chemical feed pump.

OSHA Safety: This course is a comprehensive safety program designed for anyone involved in general industry. Specifically devised for safety directors, foremen and field supervisors; the program provides complete information on OSHA compliance issues.



Water Systems Operations Specialist

Year 2 Curriculum

(WATER 218) Pump and Motor Maintenance: This course contains information on developing a maintenance program, electric motors and motor controls, centrifugal pump mechanics and hydraulics, lubrication and bearings, compression packing, mechanical seals, positive displacement pumps and other types of pumps, and safety around pumps and motors.

Backflow Prevention: This course begins with a definition of backflow and a discussion of how it can occur. The course primarily focuses on Cross Connection Control regulations, plumbing codes, hydraulics and hazards of backflow, examples of backflow incidents, and backflow prevention devices.

Line Location and Leak Detection: This session will cover the tools and techniques for locating underground utilities. Discussions will include the proper use of tracer wire and use of the various types of locating equipment. Leak detection training will focus on the stepwise methodical steps needed to maximize the ability to find leaks, also covered will be discussions on how to have an effective water loss management program.

APP 190 GPS and GIS: This session will cover the roles that the Global Positioning System and Geographic Information Systems play in modern water utilities. Students will learn the definitions of GPS and GIS, the difference between the two, and the benefits of these technologies to their utilities. Topics covered will include mapping utility assets, using GIS and mobile devices in everyday tasks, and asset management using GPS and GIS.

(WATER 208) Non-dissolved Solids Clarification and Filtration Processes: This course focuses on the removal of non-dissolved solids measured as turbidity. Processes covered include settling basins, clarification, and filters.

(WATER 210) Dissolved Solids Chemical Softening and Ion Exchange Processes: This course focuses on the addition of lime to clarification processes, advanced filtration, reverse osmosis, sodium based softening and high purity ion exchange processes.

(WATR 220) Instrumentation and Control: This course focuses on a study of instrumentation components, control theory, control systems, controllers and SCADA associated with the operation of a facility.

(WATER 214) Water Distribution & Final Treatment Processes: This course focuses on final water treatment processes for potable water. In addition, distribution concepts and equipment including trenching safety are surveyed.

Chlorinator Systems & Chemical Handling: Course covers the properties of chlorine, its purpose in the public water system, terminology, dosage calculations, cylinders, maintenance, and troubleshooting common problems.

Corrosion Control Treatment: This course will focus on the basics of corrosion control treatment optimization and provide the latest information on how to assess your system and avoid these unintended exceedances.

Water Distribution: Distribution Facilities: This course teaches operators how to identify different types of storage facilities, pipes, joints, meters, and backflow prevention devices. Operators learn how to identify suitable locations for facilities, inspect storage facilities, and take a storage facility out of service and return it to service. Discussions include storage facilities O&M and selecting and applying protective coatings. Operators learn about collecting samples from a storage facility, protecting equipment from corrosion, and maintaining records. Also discussed are the purpose of a water distribution system, distribution system storage, and pumping facilities; and the importance of hydraulics. Operators learn about safe and proper ways to install pipe and backflow protection devices. Surge control in pipelines carrying liquids is also discussed.



NRWA

Water Systems Operations Specialist

Water Distribution: Disinfection: Operators taking this course will learn to identify various types of contaminants and contamination sources, and to identify and correct causes of water quality degradation in water mains and storage facilities. Operators will also study how to disinfect new and existing wells, pumps, mains, and storage facilities; calculate chlorine dosage; operate and maintain hypochlorinators and chlorinators; troubleshoot chlorination systems; and conduct a chlorine safety program.

Water Distribution: Operation and Maintenance: This course teaches operators to develop and conduct a water distribution system surveillance program, a water quality monitoring program, and a cross-connection control program. Operators will learn how to locate and repair buried pipes and leaks, make pipe connections, flush and clean pipes, thaw frozen pipes and hydrants, test and read meters, disinfect mains and storage facilities, and conduct effective recordkeeping. In addition, operators completing this course should also be able to respond to emergencies, deal with the public, perform landscape maintenance around facilities, and safely operate and maintain a water distribution system.

Water Distribution: Management: This course teaches operators to perform the following administration functions: emergency planning, construct an organizational chart, write a job description and interview questions, and conduct employee evaluations. Through this course, operators will learn how to provide equal and fair treatment to all employees, conduct effective communication within the organization, assess and plan for financial strength of the distribution system, set up a safety program, and maintain effective distribution system record management.

Small Water System Treatment Plants: This course teaches operators about treatment requirements and methods for surface water and groundwater; the coagulation, flocculation, sedimentation, filtration, and disinfection treatment processes for a surface water treatment plant; and how to create a corrosion control program to protect treatment and distribution infrastructure. Operators will also learn about solids-contact clarification and slow sand filter systems; iron and manganese removal and water softening processes to treat groundwater; and setting up effective maintenance and safety programs for a small water system.

Utility Management Certification: Water University's Utility Management Certification is the first certification to recognize an individual's knowledge and ability in management of a water or wastewater utility. The UMC has become a standard for recognizing management expertise and advancement potential.



Water Systems Operations Specialist

Program Costs:

Course #	Course Title	Hours	NDRWA rate \$20
WATER 200	Introduction to the Water Industry	5	\$200.00
WATER 201	Laboratory Basic Procedures and Basic Water Chemistry	10	\$200.00
WATER 202	Chemical, Physical, and Biological Water Impurities	10	\$200.00
WATER 204	Water Equipment Studies	10	\$200.00
WATER 206	Water Plant Collection and Pretreatment Processes	10	\$200.00
WATER 208	Non-dissolved Solids Clarification and Filtration Processes	10	\$200.00
WATER 210	Dissolved Solids Chemical Softening and Ion Exchange Processes	10	\$200.00
WATER 212	Potable Water and Disinfection Processes	10	\$200.00
WATER 214	Water Distribution & Final Treatment Processes	10	\$200.00
WATER 218	Pump & Motor Maintenance	10	\$200.00
WATER 220	Instrumentation and Control	10	\$200.00
APP 190	GPS and GIS	8	\$200.00
MMAT 205	Basic Electricity and Electronics	32	\$400.00
	Estimated Textbook Costs		\$100.00
	Total Cost:		\$2,900.00