Nitrification Control Plan

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Districts 1 & 2

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LOUISIANA DEPARTMENT OF HEALTH

Public Health

Nitrification Control Plan – The Rule

§367. Disinfectant Residual Monitoring and Record Keeping

Where a continuous chloramination (i.e., chlorine with ammonia addition) method is used or where water that is provided to customers contains chloramines, a nitrification control plan shall be developed and submitted to the state health officer. A public water system in existence as of November 6, 2013 shall submit and comply with such a nitrification control plan no later than January 1, 2017. The plan shall conform to the guidelines contained in industry standards such as the American Water Works Association's M56 Manual on Nitrification and contain at least the following information:

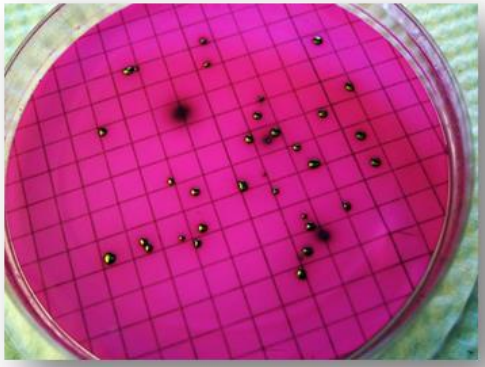
Nitrification Control Plan –Requirements

§367. Disinfectant Residual Monitoring and Record Keeping

The plan shall conform to the guidelines contained in industry standards such as the American Water Works Association's M56 Manual on Nitrification and contain at least the following information:

1. Free ammonia monitored at least weekly at the POE
2. Nitrite monitored at least quarterly, and in response to an action trigger, in the distribution system at sites prone to nitrification such as storage tanks and low flow areas.
3. Review and update NCPs
4. Retain NCPs and monitoring results on-site for a minimum of five years.

Nitrification Control Plan –Why have one?



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Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

1. **Is a chlorine to ammonia target ratio ($Cl:NH_3$) specified?**

   A $Cl2:NH_3$ ratio close to 4.1:1 (NH_3 as ammonia) or 5:1 (NH_3 as nitrogen) is typically selected to minimize excess free ammonia entering the distribution system.

Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

2. Is monitoring for chloramine optimization performed at the treatment plant?

The highest priority for monitoring at the treatment plant is 1) total chlorine, mono-chloramine, and free ammonia at the POE, and 2) free chlorine just ahead of ammonia addition. Knowing how much free ammonia is exiting the plant, and minimizing it, is perhaps the most important aspect of nitrification control. Knowing how much mono-chloramine is present with respect to total chlorine is an important indication of chloramine optimization. Total chlorine is already monitored at the POE for regulatory compliance. Monitoring for free chlorine ahead of ammonia addition is essential for determining free ammonia feed rates.

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Ten (10) questions used in the development of a NCP

3. **Does the Plan emphasize the monitoring of total chlorine and nitrite in the distribution system?**

   The highest priority for nitrification monitoring in the distribution system is total chlorine and nitrite. TC monitoring sites should overlap or complement existing regulatory compliance sites. The monitoring of nitrite may be based on a minimum total chlorine trigger. Additional parameters are encouraged to aid in the interpretation of data and to support conclusions.

Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

4. **Does the Plan adequately address the monitoring of low flow areas?**

    - Areas with excessive Water Age
    - Dead Ends

Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

5. **Does the Plan adequately address the monitoring of storage facilities both at the plant and in the distribution system?**

   The highest priority for nitrification monitoring at storage tanks is total chlorine and nitrite. The monitoring of nitrite may be based on a minimum total chlorine trigger. Additional parameters are encouraged to aid in the interpretation of data and to support conclusions.

Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

6. **Are alert and action levels specified?**

   Alert and action levels are specific to the system, can be specific to service areas, zones or even individual locations, and should be based on historic data.

Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

7. **Does the Plan address distribution system monitoring when a switch to free chlorine (i.e., burn) is made?**

   The highest priority for monitoring during a burn is free chlorine. The period of time over which free chlorine residuals are to be maintained, or another target parameter, should be specified (i.e., 30 days). Free chlorine monitoring sites should overlap or complement existing regulatory compliance sites.

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Ten (10) questions used in the development of a NCP

8. **Is monitoring data archived and accessible for analysis and interpretation?**

   Software programs that allow for the trending of data over time are especially beneficial to a utility that wishes to prevent nitrification rather than respond to its effects.

Developing a Nitrification Control Plan

Ten (10) questions used in the development of a NCP

9. **Are nitrification parameters assessed at individual locations using trend graphs?**

   Software programs that allow for the trending of data over time are especially beneficial to a utility that wishes to prevent nitrification rather than respond to its effects.

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Ten (10) questions used in the development of a NCP

10. Is the monitoring plan reviewed annually so that adjustments can be made based on historical data trends, changes in water use patterns, possible changes in treatment process, or plant or distribution system operation?

The plan should specify that it will be reviewed annually and adjusted if needed. Plans that are revised shall be submitted to the District Office for review and approval.

Developing a Nitrification Control Plan

Usefulness of Water Quality Parameters for Nitrification Monitoring

Parameter	Usefulness
Total Chlorine (TC)	VERY
Free Chlorine	VERY
Free Ammonia-N	VERY
Total Ammonia	Useful to limited
Nitrite-N	Very
Nitrate-N	Varies
HPC	Useful
ATP	Useful
Temperature	Varies
pH	Varies
Dissolved Oxygen	Limited
Alkalinity/Hardness	Limited
TOC	Limited to Useful
Monochloramine	Useful

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Water Quality Parameter Action Levels for Nitrification Monitoring

Parameter	Monitoring Location	Comment
Total Chlorine	TP, DS, SF	1.0 - 2.0 mg/l, based on historic data.
Free Chlorine	TP, DS, SF	Trace during chlorimanation; varies for breakpoint
Total ammonia	TP/DS/SF	Difficult to interpret.
Free ammonia	TP, DS, SF	minimize at POE.
Nitrite	TP, DS, SF	< 0.010 mg/l at POE (in the case of biological filters supporting nitrification)

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Nitrification Response Options - Treatment Plant

Response	Comment
Optimize Cl2:NH3 Ratio	Evaluate the chlorine to ammonia ratio, and free ammonia level at the POE; ensure target Cl2:NH3 ratio is consistently being achieved with minimal excess free NH3 entering the POE. Accurate chlorine and ammonia feed rates and Cl residual monitoring ahead of NH3 addition are essential.
Minimize excess free ammonia at POE	
pH Adjustment	The chloramine species generated and the rate of formation are dependent on pH. Monochloramine and its rate of formation are optimized at higher pH (>7).
Removal of Natural Organic Matter (NOM)	Reducing NOM by TOC removal through the treatment plant will minimizing chloramine decay in the distribution system, improving its stability. TOC removal can be accomplished by the addition of disinfectants and oxidants such as ozone, chlorine dioxide, and potassium permanganate.

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Nitrification Response Options - Distribution System

Response	Comment
Breakpoint Chlorination	Discontinue chloramination; maintain a free chlorine residual throughout the distribution system for a set time.
Booster Chlorination	Chlorination (free) or chloramination of a specific area. Monitoring for free and total chlorine during BC is essential.
Booster Chloramination	
Unidirectional Flushing	Strategic closing of valves and opening of hydrants to flush one segment of main in a SINGLE DIRECTION (UDF). Higher velocities (> 5 fps is desirable) scour and remove sediment and deposits from water mains. Effective where nitrification is primarily due to a lack of system cleanliness.
Directional Flushing	Strategic closing of valves and opening of hydrants to flush multiple mains in a SINGLE DIRECTION (DF). Effective where nitrification is primarily due to a lack of system cleanliness. Velocities > 2.5 fps are desirable. DF is less effective than UDF.

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Nitrification Response Options - Distribution System (cont.)

Response	Comment
Spot Flushing	Directed at reducing water age and raising disinfection residuals. Not intended to scour sediments and deposits. Velocity is typically held to < 2.5 fps. Less effective than UDF or DF.
Automatic Flushing Device	
Pigging	Pigging is more effective than flushing, but requires considerable expertise, materials, and time.
Valve Exercise Program	Helps to locate closed values and ensures looped pipelines are operating as designed.
pH adjustment	Higher pH (>8.3) favors chloramine stability, minimizes potential for ammonia release, and maximizes residuals.

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