Daily Duties of a Drinking Water Operator

Certification Levels and Duty Definitions

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DAILY DUTIES OF A DRINKING WATER OPERATOR: BY CERTIFICATION

Certification Level

	DSS	DSM	DSL	WT1	WT2	WT3	WT4	WT5
Algae Control - Chemicals and Procedures	☐	☐	☐	☐	☐	☐	✓	✓
Asset Management Plan - Cross check plan to make sure all assets and inventory are accounted for.	✓	✓	✓	✓	✓	✓	✓	✓
Check Chlorine Residual (Free/Total)	✓	✓	✓	☐	✓	✓	✓	✓
Chemical Addition - Dosage Calculations and Determination, inventory, and types of chemicals	☐	✓	✓	☐	✓	✓	✓	✓
Cybersecurity - Contact information, plan, familiarity of system inputs and responses.	✓	✓	✓	☐	✓	✓	✓	✓
Complaint Investigation	✓	✓	✓	✓	✓	✓	✓	✓
Corrosion Control - Chemicals, pH, Alkalinity, Langlier Index	✓	✓	✓	✓	✓	✓	✓	✓
Disinfection of Mains	☐	✓	✓	☐	✓	✓	✓	✓
Disinfection of Storage Facilities and Clear Wells - Techniques / Concentrations	☐	✓	✓	✓	✓	✓	✓	✓
Electrical Usage and Concerns – Arc Flash	✓	✓	✓	✓	✓	✓	✓	✓
Ensure Security of Storage Tanks, Wells and Facilities	☐	✓	✓	✓	✓	✓	✓	✓
Flush Mains - Pressure & Volume	✓	✓	✓	☐	☐	☐	☐	☐
Fill Water Softener	✓	✓	✓	✓	✓	✓	✓	✓
Filtration / Filter Bed Maintenance - Documenting Filter Rates, Filter Runs - Backwashing, procedures and issues that may develop	☐	☐	☐	☐	☐	✓	✓	✓
Filtration / Filter Bed Maintenance (Continued) - Turbidity	☐	☐	☐	☐	☐	☐	✓	✓
Fire Protection and Prevention Plan	✓	✓	✓	✓	✓	✓	✓	✓
Geographic Information System (GIS) - Mapping, identifying critical assets, valves, distribution system layouts, and new projects	✓	✓	✓	☐	☐	☐	☐	☐
Hydraulics		✓	✓		✓	✓	✓	✓

Inspect Equipment on a Regular Basis/ Manufacturers Recommendation	✓	✓	✓	✓	✓	✓	✓	✓
Install Fire Hydrants - Equipment, Inspection, and Types,	✓	✓	✓	☐	☐	☐	☐	☐
Install Water Mains - Curb Stops, Materials and their properties, Sizes and Restrictions	✓	✓	✓	☐	☐	☐	☐	☐
Keep a Comprehensive Map of the System	✓	✓	✓	✓	✓	✓	✓	✓
Keep Emergency Contact List Updated	✓	✓	✓	✓	✓	✓	✓	✓
Lab Analysis - Quality Control / Quality Assurance of Lab Equipment and Record Keeping, Chlorine Tests DPD, Sampling - Grab vs. Composite, pH testing, etc.	☐	✓	✓	☐	✓	✓	✓	✓
Lab Analysis - QA / QC - Turbidity, Taste and Odor	☐	☐	☐	☐	☐	☐	✓	✓
Lock-out Tag-out (Electrical Safety)	✓	✓	✓	✓	✓	✓	✓	✓
Log Books - Site Visits, Duties Done, Pressure Gauge / Meter Readings, Water Quality Parameter Testing	✓	✓	✓	✓	✓	✓	✓	✓
Know Safety Practices - Safety Data Sheets (SDS), Personal Protective Equipment (PPE), Shoring vs Dredging, confined space	✓	✓	✓	✓	✓	✓	✓	✓
Maintain System Pressure	✓	✓	✓	☐	☐	☐	☐	☐
Meters and Services - Sizes, Types, Reading Interpretations,	✓	✓	✓	☐	☐	☐	☐	☐
Monitor for Cross Connections	✓	✓	✓	✓	✓	✓	✓	✓
Observe Pump Motors to Detect Unusual Noises, Vibrations or Excessive Heat	☐	☐	✓	☐	☐	✓	✓	✓
Operate Valves for Working Order	✓	✓	✓	☐	☐	☐	☐	☐
Personal Protective Equipment (PPE) - types, usages, and maintaining inventory	✓	✓	✓	✓	✓	✓	✓	✓
Process Samples and Complete Compliance Sampling	✓	✓	✓	✓	✓	✓	✓	✓
Pump - Types and Efficiencies - Flow, Pressure, Practical Lift	☐	✓	✓	☐	✓	✓	✓	✓
Pump Maintenance - Shafts, Bearings, Packing Glands, Wear Rings, Cavitation, Stopping and Starting Procedures	☐	✓	✓	☐	✓	✓	✓	✓
Renew Certification and Obtain CEUs	✓	✓	✓	✓	✓	✓	✓	✓
Safety	✓	✓	✓	✓	✓	✓	✓	✓
SCADA						✓	✓	✓
Succession Plan	✓	✓	✓	✓	✓	✓	✓	✓
Water Storage for Fire Protection Requirement	✓	✓	✓					

DSS: Distribution System Small - Serves a population of 3,300 people or less and has no components other than pressure tanks, or storage tanks; ***OR*** Nontransient Noncommunity (NTNC) public water systems serving a population 500 or fewer utilizing no treatment other than ion exchange or inline filtration.

- Drinking Water Operators who hold this license can only operate DSS's in Indiana.
- Site Visits Required (minimum)
    - Community two (2) daily site visits a week
    - NTNC > 500 people, one (1) daily site visit a week
    - NTNC < 500 People, one (1) daily site visit every 2 weeks

DSM: Distribution System Medium - Serves a population greater than 3,300 and no more than 10,000 people. Have no mechanical means of movement of water other than pressure tanks, storage tanks, or booster pumps to storage tanks. ***OR*** Serve a population of 3,300 people or less and have pumps prior to the entry point to the system (this does not include well pumps) or booster pumps to storage tanks.

- Drinking Water Operators who hold this license can operate any DSM's and DSS's in Indiana.
- Site Visits Required (Minimum)
    - Three (3) Daily Site visits every week

DSL: Distribution System Large - Serves a population greater than 10,000 people ***OR*** serves a population of 10,000 people or less and has booster pumps other than to storage tanks or mechanical devices for movement of water beyond storage.

- Drinking Water Operators who hold this license can operate any Drinking Water Distribution system in Indiana.
- Site Visits Required (Minimum)
    - Five (5) Daily Site visits every week

WT1: Water Treatment 1 – Are community water systems that serve a population of 500 people or less and acquire water from ground water and/or purchased water. These systems may have an ion exchange softening process for cation removal and/or inline filtration device with no chemical treatment.

- Drinking Water Operators who hold this license can operate Water Treatment class WT1
    - They can operate DSS NTNC water system serving 500 or fewer people or
    - A community DSS with a population of 100 or fewer individuals
- Site Visits Required (Minimum)
    - Three (3) Daily Site visits every week

WT2: Water Treatment 2 - Systems that acquire water either from ground water or purchase it from another system. These systems may utilize chemical feed to achieve disinfection, fluoride standardization, water stabilization, and/or have an ion exchange softening process for cation removal and/or have an inline filtration device if the population served is greater than 500 or less than 3,300.

- Drinking Water Operators who hold this license can operate Water Treatment class WT2 and WT1 plants
    - They can operate DSS NTNC water system serving 500 or fewer people or
    - A community DSS with a population of 100 or fewer individuals
- Site Visits Required (Minimum)
    - Five (5) Daily Site visits every week

WT3: Water Treatment 3 – Systems that acquire water from ground water or purchase it from another system. These systems utilize chemical feed, pressure or gravity filtration, ion exchange process and/or inline filtration if the population served is greater than 3,300, lime soda softening, and/or reverse osmosis.

- Drinking Water Operators who hold this license can operate Water Treatment class WT3, WT2, and WT1 plants
    - They can operate DSS NTNC water system serving 500 or fewer people or
    - A community DSS with a population of 100 or fewer individuals
- Site Visits Required (Minimum)
    - Five (5) Daily Site visits every week

WT4: Water Treatment 4 - Serve a population of 10,000 people or less, acquire water from surface water or ground water under the direct influence of surface water

- Drinking Water Operators who hold this license can operate Water Treatment class WT5, WT4, WT2, and WT1 plants
    - They can operate DSS NTNC water system serving 500 or fewer people or
    - A community DSS with a population of 100 or fewer individuals
- Site Visits Required (Minimum)
    - Operator must be on site during water treatment plant operation unless an automated system is in place

WT5: Water Treatment 5 - Serve a population greater than 10,000 people, acquire water from surface water or ground water under the direct influence of surface water

- Drinking Water Operators who hold this license can operate Water Treatment class WT4, WT2, and WT1 plants
    - They can operate DSS NTNC water system serving 500 or fewer people or
    - A community DSS with a population of 100 or fewer individuals
- Site Visits Required (Minimum)
    - Operator must be on site during water treatment plant operation unless an automated system is in place

GLOSSARY OF DUTIES

Algae Control - Reservoirs and lakes that are used as water sources often times contain both free-floating and attached algal growths. When these growths are not removed, taste and odor problems often arise. Algae control can occur either at the source, or during the water treatment process. Copper Sulfate is the most commonly used chemical in treating algae.[1]

Asset Management Plan – A plan that identifies all infrastructure capital assets in order to reduce total costs of running and maintaining a facility in order to continue to provide services to the customer. Various resources can be utilized to aid in making and revising current water system plans. [2]

Backwashing of Pressure or Gravity Filter - Gravity Filters consist of the following substances: single media (sand, anthracite coal, or granular activated carbon); dual media (sand and anthracite coal); multi- or mixed media (sand, anthracite coal and garnet).[3] Pressure filters are similar to these except they are in a completely enclosed and pressurized tank. Once a filter clogs, the operator notices breakthrough, effluent pressure drops, or a specified period of time has passed, filtration is stopped and backwash occurs. Backwashing is the process of reversing the flow of water through the filter media to remove the entrapped solids.[4]

Calibrate Turbidity Meters - Turbidity is a measure of the relative clarity or cloudiness of a water sample. High turbidity reduces the effectiveness of disinfection processes. Turbidity is measured in NTUs (Nephelometric Turbidity Units) by the use of turbidity meters: a strong beam of light passing through water sample, the particles in the water cause the light to be scattered which is measured by a photocell.[5]

Check Chlorine Residual (Free/Total) - Chlorine is used as a disinfectant. Residual chlorine is the concentration of chlorine present in water after the chlorine demand for disinfection has been satisfied. The amount of chlorine injected into the water must be monitored due to chemical reactions the residual creates with iron, manganese, and other taste and odor producing compounds. Residual chlorine in water is measured in two forms: free & total. Free residual chlorine consists of chlorine gas, hypochlorus acid, and hypochlorite; combined residual chlorine consists of chlorine ammonia compounds.[6] Both free and combined chlorine residual make up the total chlorine residual. Water systems are to maintain a free chlorine residual of 0.2 to 0.5 mg/L (4.0 MCL), and a total chlorine residual of 0.5 to 2.0 mg/L (4.0 MCL).[7]

Chemical Addition - Various water treatment plants use processes to address unwanted characteristics. For instance, water softening is done in order to remove high levels of calcium and magnesium.[8] Iron and manganese are oxidized, sometimes with potassium permanganate to avoid the bacteria slimes that form on the inside of pipes when these react with dissolved oxygen in the water.[9] Sodium Fluoride is sometimes added to reduce tooth decay in susceptible populations i.e. fluoridation.[10] Phosphates can be added for iron sequestering and to coat piping to reduce corrosion.

Cleaning of Sedimentation/Backwash Basins - Whether a plant has coagulation, flocculation, clarifiers or gravity filters; sludge will always be a product of water treatment. Sludge contains the remnants of sediment filtered out and byproducts from disinfection and backwashing. Basins that collect this sludge must be cleaned out periodically in order to operate effectively.[11]

Complaint Investigation - Consumer concerns and complaints may indicate problems with treatment or distribution. These complaints are important to look into, as slight changes made in the process may have caused an unforeseen issue somewhere else in the system. In short, gather as much information from the consumer as possible, gather data from recent chemical and pressure tests, and consider potential causes.[12]

Cybersecurity – U.S. Drinking Water systems are infrastructures that can be targeted by online attacks if they are connected to the internet, specifically, their SCADA systems. Cyber-attacks on public water systems can and will interrupt daily functions that may not be limited to malware, stealing company information, and possibly interrupting treatment and valves opening and closing in your system. Be prepared and don't fall victim to online attacks.[13]

Disinfection - Disinfection is the process designed to kill or inactivate most microorganisms in water including essentially all pathogenic bacteria; this is different from sterilization which is complete destruction of all organisms which is not necessary in water treatment.[14] Disinfection of water provides protection against exposure to viruses, bacteria and water-borne illness. There are several ways to disinfect, both physical and chemical processes. Physical means include Ultraviolet rays, heat, and ultrasonic waves. Chemical means include chlorine, iodine, and ozone.[15]

Disinfecting the Storage Tanks and Clear Wells – Appropriate steps must be taken to maintain the integrity of water quality in Storage Tanks and Clear Wells where water can stagnate and sediment may accumulate. Perform routine inspections on your clear wells and storage tanks and follow the guides AWWA has put in place that best works for your system AWWA has whether that may be full storage disinfection, spray disinfection, or the two-step process.[16]

Effective Use of PPE - PPE (Personal Protective Equipment) comes in many forms. Protection of the operator can be done via respiratory protection, clothing, helmets, glasses and water safety. Always know where safety equipment is stored and be sure it is in proper working condition before each use. Use the equipment provided to you at all required times in order to prevent injury.[17]

Electrical Usage – An operator that knows their own electrical usage can prepare for and budget for the costs that is associated with usage of electricity. Operators must have general knowledge of how to operate instruments, know of general electrical hazards, and have a plan put in place for emergencies.[18]

Ensure Security of Storage Tanks, Wells and Facilities - Public access to water facilities and grounds can result in vandalism, injury of trespassers or even accidental or purposeful contamination of water supply. All of these can be avoided if proper security measures are completed. Examples of protection of the water supply include locked fences and gates, locked doors at the treatment plant, routine inspections of well houses for deterioration or forced entry, ladders put away when not in use at elevated storage tanks. Always report any unauthorized or suspicious persons.[19]

Flush Mains - Water pipes that carry finished water through the distribution system are referred to as water mains. Flushing is done in order to remove any impurities or sediments that may have built up in the piping. Deposits that have accumulated may create taste and odor complaints, regular flushing of mains can avoid this.[20] Flushing is done by opening fire hydrants, but should be completed by following specific procedures and planned out ahead of time. Pigging can be done to scour the inside of the pipe to remove build-up. Cameras can be used to inspect the inside of piping.

Fill Water Softener - Various water systems use water softening as a form of treatment. Hard water is the high concentration of calcium and magnesium ions, these are undesirable because they cause problems with soap use, industrial equipment such as boilers and taste complaints.[21] Softening is most commonly achieved by ion exchange. Calcium and magnesium ions are replaced with sodium ions to soften the water. This requires salt to be replenished in the softening tank periodically depending on use. The water level should never be showing above the salt in the tank due to the possibility of the water becoming septic and contaminating the distribution system. There should always be an air gap at the discharge pipe of the softener. Additionally, any salt that is being stored for future use should be kept off the ground/ floor; a good option is to store salt bags on wooden pallets.

Fire Protection and Prevention Plan – Fire protection is a serious matter and should include a plan of action, resources required, and procedures for storing dangerous chemicals on site. A fire protection prevention plan is important to have so that you know the steps to take in order to sequester the fire and/or have the knowledge in the shortest routes to escape. Additionally, there are four different classes of extinguishers, Class A – Class D, and each class are used for a specific purpose. Knowing your inventory, will assist you in deciding which type(s) of extinguishers you will need on site.[22]

Geographic Information System - is a computer program that combines mapping with detailed information about the physical structures within geographic areas. This may include locations regarding: sampling, valves, hydrants, boundaries of the water distribution system, mains and future expansion, and different pressure zones. [23]

Hydraulics and safety – a liquid, whether that may be water or some other form, that is under high pressure, such as hydraulic lifts, water in your distribution system (low pressure, but still hydraulics), hydraulic motors, etc. Typically, mechanical hydraulic systems have over 2000 PSI and have various hazards associated with it. Concerns are burns, bruises, cuts or abrasions, and possible injection of fluids into skin. Safety tips can be found at the below resource. [24]

Inspect Equipment on a Regular Basis/ Manufacturers Recommendation - The upkeep of equipment in both the treatment plant and the distribution system is important. Working with harsh chemicals and powerful machines can lead to dangerous situations. Regular checks for any abnormal operations can sometimes prevent a failure or emergency situations. All equipment should be assigned a maintenance schedule in order to keep track of when it has last been checked.

Install Water Mains - Depending on the age of the water system, water mains may need replaced periodically. Reasons for needing replaced could be corrosion or disruption/breakage from nearby construction. Mains might be made from ductile-iron, steel pipe or PVC pipe. Precautions should be taken during the entire pipe installation process. Water lines must have a vertical distance of 18" above, or a horizontal distance of 10' away from, sewer lines in Indiana.[25] There are alternatives to these standards, but they must be approved.

Keep a Comprehensive Map of the System – A map that provides and overall picture of the entire system is a comprehensive map. The map should include wells, water mains, storage tanks, booster stations, street names, valves, and fire hydrants.[26] The size of mains should be included as well as the flow. Additionally, sampling locations should be marked on the map for reference.[27] Systems may choose to use GPS for indicating these various components.

Keep Emergency Contact List Updated - With every employee change in the company or community, there might be a change of an emergency contact person. Keep up with your emergency contact list to ensure at any moment you know the right people to call in an emergency. The emergency response plan should be updated annually at a minimum.

Keep Storage at Fire Reserve Requirement - An important aspect of distribution system storage is the amount required in the event of a fire within the area covered by the water system. Although the total amount of water used in firefighting is small, the use at a time of emergency can put high demand on a system for a short period of time. Because of this, the demand must always be available.[28]

Know Safety Practices - Safety is a form of preventative maintenance that everyone is responsible for.[29] There are safety protocols for almost every task completed on the job. These should be followed strictly in an effort to prevent accidents from occurring. Common instances to apply safety practices to include: handling of chemicals, confined space work, cranes, power tools, fork lifts, trenching and dredging, fire protection, slip; trips; and falls, and electricity such as arc flash. All work responsibilities should be done considering safety in all aspects.

Lockout/Tagout (Electrical Safety) – OSHA standards that require all equipment that could unexpectedly startup or release stored energy must be locked out and tagged whenever it is being worked on. All individuals working on a machine must have their own representative lock on the machine so that others may know that multiple people or someone is working on the machine in order to prevent premature startups. No one else can remove other individual's locks in order to maintain safety. Tags are used in accordance with the locks in order to identify what a particular person is working on. [30]

Maintain Packing Glands - Centrifugal pumps are commonly used in water treatment and distribution. A key component of centrifugal pumps are wearing rings to plug internal liquid leakage. These rings are removable and replaceable because they regularly wear out. They are replaced to improve pump efficiency. These rings are used in combination with a packing gland. Packing should be replaced regularly depending on use/conditions.[31]

Maintaining Storage Facilities and Clear Wells - Because clear wells and storage facilities are both places where finished water is kept, they need to be monitored for contamination and corrosion. Examples of this include: Paint on the inside or outside of a tank to prevent rusting, air vents must be checks for holes to insure no animals or insects can enter, covers placed on top of clear wells, and cathodes in a tank to reduce corrosion.[32]

Maintain System Pressure - All public water systems must maintain 20 psi or higher. The required working pressure is 25-35 psi. If the pressure ever drops below 20 psi a boil water advisory must be issued, a Special Purpose Total Coliform sample taken, and notify your IDEM field inspector.[33] High Service and Low Service pumps should be regulated to kick on when necessary.

Monitor for Cross Connections - A cross connection is any actual or potential for water to back-siphon into the supply. If there is a loss of pressure in the system or a high use from something such as a fire emergency, there should be no possibilities of back pressure bringing in unwanted substances. Backflow devices and airgaps are the best cross-connection control.[34]

Observe Pump Motors to Detect Unusual Noises, Vibrations or Excessive Heat - Pump motors of all kinds should be monitored for any inconsistencies. A small change could indicate a bigger issue. Pumping rates should be adjusted to maintain pressure and demand. If the motors are overworking, an additional pump may need turned on. Looking, listening, feeling and smelling are all good practices in ensuring motors are operating well and efficiently.[35]

Operate pumps to regulate Flow & Pressure - The following considerations all apply to the variance in demand for water: Time of day, day of the week, season of the year, recent weather conditions, manufacturing demands, and unusual events; i.e. fire or main breaks.[36] Water pressure must be constantly maintained, even at peak demand levels.[37]

Operate Valves for Working Order - Routine valve inspections should be conducted regularly. It is best to know exactly where to go to shut off a valve in the system in the case of an emergency. Opening and closing of a valve is called exercising the valve; this should be done during each inspection. If valves are opened or closed incorrectly, water hammer or cavitation can occur. Specific instruction should be used when operating valves.[38]

Process Samples and Complete Compliance Sampling - Sampling requirements exist for many different compounds. Depending if your water is treated, you may have to sample for chlorine residual, or if you have surface water, for turbidity. Other sampling is referred to as compliance sampling which requires results to be sent to the state government. The most common requirements include: IOCs, SOCs, VOCs, RADs, Nitrate, Lead, Copper, and Total Coliform. Other contaminants may be required to be sampled for as well depending on the type of system, the county the system is located in or previously found contaminants. Each of these required samples are taken at regular interval, varying from daily, monthly, yearly or every three years.

Protect Mains and Storage from Corrosion - Storage tanks and piping are often made from steel which requires corrosion protection. Both raw and finished water have some degree of conductivity depending on the amount of total dissolved solids, which means the inside of water infrastructure needs protected. In cathodic protection, anode rods are connected to the structure containing water. These anodes corrode after a period of time and must be replaced.[39] Soil and air are also corrosive, so the outside of steel infrastructure must be protected as well.

Renew Certification and Obtain CEUs - A significant responsibility of an operator is constant learning through continuing education. In order to maintain an operator license, continuing education credit (CEUs) requirements must be met as well as renewal of certification. CEUs are obtained through attending conferences, online classes or other form of courses that have been certified by the State. Depending on the operator level, varying hours of CEU credit are required annually. All drinking water operators must renew their certification license every 3 years.[40]

SOURCES

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IN-TEXT REFERENCES

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[2] EPA Asset Management Resources for Small Drinking Water systems
[3] CSUS WT v1, 7ed, page 262-263
[4] CSUS v1, 7th ed, page 269
[5] CSUS WT v1, 6th ed, page 220-222
[6] CSUS WT v1 6th ed, page 277-282
[7] 327 IAC 8-2-1 (98) and 8-2.5-3 (a)
[8] CSUS WT v2, 6th ed, page 99
[9] CSUS WT v2, 6th ed, page 7
[10] CSUS WT v1, 6th ed, page 679
[11] CSUS WT v2, 6th ed, page 233-235
[12] CSUS WT v1, 7th ed, page 26
[13] Water Sector Cybersecurity Brief for States

[14] CSUS WT v1, 7th ed, page 326
[15] CSUS WT v1, 7th ed, page 326-333
[16] ANSI/AWWA C652-02 page 4
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[18] CSUS WT v2 6th ed, page 387-396
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[20] CSUS WD 6th ed, page 202
[21] CSUS WT v2 6th ed, page 99-107
[22] CSUS WT v2 6th ed. Page 464 - 466
[23] CSUS WD 6th ed. Pg.241/ 469
[24] Hydraulics and Safety
[25] AWWA WD 2nd ed, page 69-81
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[28] CSUS WD 6th ed, page 74
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[33] IDEM Drinking Water Branch
[34] CSUS WD 6th ed, page179
[35]CSUS WTv1 6th ed, page 465
[36] CSUS WT v1, 7ed, page 15-16
[37] IAC 8-3.4-1 (18)
[38] CSUS WD 6th ed, page 222
[39] CSUS WT v1, 7th ed, page 466-472
[40] IDEM Drinking Water Branch