



Arkansas Department of Health

Engineering Section, Operator Licensing Program

presents the

Public Water System Compliance Course

TRAINING ID NUMBER

Last 4 Digits of Social Security Number plus First 3 Letters of Last Name

PLEASE PRINT LEGIBLY						
Training ID is Last 4 Digits of Social Security Number + First 3 Letters of Last Name: 1234XXX						
#	Training ID	Last Name	First Name	Mid Initial	System Name	Hrs
1	8362NUT	Nutt	Andrew	M	Arkansas Department of Health	8
2						8
3						8
4						8
5						8
6						8
7						8
8						8
9						8
10						8
11						8
12						8





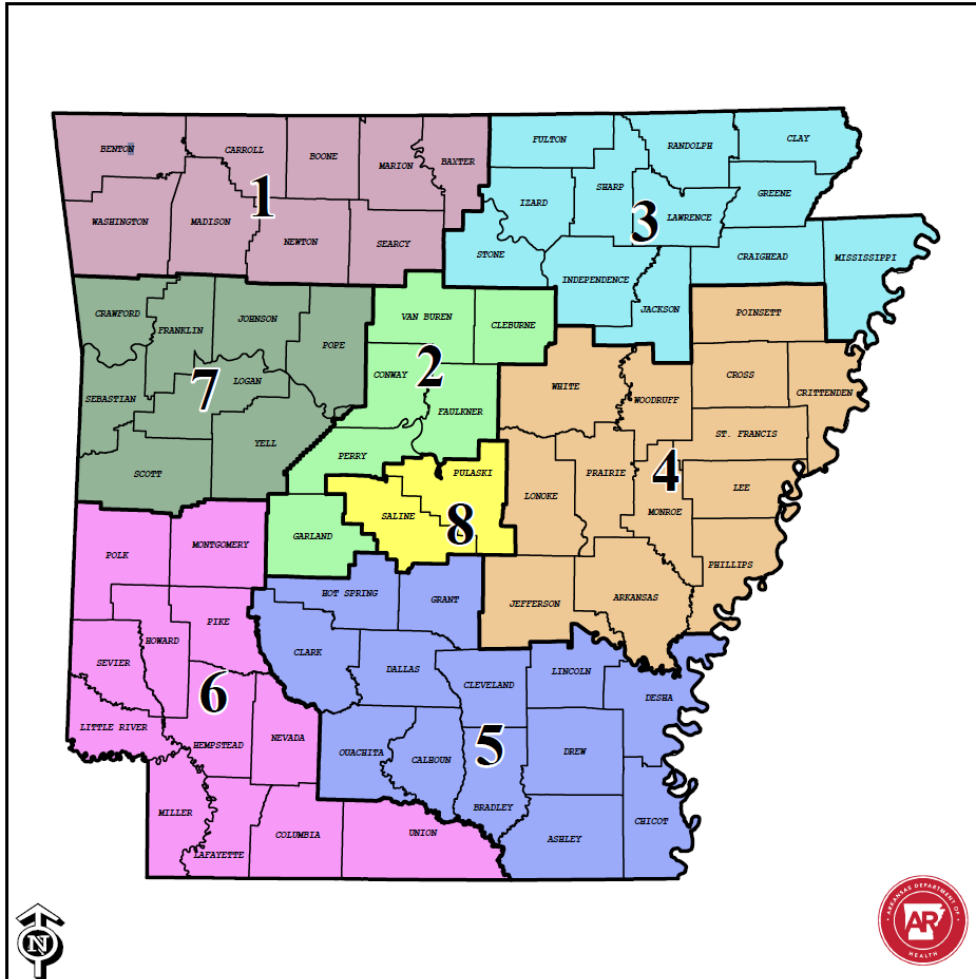
Arkansas Department of Health

Engineering Section Mission Statement

The mission of the Engineering Section is to protect the health of all of Arkansas' citizens and visitors by providing technical assistance, analytical services, training, regulation, and public education for the purpose of ensuring that public water systems provide adequate quantities of safe, palatable water and that community sewerage systems dispose of domestic wastes in a safe manner.

ENGINEERING DISTRICTS

ADH Main Engineering Number 501-661-2623



Engineering Section

Primary Contact

8 Geographical Districts

Each District has:

District Specialist

General Inquiries

Monitoring/Bacti Requirements

Operational/Treatment Reports

Sanitary Surveys

District Engineer

Water System Modifications &

Improvements Plan Review

Sanitary Surveys

Engineer Supervisor



Licensing Program Staff

Water Licensing Program General Email:
Primary e-mail to communicate with any of us.
ADH.Water.Licensing@arkansas.gov

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Compliance Course Agenda Topics

- **Compliance Course Introduction**
- **Disinfection and Fluoridation**
- **PWS Rules**
- **Monitoring and Bacteriological Sampling**
- **Ground Water Rule**
- **Surface Water Treatment Rules**
- **Disinfection By-Products Rule**
- **General Compliance Requirements**
- **Compliance Course Overview/Q & A**



Compliance Course Basics

**Much of this 8 Hour Day will be for both
Treatment and Distribution Examinees**

**Because Treatment Operators are held responsible for
more Federal and State Requirements, Treatment
topics will be given more discussion time.**



Rules and Regulations

The information from today's Compliance Course is based on the Rules Pertaining to Public Water Systems and the Public Water System Compliance Summary

Due to time constraints, not all the Rules or Compliance Summary will be covered. Study the Rules and Summary for items not covered in the presentations.

Exams no longer have specific compliance items, but compliance concepts/methods may be on all exams which may be covered in the presentations.



Purpose & Goal

- **Course Primary Goal**
 - **Prepare Operators to Operate Public Water Systems in Compliance with State and Federal Requirements**
- **Course Primary Purposes**
 - **Preparation AR Water Operator License Exams**
 - **Mandatory Course for License Exam**
 - **Continuing Education for License Renewal**
 - **8 Hours Direct Credit**



Obtaining A License! Where Do You Start?

MAKE APPLICATION (Is This Completed Yet?)

Applications Are Available

EXAM PREPARATION MATERIALS

Can Be Downloaded From The ADH “Obtain A License” Webpage

www.healthy.arkansas.gov/water-license



Water System Operator License Application

APPLICATION FOR WATER SYSTEM OPERATOR LICENSE

ARKANSAS DEPARTMENT OF HEALTH
ENGINEERING SECTION

(Register for Exam: www.healthy.arkansas.gov/water-license)

This application is submitted pursuant to Arkansas Code Annotated 17-51-101 et. seq.). The fully completed application should be filed at least 60 days prior to the desired exam session. All required fees must be included for it to be processed. Each license by exam or reciprocity requires a license fee (\$10.00) and either an exam fee (\$25.00) or reciprocity evaluation fee (\$25.00). This license application does not register you for your license exam.

Qualified applicants with disabilities, as defined in the Rehabilitation Act of 1973 or the Americans with Disabilities Act of 1990 may request any needed reasonable accommodations to participate in the licensing process.

Mail application and make check payable to:

Licensing Office, Slot 29
Arkansas Department of Health
4815 West Markham
Little Rock, Arkansas 72205-3867

Check the fee that has been enclosed:

- License by Examination Fee - \$35.00 for each License (Register for Exam: <http://health.arkansas.gov/eng>)
 - Re-examination Fee - \$25.00 per Exam (save effort, use Exam Fee Invoice provided with failed exam letter)
 - License by Reciprocity Evaluation Fee - \$35.00 for each License
- (Provide a copy of the license & proof it is current for License(s) being submitted for reciprocity evaluation.)

Applying for (circle grade): Treatment License *, Grade I II III IV and/or Distribution License *, Grade VSS I II III IV

Other Water License(s) Held _____

Last Name: _____ First: _____ Middle: _____

Name to appear on License certificate (Print Clearly): _____

Mailing Address for License Info: _____

City: _____ State: _____ Zip Code: _____

Social Security Number: _____ - _____ - _____ Driver's License #: _____

Home Phone # (____) _____ - _____ Cell/Other Phone # (____) _____ - _____ E-Mail: _____

(A) Are you an active duty military service member stationed in the State of Arkansas? Yes _____ or No _____

(B) Are you a returning military veteran applying within one (1) year of discharge from active duty? Yes _____ or No _____

(C) Are you the spouse of a person meeting A above? Yes _____ or No _____ or B above? Yes _____ or No _____

(D) Have you ever pled guilty or nolo contendere or been convicted of a crime? YES _____ NO _____

Criminal History MUST CHECK

If YES, provide the details of the conviction on the back of this page.

For a listing of criminal offenses of concern, please see (internet search) Ark. Code Ann. §17-3-102 et. seq.

Education Background (Must complete):

High School Diploma: Yes _____ No _____ If no, GED earned: Yes _____ No _____ ** Highest grade level completed _____

Name of School Attended: _____ Location _____

List College Degree or Specialized Education Certificates for Evaluation of Experience Credit:

Institution Name & Location	Degree/Course Name	# Yrs Attended	Degree Earned

Apply above degree(s) to: Experience requirement _____ or Mandatory Training Courses _____. See regulations for details.

* Please see enclosed charts to determine which license type and grade your water system job duties require.

** No HS Diploma or GED. Please contact Certification Officer for information on a possible waiver by the Licensing Committee.

FOR ADH OFFICE USE ONLY

Application Rec'd _____
Customer # _____
Pending # P _____ 2nd P _____
Exam Fee _____ License Fee _____
PWS # _____ Eng. Dist. # _____ Water Dist. _____

Employment:

Water System Operated: _____ PWS ID # _____
If you operate additional water systems, please list their system information on back of this page and check this box.

Present Position Title _____ Office Phone # _____ - _____ - _____

Employment Background for Evaluation of Experience Credit Determination: (Be sure to begin with your present employment/job duties and start date. List your water system operation, maintenance and/or management experience and job duties for each specific job duty/position held. Attach additional information, if warranted. This list of experience and the above listed education will be evaluated to determine your compliance with the experience requirement. I understand that a renewable Operator-In-Training wallet card will be issued to me, when the license exam is passed prior to meeting the experience requirement. Incomplete or vague descriptions may delay the issuance of your license.)

FROM: (MM/DD/YY)	TO: (MM/DD/YY)	Employer's Name	Describe All Job Duties Related To License (If Job Duties/Position Changed List Separate)
From: _____	To: Present	EXPERIENCE	BE DETAILED

List additional experience to be considered for credit on the back of this page and check this box.

I, the below signed individual, authorize the release of my employment, education and license records to the Arkansas Department of Health, to the extent necessary to determine my eligibility to obtain a license. I understand my License and Application information, except for my Social Security Number, is available to the public under the Freedom of Information Act. I agree to perform my duties as a Licensed Operator or Operator In Training in accordance with all applicable State and Federal Laws. I understand that failure to do so can result in administrative and/or civil penalties and the loss of my license. I certify that the information in this application is true and complete to the best of my knowledge.

The license or OIT will be valid for the balance of the present two-year renewal period. (Each renewal period ends June 30 of odd numbered years.) A renewal fee of ten dollars (\$10.00) will be charged for each license renewed. In order to renew the certificate or license, I understand I must obtain at least twenty-four (24) hours of approved training for each two-year renewal period. (The first renewal period will be prorated at one hour per month the certificate or license has been held.) Also, I understand that all training must be certified by registering for the training courses attended and providing a written list of this training to the Drinking Water Advisory and Operator Licensing Committee with each renewal period's renewal documents and fee remittance.

Applicant Signature: **YOU MUST SIGN** _____ Date: _____, 20____

Experience Validation & Verification: Must be SIGNED by Owner, Mayor, Board Chair, or System Management Representative. (If this section is not properly signed the application will be denied.)

The above-named license applicant has provided an accurate and complete description of their criminal history, work experience and education to the best of my knowledge. (The license applicant should not sign here.)

Print name: (not applicant) _____ Title: _____

Signature: (not applicant) **BOSS MUST SIGN** _____ Date: _____, 20____

Updated December 21, 2020



Required Mandatory Training

TRAINING HOUR REQUIREMENTS FOR EXAMS										
COURSE NAME	LENGTH	VSS	D-1	D-2	D-3	D-4	T-1	T-2	T-3	T-4
RULES, REGS, COMPLIANCE	8 hr.	X	X	X	X	X	X	X	X	X
BASIC MATH	8 hr.	X	X	X	X	X	X	X	X	X
APPLIED MATH	8 hr.			X	X	X		X	X	X
DISTRIBUTION BASIC	24 hr.	X	X	X	X	X				
DISTRIBUTION INTERMEDIATE	24 hr.			X	X	X				
DISTRIBUTION ADVANCED	24 hr.					X				
TREATMENT BASIC	24 hr.						X	X	X	X
TREATMENT INTERMEDIATE	24 hr.							X	X	X
TREATMENT ADVANCED	24 hr.								X	X
	Total hrs.	40	40	72	72	96	40	72	96	96



Mandatory Training

- **Mandatory Training Courses**

- **No Expiration for Meeting License Exam Requirements**

- **Does Expire For Meeting License Renewal Requirements**

- **Expire End of Renewal Period in which Attended**

- **Can be used to Renew License obtained after Attendance**



Training Class Sources

Treatment, Distribution & Math Courses

- **AR Environmental Academy**
 - **Jeremy Rowe - Instructor**
 - **East Camden, AR**
 - **(870) 574-4562**
 - **<http://www.sautech.edu/aeta/index.aspx>**
 - **E-mail: jrowe@sautech.edu**



Training Class Sources

Treatment, Distribution & Math Courses

AR Rural Water Association (ARWA)

Dennis Sternberg, Exec. Dir.

Lonoke, AR

(501) 676-2255

www.arkansasruralwater.org

E-mail: arkrwa@sbcglobal.net



•Course Options



Classroom – ARWA & AETA
(Arkansas Rural Water Association)
(Arkansas Environmental Training Academy)

Internet – AETA
(Arkansas Environmental Training Academy)



Correspondence Course Substitutions using Exam Reference Manuals –
CSUS-Office of Water Programs
(California State University at Sacramento)

Reference Books

California State University Sacramento (CSUS)

Mandatory Course Curriculum Source

Self Study Course Manuals

Review Questions **Do Not** Follow ABC Item Standard

Many Are Specific to the Book \approx \$200

American Water Works Association (AWWA)

Offers Excellent Additional Knowledge

\approx \$400



Purchasing Reference Books

Water Professionals International

<https://www.gowpi.org/services/abc-testing/examination-resources/>

Arkansas Rural Water Association

<https://arkansasruralwater.org/order-books/>

**Treatment and Distribution manual requirements differ,
some manuals more essential than others**

Manuals Listed In ABC “Needs-To-Know” Criteria

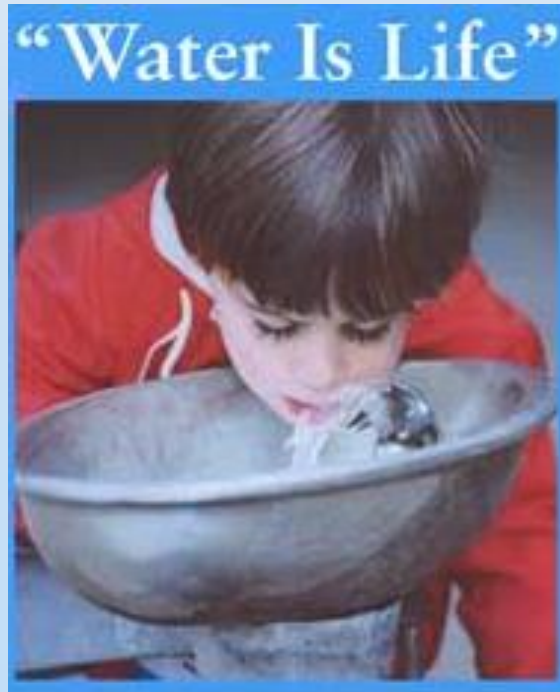
**NTK helps focus on study topics/where to spend study
time**





Arkansas Department of Health

Public Water Systems



History, Chlorination and Public Safety

Why Treat Water?

**Large Percent of Microbial Diseases
Are Waterborne and Preventable With Water Treatment and
Disinfection**



**Many diseases are transmitted through water contaminated with
sewage. Microorganisms that cause illness cannot be seen,
smelled, or tasted**

Waterborne Pathogens

A Pathogen is a bacterium, virus, or other microorganism that can cause disease.

Giardia

Cryptosporidium

Campylobacter

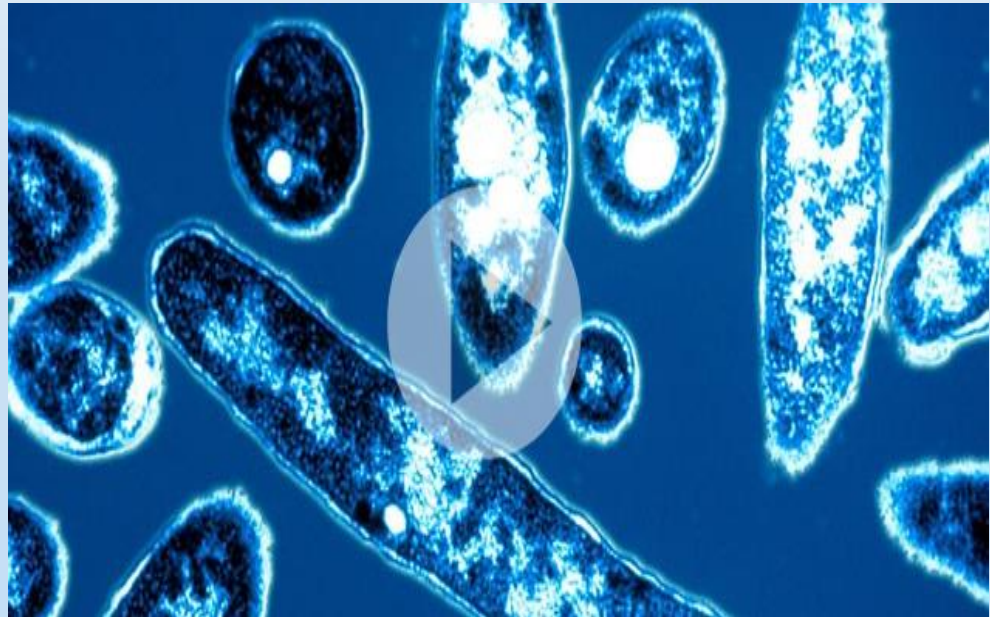
Salmonella

E. coli O157:H7

Cholera

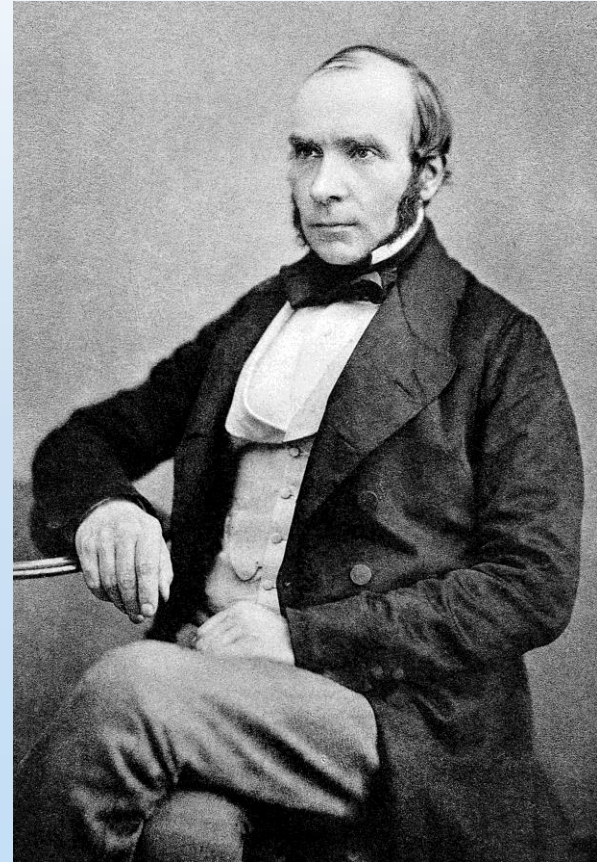
Hepatitis A virus

Legionella



History, Chlorination and Public Safety

- In 1855: epidemiologist Dr. John Snow proved cholera was waterborne disease linked cholera outbreak to public London well contaminated by sewage
- Late 1880s: Louis Pasteur demonstrated the “germ theory” of disease and explains how microscopic organisms transmit disease through water



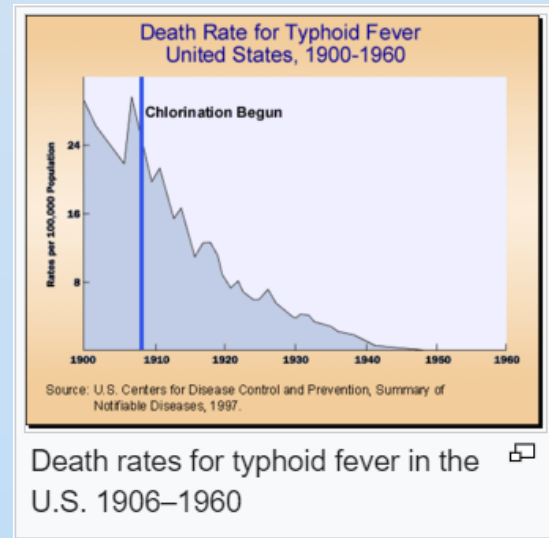
Dr. John Snow

History, Chlorination and Public Safety

- **1890's: 1st use of chlorine disinfectants to water facilities in England**
- **Early 1900s: Disinfectants (chlorine) largest role in reducing waterborne disease outbreaks**
- **1908: Chlorine 1st used as primary disinfectant in Jersey City, NJ**
- **1918: Over 1,000 U.S. cities employ chlorine disinfection. Treatment progressed to improved turbidity removal and other contaminant treatments**

First Chlorination of Drinking Water

- In 1908, George W. Fuller designed and built the first drinking water chlorination system for Jersey City, N.J.
- As drinking water disinfection spread across the nation, the typhoid fever death rate dropped dramatically.
- AWWA's George Warren Fuller Award is named in his honor and recognizes lifetime service to the waterworks profession.



Chlorine Disinfection

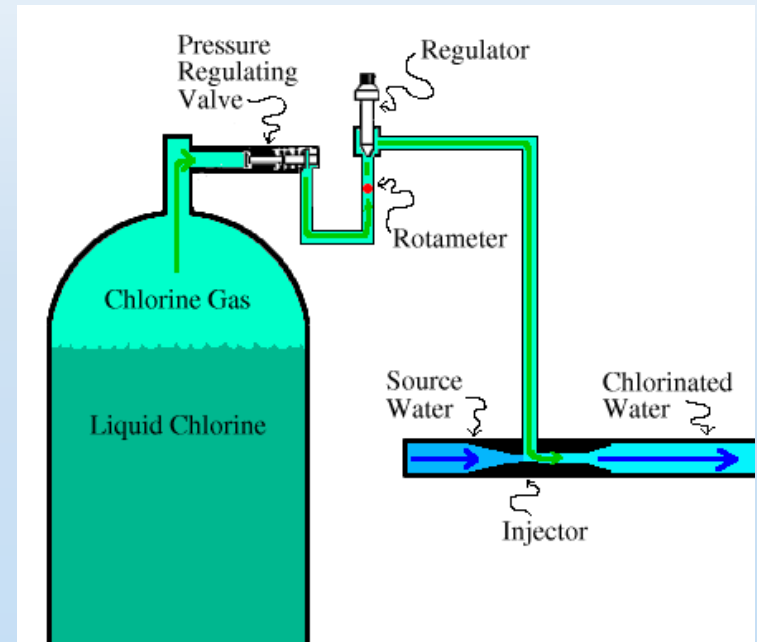
- **Public Water Systems**

- **Arkansas Rules and Regulations require that all water supplied to the public must be disinfected by an approved method.**
- **Chlorination is the most common method of drinking water disinfection because:**
 - **Chlorine is relatively cheap and can be bought in large quantities.**
 - **Chlorine forms a residual that can be used to protect the sanitation of water in tanks and distribution systems.**



Chlorine Disinfection

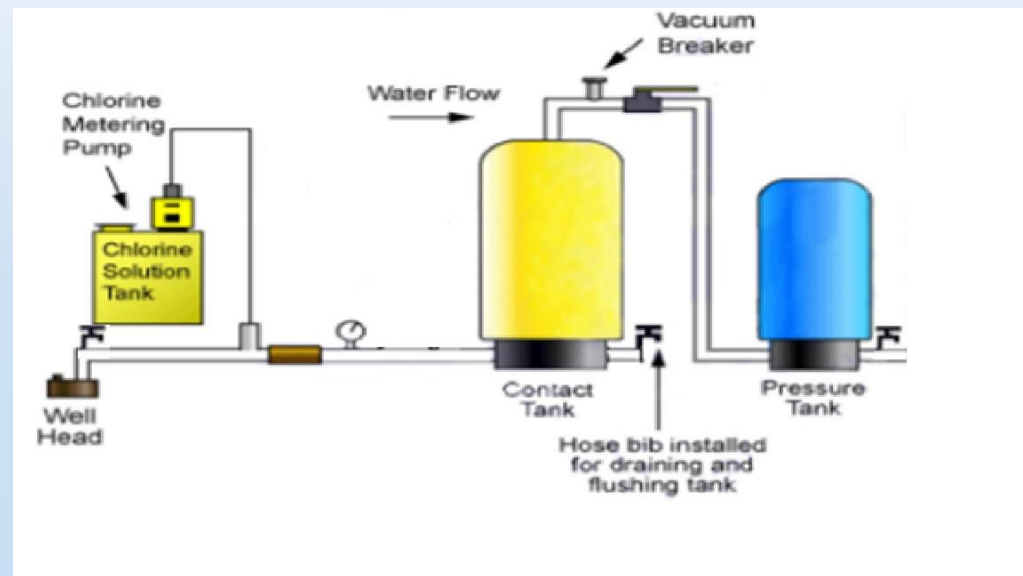
- Chlorine can be fed in the form of chlorine gas, or liquid form (bleach or a calcium hypochlorite solution.)
- Breathing chlorine gas can be fatal and appropriate safety measures and personal protective equipment must be utilized.
- Never underestimate or become complacent about the danger of working with chlorine gas.
- Note: The words injector and ejector are often used interchangeably.



Chlorine Gas Feed System

Chlorine Disinfection

- Chlorine solutions can either be bleach which is purchased as a liquid or a solution of calcium hypochlorite which is mixed onsite.
- The two types of solutions have different chlorine strengths (concentrations) and the solution feed pumps must be selected based on the strength of the solution chosen to be fed.
- If purchasing bleach, always avoid bleach with any other chemicals added such as scenting agents. Must be NSF Standard 61 Certified.



Typical Chlorine Solution Feed System

Benefits of Chlorine



Potent Germicide

Chlorine disinfectants can significantly reduce the level of many disease-causing microorganisms in drinking water

Taste and Odor Control

Chlorine oxidizes many naturally occurring substances such as foul-smelling algae secretions, sulfides and odors from decaying vegetation

Benefits of Chlorine

- **Biological Growth Control**
Chlorine disinfectants reduces the occurrence of slime bacteria, molds and algae that commonly grow in water supply reservoirs, on the walls of water mains and in storage tanks
- **Maintains a Disinfectant Residual**
Protects against secondary contamination in the distribution system. Some other disinfectants do not.



Algae

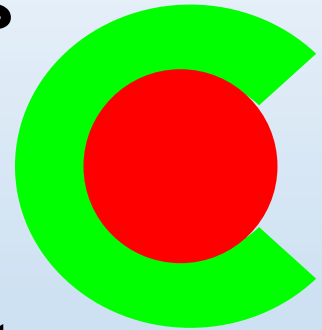
Chlorine Residual

- Chlorine that is not consumed after feeding, by disinfection or oxidation of contaminants, will persist as a chlorine residual and maintain the safety/sanitation of the water in the distribution system.
- Chlorine Dose – Chlorine Demand = Chlorine Residual



Chlorine in Water

- The amount of Chlorine required to bind with all substances is referred to as Chlorine Demand
- How does Chlorine *disinfect*?
- Chlorine combines with impurities to inactivate microorganisms and oxidize organic & inorganic matter



Chlorine in Water

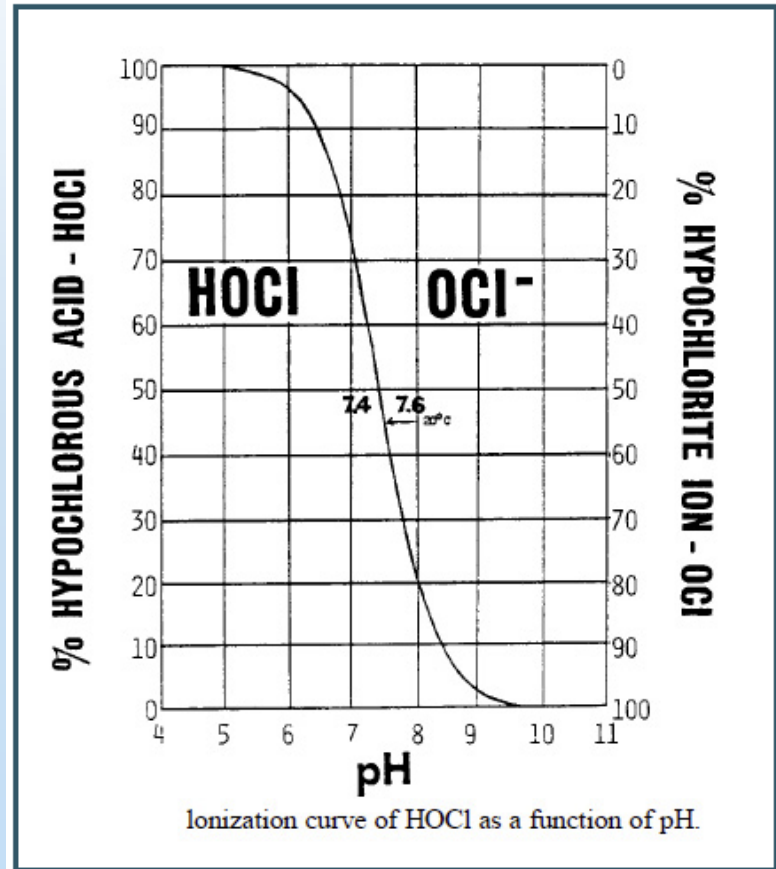
- Where more Chlorine is added to water than what is necessary to combine with contaminants, the Chlorine left over is referred to as

Free Available Chlorine
Hypochlorous acid (HOCl)
Hypochlorite ion (OCl⁻)

- The chlorine in the water still available for disinfection (combined with ammonia or free) constitutes the **Total Chlorine Residual**

Chlorine in Water

- Free Available Chlorine will form either hypochlorous acid (HOCl) or hypochlorite ion (OCl⁻) with the amount of each dependent upon the pH of the water.
- HOCl is a more effective disinfectant and forms more at lower pH. Thus, chlorine disinfection is more effective at a lower pH and less effective at higher pH.



Chlorine in Water

If the amounts of the residuals are the same, Combined Chlorine (chloramine) requires about 100 times more contact time than Free Available Chlorine.

Also, free chlorine will oxidize iron and manganese more quickly if present in the raw water.



Chlorine in Water

- The amount of Chlorine required to combine with contaminants (Chlorine Demand) *plus* the desired amount of chlorine left over (Chlorine Residual) is referred to as the

Chlorine Dose

(Chlorine Demand + Chlorine Residual)

- We monitor Chlorine Residual when taking samples to determine whether the Chlorine Dose is sufficient to protect against secondary contamination in all parts of the distribution system

Chlorine Residual Monitoring



Chlorine Residual Monitoring Various Brands Are Available



Chlorine Test Kit



**Do Not Use Swimming Pool Test Kits
Ortho toline Types Are Not
Approved For Drinking Water
Analysis**

Chlorine Residual Monitoring

The Kit should test for

DPD Free chlorine residual

DPD Combined chlorine residual

DPD Total chlorine residual

Free Cl₂ + Combined Cl₂ = Total Chlorine

**The Kit should
be kept in a safe place
have fresh/in-date chemical
be used daily**



Chlorine Residual Monitoring

- **DPD (N, N-diethyl-p-phenylenediamine) is the current industry standard testing reagent.**
- **The DPD method is more accurate and versatile than the unapproved Orthotolidine (OT) method - Which might be used in some swimming pool kits.**
- **The DPD method accurately measures free, combined, and total chlorine residuals.**
- **DPD method is not the only approved method but is the method most commonly used.**



Chlorine Residual Monitoring

It is Recommended That You:

- ✓ Check Your Residual Daily
- ✓ Keep a record of your residual and provide ADH a copy of the record.

Residual is that which remains after the greater part or quantity of something is gone.



Chlorine Residual Minimum Residual

- Two Places Speak To Minimum Required Residual
- PWS Rules states an “Adequate” residual
- Federal SDWA (Safe Drinking Water Act) & SWTR (Surface Water Treatment Rules) states a “Detectable” amount
- Neither is a definitive level or type residual
- Generally, a residual of at least **0.2 mg/L** free is recommended in the remote points in the distribution system, however some distribution systems require higher residuals to control bacterial growth.



Chlorine Residual

Minimum Residual – Chloramination

- **If combined residual (chloramination) is used:**
 - **Critical to monitor chlorine & ammonia feed rates**
 - **Higher combined residual needed than when using free**
 - **To avoid nitrification 2.5 mg/L mono-chlorine residual**
 - **Summer temps encourage rapid micro-organism growth exceeding mono-chlorine's inactivation rates**

Chloramination Monitoring

- **Systems that chloramine should daily test for:**
 - Free chlorine residual
 - Total chlorine residual
 - Free ammonia residual
 - Monochloramine residual
- **For systems using chloramines:**
 - The free chlorine residual should be near zero (0 mg/L)
 - The total chlorine residual should be near 1.0 mg/L or higher
 - Total chlorine residual should be reported with bacteriological sampling.
- **Free ammonia detected in the distribution system poses a risk of nitrification occurring in the system**

Chlorine Residual Monitoring

- **By maintaining an adequate Chlorine Residual - your water should be safe and bacteriological samples “absent” of coliform bacteria.**
- **Which In turn Keeps The Public Safe.**
- **Maintaining your residual will also help in troubleshooting...if a problem should arise.**



SECONDARY CONTAMINATION

- **Definition: Contamination after Treatment**
- **It Is Why Residuals Are Maintained**
- **Why Bacti's Are Monitored in Dist. System**
- **How does It Happen?**
 - **Poor Repair / Maintenance Procedures**
 - **Cross Connections**
 - **Others?**

Reducing the Risk of Water System and Sample Contamination

- **One Operator for Both Water & Wastewater Treatment Plants**
- **A potential source of waterborne diseases**
- **Make Sure to Utilize**
 - **Disposable gloves**
 - **Protective clothing**
 - **Disinfectant for shoes**



Reducing the Risk

Rules of Thumb

- **Schedule drinking water system maintenance and inspections before wastewater system maintenance and inspections**
- **Use separate equipment and tools or clean thoroughly**
- **Keep a handle on Personal Hygiene**
- **Avoid Taking “work microbes” Home**



Fluoridation of Drinking Water

Fluoridation is the process of adding Fluoride (the water-soluble form of Fluorine) to a substance in order to reduce the occurrence of tooth decay.



Fluoridation - History

- **Fluoridation of drinking water was first introduced in the United States in the 1940s.**
- **The studies leading up to the introduction of fluoridation centered around water supplies with higher levels of naturally occurring fluoride**
- **The populations served by these water supplies showed lower instances of dental caries . . . tooth decay**

Fluoridation - History

1930s



- H. Trendley Dean, DDS (USPHS)
- Studied effects of Fluoride in some 345 U.S. communities
- Determined that a 1 ppm concentration of fluoride in drinking water greatly reduced the occurrence of tooth decay without promoting fluorosis

Fluoridation - History

1940s

- **U.S. Public Health Service endorses fluoridation in U.S. water systems**
- **Recent Studies show 20% to 40% reduction in tooth decay in communities using fluoridated water**
- **Today, approximately 73% of U.S. Water Systems fluoridate their water**

Fluoridation

- **Act 197 of 2011 requires all water systems that serve a total of at least 5,000 persons or more to optimally fluoridate**
- **Delta Dental Foundation is funding PWS required to Fluoridate**
- **Why - Every \$1 invested in water fluoridation saves approximately \$50 in unnecessary dental treatment costs**
- **Any PWS can fluoridate - ADH does support the fluoridation of all Arkansas Drinking Water**



Fluoridation

Fluoride Drinking Water Limits

- **Maximum Contaminant Level (MCL)**

An MCL is the maximum allowable amount of a contaminant in drinking water which is delivered to the consumer .

- **Secondary Maximum Contaminant Level (SMCL)**

SMCLs are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at the SMCL.

Source: www.water.epa.gov



Drinking Water Limits

Maximum Contaminant Level (MCL)

4.0 ppm (4.0 mg/L)

Secondary MCL (SMCL)

2.0 ppm (2.0 mg/L)

AR Drinking Water Optimum Concentration

0.7 ppm (0.7 mg/L)

AR Drinking Water Optimum Range

0.6 mg/L to 1.2 mg/L



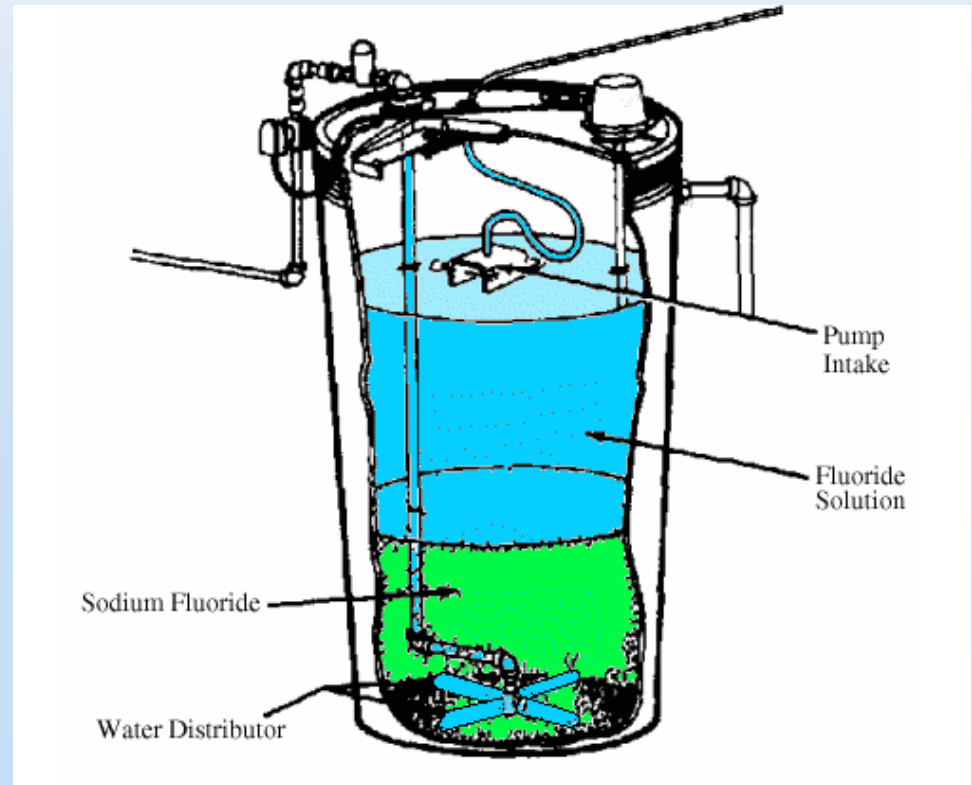
Fluoridation - Monitoring

- **Water systems should monitor and record *daily*:**
 - ***Amount* and *Type* of chemical added**
 - **Total gallons of water treated**
 - **Fluoride Concentration**

Fluoridation Feeders

- For many smaller water systems, a fluoride saturator is a good choice.
- Saturators are commonly used to treat flows up to 1 MGD.

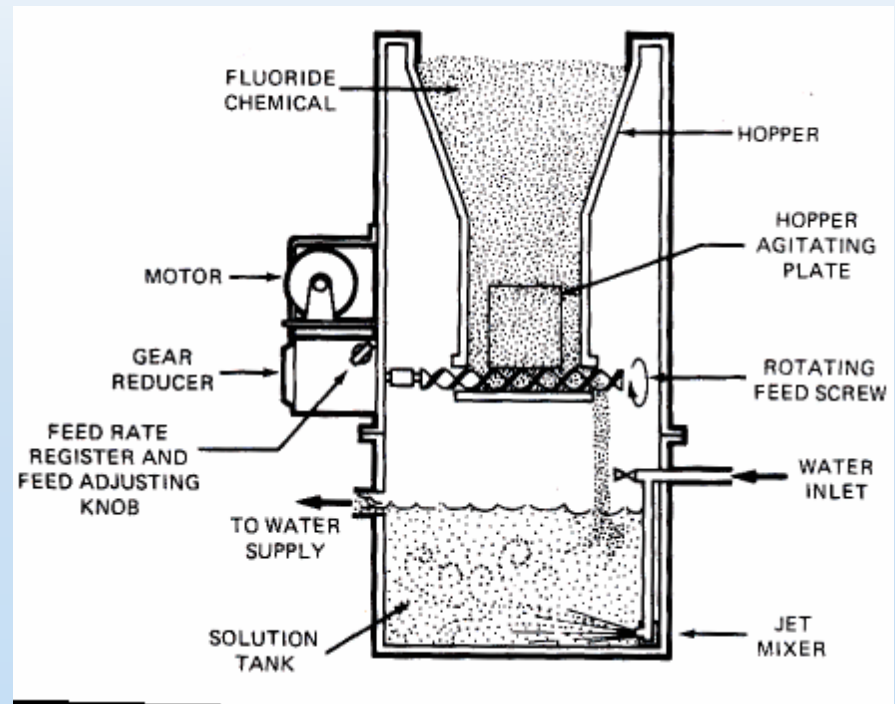
Sodium Fluoride (NaF) Saturator Feeder



Fluoridation Feeders

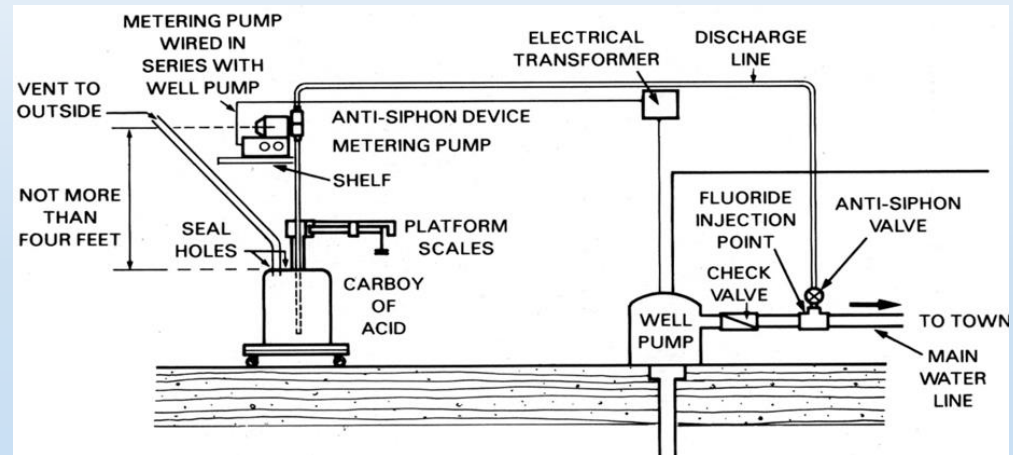
- Many surface water treatment plants use sodium fluorosilicate powder feeders.
- Typically, powder feeders do not utilize a solution feed pump.

Sodium Fluorosilicate
(Na_2SiF_6)



Fluoridation Feeders

- Many water systems of all sizes use an acid feed system.
- A pump and related tubing have to be utilized and maintained.
- Acid feed is probably the most common type of fluoride feed system.



**Fluorosilicic Acid (H_2SiF_6)
Solution Feeder**

Personal Protective Equipment

- **Fluoridation chemicals are very hazardous to work with!**
- **Water operators must have correct personal protective equipment (PPE) available and use the equipment when working with fluoride chemicals.**
- **The chemical type will dictate the PPE needed but can include:**
 - **Chemical resistant gloves, protective clothing, face shield, breathing mask, goggles, etc.**
 - **Appropriate PPE can be found on the chemicals Safety Data Sheet. Typically found in Section 8 of the SDS.**

Fluoridation - Monitoring

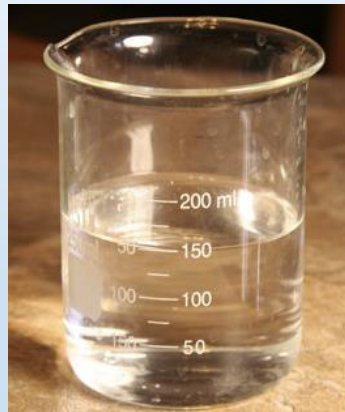
- All sampling/monitoring should be done at the *entry point* to the distribution system (finished water).
- Each fluoride feed point must be monitored daily (at least 5 times a week).
- The ADH sends Fluoride Sample Bottles and Water Sample Collection Reports to the PWS
- The majority of the report information is completed prior to sending to the PWS

Fluoridation - Monitoring

Taking the Compliance Sample



Lab



Take at
SAME TIME



Water
System
Analysis

Fluoridation

ADH Fluoride Engineer

Glenn Greenway, PE
501-661-2623

District Staff will offer training, monitoring, and reporting assistance for Fluoride..



Review



Questions?

The amount of chlorine used right away after addition that reacts with impurities is the

- A. Chlorine dose
- B. Chlorine demand
- C. Chlorine residual
- D. Free Chlorine

B. Chlorine demand



The total amount of chlorine fed to the system is the

- A. Chlorine dose
- B. Chlorine demand
- C. Chlorine residual
- D. Free Chlorine

A. Chlorine dose



The _____ gives you protection from secondary contamination

- A. Chlorine dose
- B. Chlorine demand
- C. Chlorine residual
- D. Chlorine Back-feed

C. Chlorine residual



Which of the following, in equal amounts, is the more powerful disinfectant?

- A. Free Chlorine
- B. Combined Chlorine
- C. Chloramine
- D. All about the same

A. Free Chlorine



What method is approved for field measurement of Chlorine residual levels in the water distribution system?

- A. Chlorine residual method C
- B. Colorimetric method using Orthotolidine
- C. Colorimetric method using DPD
- D. Titration method using BOD

C. Colorimetric method using DPD



The Chlorine test kit should measure

- A. Free chlorine, and total chlorine
- B. Chlorine dose, chlorine residual, and chlorine demand
- C. Free chlorine, chlorine dose, and total chlorine
- D. None of the above

A. Free chlorine and total chlorine



Combined Chlorine + Free Chlorine equals _____
_____?

- A. Chlorine dose
- B. Total Chlorine
- C. Chlorine residual
- D. Water that smells like Chlorine

B. Total Chlorine



What is the recommended Chlorine Residual level for remote sites?

- A. 0.5 mg/L
- B. 0.2 mg/L
- C. 0.5 g/L
- D. 0.2 g/L

B. 0.2 mg/L



“MCL” stands for _____?

- A. Minimum Chlorine Level
- B. Maximum Chlorine Level
- C. Maximum Contaminant Level
- D. Multiple Contact Line

C. Maximum Contaminant Level



Fluoride compliance and field analysis samples should be collected _____.

- A. at different points in the distribution system
- B. at the same time
- C. at different times for comparison
- D. in mason jars

B. at the same time



The MCL for Fluoride in Drinking Water is _____
_____.

- A. 4.0 $\mu\text{g/L}$
- B. 0.8 ppm
- C. 4.0 ppm
- D. 2.0 mg/L

C. 4.0 ppm



THE END

