



The Importance of Laboratory Support in the Implementation of Water Safety Plans

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Water Safety Plans

- Ensure the availability of safe drinking water to consumers by:
 - Minimizing the contamination of source waters;
 - The reduction or removal of contaminants through treatment processes;
 - The prevention of contamination during storage, distribution and handling of the treated drinking water.

Water Safety Plans

- Elements:
 - Describe the Water System
 - Identify Hazards and Hazardous Events
 - Determine and Validate Control Measures
 - Develop Improvement Plan
 - Develop Monitoring Plan for Control Measures
 - Verify Effectiveness of WSP

Underlying assumption: good quality laboratory support.

US EPA Drinking Water Laboratory Certification Program

- For any US laboratory testing water samples for compliance to drinking water regulations.
- Pass annual Performance Testing Samples
- Pass initial on-site audit, verifying compliance to Critical Elements
- Pass on-site audit every 3 years

Manual for the Certification of Laboratories Analyzing Drinking Water

Criteria and
Procedures
Quality Assurance

Fifth Edition

Laboratory Support- Critical Elements

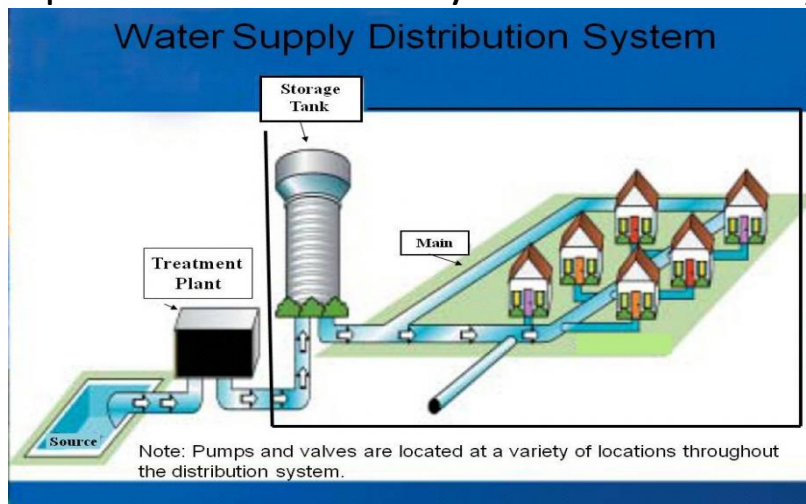
- Personnel
 - Education qualifications
 - Performance testing
- Laboratory Facilities
 - Well maintained, clean
 - Controlled space and climate
 - Presence of required safety hoods
 - Proper waste disposal facilities
- Laboratory Equipment and Supplies
 - Necessary for approved methods
- General Laboratory Practices
 - Use of reagent-grade chemicals and water
 - Glassware cleaning and preparation

Laboratory Support- Critical Elements

- Analytical Methodology
 - Use of approved methods
- Sample Collection, Handling and Preservation
 - Proper containers
 - Proper preservation
 - Holding times
 - Collection procedures
- Quality Assurance and Control
 - Proper standards (weights, thermometers, color standards)
- Records and Data Reporting
 - Maintenance of sampling records
 - Maintenance of analytical records

Laboratory Support- Water Safety Plan Implementation

- WSP Element: Water System Description
 - ***System-specific flow charts enable identification of hazards***
- Lab staff have a role in choosing sampling sites and frequency of sampling.
 - Sampling sites in distribution system should be representative of how water flows and the location of potential contamination sites.
 - Generally, only the number of samples that can be analyzed that same day should be collected.

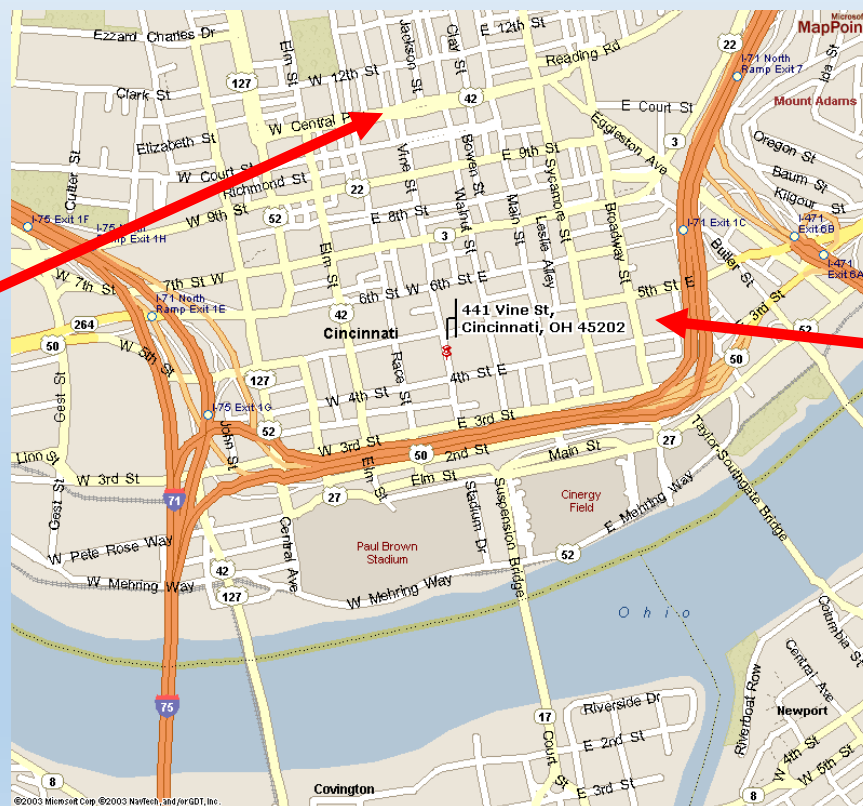


Importance of Sampling Locations

24 inch water main

Low water age

Highest quality water



6 inch water pipe

High water age

Lowest water quality

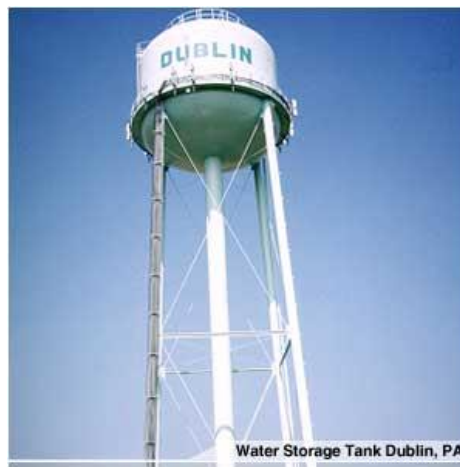
Laboratory Support- Water Safety Plan Implementation

- WSP element: Understanding the Hazards and Threats
 - ***Situations or events that could lead to the presence of a chemical or microbiological hazard.***
 - Lack of proper treatment (catastrophic consequences)
 - Water pipe repair
 - Insufficient chlorination
 - Animal feces in storage reservoirs
 - Wastewater/industrial water cross-connections
 - *Example- if Hazardous Event is inadequate chemical disinfectant dosing, Treatment plant lab staff will need to carefully calibrate and maintain chlorine meters.*
 - *Example- if Hazardous Event is a heavy rain storm in the watershed that supplies source waters, Laboratory Staff will need sensitive/accurate methods to monitor nutrient levels in order to predict harmful algal blooms.*



Laboratory Support- Water Safety Plan Implementation

- WSP element: Control Measures and Priorities
 - ***Actions and activities that prevent or minimize hazard occurrence.***
- Examples:
 - Watershed protection
 - Control of human waste/agricultural waste inputs
 - Water Treatment
 - Coagulation/flocculation
 - Filter maintenance
 - Disinfectant dosing
 - Piped Distribution System
 - Power supply backup
 - Cross-connection control
 - Integrity of storage facilities
 - Disinfectant residual



Laboratory Support- Water Safety Plan Implementation

- Control Measures and Priorities
 - Coagulation/flocculation- reduces organic and pathogen
 - Jar tests- critical for determining ideal coagulants
 - pH- critical parameter
 - Audit checklist for pH measurements:

Are meter scale graduations within 0.1 units?

Are pH buffer aliquots used only once?

Are electrodes maintained properly?

Are pH meters standardized before each use with 2 buffers?

Are both date of use, buffers used, analyst initials recorded?

Is pH slope recorded monthly after calibration?

Are pH buffer solutions dated when received/opened?

Are pH buffer solutions discarded by expiration date?



Laboratory Support- Water Safety Plan Implementation

- Control Measures and Priorities- actions and activities that prevent or minimize hazard occurrence.
 - Piped Distribution System
 - Disinfectant residual
 - Method used is important



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Laboratory Support- Water Safety Plan Implementation

- Control Measures and Priorities- actions and activities that prevent or minimize hazard occurrence.
 - Piped Distribution System
 - Disinfectant residual
 - Method used is important
 - Pool test kits- othotolidine based; only tests for total chlorine
 - Color wheel test kits- DPD based; more accurate if used correctly
 - Digital meters- DPD based; most accurate; standards available



Laboratory Support- Water Safety Plan Implementation

- Control Measures and Priorities- actions and activities that prevent or minimize hazard occurrence.
 - Piped Distribution System
 - Disinfectant residual
 - Method used is important
 - Protocol is important:
 - Is test performed in the field at the sampling site?
 - Is the proper reagent used- total vs free chlorine?
 - Is the blank used correctly?
 - Are the tubes clean before use?



Laboratory Support- Water Safety Plan Implementation

- **WSP Element: Limits and Monitoring**
 - ***Setting/Monitoring of operational limits assess whether control measures are functioning.***
 - Watershed protection
 - Rainfall, turbidity, heavy metals, algal blooms
 - **Example: Pumping rate consistent, indicating water intake functioning**
 - Water treatment processes
 - Turbidity, pH, chemical dosage, flow rate
 - **Example: no Cl- concentration of zero for >10 minutes**
 - Distribution system
 - Turbidity, pH, disinfectant, hydraulic pressure
 - **Example: workers trained in proper pipe repair**
- **Monitoring plan needed**

Laboratory Support- Water Safety Plan Implementation

- **WSP Element: Validation and Verification**
 - ***Establish that WSP is working as intended, i.e to produce safe drinking water.***
 - Treatment plant operates to remove chemical and microbiological contaminants.
 - Algal toxins, pathogens (bacterial, viral, protozoan)
 - Distribution system water quality is preserved.
 - **Absence of *E. coli***

Laboratory Support- Water Safety Plan Implementation

- **WSP Element: Validation and Verification**
 - ***Establish that WSP is working as intended, i.e to produce safe drinking water.***
 - Distribution system water quality is preserved.
 - **Absence of *E. coli***
 - Examples of QA/QC

Are thermometers calibrated annually against a traceable reference thermometer?

Do incubator units maintain temperature specified by methods, 35°C +/- 0.5°C and 44.5°C +/-0.2°C?

Are spore strips or ampules used monthly to confirm autoclave sterilization?

Is the final pH of bacteriological medium checked and recorded?

Is bacteriological medium autoclaved at 121oC for 12-15 minutes?

Is water level in water bath above the upper level of medium in culture tubes?

Is prepared medium stored in the dark and discarded after an appropriate time period?

Was disinfectant neutralizer present in sample bottle prior to sampling?

Summary

- Implementation of a Water Safety Plan can help ensure utilities produce and maintain excellent water quality from source to tap.
- Successful implementation will require excellent laboratory support.



Thanks for your attention

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