Appendix R

AGRICULTURE, FOOD AND NATURAL RESOURCES (AFNR)
YOUTH APPRENTICESHIP

ENVIRONMENTAL SYSTEMS PATHWAY
BASIC WATER RESOURCES UNIT
UNIT 10
## Basic Water Resources Unit- REQUIRED FIRST

<table>
<thead>
<tr>
<th>Competency (Work Tasks)</th>
<th>Performance Standards</th>
<th>Learning Objectives</th>
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</thead>
</table>
| **1. Apply water industry knowledge** | • Use water terms correctly  
  • Follow all safety and security rules  
  • Manage all hazards correctly (mechanical, electrical, chemical, etc.)  
  • Apply basic principles of water quality management, chemistry, and physics as indicated in job functions | • Explain the natural water cycle  
  • Define common water industry terms  
  • Classify water sources- surface water, groundwater, watersheds, wastewater types, etc.-  
  • Evaluate characteristics of source water- normal, abnormal, compliance, watershed protection  
  • Compare different industries in water resources and management  
  • Describe characteristics of wastewater (residential and industrial)  
  • Outline basic processes for treating drinking water, industry use (food, medical) water, and wastewater treatment  
  • Describe water use, processes, and conservation historically and today  
  • Define effluent  
  • Explain the purpose of ponds and lagoons in water treatment  
  • Identify basic electrical, mechanical, and hydraulic principles  
  • Discuss basic environmental water regulations such as the Clean Water Act, Wisconsin Department of Natural Resources Administrative codes for wastewater, storm water, drinking water, Wisconsin Pollutant Discharge Elimination System (WPDES) discharge permitting  
  • Describe “green” urban and infrastructure planning and how it relates to wastewater management of run-off | |

### TREATMENT & OPERATIONS

| 2. Read technical drawings & work orders | Review technical drawing as needed for operational tasks  
  • Identify symbols and meaning on technical drawings  
  • Plan work from work orders | Explain the need for technical drawings, also known as blueprints, schematics, or engineering drawings in water treatment facilities or job functions  
  • Identify terminology related to technical drawings |
### 3. Monitor operating conditions, meters & gauges
- Identify and monitor the system control instruments
- Operate flow measuring device to monitor the flow of water
  - **Collect operational data**
- Monitor and respond to alarm systems according to protocol
- Document conditions, readings, and any actions taken
- Discuss common preliminary treatment processes
- Compare pre-, primary-, secondary, tertiary, and post treatment for water quality
- Describe the flow of water and its monitoring from point of entrance to exit in your facility
- Compare flow measurement devices
- Explain the use of pumps, cross connections, backflow methods, and devices/valves in water flow through a treatment facility

### 4. Collect operational data
- View and obtain operational data at prescribed intervals
  - **Collect and store samples** for testing
- Download data from meters and data-loggers into computer system databases
- Perform physical measurements and process control calculations
- Report any abnormal conditions to worksite professional as required
- Identify the basic components of a treatment strategy
- Explain the water quality requirements for both your water supply and treatment
- Differentiate between normal and abnormal operating conditions

### 5. Use operations software (SCADA, PLC, GIS/GPS, DBs)
- Obtain and use appropriate reference materials
- Access and use appropriate file management to search for appropriate file
- Add, Edit, Verify and Query data
- Use appropriate computer codes, formatting, macros, charts, spreadsheets, etc.
- Verify data prior to entry/storage
- Generate reports as required
- Describe instrumentation and controls used on your facility
- Define Supervisory Control and Data Acquisition (SCADA), Programmable Logic Controller (PLC), Geographic Information/Positioning System (GIS/GPS) and their purpose in a water treatment facility
- Compare GIS and GPS
- Explain the need for probes, controllers, meters and alarms in water resource monitoring
- Explain how data and files are stored and “backed up”
- Describe the purpose of security and identification information within electronic and computer systems

### 6. Adjust basic operating conditions based on readings
- Collect operational data
- Adjust chemical feed rates as allowed
- Adjust flow patterns and rates as allowed
- Collect and store samples for testing as required
- Monitor adjustments to ensure conditions corrected
- List common troubleshooting processes taken in water treatment facilities
- Describe indications and purposes for common adjustments
### 7. Clean & maintain facility, tanks, filter beds, etc.

- Review procedure for cleaning and basic maintenance
- Verify safety considerations prior to task
- Gather supplies and cleaning solutions required
- **Operate tools and equipment safely**
- **Collect and store samples** for testing if required
- Document cleaning and maintenance as required

- Document conditions and actions taken

- Relate housekeeping and facility maintenance to operational quality
- Identify common by-products from water treatment
- List common housekeeping and basic maintenance functions in water treatment
- Explain safety considerations for cleaning
- Explain how to properly use pressurized fire hoses safely

### 8. Treat &/or dispose of solids/sludge/scale

- Review procedure for treatment and/or disposal of waste
- Verify safety considerations prior to task
- Gather supplies and cleaning solutions required
- **Operate tools and equipment safely**
- **Collect and store samples** of solids/sludge/scale and effluent for testing if required
- Report any abnormal conditions to worksite professional as required
- Dispose of waste materials as required
- Document treatment and/or disposal as required
- Prepare draft manifest/disposal documents

- Explain the purpose of treating/monitoring effluent
- Describe how common substances are removed and treated during water treatment such as solids, bacteria, algae, fungi, viruses, minerals, pollutants, and fertilizers
- Define sludge
- Discuss the treatment of biosolids/sludges
- Compare aerobic and anaerobic digesters
- Discuss recycling methods for biosolids/sludge
- Discuss the regulatory requirements for treatment and disposal of wastes- solids/sludge/scale, etc.
- List common methods of sludge disposal
- Discuss water reuse from a waste water treatment plant or other type of facility

### LAB

### 9. Clean & maintain lab equipment

- Rinse items thoroughly, as required, with the appropriate solvent
- Soak glassware and other items in warm aqueous solution of detergent
- Clean items to remove all residual matter
- Rinse and dry items in required manner
- Document cleaning procedure if required
- Return clean glassware and instruments to their proper storage locations

- Identify common glassware, instruments, and reusable testing supplies used in the lab
- Describe the use of common lab glassware and instruments
- Describe proper dish washing technique for chemical glassware

### 10. Collect & store samples

- Review Standard Methods for the Examination of Water and Wastewater manuals and protocols
- Identify equipment and safety requirements to collect samples
- Setup sampling equipment and materials
- Setup field testing equipment, materials, etc. (test kits)
- Identify proper method and container for sample
- Pre-label sample containers or label immediately after

- Compare manual to automatic sampling equipment
- Describe how to collect typical water test samples (samplers, flow meters, water quality sondes, etc.)
- Compare types of samples
- Describe sampling methods such as composite-timed, flow proportional, grab, ultra-clean, etc.
- Identify safety issues with sampling in the field
- Describe field test methods
<table>
<thead>
<tr>
<th></th>
<th>Collection</th>
<th>Preserve chain of custody</th>
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<tbody>
<tr>
<td></td>
<td>Collect sample according to protocol</td>
<td>Explain regulations for confined space work</td>
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<td>Place required amount of sample in container</td>
<td>Identify proper storage and preservation methods</td>
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<td>Store sample as required for test</td>
<td>Identify containers for different tests</td>
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<td><strong>Preserve chain of custody</strong></td>
<td><strong>Define chain of custody</strong></td>
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<td><strong>Plan for sampling and locations prior to task</strong></td>
<td>Explain the purpose and requirements for chain of custody of samples in water treatment testing</td>
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<td><strong>Identify sample with information such as sample person ID, date, time, location, sample number, type of sample (grab vs. composite), type of test conducted/to be conducted, other observations</strong></td>
<td>Point out common sections on chain of custody forms</td>
</tr>
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<td><strong>Label/ID each sample tested or collected</strong></td>
<td>Define what situations constitute a sample is &quot;under custody&quot;</td>
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<td><strong>Complete chain of custody form(s)/records</strong></td>
<td><strong>Identify proper storage and preservation methods</strong></td>
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<td><strong>Affix custody seals as required</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Obtain proper signatures and information when relinquishing custody</strong></td>
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<td>11.</td>
<td><strong>Preserve chain of custody</strong></td>
<td>Define chain of custody</td>
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<tr>
<td>12.</td>
<td><strong>Weigh &amp; measure accurately</strong></td>
<td>Explain the purpose and requirements for chain of custody of samples in water treatment testing</td>
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<td><strong>Perform calculations &amp; conversions</strong></td>
<td>Point out common sections on chain of custody forms</td>
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<td><strong>Review the protocol for accurately using the measuring equipment including safety precautions</strong></td>
<td><strong>Define what situations constitute a sample is &quot;under custody&quot;</strong></td>
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<td><strong>Ensure equipment is usable and current for calibration</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Weigh/measure mass (solids and liquids)</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Weigh/measure volume</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Measure temperature</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Record measurements in appropriate units</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Clean up equipment</strong></td>
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<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Review the appropriate chart or reference materials to make calculations or conversions</strong></td>
<td><strong>Define what situations constitute a sample is &quot;under custody&quot;</strong></td>
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<td><strong>Identify given values</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<tr>
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<td><strong>Identify unknown values</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td><strong>Determine the calculations or conversions and formulas that need to be performed</strong></td>
<td><strong>Define what situations constitute a sample is &quot;under custody&quot;</strong></td>
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<tr>
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<td><strong>Perform calculations or conversions as required</strong></td>
<td><strong>Identify containers for different tests</strong></td>
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<td>o Calculate volumes</td>
<td><strong>Identify containers for different tests</strong></td>
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<td>o Calculate &quot;pounds formula&quot;</td>
<td><strong>Identify containers for different tests</strong></td>
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<td>o Calculate pump rates</td>
<td><strong>Identify containers for different tests</strong></td>
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<td>o Calculate detention times</td>
<td><strong>Identify containers for different tests</strong></td>
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<td>o Calculate percent removal</td>
<td><strong>Identify containers for different tests</strong></td>
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<td>o Convert flow rates</td>
<td><strong>Identify containers for different tests</strong></td>
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<tr>
<td></td>
<td><strong>Verify calculations or conversions with worksite</strong></td>
<td><strong>Define what situations constitute a sample is &quot;under custody&quot;</strong></td>
</tr>
</tbody>
</table>
| 14. Conduct basic lab testing | - Review the testing protocol including safety precautions  
- Select and set-up the correct equipment and supplies  
- Prepare reagents, solutions, and/or buffers  
- Prepare any quality control samples required  
- Locate and identify the sample(s) to be tested  
- Prepare samples for testing according to protocol  
- Test the sample(s) according to protocol  
- Include Quality Control (QC) samples, if applicable  
- Operate lab equipment properly  
- Records results  
- Clean glassware and instruments  
- Segregate, Recycle or Dispose of chemical, biohazardous, or infectious waste according to facility guidelines using Standard Precautions  
- Document testing results  
- Compare routine lab testing to special projects analysis  
- Describe the chemistry of common water tests  
- Describe how to conduct testing for Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), solubility, pH, colloids, H+ concentration, Ammonia Nitrogen (NH3-N), Total Phosphorus (TP), and Total Residue Chlorine (TRC), etc.  
- Define limit of detection (LOD)  
- Discuss common water quality standards  
- Explain common treatment requirements based on test results and permit requirements  
- Describe the proper storage and handling of various chemicals: Inorganic, Organic, acids, chlorinated chemicals, flammable, corrosive  
- Define the common uses of reagents, solutions, and buffers in testing labs  
- Explain how to avoid contaminating reagents during preparation  
- Discuss the requirement for quality control (QC) samples and/or equipment controls in testing  
- Define positive and negative control  
- Explain the procedures for safe handling and disposal of chemical and biological Materials  
- Define the purpose of Standard Precautions  
- Explain how to handle and dispose of laboratory wastes safely |
|---|---|
| 15. Operate tools & equipment safely | - Operate only equipment trained on  
- Choose correct tool or equipment for the task  
- Follow and complete any tool check list  
- Verify tool/equipment is available for use and in working order  
- Verify tool/equipment is current for preventative maintenance and/or calibration  
- Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use  
- Inspect tool/equipment and work area for safety  
- Describe the types and uses of pumps used in water treatment in your facility  
- Describe common water treatment equipment used in aeration, filtering, disinfecting, coagulation, sedimentation, screening, sludge treatment, nutrient removal, etc.  
- Explain the proper use of fire hoses, hydrants, and hose bibs  
- List the various tools and equipment used at your facility |
considerations

- Set up and prepare tool/equipment for safe operation:
  - Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the tool/equipment
  - Operates tool/equipment safely with guarding devices in the manner required for the job task
  - Monitor tool/equipment for safe operation while operating

- Compare tool/equipment performance regularly to optimal equipment operations
  - Follow facility procedures for cleanup and shut down after use
  - Investigate and promptly report abnormal tool/equipment conditions
  - Properly shut down and label any tool/equipment that is not operating as expected
  - Follow Lock Out/Tag Out procedures as applicable
  - Document use as required

- Outline applications of each tool and equipment

- Describe and demonstrate the safety requirements for each tool and equipment

- Describe emergency shutdown procedures for the tool/equipment you will operate

- Explain how to recognize and address malfunctions for the tool/equipment you will operate

- Describe how to recognize wear and tear on equipment components

- List which tools and equipment require safety certification

- Explain Lock Out/Tag Out indications and procedures in your facility

| 16. Monitor pumps & equipment for correct operation | \- Identify the pump and equipment quality measures tracked
- Compare current pump and equipment performance to optimal equipment operations on a regular basis
- Report any noted deviations from expected performance
- Assist worksite professional to investigate abnormal equipment conditions in a timely manner
- Continuously monitor equipment that is corrected to ensure that the corrective action solved the problem
- Document all monitoring activities |
| | \- Discuss pump and water treatment equipment features and performance
- Explain basic hydraulic and pneumatic principles, and lubricant and fluid characteristics
- Describe how trends for malfunctioning equipment might appear in facility records
- List common tools and equipment that must be monitored and maintained
- Define Total Productive Maintenance (TPM)
- Identify the purpose of a control chart
- Identify conditions that require preventive or corrective actions |