



Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

August 5, 2014

Mr. Mark Southard
Water Source/Purification Superintendent
City of Wichita Falls
4801 Big Ed Neal Drive
Wichita Falls, Texas 76310

Subject: Public Drinking Water System Contact Time Study
City of Wichita Falls - PWS ID No. 2430001
Cypress Temporary Direct Potable Reuse Water Treatment Plant,
TCEQ Plant ID No. TP410791
Wichita County, Texas
CN600129316 RN105598759

Dear Mr. Southard:

The Texas Commission on Environmental Quality (TCEQ) Technical Review and Oversight Team (TROT) has reviewed the comments on our CT Study Approval Letter dated June 24, 2014 which were submitted by Mr. Russell Schreiber on July 2, 2014. Based on this feedback, we are issuing this revised approval letter for the CT Study for the full-scale Direct Potable Reuse Water Treatment Plant (Temporary DPR WTP) which was submitted on April 25, 2014. Specifically, this letter:

- 1) corrects the location of the flow meter located upstream of the splitter box at the 2010 Cypress Water Treatment Plant (WTP);
- 2) deletes a superfluous sentence regarding the sampling locations on the transmission line from the Secondary Reservoir;
- 3) eliminates the erroneous references to a secondary/standby rechloramination point at the 2010 Cypress WTP High Service Pump Station; and
- 4) clarifies that at least 50% of the water passing through the Temporary DPR WTP will be obtained from the Secondary Reservoir.

Based on the information provided, we are approving the proposed disinfection protocol.

Please note that this CT Study Approval Letter replaces, rather than supplements, our June 24th letter. Also note that, like the original letter, this approval does not waive any of the conditions required in the TCEQ's revised exception letter dated August 5, 2014, and applies when the temporary DPR Project is in operation. As you are aware, the City will need to submit another CT Study update at the conclusion of the DPR Project.

During the temporary DPR Project, the raw water for the Temporary DPR WTP will be supplied by a transmission line that delivers treated effluent from the River Road Waste Water Treatment Plant (RR WWTP). For the duration of the Project, the DPR WTP will include:

- all of the treatment units at the 2008 Cypress Microfiltration/Reverse Osmosis Water Treatment Plant (2008 Cypress MF/RO WTP), which includes a Flocc-Clarifier; five MF filters; and six two-stage RO units;
- all of the treatment units at 2010 Cypress WTP, which includes a splitter box that, under normal (non-DPR) operating conditions, distributes water between the 1961, 1987, and 2010 plants; a mechanical rapid mix; a Parshall Flume meter; a solids contact, slurry recirculation clarifier; a recarbonation basin; five dual-media gravity filters; and the small 2010 Clearwell and filtered water transfer pump station;
- a 10 million gallon (MG) 2010 Ground Storage Tank (GST) that has been isolated from the rest of the GSTs at the Cypress site; and
- the 2010 High Service Pump Station (HSPS) that discharges to the distribution system.

The proposed disinfection protocol at the DPR WTP involves the injection of chlorine at the RR WWTP chlorine contact chamber and the injection of chlorine (Cl_2) and ammonia (NH_3) at the outlet of the splitter box. There is also a standby liquid ammonium sulfate (LAS) injection point at the RR WWTP chlorine contact chamber, standby/secondary Cl_2 and LAS injection points at the 2008 clarifier, and standby/secondary Cl_2 and NH_3 injection points at the 2010 Clearwell

A disinfection zone is a segment of the treatment process which begins at a disinfectant application point and ends at a subsequent disinfectant application or residual sampling point. Hence, each disinfectant application point, regardless of the frequency of use, represents the beginning of a separate disinfection zone. Similarly, a plant may have only one disinfectant point, but may also choose to monitor disinfection residuals at more than one point, thus creating multiple disinfection zones.

Based on your proposal, we concur that there are five disinfection zones at the DPR WTP. The first disinfection zone, D1, consists of the treated effluent water line from the RR WWTP. The second disinfection zone, D2, consists of the Clari-flocculator in the 2008 MF/RO WTP and the third disinfection zone, D3, includes the MF cells and their inlet channel and associated piping. The fourth zone, D4, contains the rapid mix, clarifier, recarbonation basin, granular media filters, and associated piping at the 2010 Cypress WTP. The last disinfection zone, D5, incorporates the 2010 Clearwell and 2010 GST and the associated piping.

Contact Time (CT) calculations are used to evaluate the disinfection process. The time that the disinfectant is in contact with water in the disinfection segment must be determined on a daily basis to complete the CT calculations. This contact time, measured as T_{10} , is determined based on the peak hourly flow rate occurring during the 24-hour period and the detention time that is equaled or exceeded by 90 percent of the water passing through the basin. Since T_{10} values are required to calculate the CT for the treatment process, Table 1 was developed for the DPR WTP. The T_{10} values are based on the information provided the CT Study template you submitted on April 25, 2014.

**TABLE 1: T₁₀ TABLE FOR THE
TEMPORARY DIRECT POTABLE REUSE WATER TREATMENT PLANT (TP410791)**

DISINFECTION ZONE	TREATMENT UNIT	VOLUME (GAL)	FLOW RATE (MGD)	BAFFLING FACTOR	T ₁₀ (MIN)	
					Unit	Sum
D1	Treated Effluent Transmission Line	1,859,200 ⁽¹⁾	7.5 ⁽¹³⁾	1.0 ⁽¹⁷⁾	357.0	357.0
D2	2008 Flocc-Clarifier	3,875,600 ⁽²⁾		0.3 ⁽¹⁸⁾	223.2	223.2
D3	Piping	13,200 ⁽³⁾		1.0 ⁽¹⁷⁾	2.5	5.9
	Microfiltration Inlet Trough	5,500 ⁽⁴⁾	3.0 ⁽¹⁴⁾	0.1 ⁽¹⁹⁾	0.1	
	Microfiltration Cells	9,650 ⁽⁵⁾		0.7 ⁽²⁰⁾	3.2	
D4	Piping	14,800 ⁽⁶⁾	10.0 ⁽¹⁵⁾	1.0 ⁽¹⁷⁾	2.1	67.1
	Rapid Mix	4,850 ⁽⁷⁾		0.1 ⁽²¹⁾	0.1	
	2010 Clarifier	926,500 ⁽⁸⁾		0.3 ⁽²²⁾	40.0	
	Recarbonation Basin	183,000 ⁽⁹⁾		0.5 ⁽²³⁾	13.2	
	Granular Media Filters	29,100 ⁽¹⁰⁾	2.5 ⁽¹⁶⁾	0.7 ⁽²⁴⁾	11.7	
D5	2010 Clearwell	109,100 ⁽¹¹⁾	10.0 ⁽¹⁵⁾	0.5 ⁽²⁵⁾	7.9	223.3
	2010 Ground Storage Tank	4,987,000 ⁽¹²⁾		0.3 ⁽²⁶⁾	215.4	

Notes:

1. Based on a 27-inch diameter pipe that is 62,500 feet long.
2. Based on a flocculation clarification unit that has a 155-foot diameter, a 25.3-foot side water depth, and a 31.76-foot center water depth.
3. Based on a 36-inch diameter pipe that is 250 feet long.
4. Based on the section of the influent trough from the trough inlet to the closest of the microfiltration cells. This section of the trough is 25.16 feet long and 11 feet wide and has a 2.66-foot side water depth.
5. Based on the volume of water contained in a single filter cell containing 504 submerged microfiltration membrane modules.
6. Based on cumulative volume in 220 linear feet of 36-inch piping between the splitter box to the rapid mix and 85 linear feet of 30-inch piping from the rapid mix to the 2010 clarifier.
7. Based on a basin that is 27 feet long and 6 feet wide with a water depth of 4 feet.
8. Based on a basin that has a 90-foot diameter, an 18.9-foot side water depth, and a 20.6-foot center water depth.
9. Based on a basin that is 45.5 feet long and 32 feet wide and has a 16.8 foot side water depth.
10. Based on one dual-media gravity filter that is 24 feet long and 15 feet wide, contains 6 feet of gravel and media, and an underdrain system that is 1 foot tall. The minimum water depth over the media was reported to be 6.8 feet and a 50% porosity of the filter media is assumed.
11. Based on a clearwell that is 98.4 feet long and 26 feet wide. The maximum water depth and minimum operating levels in the clearwell are 11.3 feet and 5.7 feet, respectively.
12. Based on a tank that has a 206-foot diameter, a 40-foot maximum water depth, and a 20-foot minimum operating level.
13. Based on the maximum anticipated flow rate of treated effluent from the RRWTP.
14. Based on the rated capacity of 504 submerged membrane modules with a total surface area of 334.9 square feet per module and a TCEQ-approved flux rate of 19.6 gallons per square foot per day.
15. Based on the design capacity of the DPR Project and the assumption that at least 50% of the source water for the 2010 Cypress WTP will be obtained from the raw water transfer pumps at the Secondary Reservoir.
16. Based on the design capacity of the DPR Project and the assumption that flow will be evenly distributed between four of the five filters.
17. Assumes that the flow conditions that exist in long pipeline segments will virtually eliminate the possibility of short-circuiting and create "perfect" baffling characteristics.
18. Assumes that a Flocc-Clarifier with a central, single-stage flocculation chamber and a single baffle wall between the flocculation and settling zones will result in some short-circuiting and an overall "poor" baffling characteristic within the unit.

Notes continue on the following page.

Table 1 Notes (continued)

19. Assumes that the signification hydraulic short-circuiting occurring in a trough with a single inlet and a 2.5:1 length to width ratio will result in an “unbaffled” baffling characteristic within the basin.
20. Assumes that the hydraulic conditions that exist in a filter cell with 504 membrane unit will create “superior” baffling characteristics within the cell.
21. Assumes the rapid mix completely mixes the water within the unit and results in an “unbaffled” baffling characteristic within the basin.
22. Assumes that the mixing zone within the solids contact clarifier results in sufficient short-circuiting that the overall baffling characteristic of the clarifier will be “poor”.
23. Assumes that “average” baffling conditions will occur in a tank that contains multiple baffle walls that create a contactor with an effective length:width ratio greater than 20:1 but less than 50:1.
24. Assumes that the hydraulic conditions that exist in a gravity filter will create “superior” baffling characteristics within the filter.
25. Assumes that a tank with two inlets, three internal baffle walls, and a single outlet will exhibit some short-circuiting and demonstrate “poor” baffling characteristics.

We have prepared a Disinfection Process Parameters table to help the operators complete their Surface Water Monthly Operating Report (SWMOR). In Table 2, we have characterized the T_{10} available in each of the disinfection zones based on the flow rate through the unit(s) that contributes most to the disinfection process within that zone. We have also provided the operators with the disinfection requirements that the Temporary Direct Potable Reuse WTP must meet on a continuous basis.

**TABLE 2: DISINFECTION PROCESS PARAMETERS FOR THE
TEMPORARY DIRECT POTABLE REUSE WATER TREATMENT PLANT (TP410791)**

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivation	
	D1	D2	D3	D4	D5	Giardia	Viruses
Flow Rate (MGD)	7.50	7.50	3.308	10.00	10.00	2.0	5.0
T_{10} (minutes)	357.0	223.2	5.6	67.1	223.3		

As you are aware, zone D4 includes the 2010 clarifier, recarbonation basin, and conventional filters. As we have discussed, this grouping of treatment processes results in some constraints on the manner in which the plant must be operated and monitored. Specifically:

- **The operators must monitor the pH in disinfection zone D4 at the outlet of the 2010 clarifier.** Historically, the 2010 Cypress WTP has practiced full lime softening and, therefore, the clarifier has operated at a higher pH range in order to achieve greater hardness reductions and improved total organic carbon removal. During the temporary DPR project, the Temporary DPR WTP expects to meet these two treatment objectives by blending the surface water (from Lake Kickapoo and Lake Arrowhead) with RO permeate produced by the 2008 Cypress MF/RO WTP plant. However, the City would like to retain the flexibility to practice partial lime softening when conditions warrant.

This desired level of flexibility is understandable. However, the US Environmental Protection Agency’s CT Tables for chloramine only apply when pH levels are between 6 and 9, i.e., from 5.5 through 9.49. Because zone D4 includes both the clarification and recarbonation processes and recarbonation lowers pH, the pH in zone D4 must be measured before recarbonation. Consequently, the operators must monitor the pH for disinfection zone D4 at the outlet of the clarifiers rather than at the typical site located at end of the disinfection zone. The alternate location will ensure that the Temporary DPR WTP does not overestimate disinfection levels when the pH in the 2010 Clarifier reaches 9.5.

- **The operators must have at least four filters in operations whenever the plant is treating water.** This operational constraint is needed because zone D4 contains both the plant's gravity filters and the disinfection contact time within the zone depends on the flow rate of the water and the total volume of water contained in the treatment units. Consequently, the CT calculations will underestimate the level of viral inactivation achieved if fewer than four filters are on line whenever the plant is treating water.

During the duration of the temporary DPR process, the operators must continue to measure monochloramine, as opposed to total chlorine, residuals at the end of disinfection zones D1, D2, and D3. Because the source water for the Temporary DPR WTP is the treated effluent from the River Road WWTP, there is a possibility that the water in these three disinfection zones will contain significant amounts of organic chloramines and other chemical compounds that can be detected by the total chlorine test methods. Since the effectiveness of these chemicals as a disinfectant has not been studied, measuring monochloramine levels will reduce the potential for significantly overestimating the level of disinfection in these zones if elevated levels of these other chemicals are present. On the other hand, the operators must continue to measure total chlorine residuals in zones D4 and D5 using an approved total chlorine method since the water is dechlorinated at the end of disinfection zone D3.

Please note that this approved CT study is only applicable for the duration of the temporary DPR Project and only if the plant adheres to the operational constraints identified above. **Therefore, you must submit another revised CT study when the plant returns to its traditional source water and operational practices.**

If you have any questions concerning our evaluation or if we may be of other assistance, please contact Mr. Joel Klumpp at (512) 239-4453, by e-mail at joel.klumpp@tceq.texas.gov, or by correspondence at:

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Sincerely,

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Enclosure: CT Study Worksheet

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Mr. Mark Southard
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Blind Copies:

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