Arkansas Department of Health 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

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<th>First Name</th>
<th>Mid Initial</th>
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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.
Arkansas Board of Health

Dr. José Romero, MD, Interim Secretary of Health

Renee Mallory, BSN, Interim Chief of Staff

Renee Mallory, BSN, Deputy Director for Public Health Programs

Cassie Cochran, MPH, Center For Local Public Health Director

Terry Paul, RS, Environmental Health Branch Chief

Jeff Stone, P.E., Engineering Section Director
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*

<table>
<thead>
<tr>
<th>Training and Certification Officer</th>
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<tbody>
<tr>
<td>Martin Nutt</td>
<td><a href="mailto:Martin.Nutt@arkansas.gov">Martin.Nutt@arkansas.gov</a></td>
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</table>

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<tr>
<th>Training Coordinator</th>
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<tr>
<td>Krista Myrick</td>
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<th>Administrative Specialist</th>
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<tr>
<td>Ida Hampton</td>
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</table>
Compliance Course Agenda Topics

- Compliance Course Introduction
- Chlorine Residual and Waterborne Diseases
- PWS Rules
- Monitoring and Bacteriological Sampling
- Surface Water Treatment Rules
- Disinfection By-Products Rule
- General Compliance Requirements
- Compliance Course Overview/Q & A
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.
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 for 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
OR
Can Be Downloaded From The ADH “Obtain A License” Webpage
www.healthy.arkansas.gov/water-license

GET THE STUDY PACKET (CD)
Mailed to applicant after an application has been submitted
Water System Operator License Application

**MUST CHECK**

FOR ADD OFFICE USE ONLY

ARCHARKANSAS DEPARTMENT OF HEALTH
ENGINEERING SECTION
(Register for Exam: www.healthy.arkansas.gov/waterlicens)

This application is submitted pursuant to Arkansas Code Annotated 17-81-101 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 and 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, 3rd Fl., Little Rock, Arkansas 72205-3867

Check the fee that has been enclosed:

- License by Examination Fee - $35.00 for each License
- Re-examination Fee - $25.00 per Exam (see note below, see Form 400 - Re-examination Fee - $25.00 for each License
- Reciprocity Evaluation Fee - $25.00 for each License

(Provide a copy of the license & proof it is current for those being submitted for reciprocity evaluation.)

Applying for license:
- Treatment License I, II, III, IV and/or Distribution License I, II, III, IV
- Other Water Licensees: (Hold)

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 answer A? Yes or No
(D) Are you under the age of 18? Yes or No
(E) Are you employed by a contractor providing services to Drinking Water Advisory or Operator Licensing Programs? Yes or No
(F) Have you ever been convicted of a felony or a crime involving moral turpitude or been convicted of a crime involving moral turpitude

For a listing of criminal offenses of concern, see (internet address) AR 4-09

Education Background (Must complete):

High School Diploma: Yes or No
GED earned: Yes or No
** Highest grade level completed
Name of School Attended:
Location:

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

<table>
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<tr>
<th>Institution Name &amp; Location</th>
<th>Degree/Course Name</th>
<th>Years Attended</th>
<th>Degree Earned</th>
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** Must complete

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

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

**

Employment:

Water System Operator:
Water System Operator:

Employment Background for Evaluation of Experience Credit Determination:

If you operate additional water systems, please list their system information on the back of this page and check this box. **

Position Title: __________________________
Office Phone #: __________________________

** Must be completed by owner, mayor, board chair, or system manager.

Experience Validation & Verification:
Must be signed by owner, mayor, board chair, or system manager.

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

Applicant Signature: __________________________
Date: __________________________

You must sign

Print Name: __________________________
Signature: __________________________
Date: __________________________

Boss must sign
## REQUIRED MANDATORY TRAINING

### TRAINING HOUR REQUIREMENTS FOR EXAMS

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Mandatory Training

• Mandatory Training Courses
  - No Expiration for Meeting License Exam Requirements
  - Do Expire Used for 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 \textbf{Do Not} Follow ABC Item Standard
  - Many Are Specific to the Book
  - \$200

- American Water Works Association (AWWA)
  - Offers Excellent Additional Knowledge
  - \$400
Reference Books

Where To Purchase?
Drinking Water Education Material Cooperative
Arkansas Rural Water Association Administers

Must I Purchase All?
Treatment and Distribution manual requirements differ, some manuals more essential
Manuals Listed In ABC “Needs-To-Know” Criteria
NTK helps focus on study topics/where to spend study time
End Of Introduction

Water Sector Workforce

Water sector professionals are vital to protecting public health through the operation and maintenance of water and wastewater treatment plants.

They ensure that clean and safe water is consistently provided to the public.

Learn about what EPA is doing to promote and ensure a sustainable water sector workforce.

http://water.epa.gov/infrastructure/drinkingwater/pws/dwoperatorcert/index.cfm
Public Water System

History, Chlorination & Public Safety

“Water Is Life”
Why Treat Water?

Large Percent of Microbial Diseases Are Waterborne and Treatable

Many diseases are transmitted through water infiltrated with sewage. Microorganisms that cause illness cannot be seen, smelled, or tasted.
The History of Drinking Water Treatment

http://www.epa.gov/safewater/sdwa25/sdwa.html

- Ancient civilizations established themselves around water sources
- Saw need for ample water *quantity* for drinking and other purposes
- Understanding water *quality* was not well known or documented
- Aesthetic (appearance, taste or smell) problems was the focus
- Ancient writings water treatment methods such as filtering through charcoal, exposing to sunlight, boiling, and straining
- Visible cloudiness (later termed turbidity) was the driving force behind earliest water treatments
Historical Timeline

• 4000 B.C.: methods to improve the taste and odor recorded
• 1500 B.C.: Egyptians used alum to settle suspended particles in water
• 1700s: filtration effective means to remove particles from water
• Early 1800s: slow sand filtration used regularly in Europe
• Mid to late 1800s: scientists greater understanding of sources and effects of drinking water contaminants, especially those not visible to the naked eye
• 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
  • Explains how microscopic organisms transmit disease through water
- 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
- 1914: US Public Health Service Water Standards initially established
  - Standards Expanded 1925, 1946, & 1962 to total of 28 substances
- 1916: ADH gained legislative authority to regulate AR drinking water
  - Used USPHS Water Standards to guide water quality enforcement
1957: Mandatory Water Licenses established

1972: Passage of the USEPA Clean Water Act to restore and maintain surface water quality

1974: Passage of the USEPA Safe Drinking Water Act; provided authority to set water quality standards which states must enforce

1976: ADH gained SDWA Primacy (primary enforcement)

1996: Amendments to the SDWA extend existing law to recognize
  Source water protection, operator training, funding for water system improvements, and public information

2010 . . . The Rest of the Day
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

Legionella pneumophila, the bacteria responsible for Legionnaires' disease.
Chlorine Residual

In Public Water Systems

Arkansas Rules and Regulations require that all water supplied to the public must be disinfected by an approved method.

- Chlorination disinfection
- most common method
Chlorine Residual
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.
**Chlorine Residual**

**Benefits of Chlorine**

**Biological Growth Control**
Chlorine disinfectants reduce 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. Other disinfectants do not.
Chlorine in Water

The amount of Chlorine required to disinfect water 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 or free) constitutes the **Chlorine Residual**
Chlorine in Water

If the amounts of the residuals are the same, **Combined** Chlorine requires about 100 times more contact time than **Free Available Chlorine**.
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 Test Kit
Chlorine Residual Monitoring

Chlorine Test Kit
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.

Is not the only approved reagent
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.
Chlorine Residual
Minimum Residual – Chloramination

If combined residual (chloramination) is used
Critical to monitor chlorine & ammonia feed rates
Higher combined residual needed
To avoid nitrification 2.5 mg/L mono-chlorine residual
Should monitor for mono & total chlorine residuals
  - Mono requires specific test procedure
Should monitor for free ammonia
  - Detected in distribution network indicates nitrification
Summer temps encourage rapid micro-organism
growth exceeding mono-chlorine’s inactivation rates
Chlorine Residual Monitoring

By maintaining an adequate Chlorine Residual - your water should be safe...

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
Example Case

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

Immunization of staff

Use separate equipment and tools or clean thoroughly

Keep a handle on Personal Hygiene
Avoid Taking “work microbes” Home
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 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.
1901 to 1930s

Dr. Frederick McKay, DDS

Studied “Colorado Brown Stain” . . . (Fluorosis)

Proposed a connection between naturally occurring fluoride & resistance to tooth decay
Fluoridation - History

1930s

H. Trendley Dean, DDS (USPHS)

Studied effects of Fluoride in some 345 U.S. communities

Determined that a 1ppm 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 - History

Arkansas

More than 150 water supplies have naturally occurring fluoride in concentrations ranging from 0.2 - 1.7 mg/L. A few get as high as 5.2 mg/L.

86% AR Public Water Systems are optimally fluoridated to optimal levels.

Approximately 85% of AR residents are provided with optimally fluoridated water.
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

Application Standards

**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
Fluoridation Application Standard

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

Should monitor and record *daily*:

*Amount* and *Type* of chemical added

Total gallons of water treated

Fluoride Concentration
Fluoridation

Fluoride comes in 3 basic forms

Sodium Fluoride (NaF)  
Saturator Feeder

Sodium Fluorosilicate (Na$_2$SiF$_6$)  
Volumetric Feeder

Fluorosilicic Acid (H$_2$SiF$_6$)  
Solution Feeder
Fluoridation
Specific Ion Electrode
Fluoridation
SPADNS
Fluoridation - Monitoring

All sampling/monitoring should be done at the *entry point* to the distribution system (finished water).

The Department 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

Take at SAME TIME

Lab

Field Analysis
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, combined 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

Answer: A. Free chlorine, combined 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
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 C. 4.0 ppm.
The colorimetric field method for analyzing Fluoride concentration is ______.

A. Electrophoresis  
B. HACH Fluoride Test Strips  
C. Specific Ion Electrode  
D. SPADNS

D. SPADNS
THE END