



Arkansas Department of Health

GROUND WATER RULE

ADH Compliance Short School

The GROUND WATER RULE (GWR) Overview

- **Applies to all Public Water Systems (PWS) serving ground water**
- **Wholesale systems supplying ground water**
- **Consecutive systems buying ground water**
- **Mixed systems using both ground water and surface water not combined**
- **Does not apply to systems who combine all their ground water with surface water (or groundwater under the influence of surface water) prior to treatment meeting Subpart H (Surface Water Treatment Rule)**



The GROUND WATER RULE (GWR) Overview

Purpose:

Provides an additional barrier from microbial contamination and from pathogens entering drinking water by correcting deficiencies identified in the sanitary survey

Examples: well defects, sources of contamination, water treatment plant (WTP) defects



GWR COMPONENTS

- 1. Triggered Monitoring (triggered by total coliform positive (TCP) distribution sample collected as part of routine monitoring)**
- 2. Compliance Monitoring**
- 3. Sanitary Surveys**
- 4. Corrective Action Plan**
- 5. Source Water Assessment Monitoring (State option)**



GWR COMPLIANCE STRATEGIES

- **Triggered source water monitoring**
- **Compliance Monitoring - Treatment to 4 log (99.99%) inactivation and/or removal of viruses**

Most water system in Arkansas comply with the Ground Water Rule by performing triggered source water sampling when a positive coliform sample result is obtained during routine monthly monitoring. A small number of water systems comply through ensuring and documenting adequacy of the disinfection process (4 log viral removal/inactivation).



TRIGGERED MONITORING

- **Triggered by a TCP Routine sample under the Revised Total Coliform Rule (RTCR).**
 - 1 sample from each source collected within 24 hours of notification
 - Applies to wholesale & purchase systems, too.
- **Applies to all GWR systems that do not provide 4-log inactivation or removal of viruses.**



TRIGGERED MONITORING

- If a purchase system gets a TCP, it must notify the source system so that they will be aware of the possible need to perform source water sampling per federal regulations.
- However, in Arkansas, most purchase systems have master meters that are far enough from the source system treatment that 4-log virus inactivation has occurred if there is a chlorine residual. This would negate the need for source sampling.
- The ADH will confirm with the source system, if source water sampling is required.



TRIGGERED MONITORING

- **Consecutive systems (purchase systems)**
 - **Must advise source system of routine bacteriological positive sample (TCP)**
 - **Must record chlorine residual on bacteriological sample collection form**
 - **Must provide public notice if source system has a treatment technique or monitoring violation**



TRIGGERED MONITORING

- **As long as you record your chlorine residual on your bacti sample collection form and on your monthly Bacteriological Monitoring Record (BMR) the source system will likely not be required to collect triggered (raw) water samples from their wells. The ADH will make that decision.**
- **Distribution systems have been evaluated to determine if the State established criteria has been met.**
- **If the chlorine residual has not been recorded on the bacti sample collection form or is not present then the source system will be required to collect source water samples.**





Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000

Governor Mike Beebe

Paul K. Halverson, DrPH, FACHE, Director and State Health Officer

Engineering Section, Slot H37
www.HealthyArkansas.com/eng/

Ph 501-661-2623

Fax 501-661-2032

After Hours Emergency 501-661-2136

Monday, December 07, 2009

ANYTOWN WATERWORKS
JOHN SMITH
1905 VIRUS WAY
ANYTOWN, AR 72990

PWS# 999

**Example Report:
Routine Distribution TC+ Result –
Triggers Collection of Raw Sample(s)**

RE: GWR Triggered Monitoring

Dear: JOHN SMITH

Your system or a public water system which purchases water from you has had either a total coliform positive result on one or more of the routine monthly distribution system samples collected for compliance with the TCR, or your system has had an E. coli positive raw water sample (see results below).

The **Ground Water Rule** requires that you collect at least one raw water sample either on the combined raw water line prior to treatment at each water treatment plant or from each of your well(s) that were in operation on the date the TCR compliance sample(s) was collected. This notice approves you to monitor at either location. Additionally, if source sample(s) are E. coli positive, additional source monitoring will be required.

BOTTLE(S) ARE BEING SENT TO YOU FOR GROUNDWATER SOURCE SAMPLING

System Name: ANYTOWN WATERWORKS									
Lab No.	Site	Site Address		County	Collected	Time	Received	Time	Collected By
1014307	999B001	ANYTOWN GENERAL STORE 1212 H2O St.		ARKA	12022009	0800	12032009	0742	J SMITH
Specimen code	WEL	Purpose	REG	Category	PUB	Rejection	Result:	P EA	TOTAL COLIFORMS E. coli
									Present Absent
Comments:									Chlorine Residual: 0.3
Actions to Take: The sample above has triggered source water monitoring for your system. You must collect a single sample from either a raw water tap on the combined raw water header prior to treatment at each of your water treatment plants or a single sample from a raw water tap at each of your wells that were <u>in operation on the day that the above distribution sample was collected.</u>									
The sample(s) must be collected within 24 hours of receiving this notice.									

Select the Site Code and Sample Location from the list of your treatment plant(s) and well(s) below: Enter in the "Site Code" box and "Definite Location of Sample" box on the bacti report form exactly as shown.

	Site Code	Location
WTP:	99901	WTP #1 (DOWNTOWN)
WTP:		
WTP:		
WTP:	99902	WTP #2 (MT HOLLY)
WTP:		
WTP:		
WTP:	99903	WTP #3 (MORNING STAR)

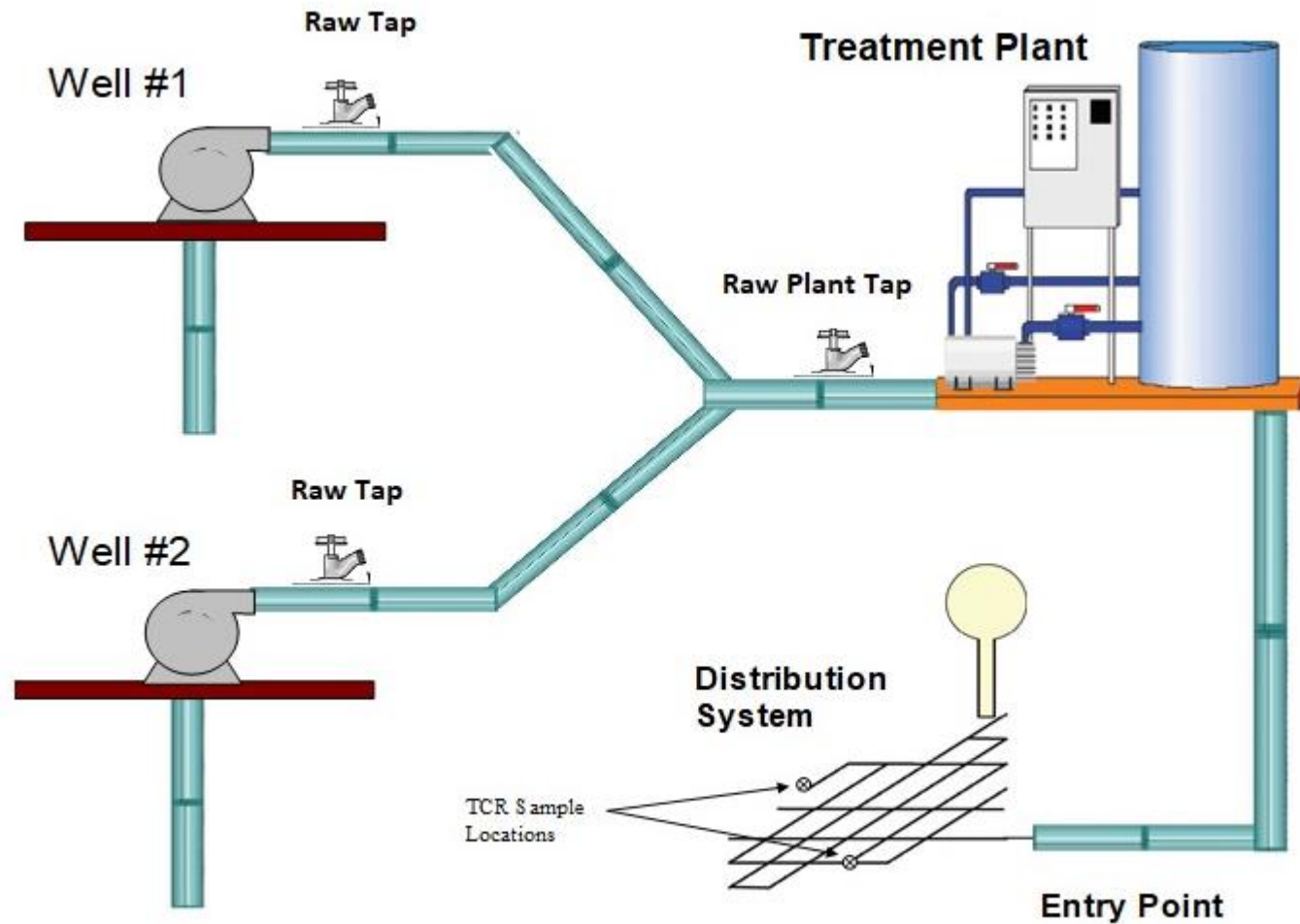
	Site Code	Location
WELL:	999101	WELL #10A
WELL:	999102	WELL #11
WELL:	999103	WELL #12A
WELL:	999104	WELL #15
WELL:	999201	WELL #17
WELL:	999202	WELL #18
WELL:	999203	WELL #19
WELL:	999204	WELL #20
WELL:	999301	WELL #16 MORNIIG STAR



TRIGGERED MONITORING

	<u>SITE CODE</u>	<u>LOCATION</u>		<u>SITE CODE</u>	<u>LOCATION</u>
WTP:	99901	WTP #1 DOWNTOWN	WELL:	999101	WELL #10A
				999102	WELL #11
				999103	WELL #12A
				999104	WELL #15
	99902	WTP #2 MOUNT HOLLY		999201	WELL #17





IF BOTH WELLS WERE PRODUCING ON DAY OF TCP TAKE FROM COMBINED TAP

IF ONLY ONE WELL PRODUCING ON DAY OF TCP TAKE FROM THAT RAW TAP

ENTRY POINT ON GRAPHIC IS COMPLIANCE MONITORING SAMPLE LOCATION (FIRST CUSTOMER)

TRIGGERED MONITORING

- If a triggered source water sample is positive for *E. coli*, the State will require the system to:
 - Collect 5 additional raw water samples from the well(s) within 24 hours of receiving notification of the positive result.
 - If the *E. coli* positive sample is from the combined raw water line prior to treatment, then collect additional raw water samples from each well that was in service at the time the TCR monitoring was conducted.





Arkansas Department of Health

4815 West Markham Street • Little Rock, Arkansas 72205-3867 • Telephone (501) 661-2000

Governor Mike Beebe

Paul K. Halverson, DrPH, FACHE, Director and State Health Officer

Engineering Section, Slot H37 Ph 501-661-2623 Fax 501-661-2032
www.HealthyArkansas.com/eng/ After Hours Emergency 501-661-2136

Monday, December 14, 2009

ANYTOWN WATERWORKS
JOHN SMITH
1905 VIRUS WAY
ANYTOWN, AR 72990

PWS# 999

**Example Report:
Triggered Raw Sample - E. coli + Result
Requires Collection of Additional Raw Samples**

RE: GWR Triggered Monitoring

Dear: JOHN SMITH

Your system or a public water system which purchases water from you has had either a total coliform positive result on one or more of the routine monthly distribution system samples collected for compliance with the TCR, or your system has had an E. coli positive raw water sample (see results below).

The **Ground Water Rule** requires that you collect at least one raw water sample either on the combined raw water line *prior to treatment* at each water treatment plant or from each of your well(s) that were in operation on the date the TCR compliance sample(s) was collected. This notice approves you to monitor at either location. Additionally, if source sample(s) are E. coli positive, additional source monitoring will be required.

8 BOTTLE(S) ARE BEING SENT TO YOU FOR GROUNDWATER SOURCE SAMPLING

System Name: ANYTOWN WATERWORKS									
Lab No.	Site	Site Address	County	Collected	Time	Received	Time	Collected By	
1014948	99901	WHS #1 (DOWNTOWN)	ARKA	12092009	0845	12102009	0752	J SMITH	
Specimen code	WEL	Purpose	RWE	Category	PUB	Result:	P EP	TOTAL COLIFORMS E. COLI	Present Present
Comments:									Chlorine Residual: 0.0
Actions to Take: The above raw water sample was E. coli positive. You must conduct additional monitoring at each well represented by this sample. If one well is represented by this sample, collect 5 additional raw water samples from that well; if 2 wells are represented collect at least 3 samples from each well; if 3 or 4 wells are represented collect at least 2 samples from each well; and if 5 or more wells are represented collect at least 1 sample from each well.									
Monitoring must be conducted at the raw water tap on the well(s) within 24 hours of receiving this notice.									

Select the Site Code and Sample Location from the list of your treatment plant(s) and well(s) below: Enter in the "Site Code" box and "Definite Location of Sample" box on the bacti report form **exactly** as shown.

WTP:	<u>Site Code</u>	<u>Location</u>	WELL:	<u>Site Code</u>	<u>Location</u>
WTP:	99901	WTP #1 (DOWNTOWN)	WELL:	A999101	WELL #10A
WTP:			WELL:	A999102	WELL #11
WTP:			WELL:	A999103	WELL #12A
WTP:			WELL:	A999104	WELL #15
WTP:	99902	WTP #2 (MT HOLLY)	WELL:	A999201	WELL #17
WTP:			WELL:	A999202	WELL #18
WTP:			WELL:	A999203	WELL #19
WTP:			WELL:	A999204	WELL #20
WTP:	99903	WTP #3 (MORNING STAR)	WELL:	A999301	WELL #16 MORNING STAR



TRIGGERED MONITORING

- **If a system has one well, 5 raw samples are required**
- **2 wells – 3 samples each**
- **3 or 4 wells – 2 samples each**
- **5 wells or more – 1 sample each**

BACTERIOLOGICAL FORM

ARKANSAS DEPARTMENT OF HEALTH
Public Health Laboratory, 201 South Monroe Street
Little Rock, AR 72205-5425

WATER ANALYSIS-BACTERIOLOGICAL

LABORATORY USE ONLY DO NOT WRITE IN THIS SPACE →		Sample Shipped Via (Laboratory Use Only)	Laboratory Number (Laboratory Use Only)	Date and Time Received (Laboratory Use Only)
SECTION 1 – Date and Time Sample Collected (Required)				SECTION 4 – Sample Type
MONTH	DAY	YEAR	HOUR (Must Check Box)	<input type="checkbox"/> Public Community <input type="checkbox"/> Non-community <input type="checkbox"/> Semi-Public
			Exact Time <input type="checkbox"/> AM <input type="checkbox"/> PM	<input type="checkbox"/> Private - \$17 Fee REQUIRED
SECTION 2 – Public, Non-Community and Semi-Public System Use Only				
Water System Name		Water System ID Number (Required)	Site Code Xxx101	SECTION 5 – Source
Definite Location of Sample Well 1		City	County	<input checked="" type="checkbox"/> Well <input type="checkbox"/> Surface <input type="checkbox"/> Cistern <input type="checkbox"/> Spring
Collected By:		SECTION 6 – Purpose		
Definite Location of Sample		<input type="checkbox"/> Boil Order <input type="checkbox"/> Special/Investigation <input type="checkbox"/> New Construction		
City		<input checked="" type="checkbox"/> Raw Water <input type="checkbox"/> Raw Water with Count		
County		<input type="checkbox"/> Regular Distribution Sample		
Collected By:		Resample Type: <input type="checkbox"/> Repeat <input type="checkbox"/> Replacement		
City		Original Lab # <input checked="" type="checkbox"/> Triggered Raw		
County		Required		
Note: \$17.00 Fee Per Sample <input type="checkbox"/> Credit on File, No Fee Included		Chlorine Residual _____ (circle one) Free or Total		
Send Report To:		ENVIRONMENTAL HEALTH SPECIALIST ONLY		
Name _____		<input type="checkbox"/> Swim Beach <input type="checkbox"/> Investigation		
Address _____		LABORATORY USE ONLY		
City/State/Zip _____		Rejection/Disclaimer Code _____ Initials _____		
HL-01 (R 04/17)		Analyst Notes:		



TRIGGERED MONITORING

- Correct information on forms is important to receive credit for collecting the raw sample
- These are issues experienced by our Staff:
 - **Incorrect site code** – correct sites are at the bottom of your notice
 - **Incorrect “Definite Location of Sample”** – listed at bottom of your notice
 - **“Collected by”** not filled in
 - Failing to include **“Original Lab Number”**



PUBLIC WATER SYSTEM - BACTERIOLOGICAL MONITORING RECORD

Arkansas Department of Health / Engineering Section

PUBLIC WATER SYSTEM NAME AnyTown Waterworks PWS ID # _____
 MONTH December YEAR 2009 COUNTY _____

DATE	SAMPLE SITE #	TYPE -- REGULAR OR RESAMPLE	CL2 RESIDUAL (MG/L)	LAB RESULTS	LAB #	ORIGINAL LAB # (Of Triggering Sample)	DAY/DATE RESULTS RECEIVED
12/1/2009	999B007	regular	0.5	A	1014304		12/4/2009
12/1/2009	999B006	regular	0.5	A	1014305		12/4/2009
12/1/2009	999B003	regular	0.5	A	1014306		12/4/2009
12/4/2009	999B007	regular	0.2	P/ EA	1014307		12/6/2009
12/4/2009	999B003	regular	0.5	A	1014308		12/6/2009
12/10/2009	999B005	Resample	0.5	A	1014859	1014307	12/9/2009
12/10/2009	999B007	Resample	0.5	A	1014860	1014307	12/9/2009
12/10/2009	999B007	Resample	0.5	A	1014861	1014307	12/9/2009
12/10/2009	99901	Triggered	0	A	1014862	1014307	12/9/2009
12/10/2009	99902	Triggered	0	A	1014863	1014307	12/9/2009
12/15/2009	999B007	regular	0.5	A	2034667		12/22/2009
12/16/2009	999B003	regular	0.5	A	2034668		12/22/2009
12/17/2009	999B005	regular	0.5	A	2034669		12/22/2009
12/18/2009	999B004	regular	0.5	A	2034670		12/22/2009
12/19/2009	999B001	regular	0.5	P/EA	2034671		12/22/2009
12/23/2009	999B007	Resample	0.5	A	3351332	2034671	12/26/2009
12/23/2009	999B001	Resample	0.5	A	3351333	2034671	12/26/2009
12/23/2009	999B002	Resample	0.5	A	3351334	2034671	12/26/2009
12/23/2009	999B003	Resample	0.5	A	3351335	2034671	12/26/2009
12/23/2009	99901	Triggered	0.5	A	3351336	2034671	12/26/2009
12/23/2009	99902	Triggered	0.5	P/EP	3351337	2034671	12/26/2009
12/27/2009	999201	Additional	0.5	A		3351337	12/30/2009
12/27/2009	999201	Additional	0.5	A		3351337	12/30/2009
12/27/2009	999201	Additional	0.5	A		3351337	12/30/2009
12/27/2009	999202	Additional	0.5	A		3351337	12/30/2009
12/27/2009	999202	Additional	0.5	A		3351337	12/30/2009
12/27/2009	999202	Additional	0.5	A		3351337	12/30/2009

I certify that the information in this report is true and accurate to the best of my knowledge. I acknowledge knowingly false or misleading information may be punishable under 18 USC 1001 and other applicable law.

Printed Name: _____ Signature: _____

Put any notes or comments on reverse side; make a copy for your records & return to address on reverse side.



TRIGGERED MONITORING

- **E. coli positive result from source water sampling, provide Tier 1 Public Notice within 24 hours of notification.**
Applies to wholesale and purchase
Media broadcasting, hand delivery, public locations, official websites
- **E. coli positive, collect additional samples or take corrective action.**
Samples must be collected within 24 hours of notification.
- **If the resample E. coli pos – PWS MUST take corrective action. (consult w/ State w/in 30 days)**



COMPLIANCE MONITORING

Treatment for 4-Log Viral Removal/Inactivation

- Although considered a “corrective action”, treatment and documentation of treatment to 4-log viral removal/inactivation is an option that will avoid the requirement to sample source water in the event of a total coliform result from RTCR monitoring.
- However, if this option is chosen by the water system or required by the state, then any failure to adequately treat, monitor, or document adequate treatment can result in a treatment technique violation and required public notice.



COMPLIANCE MONITORING

Treatment for 4-Log Viral Removal/Inactivation

Monitoring requirements

- **> 3,300 pop. monitor continuously**
- **$\leq 3,300$ pop. monitor daily**
- **State assigned residual disinfection concentration**
- **State approved location**



COMPLIANCE MONITORING

> 3,300 people served

- Continuously monitor residual disinfectant concentration and record its *lowest reading* each day
- If equipment fails: grab samples every 4 hours until return to service
- System must resume continuous monitoring within 14 days (repair or replace continuous monitor)



COMPLIANCE MONITORING

≤ 3,300 people served

- **Collect grab sample during the hour of peak flow or other state-specified time each operating day**
- **If daily grab sample falls below the specified minimum residual, follow-up samples must be taken every 4 hours until the residual is returned to the state-determined minimum level.**
- **May monitor and record continuously – record lowest reading**



DATE	Previous Meter Reading		Hours Plant Run	Rainfall (in)	Temperature		Lbs. Chemical Used (List Chemicals)						pH			TURBIDITY (NTU)			ODOR		ALKALINITY (ppm)			HARDNESS (ppm)		Fluoride (ppm)	Sampling Point Entry point to distribution system		GWR CT Conditions within limits below?		NUMBER USED	HOURS OPERATED	WASHED FILTER NUMBER(s)	WASH WATER USED x1000 gal			
	Master Meter Reading (gal)	Total Treated x1000 gal			F or C		Raw	Settled	Finished	Raw	Settled	Finished	Raw	Finished	Raw	Settled	Finished	Raw	Settled	Cl2 (free) Residual (mg/l)		Y / N	Y / N														
					Air	Water														AM	PM																
1																																					
2																									0.4			Y		YES							
3																																					
4																																					
5																																					
6																																					
7																																					
8																																					
9																																					
10																																					
11																																					
12																																					
13																																					
14																																					
15																																					
16																																					
17																																					
18																																					
19																																					
20																																					
21																																					
22																																					
23																																					
24																																					
25																																					
26																																					
27																																					
28																																					
29																																					
30																																					
31																																					
Total																																					
Average																										0.4											
Maximum																										0.4											
Minimum																											0.4										

COMMENTS: _____

GWR CT Conditions
Maximum pH ≤9
Minimum Temp ≥14 C
Plant/Well Flow ≤2000 gpm
High Service Flow ≤3800 gpm
Clearwell Depth ≥7 FT

I certify that the information in this report is true and accurate to the best of my knowledge. I acknowledge that any knowingly false or misleading information may be punishable under 18 USC 1001 and other applicable laws.

Signature: _____ Date: _____

Printed Name: _____ Position: _____ License #: _____

Make a copy for your records & return by the 10th of the following month to the above address.



Sampling Point		GWR CT	
Disinfectant Residual (mg/l)		Flow rate, pH and Temp. within limits?	CT Compliance Met?
AM	PM	Y / N	Y / N
0.4		Y	YES



PUBLIC WATER SYSTEM - CHEMICAL TREATMENT RECORD
Arkansas Department of Health - Engineering Section

Public Water System Name & Entry Point			ID #	County	Month	Year			
Previous Meter Reading			Chemicals Applied				Disinfectant Residual & CT		
Master Meter Reading (gal)	Date	Thousands of Gallons Treated	Chlorine				Sample Location	Flow rate(s), pH and Temperature within limits below?	GWR
			Pounds Used	mg/L	Pounds Used	mg/L			
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								
	20								
	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								
	30								
	31								
TOTAL									
AVG									
MAX									
MIN									

Comments:

I certify that the information in this report is true and accurate to the best of my knowledge. I acknowledge that any knowingly false or misleading information may be punishable under 18USC 1001 and other applicable laws.

Printed Name _____ Title _____
 Signature _____ Date _____

Make a copy for your records and return by the tenth of the following month to: Arkansas Department of Health, Engineering Section (Slot-37), 4815 West Markham, Little Rock AR 72205-3867 SGW-15



ASSESSMENT MONITORING

- **If directed by the State, GWSs shall conduct Assessment monitoring.**
- **Assessment monitoring generally consists of monthly source samples for a period of 12 months.**
- **Required for all new wells.**



SANITARY SURVEYS

- **Every 3 years for groundwater systems; 2 years for surface systems**
- **Evaluate the elements**
 - **Source**
 - **Treatment**
 - **Distribution system**
 - **Finished water storage**
 - **Pumps, pump facilities, and controls**
 - **Monitoring, reporting, and data verification**
 - **System management & operation**
- **Identify significant deficiencies**
 - **Requires special notice to the public**
 - **Including fecal contamination of source water**



GWR Violations – Tier 1

- **E. coli positive result from source water sampling, provide Tier 1 Public Notice within 24 hours of notification.**
Applies to wholesale and purchase
Media broadcasting, hand delivery, public locations, official websites



GWR Violations – Tier 2

Treatment Technique Violations -- Public Notice

- **GWS that does not maintain 4 log virus removal at or before the first customer.**
- **Significant deficiency found during sanitary survey is not corrected w/in 120 days, interim measures not met or schedule not followed.**
- **Failure to consult w/ State w/in 30 days of notification.**
- **Corrective Action Plan (CAP) not completed w/in 120 days, interim measures not met or schedule not followed after fecal indicator + source sample(s)**



GWR Violations – Tier 3

- **Monitoring Violations -- Public Notice**
 - **Failure to conduct triggered source water monitoring or to demonstrate compliance w/ 4-log virus inactivation by monitoring and reporting. (failure to submit operations reports)**
 - **Failure to conduct source water *E. Coli* monitoring.
Failure to notify other PWS of TCP trigger or *E. Coli* source.**
 - **Positive source water sample – Tier 1 Public Notice required w/in 24 hours.**
 - **Failure to conduct source assessment monitoring for new sources.**



Corrective Action Plan

- **If a significant deficiency is identified during the sanitary survey.**
- **E. coli detected in the source water or repeat samples.**

Corrective Action Plan

- **Corrective actions include:**
 - **Correct all significant deficiencies**
 - **Provide alternate source of water**
 - **Eliminate source of contamination**
 - **4-log inactivation and/or removal of viruses**



Corrective Action Plan

- **System has 30 days to consult with State and devise an appropriate plan. State may have specific plan and schedule to follow.**
- **Corrective Action must take place within 120 days, or be in compliance, with state approved corrective action plan.**





An example of inadequate well construction that leaves the well vulnerable to contamination.



An example of a properly constructed well.

UNDERSTANDING CT

- **Federal regulations contain values for minimum chlorine contact time with drinking water to ensure that 4-log viral removal/inactivation has occurred.**
- **This is called “CT”, “chlorine contact time”.**
- **The state will evaluate well water disinfection applications and award the “contact time” that can be used in calculating CT**
- **These issues are relevant for systems that using treatment for 4-log viral removal/inactivation as a way of complying with the GWR.**



UNDERSTANDING CT

Calculating CT

$$CT = C \times T$$

C = concentration of disinfectant residual (mg/L)

- For systems using chlorine, C can be measured with: portable or continuous monitor using an EPA-approved method.
- C must be measured before or at first customer

T = contact time (minutes)

- between point of application of disinfectant & point where disinfectant residual is measured usually entry point to system
- Based on system components – volume of water from application point to entry point

Calculation:

$$\frac{\text{capacity (gal) of system component (pipe, storage tank)}}{\text{system flow (gpm)}}$$

- CT is expressed as (min-mg/l)



UNDERSTANDING CONTACT TIME

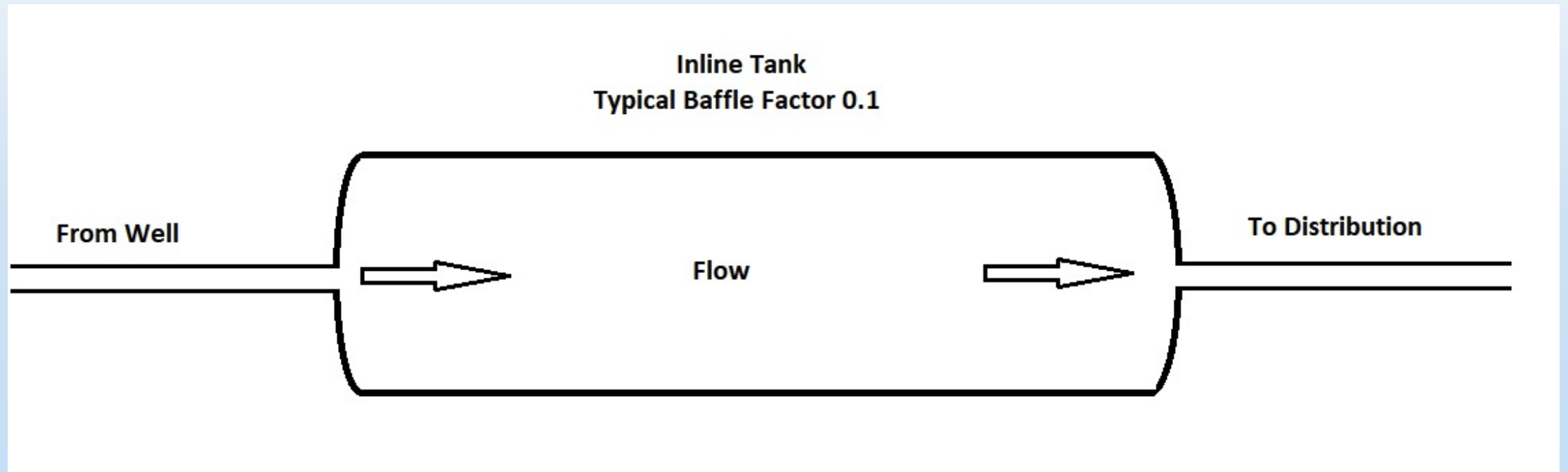
BAFFLE FACTORS

- **Baffle factors in clear wells add “credit” to your CT.**
- **Baffles force the flow of water to utilize more of the tank or basin volume thus increasing CT.**
- **Must be an applicable baffle factor.**
- **The next 3 slides show types of tanks than are commonly used with ground water systems and shows the beneficial effect of baffles.**



UNDERSTANDING CONTACT TIME

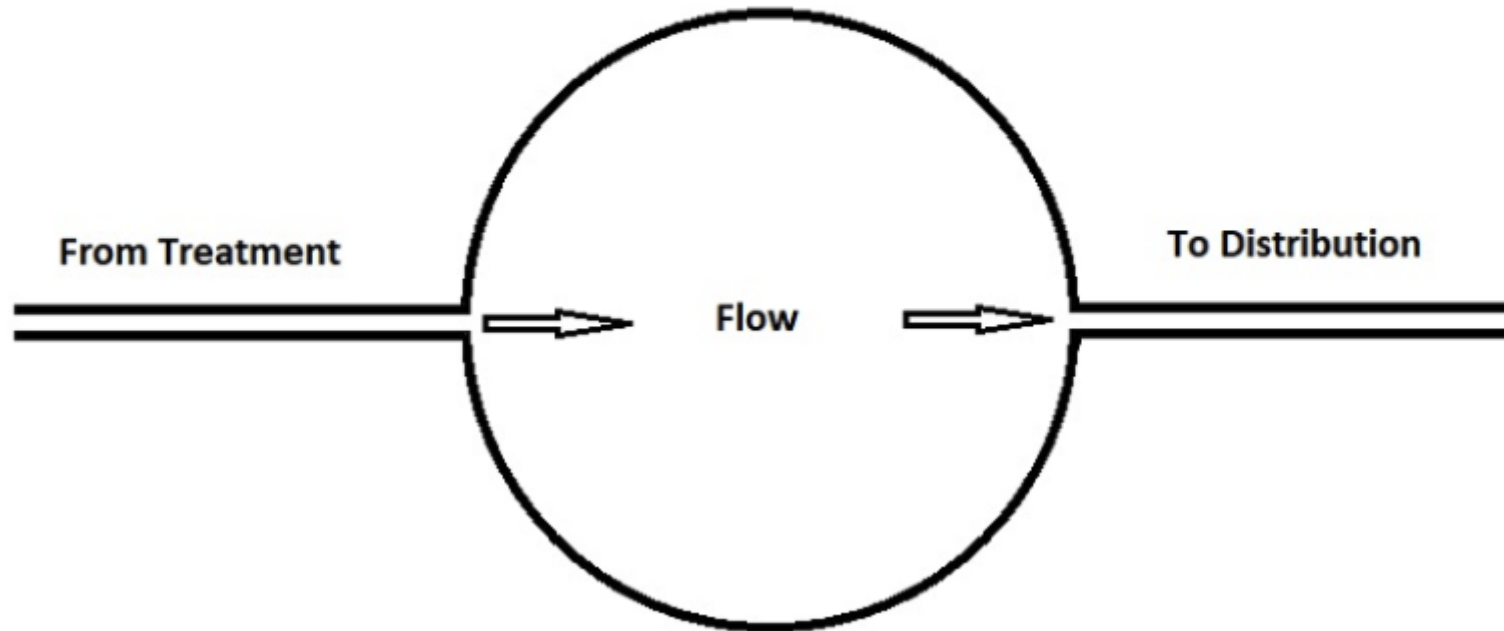
BAFFLE FACTORS



UNDERSTANDING CONTACT TIME

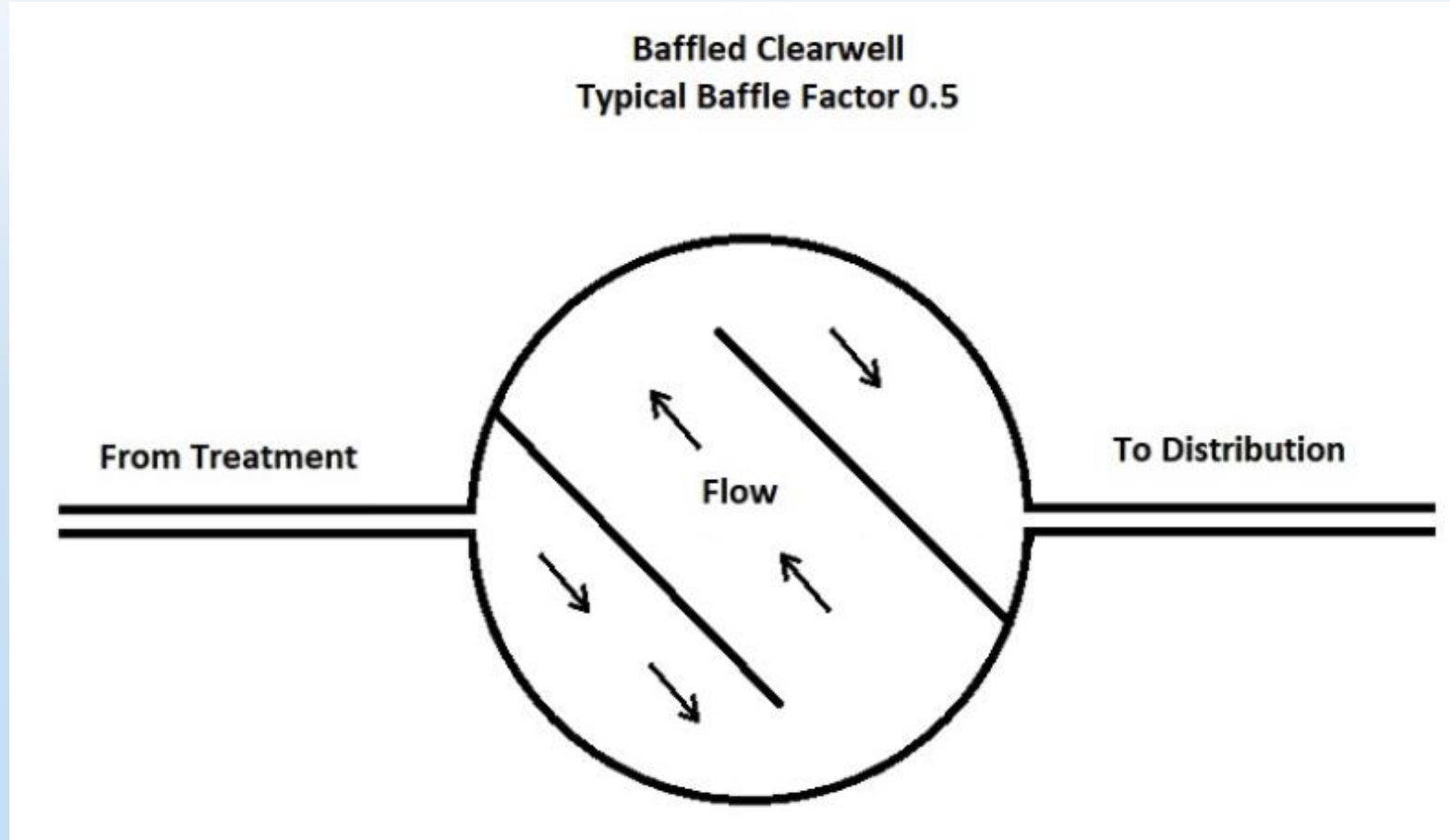
BAFFLE FACTORS

Unbaffled Clearwell
Typical Baffle Factor 0.1



UNDERSTANDING CONTACT TIME

BAFFLE FACTORS



Required CT Values

CT VALUES* FOR 4- LOG INACTIVATION OF VIRUSES BY FREE CHLORINE

<u>Temperature (°C)</u>	pH	
	<u>6-9</u>	<u>10</u>
0.5	12	90
5	8	60
10	6	45
15	4	30
20	3	22
25	2	15

*Although units did not appear in the original tables, units are min-mg/L.



RECORDKEEPING

- **Documentation of corrective actions - 10 years.**
- **Documentation of public notice - 3 years.**
- **Records of minimum residual - 10 years.**
- **Record of lowest residual and date and duration of any failure to maintain min residual for a period of more than 4 hours- 5 years.**



REVIEW QUESTION

- **Who is affected by the Ground Water Rule (GWR)**
- **A – All systems**
- **B – Ground water systems**
- **C – Small Systems**
- **D – Large systems**



ANSWER

- **B Ground water systems only**

REVIEW QUESTION

- **What is purpose of GWR?**
- **A – Annoy water operators with additional sampling requirements**
- **B – Give the lab more work**
- **C – Provide an additional barrier against pathogens**



ANSWER

- **C – Provide an additional barrier against pathogens**



REVIEW QUESTION

How is Compliance Monitoring conducted?

A – Continuous monitoring of disinfectant residual

B – Grab samples of disinfectant residual

C – Only conducted by systems >3300

D – Only conducted by systems <3300



ANSWER

A – Continuous monitoring of disinfectant residual

AND

B – Grab samples of disinfectant residual



REVIEW QUESTION

- **When will a triggered (raw) sample be required?**
- **A – Every month**
- **B – Once a year**
- **C – When a routine RTCR sample results in a total coliform positive**

ANSWER

- **C – When a routine RTCR sample results in a total coliform positive**



REVIEW QUESTION

- **How many samples are required for a triggered sample?**
- **A – Depends on the number of wells in use that day**
- **B – One sample per well**
- **C – 5 samples per well**



ANSWER

- **A – Depends on the number of wells in use that day**
- **The other answers are somewhat correct but A is the best answer**



REVIEW QUESTION

- **E. coli is identified in the triggered sample. How many samples are required?**
- **A – Depends on the number of well in use that day**
- **B – None**
- **C – 5 samples per well**



ANSWER

- **A – Depends on the number of well in use that day**
- **C - Is correct if the system has only one well**



Questions?

- **Questions or Comments?**

- safewater@arkansas.gov
- 501-661-2623

