

PTR SECTION STAFF GUIDANCE

BLENDING CHLORAMINATED AND CHLORINATED WATERS

Rules Affected: Title 30 Texas Administrative Code (30 TAC) §290.39(j), §290.39(l), and §290.42(e)(3)(G)

Background:

This TCEQ staff guidance is provided to TCEQ staff in order to ensure a consistent review of exception requests. In this document, the word “you” refers to TCEQ staff performing that task.

Many public water systems (PWSs) use chloramines as a disinfectant in treatment processes and throughout the distribution system. Chloramines maintain a longer-lasting disinfectant residual and also help lower the levels of regulated disinfection byproducts such as trihalomethanes (THMs) and haloacetic acids (HAAs) that are produced by chlorine disinfectants. With chloramines, less free chlorine is available for interaction with naturally-occurring organic matter, thus reducing the potential to form THMs and HAAs.

Chloramines are formed by combining ammonia and chlorine. The chemistry of this reaction is described by the ‘breakpoint’ reaction, which is primarily dependent upon pH and the ratio of chlorine to ammonia-nitrogen ($\text{Cl}_2:\text{NH}_4\text{-N}$). Regulations in 30 TAC §290.110 set minimum and maximum disinfectant residual levels. These requirements include weekly monitoring for total chlorine, monochloramine, and ammonia, and less frequent monitoring for nitrite and nitrate. Total chlorine measures the sum of all oxidative species present, including free chlorine, monochloramine, dichloramine, trichloramine, and any oxidative organoamines. The desirable species is monochloramine, which is responsible for disinfection.

Until July 30, 2015, all systems using chloramines needed an exception. With the rule change effective July 30, 2015, **only systems** that blend chloraminated and chlorinated water or use both free chlorine and chloramines as disinfectants in the distribution system in isolated areas are required to have an exception. The monitoring, operation, notification, design, calibration and record keeping requirements for systems with a chloramine residual are included in the rules.

Under these rules, an exception will need to be requested on behalf of the PWS to use chloramines in their system, as 30 TAC §290.42(e)(3)(G) states, “**if water containing chloramines and water containing free chlorine are blended.**” All requests for exceptions must be received and approved (or denied) in writing by the TCEQ. Once written notification and an exception request are provided to the TCEQ, staff will review then grant or deny the exception, as well as notify the PWS whether engineering plans and specifications are required.

Guidance:

1. **Notification:** The notification of a proposed change to chloramines and the exception request must be submitted to the TCEQ in writing by the water system’s owner, representative, or professional engineer.

2. **Grant or Deny Exception:** The exception request will be granted, or further information will be requested, based on a review of the submittal's merits and after review by the Water Supply Division teams and the applicable TCEQ region. Appropriate correspondence will be drafted and sent to system officials. The correspondence will either:
 - a. State why the exception cannot be granted, and request additional information for further review if needed; or,
 - b. Grant the exception request and formalize conditions the PWS must meet to sustain the granted exception.
3. **Blending chloraminated and chlorinated water in distribution:** Mixing chlorinated and chloraminated water is not recommended. When the stream of water with free chlorine meets the stream of water with chloramines, the $\text{Cl}_2:\text{NH}_4\text{-N}$ ratio changes in an uncontrolled manner.

If a PWS proposes to blend chlorinated and chloraminated water, they must perform sampling to ensure that the $\text{Cl}_2:\text{NH}_4\text{-N}$ ratio is maintained in a way that ensures formation of monochloramine, which is the only species that provides reliable disinfection. The template letter includes a paragraph regarding the potential issues related to blending chlorinated and chloraminated water. Often, a system will change or add new sources to maintain capacity. If a system proposes to start blending chloraminated surface water and free-chlorinated ground water, the PWS must first ensure that no unplanned blending occurs. A PWS that wishes to blend chlorinated and chloraminated water has the following alternatives.

- a. *Ammoniate the Chlorinated Water:* The PWS may use chloramines in the entire distribution system by adding ammonia after free chlorine injection to the water that uses the free chlorine. If the PWS wishes to pursue this option, engineering plans and specifications must be submitted to the TCEQ's Plan Review Team (MC 159) for review and receive approval to construct prior to construction as specified in 30 TAC §290.39(j)(1)(A). **No exception will be needed if the PWS chloraminates all water sources.**
- b. *Break-Point Chlorinate:* The PWS may use free chlorine in the entire distribution system. To do so, they must ensure that all of the water enters specific storage tanks prior to distribution - specifically, that chloraminated water is delivered to a designated tank with chlorination facilities before distribution. Sufficient free chlorine must then be added to the designated storage tank(s) to transform ("break point") the chloramines, and the PWS must monitor for free chlorine in the distribution system. Please note that due to the additional chlorine required for this option, the PWS may encounter elevated concentrations of disinfection byproducts. If the PWS wishes to pursue this option, they must provide the following information prepared by a licensed professional engineer to the TCEQ's Plan Review Team (MC 159) for review and receive approval:
 - i. Drawings showing the piping modifications to be performed to deliver all the purchased chloraminated water to the storage tanks.
 - ii. Drawings of all current purchased water interconnections that currently feed to storage tanks.
 - iii. Locations of all chlorine injection and monitoring points at the storage tanks where chloraminated water will be introduced.

- iv. Documentation of the method for determining the proper amount of chlorine to be added. The PWS should show the range of purchased water flow rates and chloramine residual expected.

No exception will be needed if the PWS chlorinates all their water sources.

- c. *Do Not Blend*: The PWS may physically isolate areas of the distribution with free chlorine from areas with chloramines. Free chlorine should be monitored in the portions of the distribution system that are supplied solely by chlorinated water; free ammonia, monochloramine, and total chlorine should be monitored in the portions of the distribution system that are supplied by chloraminated water. If the PWS wishes to pursue this option, they must provide the following information:
 - i. A distribution map of the above-referenced water system(s), showing how they will be divided. The PWS should indicate which portion(s) will be disinfected with free chlorine and which portion(s) disinfected with chloramines.
 - ii. The map must include all entry points, storage tanks, treatment facilities, service area boundaries, pressure-maintenance facilities (tanks and pumps), and points at which wholesale water is delivered to any downstream PWSs.
 - iii. The map must show distribution piping starting from largest to smallest, to the extent that a clear view of general layout is given. For example, a medium-sized PWS might show water mains from their maximum of 12-inch outer diameter down to a diameter of 4 inches.

An exception must be requested for this option. The exception will show that the system has stopped blending and will document that even though there are 2 different disinfectant in the distribution system, those disinfectants will not blend together. Plans must be submitted for any new equipment used to hydraulically separate areas of the distribution system.

- d. *Ensure Controlled Blending*: For this option, a PWS must develop a method that will ensure chlorine residuals will remain acceptable in a blended distribution system by injecting the appropriate amount of chlorine in the free-chlorinated well water to combine with free ammonia present in the chloraminated water. If the PWS wishes to pursue this option, they must provide the following information:
 - i. Documentation showing how blending occurs.
 - ii. Documentation showing how the areas of blending will be documented during actual operations. As demands change this area can also change. For example, how will a PWS determine where the blending area is during purchased water usage?
 - iii. Documentation of the sampling type and frequency that the PWS will perform to ensure adequate chlorine/chloramine residuals.
 - iv. Documentation of the sample type and frequency that the PWS will perform to ensure monochloramine--not di- nor tri-chloramine—is being formed.

- v. Documentation of the sample type and frequency that the PWS will perform to ensure nitrification is not present in the blending area.
- vi. Documentation of the corrective actions to be taken if the sampling shows inadequate disinfectant residuals, taste and odor issues, bacteriological sample issues, or potential nitrification. This should be a part of the Nitrification Action Plan (NAP) required by 290.46(z), attached to the Monitoring Plan (see #11, below). The NAP should include a map following the criteria listed above under #3.

An exception must be requested for this option. If granted the exception letter will provide the monitoring and other activities that must occur.

4. **Blending chloraminated and chlorinated water in a tank:** Mixing chlorinated and chloraminated water is not recommended. When the stream of water with free chlorine meets the stream of water with chloramines, the ratio of chlorine, ammonia, and monochloramine changes in an uncontrolled manner.

If a PWS proposes to blend chlorinated and chloraminated water in a tank, they must perform sampling to ensure that the $\text{Cl}_2:\text{NH}_4\text{-N}$ ratio is maintained in a way that ensures the presence of monochloramine, which is the only species that provides reliable disinfection. Often, a system will change or add new sources to maintain capacity. If a system proposes to start blending chloraminated surface water and free-chlorinated ground water, the PWS must first ensure that no unplanned blending occurs. A PWS that wishes to blend chlorinated and chloraminated water has the following alternatives.

- a. *Ammoniate the Chlorinated Water:* The PWS may add ammonia after free chlorine injection to the water that uses free chlorine thus creating the chloramines in a controlled manner. If the PWS wishes to pursue this option, engineering plans and specifications must be submitted to the TCEQ's Plan Review Team (MC 159) for review and receive approval to construct prior to construction as specified in 30 TAC §290.39(j)(1)(A). **No exception will be needed if the PWS chloraminates all water sources.** However, sampling in the effluent of the blending tank is required.
- b. *Break-Point Chlorinate:* The PWS may use free chlorine. To do so, they must ensure that all of the water enters specific storage tanks prior to distribution - specifically, that chloraminated water must be delivered to a designated tank with chlorination facilities before distribution. Sufficient free chlorine must then be added to the designated storage tank(s) to transform ("break point") the chloramines, and the PWS must monitor for free chlorine in the distribution system. Please note that due to the additional chlorine required for this option, the PWS may encounter elevated concentrations of disinfection byproducts. If the PWS wishes to pursue this option, they must provide the following information prepared by a licensed professional engineer to the TCEQ's Plan Review Team (MC 159) for review and receive approval:
 - i. Drawings showing the piping modifications needed to deliver all the chloraminated water to the storage tank(s).
 - ii. Drawings of all current water interconnections that feed the storage tank(s).

- iii. Locations of all chlorine injection and monitoring points at the storage tank(s) where chloraminated water will be introduced.
- iv. Documentation of the method for determining the proper amount of chlorine to be added to the tank(s). The PWS should show the range of purchased water flow rates and chloramine residual expected.

No exception will be needed if the PWS chlorinates all their water sources. However, sampling at the tank effluent must occur to ensure that free chlorine is produced.

- c. *Ensure Controlled Chloramine Formation after Mixing the Sources in the Tank:* For this option, a PWS must develop a method that will ensure that chlorine and chloramine residuals will remain acceptable in water leaving the tank by injecting the appropriate amount of chlorine and ammonia at all times. If the PWS wishes to pursue this option, they must provide the following information:
 - i. Documentation showing that the tank is completely mixed.
 - ii. Documentation of the free chlorine, total chlorine, free ammonia, and monochloramine sampling locations and frequency that the PWS will perform to know the appropriate amount of chlorine and ammonia dose.
 - iii. Documentation of the calculations used to determine the dose of chlorine and ammonia to apply.
 - iv. Documentation of the sample type and frequency that the PWS will perform to ensure monochloramine--not di- nor tri-chloramine—is being formed.
 - v. Documentation of the corrective actions to be taken if the sampling shows inadequate disinfectant residuals, taste and odor issues, bacteriological sample issues, or potential nitrification. This should be a part of the NAP required by 290.46(z), attached to the Monitoring Plan (see #8, below).
5. **Plan Review:** Rule 30 TAC §290.39(l)(1) states that requests for exceptions are to precede the submission of engineering plans and specifications. If the Plan Review Team (PRT) receives a submittal for an exception request, the submittal will be forwarded to TROT so that the exception request(s) can be logged into the Water Utilities Database (WUD) for evaluation by TROT.
- a. If engineering plans and specification were not received by TROT with the written notification, TROT must determine whether they are required. Engineering plans and specifications are not required if all of the chemical feed facilities have already been approved.
 - b. If TROT determines that engineering plans and specifications are required after this chloramines exception is granted, the TCEQ's correspondence will contain the following conditions to be met by the PWS:
 - i. Engineering plans and specifications must be submitted to the PRT for review; and
 - ii. The PWS must receive written approval to construct from the PRT before construction can be started.
 - c. If TROT determines that engineering plans and specifications are not required, the TCEQ's correspondence will state that the PWS is not required to submit engineering plans and specifications.

6. **Public Notification and TCEQ Notification:** The public notification required by chloraminating systems in 30 TAC §290.47(h) will be required for customers having the potential to receive chloraminated water in a blended system.
7. **Design of Chloramination Systems:** The design requirements in 30 TAC §290.42(e) apply to any portion of the system that is creating chloramines, or boosting chloramines.
8. **Monitoring Frequency and Locations:** The sampling requirements in 30 TAC §290.110(c) are required for any portion of the system that contains chloramines. If the system is changing chloraminated water to chlorinated water, the only chloramination-effectiveness monitoring required is in the plant(s) that is (are) performing breakpoint chlorination. All sampling must be documented in the system's monitoring plan per 30 TAC §290.121
9. **Analytical Methods:** The sampling requirements and calibration requirements in 30 TAC §290.110(d) and §290.46(s), respectively, are required for any portion of the system that is creating chloramines, boosting chloramines or changing chloramine to chlorine.
10. **Record Keeping:** The record retention requirements in 30 TAC §290.46(f) are required for any portion of the system that is creating chloramines, boosting chloramines or changing chloramine to chlorine.
11. **Nitrification Action Plans:** The requirement for a NAP in 30 TAC §290.46(z) applies to any portion of the system that is creating chloramines or boosting chloramines. If the system is breakpoint chlorinating then a NAP is required only for the plant(s) that is (are) performing the breakpoint chlorination.

Finalized and Approved by:

Joel Klumpp., Plan and Technical Review Section Manager, 09/23/2015

If no formal expiration date has been established for this staff guidance, it will remain in effect until superseded or canceled.

Revision History:

Date	Action	Action by
9/23/2015	Approved	Joel Klumpp