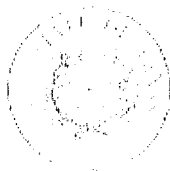


Bryan Shaw, Ph.D., *Chairman*
Carlos Rubinstein, *Commissioner*
Toby Baker, *Commissioner*
Zak Covar, *Executive Director*



PWS/1140038/CO
PWS/0680002/CO
PWS/1140001/CO
PWS/1590001/CO
PWS/1650001/CO
PWS/2080001/CO

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

April 11, 2013

Mr. David W. Sloan, P.E., BCEE
Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109

Subject: Revision to the Previously Granted Exception to Use Membrane-Treated Reclaimed Wastewater from the Big Spring Wastewater Treatment Plant as a Raw Water Source for Public Drinking Water Systems
Colorado River Municipal Water District - PWS ID No. 1140038
Howard County, Texas

CN602515967

RN105692891

Dear Mr. Sloan:

The Texas Commission on Environmental Quality (TCEQ) received your March 1, 2013 letter requesting review and changes in some of the conditions described in the TCEQ's November 30, 2010 letter approving an innovative raw water source. The Colorado River Municipal Water District (CRMWD) Big Spring Regional Water Reclamation Project (reclamation facility) had requested an exception to the requirements for the raw water source. The exception request proposed the use of City of Big Spring Wastewater Treatment Plant (WWTP) effluent treated at the CRMWD reclamation facility by hollow fiber (HF) microfiltration (MF) membranes followed by reverse osmosis (RO) membranes to be used as a raw water source for the City of Big Spring (PWS ID 1140001), City of Snyder (PWS ID 2080001), City of Odessa (PWS ID 0680002), City of Stanton (1590001), and City of Midland (PWS ID 1650001) surface water treatment plants (SWTPs).

The CRMWD correspondence contained requests that were not specified or are not consistent with the requirements and approvals addressed in the TCEQ's November 30, 2010 letter. The TCEQ has reevaluated the conditions of the approved exception for the reclamation facility because of the CRMWD's requests to:

- Use ultraviolet light (UV) in lieu of chlorine for viral control;
- Base membrane cleaning on the volume of water treated instead of on time in service;
- Gain approval of the HF MF membrane direct integrity test (DIT) parameters;
- Increase the allowed instantaneous ratio of CRMWD reclamation effluent to EV Spence water from 15% to 20%;
- Monitor key parameters instead of recording the amount of chemicals used daily;
- Gain clarification that field sampling methods are allowed for certain analyses; and
- Modify the total dissolved solids (TDS) monitoring requirements.

TCEQ recognizes the CRMWD reclamation facility will produce source water from wastewater effluent for public water systems. This constitutes direct potable reuse of wastewater effluent without an environmental buffer. Because of the knowledge gained while approving several

April 11, 2013

direct potable reuse facilities, the TCEQ has modified the conditions under which the CRMWD reclamation facility can produce water. A summary of the changes is listed below. A complete list of all the conditions, both original (from the November 30, 2010 letter) and amended to address the March 1, 2013 request, is provided as Enclosure A.

Summary of Changes

- The requirement for a 1.0 milligram per liter (mg/L) free chlorine residual in the water received from the WWTP is replaced with a requirement for the reclamation facility to provide at least 4.0-log viral inactivation through UV disinfection. The reclamation facility may only claim 4.0-log viral inactivation credit when:
 - all of the permeate from the RO units is passing through a series of two modified Trojan UVPhox™ 72AL75 UV reactors;
 - the reactors are operating at validated flow rates;
 - the calculated validated dose (D_{val}) for each reactor is greater than or equal to 100 millijoules per square centimeter (mJ/cm^2) which is the dose required (D_{req}) for 2.0 log viral inactivation; and
 - no more than 2 of the 144 lamps are inoperative.Conversely, the reclamation facility may not claim 4.0-log viral inactivation credit when all of the permeate is not passing through both reactors, the reactors are not operating at validated flow rates, when the D_{val} for either reactor is lower than the D_{req} , or when more than 2 of the 144 lamps are inoperative (even if the D_{val} for each reactor is exceeding D_{req}).
- The conditions under which the MF membrane modules will need an enhanced maintenance clean are amended. We have based the cleaning frequency on the volume of water processed instead of the time in use, as requested.
- The requested DIT parameters for the facility are approved.

TABLE 1: DIT PARAMETERS FOR THE TWO HF MF MEMBRANE UNITS AT THE CRMWD RECLAMATION FACILITY ⁽¹⁾

Initial Test Pressure (P_{test}) (psi)	Upper Control Limit (UCL) (psi/min)	Log Removal Credit (LRC) (log)
25.0	0.07	4.0

(1) Based on the data and calculations shown in Enclosures A & B.

- The ratio of CRMWD reclamation facility water to raw surface water in the Spence raw water pipeline must remain at or below 20%. That ratio must be measured and recorded once every four hours. During periods of drought, TCEQ may reevaluate the ratio based on a written request from CRMWD.
- The TCEQ has reviewed the planned automated control system showing that all key parameters are measured, recorded, and that alarms and shut-down commands are in place when the key parameters reach the required levels. The CRMWD's central operation center is staffed at all times when the facility is producing water and an operator can be summoned to the CRMWD reclamation facility when an alarm is sounded. If the plant is shut-down it can only be re-started by an operator on site at the CRMWD reclamation facility. The conditions in which an operator must be present have been clarified. Additionally, the TCEQ has amended the letter to allow measurement of key parameters instead of direct measurement of the chemicals used during automated operation.

- The TCEQ encourages the use of field sampling to assure results are received in the timeliest fashion. Therefore, the conditions to use only methods available in 30 TAC §290.119 has been changed to allow the use of any reasonable field methods if approved by the TCEQ.
- The trigger level for shut down of the RO unit has been modified to incorporate a finite value of TDS.
- The TCEQ has received sample results from samples collected on January 31, 2013 from the CRMWD reclamation facility effluent. Based on those results, the TCEQ will require three additional quarterly sampling events for regulated minerals, metals and organic compounds for a total of one year of quarterly samples. The sampling frequency will be reevaluated based on sample results after receipt of four consecutive quarterly samples.
- A DIT must be performed daily for each HF MF membrane unit instead of every seven days. This is consistent with EPA's Long Term 2 Enhanced Surface Water Treatment (LT2) Rule. The LT2 rule requires DITs every day for systems using sources with elevated pathogen levels. Wastewater has elevated pathogen levels, and thus will require daily DITs.
- The nitrate and nitrite levels in the combined CRMWD effluent and raw water pipeline must remain below 10 milligrams/liter (mg/L) and 1.0 mg/L respectively. These are the maximum contaminant levels for nitrate and nitrite in drinking water. Nitrate and nitrite have acute health effects. The nitrate and nitrite levels must be measured and recorded daily.
- The *Cryptosporidium*, and *Giardia* concentrations in the WWTP effluent and CRMWD reclamation facility's effluent must be measured once a month for 2 years. The CRMWD effluent sampling must begin when the CRMWD reclamation facility is first placed in service. The WWTP effluent monitoring must begin when CRMWD secures funding or by September 30, 2013, whichever comes first. The TCEQ will evaluate the need for continued pathogen monitoring once the two years of data have been collected and reviewed.
- The *E. coli* concentrations (enumeration) in the WWTP effluent and the CRMWD reclamation facility's effluent must be measured once every seven days for two years. The TCEQ will evaluate the need for continued pathogen monitoring once the two years of data have been collected and reviewed.
- The total organic carbon (TOC) in the WWTP effluent, RO feed water, RO permeate, and CRMWD reclamation facility effluent must be measured and recorded once per weekday for at least one month. At the end of the month, the TCEQ will review the results and determine a final monitoring schedule for TOC.
- The Texas Pollutant Discharge Elimination System (TPDES) and 30 TAC 210 permits of the Big Spring WWTP must be current.
- The TCEQ has added a recommendation that the facility inform the receiving public water systems (PWS) and the TCEQ if the CRMWD reclamation facility is shut down since this could result in less water being sent to the receiving PWSs.
- The CRMWD reclamation facility's operations and maintenance manual must contain the communications plan with local health officials and the procedures and contact information for contacting the TCEQ and the receiving PWSs. A copy must be maintained at the CRMWD reclamation facility.

Mr. David W. Sloan, P.E., BCEE

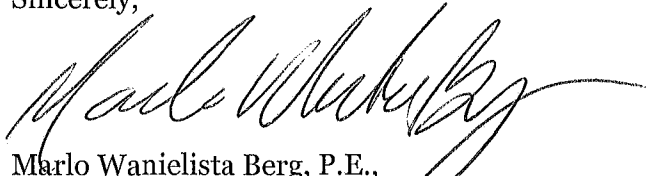
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- The CRMWD reclamation facility must submit monthly reports to TCEQ using the TCEQ's specified reporting formats when a customized form is made available. Since the November 10, 2010 response letter was written, the TCEQ's reporting form has been updated to include MF membrane units and UV reactors. The TCEQ will further assist CRMWD by customizing the form for its specific needs. Until TCEQ provides the customized form, a form created by CRMWD containing all the items required to be reported in Enclosure A may be used. This temporary form must be submitted to the TCEQ by the tenth day of the month following the end of the reporting period.
- The calibration, reporting, and record keeping requirements have been modified to incorporate the above changes.
- The TCEQ recommends that CRMWD monitor the untreated WWTP's effluent, and the CRMWD reclamation facility's effluent for the potential chemical and microbiological contaminants of concern on a quarterly basis.

Please see Enclosure A for a complete list of the amended conditions for the CRMWD reclamation facility. If you have any questions or need further assistance, please contact Ms. Marlo Wanielista Berg, P.E. of my staff at marlo.berg@tceq.texas.gov, or at (512) 239-6967.

Sincerely,



Marlo Wanielista Berg, P.E.,
Technical Review and Oversight Team
Plan and Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality



Linda Brookins, Director
Water Supply Division
Office of Water
Texas Commission on Environmental Quality

Enclosure A: CRWMD Big Spring Reclamation Facility List of Conditions

Enclosure B: DIT Worksheet

Enclosure C: Comparison of CRMWD Reclamation Facility and Spence Reservoir Sample Results

Enclosure D: Unregulated Contaminants of Concern

LB/mew

Mr. David W. Sloan, P.E., BCEE

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April 11, 2013

cc: Mr. John Grant, General Manager, Colorado River Municipal Water District, PO Box 869,
Big Spring, TX 79721- 0869
Mr. Jim R. Purcell, Colorado River Municipal Water District, PO Box 869, Big Spring,
TX 79721- 0869
The Honorable Tommy Duncan, Mayor, City of Big Spring, 310 Nolan Street, Big Spring,
TX 79720-2657
Mr. Tony Modisette, City of Big Spring, 310 Nolan Street, Big Spring, TX 79720-2657
The Honorable Terry Martin, Mayor, City of Snyder, PO Box 1341, Snyder, TX 79550-
1341
Mr. Chris Woodard, City of Snyder, PO Box 1341, Snyder, TX 79550-1341
The Honorable W. Wesley Perry, Mayor, City of Midland, PO Box 1152, Midland, TX
79702-1152
Mr. Stuart T. Purvis, City of Midland, PO Box 1152, Midland, TX 79702-1152
The Honorable David Turner, Mayor, City of Odessa, PO Box 4398, Odessa, TX 79760-
4398
The Honorable Justin Burch, Mayor, City of Stanton, PO Box 370, Stanton, TX 79782-
0370
Mr. Jessie Montez, City of Stanton, PO Box 370, Stanton, TX 79782-0370
TCEQ Midland Regional Office – R7
Ms. Vera Poe, P.E., Team Leader, Utilities Technical Review Team – MC159
Mr. Joel Klumpp, Team Leader, Technical Review and Oversight Team – MC159
Mr. Bob Patton, Section Manager, Public Drinking Water Section - MC155
Mr. Gary Chauvin, Team Leader, Drinking Water Quality Team - MC155
Ms. Jaya Zyman-Ponebshek, Assistant Director, Water Quality Division – MC145

Enclosure A

Revised List of Conditions, April 11, 2013

CRMWD Big Spring Reclamation Facility

The following list of conditions replaces the conditions outlined in the November 30, 2010 Texas Commission on Environmental Quality (TCEQ) letter for the Colorado River Municipal Water District (CRMWD) Big Spring Regional Water Reclamation Project (reclamation facility).

The proposed project's purpose is to supplement the raw source water received for drinking water treatment at the City of Big Spring (PWS ID 1140001), City of Snyder (PWS ID 2080001), City of Odessa (PWS ID 0680002), City of Stanton (1590001), and the City of Midland (PWS ID 1650001) surface water treatment plants (SWTPs). The current raw water sources for these systems are provided by the CRMWD through a series of regional raw water pipelines from groundwater and surface water sources. At this time, raw surface water can be delivered through these interconnected raw water pipelines from several groundwater well fields, OH Ivie Reservoir, EV Spence Reservoir, and Lake JB Thomas to each of the above public water systems (PWSs).

The project would supplement the raw groundwater and surface water sources by introducing treated reclaimed wastewater effluent as an alternate raw source water. The alternate source water will be carried by the pipeline from the EV Spence Reservoir to the City of Big Spring's SWTP and other CRMWD raw water pipelines, allowing the blended alternate raw water source and raw surface water to be further distributed to the other four SWTPs for additional treatment. Up to twenty percent of the EV Spence Reservoir pipeline water will be made up of the reclaimed wastewater treatment plant effluent (WWTP). The CRMWD reclamation facility will take the effluent from the Big Spring WWTP, treat it with hollow fiber (HF) microfiltration (MF) membranes, reverse osmosis (RO) and advanced oxidation with ultraviolet light (UV) and hydrogen peroxide before the CRMWD reclamation facility's effluent is discharged into the EV Spence Reservoir raw water pipeline.

This enclosure includes the minimum site-specific requirements for the granted exception for the proposed direct potable reuse (DPR) of WWTP effluent as a raw water source for human consumption. Additionally, this enclosure sets the minimum design, operation, reporting, calibration and record keeping requirements for the CRMWD reclamation facility as an alternative source of raw water for PWSs. The requirements in this document supersede all previously stated conditions for this exception request to use an alternate raw water source other than groundwater or surface water to be treated for human consumption.

Title 30 Texas Administrative Code (30 TAC) Chapter 290, Subchapters D, E, and F rules apply to all PWSs. The CRMWD reclamation facility will produce a new alternate raw water source for other PWSs. However, requirements for treatment and distribution of drinking water found in Subchapters D, E and F are not applicable. The following conditions are TCEQ site-specific minimum operation, design, reporting, calibration, and record keeping requirements for the proposed innovative integrated membrane CRMWD reclamation facility which will produce an alternate raw water source for PWSs and are based on the pilot study data supplied.

OPERATIONAL REQUIREMENTS

1. The CRMWD reclamation facility may only discharge source water into the CRMWD EV Spence Reservoir raw water pipeline when all of the following conditions have been met. Except when notice is required, it is recommended that the facility inform the receiving PWSs and the TCEQ if the CRMWD reclamation facility, or a

treatment process such as a membrane unit, must be taken offline because this can result in less water being sent to the receiving PWSs. The conditions are:

- a. The WWTP effluent turbidity is below 10 Nephelometric Turbidity Units (NTU). If the WWTP effluent turbidity level is above 10 NTU the water from the WWTP must not enter the CRMWD reclamation facility. As described in the Freese and Nichols, Inc. pilot study report on page 30, turbidity levels above 10 NTU may cause performance issues with the HF MF membranes.
- b. The HF MF membrane units have passed the most recent direct integrity test (DIT). All DITs must be conducted using a sensitivity of 4.0-log and a resolution capable of detecting a 3.0 micron breach using the parameters approved by TCEQ and shown in Table 1 of Item No. 3 below. If a HF MF membrane unit fails a DIT, it must be taken off line, inspected and, if necessary, repaired. The HF MF membrane unit cannot be returned to service until the inspection and any needed maintenance have been performed and the unit passes a subsequent DIT. The pilot study HF MF membrane test units with a DIT sensitivity of 4.0-log removal produced water with the same levels (non-detectable) of *Cryptosporidium* oocysts and *Giardia* cysts as those found in the CRMWD EV Spence Reservoir raw water pipeline.
- c. The ratio of CRMWD reclamation facility water effluent to raw EV Spence Reservoir water is at or below 20%. If at any time the ratio is found to be above 20% the facility must be taken off line until the ratio can be returned to 20% or less. During periods of drought, TCEQ may reevaluate the ratio based on a written request from CRMWD.
- d. If conductivity or total dissolved solids levels of an RO unit's permeate increase by the larger of 20% or 40 microSiemens per centimeter ($\mu\text{S}/\text{cm}$) over the last reading then the RO unit must be removed from service, the problem repaired, and an acceptable conductivity or total dissolved solids achieved in the permeate before discharge to the CRMWD raw water pipeline can be resumed.
- e. The nitrate and nitrite levels in the CRMWD reclamation facility effluent are below 10.0 mg/L and 1.0 mg/L respectively. If the sample results show the nitrate level to be above 10.0 mg/L or the nitrite level to be more than 1.0 mg/L then the facility must sample the blended raw and reclamation facility water in the EV Spence Reservoir raw water pipeline. If nitrate concentration of the blended water is over 10.0 mg/L for nitrate or 1.0 mg/L for nitrite, the plant must be taken off line, inspected, and, if necessary, repaired. Due to the acute health risk, CRMWD must notify the TCEQ and the receiving PWSs immediately after receipt of any results over 10.0 mg/L for nitrate and 1.0 mg/L for nitrite in the blended water.
- f. The *E. coli* concentration levels in the reclamation facility effluent are zero (0) Colony Forming Units/Liter (CFU/L). If *E. coli* is present in the CRMWD reclamation facility effluent, the reclamation facility must be shut down, inspected and, if necessary, repaired. CRMWD must resample *E. coli* and receive a zero CFU/L concentration before the CRMWD reclamation facility can be returned to service.
- g. All the water passes through each of the treatment units including the entire WWTP process, HF MF, RO, and advanced oxidation with UV light and hydrogen peroxide.
- h. The reclamation facility must provide at least a 4.0-log inactivation of viruses through the use of UV light. If the CRMWD reclamation facility produces off-spec water for more than four (4) consecutive hours during a day, the facility

must be taken off line and the reactors must be inspected and, if necessary, repaired.

2. Item No. 1, above, contains the conditions under which the CRMWD reclamation facility, or a particular treatment process, must be shut down. If the CRMWD reclamation facility produces source water that does not meet the conditions in Item No. 1, the TCEQ and the receiving PWSs must be contacted within 24 hours by telephone at 1-888-777-3186 or by e-mail at pdws@tceq.state.tx.us. Within five working days, the CRMWD must submit written notification to:

TCEQ Technical Review and Oversight Team (MC 159)
 P.O. Box 13087
 Austin, TX 78711-3087

The written notification must include:

- a. The problem that required:
 - i. The WWTP Effluent to be returned to the head of the WWTP; or
 - ii. The CRMWD reclamation facility, or a particular treatment process, to be taken out of service;
 - b. The corrective actions taken;
 - c. The quantity and duration of any unacceptable water discharged to the CRMWD EV Spence Reservoir raw water pipeline; and
 - d. A list of the PWSs using the water at that time.
3. The CRMWD must conduct a DIT on each HF MF membrane unit to verify that the integrity of the HF MF membranes has not been compromised and the approved 4.0-log removal credit for *Cryptosporidium* oocysts and *Giardia* cysts is being continuously achieved. A DIT must be conducted on a HF membrane unit :
 - a. Once each day;
 - b. Before returning a HF MF membrane unit to service after failing an initial DIT and being repaired; and
 - c. After each clean-in-place (CIP) procedure.
 4. The DIT must be conducted using a procedure approved by the TCEQ including resolution and sensitivity requirements. The DIT must show 4.0-log removal sensitivity.

**TABLE 1: DIT PARAMETERS FOR THE TWO HF MF MEMBRANE
 UNITS AT THE CRMWD RECLAMATION FACILITY ⁽¹⁾**

Initial Test Pressure (P_{test}) (psi)	Upper Control Limit (UCL) (psi/min)	Log Removal Credit (LRC) (log)
25.0	0.07	4.0

(1) Based on the data and calculations shown in Enclosure B.

5. The CRMWD reclamation facility must immediately conduct a DIT on any HF MF membrane unit that produces filtered water with a turbidity level above 0.15 NTU in two consecutive 5-minute readings.
6. Continuous indirect integrity monitoring of each HF MF membrane unit's filtrate turbidity levels must be conducted using the Hach Model FilterTrak method 10133, or an alternative acceptable to the TCEQ. The results must be recorded every five minutes.
7. All of the permeate from the RO units must pass through a series of two modified Trojan UVPhox™ 72AL75 UV reactors.
 - a. Because the validation study was conducted on a Trojan UVFit™ 72AL75 reactor, the sensor in each of the UVPhox 72AL75 reactors must be replaced with the sensor used in the validated UVFit reactor. With the exception of the end caps on the UVPhox reactors, the parts, construction, and design of the modified UVPhox reactors must exactly match those of the validated UVFit reactor.
 - b. Following the modification, the two reactors must meet the following specifications.

Number/Type of Lamps and Sleeves	72 Low Pressure, High Output (LPHO) lamps
Lamp Model and Part Number	Trojan UVPhox , P/N 794447-ORD (Lamp, GA64T6HE ANG)
Sleeve Model and Part Number	Trojan UVPhox P/N 793024 (Sleeve, QTZ 28x25x)
Number of UV Intensity Sensors	1
Sensor Model and Part Number	Trojan UVFit, PN 015389-PX-S-480N

- c. The reactor must be operated based on the validated conditions for the UVFit™ 72AL75 reactor, which are shown in the table below.

Validated UV Transmittance (UVT) Range	40.3 to 81.0 %*
Validated Flow Rate Range	0.73 to 7.39 MGD* (507 to 5,132 gpm)
Maximum Viral Inactivation Credit Allowed and its corresponding Required Validated Dose (D _{req})	2.0-log @ 100 millijoules per square centimeter (mJ/cm²)

* The minimum validated flow and/or maximum validated UVT must be used in the calculation of Validated Dose.

- d. The calculated Validated Dose for each reactor must be determined using the following equation.

$$D_{VAL} = \frac{RED_{CALC}}{VF} = \frac{10^A \times Q^B \times UVT^C \times \left(\frac{S}{S_0}\right)^D}{1.183}$$

- Where:
- D_{val} = the calculated Validated Dose, mJ/cm²;
 - RED_{calc} = the calculated Reduction Equivalent Dose, mJ/cm²;
 - VF = Validation Factor, unitless;
 - Q = flow rate, MGD
 = 0.73 if the actual flow rate is less than 0.73 MGD, the minimum validated flow rate; or
 = the actual flow rate through the reactor or 0.73 MGD, the minimum validated flow rate, whichever is greater;
 - UVT = percent UV transmittance of the water, %
 = 81 if the actual UVT exceeds 81%, the maximum validated UVT;
 = the actual UVT or 81%, the maximum validated transmittance, whichever is lower;
 - S = the (sensor's) UV intensity measured under actual operating conditions, milliwatts per square centimeter (mW/cm²)
 = S_0 if actual intensity reading exceeds S_0 , the maximum validated sensor reading;
 = the actual measured UV intensity or S_0 , the maximum validated sensor reading, whichever is lower;
 - S_0 = the corresponding UV intensity, in mW/cm², with new lamps and sensor and without any fouling
 = $1.0536 \times 10^{-5} \times UVT^{2.7691}$ mW/cm²; and
 - A, B, C, and D = the regression equation coefficients shown in November 2009 Validation Report for the TrojanUVFit 72AL75 reactor.

8. The UV facilities may only claim 4.0-log viral inactivation credit when all of the permeate from the RO units is passing through both UV reactors, the reactors are operating at less than 7.39 MGD and a UVT greater than 40.3%, the D_{val} for each reactor is greater than or equal to D_{req} , and no more than 2 of the 144 lamps are inoperative. Conversely, the UV facilities will not be providing 4.0-log viral inactivation when any of the permeate bypasses either reactor, when the reactors are not operating at validated flow rates, when the D_{val} for either reactor is lower than the D_{req} , or if more than 2 of the 144 lamps are inoperative (even if the D_{val} for each reactor exceeds D_{req}). When the CRMWD reclamation facility is not meeting the 4.0-log viral inactivation requirement, it is producing "off-spec" water.
9. The status of each lamp, UV sensor reading, flow rate, and D_{val} result for each reactor must be recorded at least once every 5 minutes so that the plant can determine:

- a. The volume of permeate treated each day,
 - b. The volume of off-spec water produced each day,
 - c. The duration of each off-spec event, and
 - d. The percentage of off-spec water each month.
10. The accuracy of the UV sensor in each reactor must be checked against a reference sensor at least once each month. If the duty sensor does not read within 20% of the reference sensor, the D_{val} result must be corrected to compensate for the discrepancy until the duty sensor is recalibrated or replaced. After submitting 12 months of data, the CRMWD may propose an alternative verification frequency.
 11. The UV transmittance (UVT) of the RO permeate must be recorded at least once every 4 hours. If an online UVT monitor is used, the accuracy of the online unit must be checked against a calibrated benchtop unit at least once each week. If the on-line analyzer reads more than 2%UVT higher than the benchtop monitor, the online sensor must be replaced or recalibrated. Until the error in the online UVT analyzer is corrected, the D_{val} result must be based on the results of the 4-hour benchtop readings or the maximum validated UVT, whichever is lower. After submitting 12 months of data, the CRMWD may propose an alternative verification frequency.
 12. The flow to the HF MF membrane units must be monitored continuously and the results must be recorded every 30 minutes.
 13. The performance of the individual RO units shall be continuously monitored by a conductivity meter or a total dissolved solids meter. The highest confirmed reading shall be recorded each day.
 14. Data collected from on-line instruments may be recorded electronically by a SCADA system or on a strip chart recorder. The recorder must be designed so that the operator can accurately determine the value of the readings at the required monitoring interval for reporting.
 15. If there is a failure in the continuous monitoring equipment, grab sampling must be conducted every four hours in lieu of continuous monitoring, but for no more than five working days following the failure of the equipment.
 16. The ratio of CRMWD reclamation facility effluent to raw water in the EV Spence Reservoir raw water pipeline must be determined and recorded every four hours. The highest daily ratio must be reported on the monthly operating report.
 17. The nitrate and nitrite levels must be measured and recorded once per day in the CRMWD reclamation facility effluent.
 18. The total organic carbon (TOC) in the WWTP effluent, RO feed water, RO permeate, and CRMWD reclamation facility effluent must be temporarily measured and recorded once per weekday for at least one month. At the end of the month, the TCEQ will review the results and determine a final monitoring schedule for TOC.

19. For two years, *E. coli* enumeration must be performed and recorded once every seven days in the WWTP effluent and the CRMWD reclamation facility effluent. The monitoring frequency will be reevaluated at the end of two years.
20. Once the CRMWD reclamation facility is discharging effluent into the EV Spence Reservoir pipeline, Long Term 2 Enhanced Surface Water Treatment Rule (LT2) raw source water sampling must be performed on the alternative blended source water for all of the PWSs that have the potential to receive this alternative blended source water as described in 30 TAC §290.111(b). *Cryptosporidium* and *Giardia* sampling must be performed once a month for 2 years. *Cryptosporidium* analysis must be performed by a laboratory approved by EPA for *Cryptosporidium* analysis. *Giardia* analysis must be performed concurrently. The monitoring frequency will be reevaluated at the end of two years.
21. CRMWD must contact each of the PWSs that can receive the alternative source water from the CRMWD reclamation facility to notify them of the new source water monitoring requirement. CRMWD must also notify the Technical Review and Oversight Team (MC-159) in writing when the reclamation facility begins producing source water at:

TCEQ Technical Review & Oversight Team (MC 159)
P.O. Box 13087
Austin, Texas 78711-3087

22. For two years, CRMWD must collect monthly samples for *Cryptosporidium* and *Giardia* in the WWTP effluent. The sampling is to begin as soon as CRMWD secures funding or by September 30, 2013 whichever is sooner. The monitoring frequency will be reevaluated at the end of two years. *Cryptosporidium* analysis must be performed by a laboratory approved by EPA for *Cryptosporidium* analysis. *Giardia* analysis must be performed concurrently.
23. All monitoring required as a condition of this exception must be conducted using methods that conform to the requirements of 30 TAC §290.119. If alternative methods are preferred, reasonable field methods can be approved by the TCEQ.
24. A plant operations manual that meets the requirements of 30 TAC §290.42(l) must be kept on site and must be made available to TCEQ staff upon request. The operations manual shall include the communication plan with local health officials of all receiving PWS. The manual shall also include the procedures and contact information for the TCEQ and the receiving PWSs.
25. A Class B surface water operator must be employed by the CRMWD reclamation facility. Class C surface water operators can operate the CRMWD reclamation facility if the Class B operator is on call. Operators having both a water and wastewater license may work in the CRMWD reclamation facility and Big Spring WWTP, but not during the same shift, to prevent the introduction of contaminants.
26. The CRMWD reclamation facility must have a Class C or higher Surface Water operator on site when CIP procedures are being conducted on the HF MF and RO membrane units, lab instruments and UV sensors are calibrated, any time UV

maintenance (lamp, sensor, sleeve or other replacements) occur, and to respond to alarms and shut-downs caused by the automated control system.

27. The TCEQ has received chemical analytical results of the CRMWD reclamation facilities' treated water as shown in Enclosure C. Based on these results, the TCEQ will require quarterly sampling for one year. The January 31, 2013 sample will be considered the first of the four samples. TCEQ will reevaluate the sample schedule after the end of one year. If during future sampling events, the chemical sample results are higher than the MCL for any constituent, the receiving PWSs may need to increase their sampling frequency.
28. Results of pilot study sampling showed an increase in total trihalomethane (TTHM) levels above those seen in the EV Spence Reservoir raw water pipeline. The CRMWD must notify all of the PWSs that have the potential to receive the CRMWD reclamation facility effluent as an alternative source water of the levels found so that the PWSs can assess the impact to their finished drinking water compliance.
29. TCEQ recommends that CRMWD disinfect newly constructed or repaired facilities and verify the effectiveness of the disinfection procedure in accordance with American Water Works Association (AWWA) regulations as described in 30 TAC §290.46(g) as practical.
30. The CRMWD reclamation facility HF MF membrane filtrate tank and the RO membrane permeate storage tank must be inspected annually by the facility's licensed water operators or a contract inspection service as described in 30 TAC §290.26(m).
31. All electrical wiring must be securely installed in compliance with local or national electrical codes.
32. The CRMWD reclamation facility must maintain internal procedures to notify TCEQ immediately if an emergency event would negatively impact the delivery of the alternative blended source water. A list of such events is located in 30 TAC §290.46(w)
33. All backflow prevention assemblies that are required by this enclosure shall be tested upon installation and then once every 12 months as described in 30 TAC §290.44(h)(4).
34. Comprehensive Compliance Investigations of the CRMWD reclamation facility will be conducted by TCEQ staff periodically to assure the conditions of this letter and enclosures are being met. The investigations will be conducted as part of a PWS investigation, not a wastewater investigation because the effluent of the CRMWD reclamation facility is being discharged into a pipeline, not a water body.
35. The Texas Pollutant Discharge Elimination System (TPDES) and 30 TAC 210 permits of the Big Spring WWTP must be current. For assistance, please contact TCEQ's Wastewater Permitting Section (MC 148) for information at (512) 239-2369.

36. The TCEQ recommends that CRMWD monitor the untreated WWTP's effluent, and the CRMWD reclamation facility's effluent for the potential chemical and microbiological contaminants of concern contained in Enclosure D: Unregulated Contaminants of Concern on a quarterly basis.

DESIGN REQUIREMENTS

37. Engineering specifications and drawings were submitted for the TCEQ review on January 14, 2011 and approved with conditions on March 14, 2011. Additional information on the UV facilities was submitted after the plans and specification were approved.
38. In the future, the CRMWD reclamation facility must notify TCEQ prior to making any change (increase or decrease) in production, treatment, storage, disinfection (disinfectant method/type used, application points, or monitoring points), replacement of membranes (MF or RO), blending ratio, or any additional treatment processes (such as corrosion control) as described in 30 TAC §290.39(j).
39. All waste discharge must be in accordance with federal and state requirements as described in 30 TAC §290.42(i). For assistance, please contact TCEQ's Wastewater Permitting Section (MC 148) for information required for the proper disposal of generated waste (such as RO membrane reject, CIP cleaning solutions, etc.) and any required discharge permit at (512) 239-2369.
40. A full-scale HF MF membrane system with Pall Microza® Model UNA-620A HF MF membrane modules (See the HF Membrane Details section for further details.) must be installed with the following design specifications:
- a. Pre-treatment facilities consisting of a 300 micron strainer;
 - b. Pall Microza® Model UNA-620A HF MF membrane modules with the following specifications:
 - i. A HF MF pressure membrane module six inches in diameter, approximately 80 inches (in) in length and containing polyvinylidene fluoride (PVDF) fibers with a total feed side surface area of 538-square feet (sf);
 - ii. A membrane fiber nominal pore size of 0.1 microns;
 - iii. Outside-to-inside flow mode with dead-end operation;
 - iv. Allowable transmembrane pressure (TMP) operating range of 1 to 43.5 pounds per square-inch (psi);
 - v. Allowable operating temperature range of 0° to 40° C;
 - vi. A 1,000 mg/L chlorine tolerance; and
 - vii. Manufacture's allowable feed water turbidity level spike of 600 NTU.
 - c. Facilities to allow a filtrate duration of 20 minutes;
 - d. Facilities for a backwash cycle procedure on each HF MF membrane unit every 20 minutes using a Simultaneous Air Scrubbing and Reverse Filtration (SASRF) procedure for 60 seconds followed by Forward Flush (FF) for 20 seconds;
 - e. Facilities to conduct both a sodium hypochlorite and 1% citric acid enhanced filtrate maintenance (EFM) wash procedure utilizing RO permeate as make up water as needed. One EFM will be conducted once every 2.88 million gallons (MG) for a duration of 37 minutes;

- f. Facilities to conduct a HF MF membrane unit chemical CIP procedure no less than once every 30 days for a duration of approximately six hours utilizing RO permeate as makeup water;
 - g. Facilities to provide an average instantaneous filtrate flux rate of 37.2 gallons per square-foot per day (gfd) (temperature corrected to 20° C);
- 41. A full-scale RO membrane system of Toray TML 10 RO elements, or another TCEQ acceptable Toray element (see the RO Membrane Details section for further details) must be installed in pressure vessels arranged in a two-stage configuration with twice as many pressure vessels and elements in each Stage 1 as are in the corresponding Stage 2 (2:1 array) with the following specifications:
 - h. Toray TML 10 RO elements model with the following specifications:
 - i. 4-inch diameter or if a larger Toray membrane is used, the elements must have the same leaf length as the pilot TML 10;
 - ii. A leaf length of 40 inches;
 - iii. An active membrane area of 75 sf;
 - iv. Minimum salt rejection of 99%;
 - v. Recovery rate of 75%;
 - vi. Maximum operating temperature of 113° F;
 - vii. Maximum allowed continuous free chlorine value of non-detectable;
 - viii. An operating pH range of 2 to 11;
 - ix. A pH cleaning range of 1 to 12;
 - x. A maximum operating pressure of 600 psi;
 - xi. A maximum pressure drop per element of 20 psi; and
 - xii. A maximum silt density index (SDI) of 5.
 - i. Facilities for dechlorination of the water prior to the RO membrane units must be provided;
 - j. Facilities to assure complete dechlorination was achieved must be provided;
 - k. Facilities to feed sulfuric acid or another antiscalant for scale control must be provided;
 - l. Facilities for performing an RO membrane unit CIP procedure using both caustic and acid heated solutions; and
 - m. Facilities to achieve an average flux rate of 10.5 gfd.
- 42. Open tanks or basins at the CRMWD reclamation facility must be located at least 500 feet from any wastewater treatment units or lands irrigated with sewage effluent. The enclosed portion of the CRMWD reclamation facility must be located at least 150 feet from any wastewater treatment units or lands irrigated with sewage effluent.
- 43. The CRMWD reclamation facility shall be located at a site that is accessible by an all-weather road as described in 30 TAC §290.42(a)(3).
- 44. All water discharged to the CRMWD EV Spence Reservoir raw water pipeline must be treated by the HF MF and RO membrane units and the advanced oxidation (using UV and hydrogen peroxide) processes. This means, the CRMWD reclamation facility units must be designed to treat all of the WWTP effluent received. Blending of WWTP effluent with reclamation facility effluent is not approved.

45. No return of decanted water or solids to the beginning of the CRMWD reclamation facility is proposed. If recycle return is desired in the future, please contact the TCEQ Technical Review & Oversight Team (MC 159) at the following address:

TCEQ Technical Review & Oversight Team (MC 159)
P.O. Box 13087
Austin, Texas 78711-3087
46. The CRMWD reclamation facility, including all filtrate and permeate storage tanks, shall be enclosed by an intruder-resistant fence as described in 30 TAC §290.38(37). The gates shall be locked during periods of darkness and when the plant is unattended.
47. Chemical storage facilities shall comply with the applicable requirements in 30 TAC §290.42(f)(1).
48. Chemical feed facilities shall comply with the applicable requirements in 30 TAC §290.42(f)(2).
49. Pipe galleries shall provide ample working room, good lighting, and good drainage provided by sloping floors, gutters, and sumps. Adequate ventilation to prevent condensation and to provide humidity control is also required as detailed in 30 TAC §290.42(d)(12).
50. The identification of piping shall be accomplished by the use of labels or various colors of paint as described in 30 TAC §290.42(d)(13).
51. Sanitary facilities for water works installations must be provided as described in 30 TAC §290.42(h).
52. The safety requirements of 30 TAC §290.42(k)(1) must be followed.
53. No cross-connection shall be permitted to exist between the WWTP effluent and the CRMWD reclamation facility effluent or any stage of prior treatment as described in 30 TAC §290.42(d)(2).
54. All reclaimed customer connections between the CRMWD reclamation facility and the CRMWD EV Spence Reservoir raw water pipeline shall be provided with backflow/back-siphonage protection to eliminate the possibility of chemical contamination and pathogen contamination as described in 30 TAC §290.44(h)(1)(A).
55. Separation distances between the CRMWD reclamation facility's effluent distribution/transmission piping and potable water piping shall be as specified in 30 TAC §290.44(e)(7).
56. Separation distances between the CRMWD reclamation facility's effluent distribution/transmission piping and wastewater collection mains and other potential sources of contamination shall be as described in 30 TAC §290.44(e)(7).

57. Sampling taps must be located after the CRMWD reclamation facility's source water (WWTP effluent) storage tank, on the HF MF membrane filtrate storage tanks' effluent, RO membrane permeate storage tanks' effluent and the CRMWD reclamation facility's discharge piping to the CRMWD EV Spence Reservoir raw water pipeline as described in 30 TAC §290.43(c) and §290.42(d)(14). These sample taps must be readily accessible to the plant operators and TCEQ representatives.
58. All treatment chemicals and media used in the full-scale facility must conform to American National Standard Institute/National Sanitation Foundation (ANSI/NSF) Standard 60 for direct additives and ANSI/NSF Standard 61 for indirect additives and be certified by an organization accredited by ANSI as described in 30 TAC §290.42(j). This includes dechlorination compounds, disinfectants, anti-scalants, acids, caustics and other membrane cleaning chemicals.
59. Flow measuring devices will be required on the WWTP effluent, the feed to each HF MF membrane unit, the HF MF membrane backwash supply, the combined HF MF membrane filtrate, RO concentrate, UV reactor influent stream(s), and the CRMWD reclamation facility discharge piping to the CRMWD EV Spence Reservoir raw water pipeline as described in 30 TAC §290.42(d)(5). The RO permeate flow rate may be calculated by subtracting the RO concentrate flow from the RO influent flow or by direct measurement.
60. The CRMWD reclamation facility must be designed to conduct and record continuous turbidity monitoring of the WWTP effluent.
61. The HF MF membrane system must be designed to conduct and record continuous indirect integrity monitoring on each HF MF membrane unit using the Hach FilterTrak method 10133, or an acceptable TCEQ alternative as described in 30 TAC §290.42(g)(3)(C).
62. The RO membrane system must be designed to conduct and record continuous conductivity or total dissolved solids on each RO membrane unit.
63. The HF MF and RO membrane systems must be designed so that the membrane units' feed water, filtrate, backwash supply, waste, and chemical cleaning piping shall have cross-connection protection to prevent chemicals from all chemical cleaning processes from contaminating other membrane units' filtrate and permeate in other modes of operations. This may be accomplished by the installation of a double block and bleed valving arrangement, a removable spool system, or other alternative method approved by the TCEQ.
64. The CRMWD reclamation facility's feed water must receive the same pretreatment, at a minimum, under full-scale operation as received during this pilot study. The treatment is provided at the Big Spring WWTP and is as follows: Raw wastewater is first screened and de-gritted, then flows to a primary clarifier. Primary effluent then proceeds to a single rock media trickling filter for biological stabilization and then is pumped to the aeration basin for additional biological treatment. The contents of the aeration basin flow to the final clarifier, where the active biomass is separated from the treated effluent and recycled to the aeration basin. The effluent is

chlorinated. The filtered effluent containing the chlorine residual was the source water for the pilot study.

65. The CRMWD reclamation facility must be designed to conduct and record the results of DITs as described in 30 TAC §290.42(g)(3)(B). The DIT values are calculated as described in the *DIT Resolution and LRV_{DIT} Sensitivity Calculations* under the HF MF Membrane Details section.
66. An adequately equipped laboratory must be available so that daily tests such as disinfectant residual, UV transmittance, turbidity, pH, conductivity or total dissolved solids, and all other tests required by the conditions of this letter may be performed.
67. The water storage tank used to store CRMWD reclamation facility's effluent before it is sent to the CRMWD EV Spence Reservoir raw water pipeline must meet the requirements of 30 TAC §290.43(c).

CALIBRATION

68. Conductivity or dissolved solids meters used to monitor the RO membrane units' permeate shall be calibrated with solution of known concentrations at least once every 90 days.
69. Flow measuring devices and rate-of-flow controllers shall be calibrated at least once every 12 months. Magnetic flow meters shall be verified at least once every 12 months and calibrated if needed.
70. pH meters shall be properly calibrated as described in 30 TAC §290.46(s)(2)(A).
71. Turbidimeters shall be properly calibrated as described in 30 TAC §290.46(s)(2)(B).
72. Pressure monitors used for DIT measurements shall be calibrated or verified at least once every 12 months.
73. Instruments used to monitor nitrate and nitrite shall be calibrated or verified at least once every 12 months.
74. Instruments used to monitor TOC shall be calibrated or verified at least once every 12 months.
75. The accuracy of the UV sensor in each reactor must be checked against a reference sensor at least once each month for at least 12 months. If the duty sensor does not read within 20% of the reference sensor, the duty sensor must be recalibrated or replaced. After 12 months, the CRMWD may propose an alternative verification frequency.
76. If an online UVT monitor is used, the accuracy of the online unit must be checked against a calibrated benchtop unit at least once each week for at least 12 months. If the on-line analyzer reads more than 2%UVT higher than the benchtop monitor, the

online sensor must be replaced or recalibrated. After 12 months, the CRMWD may propose an alternative verification frequency.

REPORTING

77. The TCEQ will require the CRMWD reclamation facility to record the following:
 - a. The highest daily confirmed turbidity in the WWTP's effluent;
 - b. The daily maximum flow rates to each HF MF membrane units;
 - c. Total water produced by each HF MF membrane unit each day;
 - d. The total daily flow to the RO membrane units;
 - e. The highest confirmed daily turbidity of each HF MF membrane unit;
 - f. Any HF MF membrane unit DIT's starting test pressure and decay pressure rate in pounds per square inch per minute (psi/min);
 - g. Any corrective actions taken, such as pinning, to correct a failed HF MF membrane DIT;
 - h. Any CIP that has been performed on a HF MF or RO membrane unit;
 - i. The daily highest confirmed conductivity or total dissolved solids for each RO membrane unit;
 - j. The minimum validated UV dose (D_{val}) achieved each day in each UV reactor, the values of the parameters used to calculate the minimum D_{val} , the volume of off-spec water produced each day, the number of consecutive hours that the UV facility produced off-spec water each day, and the percentage of off-spec water produced each month;
 - k. The amount of each chemical used per day, except for on weekends and holidays;
 - l. The amount of WWTP effluent treated per day;
 - m. The amount of water sent to the EV Spence Reservoir raw water pipeline per day;
 - n. The daily maximum ratio of CRMWD reclamation facility effluent to raw water in the EV Spence Reservoir raw water pipeline;
 - o. The nitrate and nitrite results found in the CRMWD reclamation facility effluent and if necessary the EV Spence Reservoir raw water pipeline each day;
 - p. The weekly *E. coli* of the WWTP and CRMWD reclamation facility effluent;
 - q. The daily TOC in the WWTP effluent, RO feed water, RO permeate, and CRMWD reclamation facility effluent each weekday for one month only; and
 - r. Any *Cryptosporidium* or *Giardia* sample results received. .
78. The TCEQ will require the CRMWD reclamation facility to record the following:
 - a. The dates that storage tanks and other facilities were cleaned and/or repaired; and
 - b. The maintenance and/or replacement activities for the system equipment and facilities.
79. The CRMWD reclamation facility shall record the daily and monthly data required in the reporting section of this Enclosure using the most recent version of the Surface Water Monthly Operating Report (SWMOR-Alt, form number 00102D) and submit the form monthly to the TCEQ. The TCEQ shall customize this report for the facility. The facility can use a self-created form until the time TCEQ produces a customized report. The records must be completed in ink, typed, or computer printed and must be signed by a Class B Surface Water Operator
80. The CRMWD reclamation facility must submit the monthly operating reports and other reports listed in the reporting section of this enclosure to the TCEQ by the

tenth day of the month following the end of the reporting period. Send the reports to:

TCEQ Technical Review & Oversight Team (MC 159)
P.O. Box 13087
Austin, Texas 78711-3087

81. The TCEQ will require the reclaimed wastewater to be identified as a raw water source on the consumer confidence report (CCR) for any PWS using this water as a raw water source.
82. The CRMWD must report to TCEQ as described in Item No. 2. If the CRMWD reclamation facility produces source water that does not meet the conditions in Item No. 1, it must contact the TCEQ within 24 hours by telephone at 1-888-777-3186 or by e-mail at pdws@tceq.state.tx.us, and immediately notify all PWSs receiving the source water. Within five working days, submit written notification regarding the problem that required the CRMWD reclamation facility, or part of the facility, to be taken out of service, the corrective actions taken, quantity of any unacceptable water discharged to the CRMWD raw water pipeline, and the PWSs using the water at that time to:

TCEQ Technical Review and Oversight Team (MC 159)
P.O. Box 13087
Austin, TX 78711-3087
83. Data on system ownership and management shall be provided as detailed in 30 TAC §290.46(p)(1).

RECORD RETENTION

84. The following records must be retained for at least two years:
 - a. The amount of chemicals used each day except for on weekends and holidays;
 - b. The volume of water treated each day;
 - c. The dates that storage tanks and other facilities were cleaned; and
 - d. The maintenance records for the system equipment and facilities.
85. The following records must be retained for at least three years:
 - a. Turbidity monitoring results for the individual HF MF membrane units;
 - b. The online and benchtop data for all parameters used to determine the viral inactivation achieved in the UV reactors; and
 - c. The calibration records for laboratory equipment, flow meters, on-line turbidimeters, on-line conductivity or total dissolved solids meters, UV sensors and disinfectant residual analyzers.
86. This letter must be retained while the exception is valid and then for at least five years after the exception is no longer valid.
87. Results of inspections of all water storage facilities must be retained for at least five years.
88. The following records must be retained for at least ten years:
 - a. The daily highest confirmed turbidity in the wastewater effluent;
 - b. The daily maximum flow rates to the HF MF membrane units;

- c. Total water produced by each HF MF membrane unit each day;
- d. The total daily flow to the RO membrane units;
- e. The highest daily confirmed turbidity in the HF MF membrane effluent;
- f. Any HF MF membrane unit DIT's starting test pressure, and decay pressure rate in psi/min;
- g. Any corrective actions taken, such as pinning, to correct a failed DIT or to address performance problems with the UV reactors;
- h. Each CIP performed on a HF MF or RO membrane unit;
- i. The daily highest confirmed conductivity or total dissolved solids for each RO membrane unit;
- j. The minimum validated UV dose (D_{val}) achieved each day in each UV reactor, the values of the parameters used to calculate the minimum D_{val} , the volume of off-spec water produced each day, the number of consecutive hours that the UV facility produced off-spec water each day, and the percentage of off-spec water produced each month;
- k. The amount of WWTP effluent treated per day;
- l. The amount of water sent to the EV Spence Reservoir raw water pipeline per day;
- m. The daily maximum ratio of CRMWD reclamation facility effluent to raw water in the EV Spence Reservoir raw water pipeline;
- n. The nitrate and nitrite results found in the CRMWD reclamation facility effluent and if necessary the EV Spence Reservoir raw water pipeline each day;
- o. The weekly *E. coli* of the WWTP and CRMWD reclamation facility effluents;
- p. Daily TOC in the WWTP effluent, RO feed water, RO permeate, and CRMWD reclamation facility effluent collected each weekday for one month only.
- q. A laboratory report containing *Cryptosporidium* and *Giardia* concentrations in the WWTP and CRMWD reclamation facility effluent; and
- r. The results of all chemical analyses.

89. Accurate, up-to-date, detailed plans and specification for the facility shall be maintained at the system until the facility is decommissioned.

HF MF MEMBRANE DETAILS

Pall Microza® Model UNA-620A MF Membrane Details

Based on approximately 30 days of operation (Cycle #7 of the pilot study report), from October 8, 2009 through November 10, 2009, of the Pall HF MF membrane test unit, the TCEQ finds that the following piloted operating parameters are accepted to yield a maximum of 17,959 gallons per day (GPD) of total filtrate water at 20° C per 538 sf membrane module.

- 1. Pre-treatment consists of a 300-micron strainer;
- 2. The water is not dechlorinated until after the HF MF membrane unit, thus the treatment unit has a 1 to 5 mg/L chlorine residual across the membranes;
- 3. The maximum recorded turbidity from the submitted turbidity data was approximately 80 NTU, but the CRMWD reclamation facility is choosing to divert the wastewater back to the WWTP if the turbidity is over 10 NTU. Based on this choice, the maximum allowable feed water turbidity for the treatment plant will be 10 NTU;

4. Pall Microza® Model UNA-620A HF MF membrane modules with the following specifications:
 - a. A HF MF pressure membrane module six inches in diameter, approximately 80 inches (in) in length and containing polyvinylidene fluoride (PVDF) fibers with a total feed side surface area of 538-sf;
 - b. A membrane fiber nominal pore size of 0.1 microns;
 - c. Outside-to-inside flow mode with dead-end operation;
 - d. Allowable TMP operating range of 1 to 43.5 psi;
 - e. Allowable operating temperature range of 0° to 40° C;
 - f. A 1,000 mg/L chlorine tolerance; and
 - g. Manufacture's allowable feed water turbidity level spike of 600 NTU.
5. A filtrate duration of 20 minutes;
6. A backwash cycle using a SASRF frequency of once every 20 minutes at a flow rate of 8 gallons per minute (gpm) of filtrate and 3 standard cubic feet per minute (SCFM) of air for a duration of 1.0 minute, followed by a forward flush (FF) at a flow rate of 18 gpm of feed water for a duration of 20 seconds;
7. A sodium hypochlorite enhanced filtrate maintenance (EFM) wash procedure once every 2.81 MG for a duration of 37 minutes with either 500 parts per million (ppm) sodium hypochlorite solution circulated or 1% citric acid solution for 30.0 minutes followed by a SASRF and FF for a total filtrate water use of 15 gallons per module. RO permeate is used for EFM make up volume. In times of poor water quality, an EFM utilizing 1000 ppm sodium hypochlorite instead of 500 ppm sodium hypochlorite will be performed. It is not expected that the 1000 ppm sodium hypochlorite EFM will be needed in full-scale because water with over 10 NTU will be returned to the WWTP;
8. A total of 1,331.4 minutes per day in filtrate mode and 108.8 minutes per day in SASRF, FF, and EFM;
9. A minimum chemical CIP frequency of no less than once every 30 days for a duration of approximately six hours. The CIP uses a heated 1% caustic and sodium hypochlorite pH 11 solution re-circulated through the membranes and filtrate piping for 2 hours with a subsequent air scrub and feed side rinse. The process is repeated with a heated 1% citric acid pH 3 solution re-circulated for 1 hour. RO permeate is used for the CIP make up volume;
10. An average instantaneous filtrate flux rate of 37.2 gfd (temperature corrected to 20° C); and
11. A gross filtrate production of 18,499 gpd and an in-plant use of filtrate of 540 GPD to yield a net filtrate of 17,959 gpd per a 538-sf module at 20° C available for future customer use.

Based on two units with 78 Pall UNA-620A HF MF membrane modules each, the HF MF membranes can produce 2.8 MGD.

The TCEQ determines the capacity of HF MF membrane facilities based on an instantaneous filtrate flux corrected to 20° C. This amount is determined by subtracting the total in-plant use of filtrate (for backwashing membranes and maintenance cleaning such as EFMs, and any other

in-plant use) from the gross potential filtrate production of a membrane unit in service for a 24-hour period of operation.

$$\text{Pall's filtrate flux at feed water temperature} = \frac{(\text{filtrate flux at } 20^{\circ}\text{C}) * 0.9826}{0.0004481 * T^2 - 0.03946 * T + 1.5926}$$

Where T is the HF MF membranes' feed water temperature in degrees centigrade, and filtrate flux at 20°C is 37.2 gfd.

**** Please note this is a Pall specific formula. It must be used at your facility, and cannot be used with other manufactures membrane units. ****

DIT Resolution and LRV_{DIT} Sensitivity Calculations

On February 26, 2013 the TCEQ received your e-mail providing information for the DIT calculations for the membrane treatment units at the CRMWD Reclamation facility – TCEQ Plant No 21710. The TCEQ is **approving** the following DIT values. To comply with the conditions of this letter, CRMWD must conduct daily DITs to verify the removal efficiency of the membrane treatment process.

Membrane Filtration Units – Unit 1 - 2

The TCEQ evaluated the design data submitted with your February 26, 2013 e-mail and prepared Table 1 to help the CRMWD reclamation facility operators complete the monthly report for units 1-2.

TABLE A-1: DIT PARAMETERS FOR THE TWO UNITS AT THE CRMWD RECLAMATION FACILITY ⁽¹⁾

Initial Test Pressure (P_{test}) (psi)	Upper Control Limit (UCL) (psi/min)	Log Removal Credit (LRC) (log)
25.0	0.07	4.0

(1) Based on the data and calculations shown in Enclosure B.

Direct Integrity Test (DIT) Resolution and Sensitivity Calculations:

Removal credit awarded to the CRMWD reclamation facility membrane filtration system is based on the lower of either the log removal value (LRV) demonstrated by a direct integrity test (LRV_{DIT}) or the log removal value validated by a challenge study (LRV_{C-Test}). The values used in these calculations are required for the TCEQ to approve removal credits for the CRMWD reclamation facility, TCEQ Plant ID 21710 .

Pall Corporation provided detailed descriptions of the calculations methods and values for the DIT. All formulas and methods of calculation are from the US EPA Membrane Filtration Guidance Manual and are in accordance with the DIT requirements of 40 Code of Federal Regulations (CFR) §141.719(b)(3). **Based on our review of the submitted calculations for determining the necessary values to verify a DIT test pressure resolution of 3.0 microns and sensitivity for the log removal credit (LRC) required, the following are TCEQ accepted values:**

Approved Minimum Test Pressure for DIT

The DIT procedure must be conducted at a pressure high enough to detect a 3-micron breach in the membrane.

1. The TCEQ accepts the use of 25.0 psi for the Minimum Test Pressure (P_{test}).

Equation 4.1 (for a 3.0 micron defect): $P_{\text{test}} = (0.193 * \kappa * \sigma * \cos(\theta) + BP_{\text{max}})$

Where:

Membrane specific pore shape correction factor (κ) = 1.0,
Surface tension at the air-liquid interface (σ) = 74.9 dynes/centimeter (cm),
Liquid-membrane contact angle (θ) = 0 degrees, and
Maximum back pressure (BP_{max}) on the system = 3.0 psi.

The TCEQ accepts the use of the most conservative values for κ , σ , and θ (as described above). This test pressure meets the required DIT resolution to detect a 3-micron defect or larger. The equation above calculates a P_{test} of 17.5 psi, but the documentation provided states that the facility utilizes a P_{test} of 25 psi. The 25 psi P_{test} is further used throughout the UCL calculations, thus a P_{test} of 25 psi has been granted as the minimum test pressure.

Please note that the plant may conduct its DITs at any pressure that is greater than or equal to the approved minimum test pressure shown above.

Approved Log Removal Credit (LRC) for the Membrane Unit

2. The TCEQ accepts the volume of pressurized air in the system during the test (V_{sys}) of 1,875 liters (L) for the full-scale HF MF membrane unit.

V_{sys} is used in equation 4.9 of the US EPA's Membrane Filtration Guidance Manual to verify that the sensitivity of the DIT conducted during the pilot study is equal to, or greater than, the required Log Removal Credit (LRC) of **4.0-log**.

$$\text{Equation 4.9: } LRV_{\text{DIT}} = \log [(Q_p \times \text{ALCR} \times P_{\text{atm}}) \div (\Delta P_{\text{test}} \times V_{\text{sys}} \times \text{VCF})]$$

Where Q_p is the design capacity filtrate flow, ALCR is air-liquid conversion ratio, P_{atm} is atmospheric pressure, VCF is the volumetric concentration factor, and ΔP_{test} (0.06 psi per minute as given by the manufacturer) is the smallest rate of pressure decay that can be reliably measured during the integrity test.

3. The TCEQ accepts the use of 24.32 for the ALCR;

$$\text{Equation C.4: } \text{ALCR} = 170 \times Y \times [(P_{\text{test}} - BP) \times (P_{\text{test}} + P_{\text{atm}}) / (460 + T) \times \text{TMP}]^{1/2}$$

Using the following values:

- $P_{\text{test}} = 25$ psi;
- $P_{\text{atm}} = 14.7$ psia;
- $BP = 0.0$ psi;
- Temperature (T) = 90°F ;
- TMP = 35 psi maximum allowable per Pall Corporation;
- Net expansion factor for compressible flow through pipe to a larger area (Y) = 0.630. (from Appendix C Equation C.5 Membrane Filtration Guidance)

The above equation, Eq. C.4, is based on the Darcy Pipe Flow Model assuming turbulent flow such as from a broken hollow fiber (as defined in the US EPA Membrane Filtration Guidance Manual).

4. **The TCEQ accepts the use of 4103.65 liters per minute (L/min) as the design capacity Q_p** , based on a flow of 37.2 gallons per square foot per day (gfd) as in the TCEQ letter dated November 30, 2010, module square footage of 538 ft², and 78 modules per rack as verified by the water treatment plant.
5. **A VCF of 1.08 for the full scale HF MF membrane units is acceptable.**
6. Using the smallest verifiable decay rate of 0.06 psi/min (ΔP_{test}), as provided by the manufacturer, a sensitivity of 4.08-log was determined from the LRV_{DIT} calculation specified in Equation 4.9. For the purpose of validating that the response from the pressure decay test can verify **a 4.0 log removal credit (LRC), the TCEQ accepts the use of an upper control limit (UCL) of 0.07 psi/min.**

Equation 4.17: Upper control limit (UCL) = $(Q_p \times \text{ALCR} \times P_{\text{atm}}) / (10^{\text{LRC}} \times V_{\text{sys}} \times \text{VCF})$
Where:

- $Q_p = 4103.65 \text{ L/min}$;
- $\text{ALCR} = 24.32$;
- $P_{\text{atm}} = 14.7 \text{ psia}$;
- $\text{LRC} = 3.0$;
- $V_{\text{sys}} = 1,875 \text{ L}$; and,
- $\text{VCF} = 1.08$

Challenge Study

Pall Corporation has provided challenge test data for the installed Pall UNA 620A. The TCEQ has received the data and approved a Challenge Test Log Removal Value (LRV_{CT}) of 5.68. TCEQ has also approved the Non-Destructive Performance Testing (NDPT) method, corresponding Quality Control Release Value (QCRV) and method for the Direct Integrity Test Log Removal Value (LRV_{DIT}) as specified in the US EPA's LT2ESWTR and US EPA Membrane Filtration Guidance Manual.

Because the approved pathogen removal values are based on the lower of the LRV_{CT} and the LRV_{DIT} the 4.0 *Cryptosporidium* and *Giardia* log removal shown in the challenge study can be verified in full scale using the above DIT parameters.

RO MEMBRANE DETAILS

Toray TML 10 RO Membrane Details

Toray TML 10 RO membranes were piloted in conjunction with the HF MF membrane units in a simulated full-scale design configuration. The Toray RO test unit consisted of six pressure vessels (PV) each containing three RO test elements. Two PV were piloted in parallel with HF MF membrane filtrate water as their feed water source. Each of these two PVs' concentrate was fed to two more PVs in parallel. The concentrate from the second set of PVs was blended and used as feed water for a fifth PV. The fifth PV's concentrate was fed to the sixth and final PV. The first four PVs simulated two full-scale PVs operating in parallel with six RO elements each

and the last two PVs simulated a single full-scale PV containing six RO elements. This is a commonly used pilot study arrangement achieving a 2:2:1:1 test array and simulating a full-scale 2:1 array with 6 membranes per PV.

Based on our review of Cycle #6, performed November 6, 2009 to November 24, 2009, the Toray TML 10 RO membrane elements can be installed under the following conditions:

1. Each array must achieve an average flux rate of 10.5 gfd for the Toray TML 10 RO membrane element's feed side surface area.
2. Each full-scale RO membrane unit must use a two-stage 2:1 array as simulated by the pilot study.
 - a. All RO elements are to be the same model, or a larger TCEQ acceptable Toray RO element model having the same leaf length, salt rejection, removal efficiency and design (no mixing of non-piloted elements); and
 - b. Twice the number of PV and RO elements in each Stage 1 as is in Stage 2.
3. The full-scale RO membranes must meet the following specifications:
 - a. 8-inch diameter;
 - b. An active membrane area of 400 square feet;
 - c. Have a leaf length of 40 inches;
 - d. Minimum salt rejection of 99%;
 - e. Recovery rate of 75%;
 - f. Maximum operating temperature of 113° F;
 - g. Maximum allowed continuous free chlorine value of non-detectable;
 - h. An operating pH range of 2 to 11;
 - i. A pH cleaning range of 1 to 12;
 - j. A maximum operating pressure of 600 psi;
 - k. A maximum pressure drop per element of 20 psi; and
 - l. A maximum silt density index (SDI) of 5.
4. The full-scale Toray membrane elements, internal surface of the PVs and associated RO membrane unit piping must be NSF 61 certified.
5. ANSI/NSF Standard 60 certified chemicals must be used. It is noted that Hypersperse MDC150 by GE Betz Inc. and sulfuric acid were used as the RO anti-scaling products.
6. ANSI/NSF Standard 60 certified sodium bisulfite must be used at a dose necessary to remove all chlorine residual before the RO membranes. During the pilot this dose was 22 mg/L.
7. A CIP must be conducted on each RO membrane unit using ANSI/NSF Standard 60 certified cleaning chemicals and the following procedure:
 - a. Perform a flush of the pressure vessels using clean RO permeate or dechlorinated potable water;
 - b. Start recirculation of cleaning solution through the system;
 - i. Allow low pH ~ 3, 1% citric acid cleaning solution to circulate through the system for approximately one hour while maintaining the solution at approximately 95°F;
 - ii. Drain the RO unit

- iii. Collect waste and neutralize;
- c. Perform another flush of the system to remove any traces of the cleaning solution;
- d. Repeat the recirculation of the cleaning solution with 0.1% caustic soda solution at a pH of 12 for 1 hour at 95°F through the system; and
- e. Flush the system with dechlorinated tap water or permeate.

GENERAL INFORMATION

The pilot study report contained data supporting the use of HF MF or HF ultrafiltration (UF) followed by RO membranes. Two treatment trains were pilot tested:

1. Pall Microza® UNA-620A HF MF followed by Toray TML 10 RO membranes; and
2. Siemens L20V HF UF membranes followed by Hydronautics BW30LE RO membranes.

The source water for the membrane pilot study was the effluent of the Big Spring WWTP. The WWTP is a hybrid plant, including both fixed film and suspended growth biological processes. Raw wastewater is first screened and de-gritted, then flows to a primary clarifier. Primary effluent then proceeds to a single rock media trickling filter for biological stabilization and then is pumped to the aeration basin for additional biological treatment. The contents of the aeration basin flow to the final clarifier where the active biomass is separated from the treated effluent and recycled to the aeration basin. The effluent is chlorinated. The filtered effluent containing the chlorine residual was the source water for the pilot study. The effluent of the WWTP is currently subject to permit number TPDES 10069-003.

Additional information on the UV facilities was submitted at later dates and included the following.

- a. An e-mail from David Sloan, P.E., dated November 30, 2012, that was accompanied by one sheet of engineering drawings for the CRMWD Big Springs UV reactor installation.
- b. A letter from Scott Bindner, of Trojan Technologies, dated November 21, 2012, that was accompanied by
 - i. detailed calculations on viral inactivation dated November 21, 2012,
 - ii. a Trojan UVFit™ 72AL75 UVDGM Equivalency Report dated October 16, 2012, and
 - iii. a Trojan UVFit™ 72AL75 Validation Report dated November 2009.
- c. An e-mail from Adam Festger, of Trojan Technologies, dated December 19, 2012, that was accompanied by
 - i. his letter of that same date responding to some questions that had been raised during the review,
 - ii. one sheet of standard drawings on the UVPhox 72AL75 reactor, and
 - iii. one sheet of standard drawings on the UVFit 72AL75 reactor.
- d. An e-mail from Mr. Festger dated January 8, 2013, that was accompanied by a December 12, 2012, letter from Greg Warkentin, of Trojan Technologies, regarding the equivalency of the UVFit 72AL75 and UVPhox 72AL75 reactors.
- e. A letter from Neil Brown, of Trojan Technologies, dated February 5, 2013 describing the reactor control strategy for the CRMWD Big Springs UV system.
- f. An e-mail from Robert Haas, of Trojan Technologies, dated February 11, 2013, that was accompanied by
 - i. a parts list for the UVFit 72AL75 reactor,
 - ii. a parts list for the UVPhox 72AL75 reactor, and

- iii. an image of the UVFit 72AL75 reactor.
- g. An e-mail from Robert Haas, dated March 1, 2013, that was accompanied by an unsigned letter of that same date regarding the control algorithm for the CRMWD Big Springs UV system.
- h. An e-mail from Robert Haas, dated March 8, 2013, that was accompanied by the CFD Model Report comparing the piping configuration that existed during reactor validation with the configuration used at the CRMWD Big Springs UV reactor installation.
- i. E-mails from Mr. Festger and Mr. Sloan providing some additional details about the control algorithm for the UV system.

This exception for the alternative raw water source approval is subject to periodic review and may be revoked or amended if warranted. All conditions contained are site-specific minimum operation, design, reporting, calibration and record keeping requirements for the CRMWD reclamation facility as specified in 30 TAC §290.39(1)(4). Failure by the CRMWD reclamation facility to comply with these conditions can result in the water produced no longer being able to be used as a source of raw water for public drinking water systems.

Enclosure B -1 76 modules per rack
CRMWD Big Spring Reclamation facility - PWS 1140038
WATER RECLAMATION PLANT - TCEQ ID 21710
Pall Microza UNA-620A

P_{test} (psi)	LRC _{DIT}	UCL psi/min
25.0	4.00	0.07

Q_p L/min	V_{sys} (L)
3998.43	1875.14

P_{test} Minimum Pressure Test (Equation 4.1)	P_{test} (psi)	k Pore Shape Correction Factor	s Surface Tension	cos q liquid-- membrane contact angle	BP _{max}
$P_{test} = (0.193 * k * s * \cos q) + BP_{max}$	17.5	1	74.9	0	3

ALCR Turbulent Flow (Equation C.9)	ALCR	Y	P_{atm} (psia)	Ptest used (psi)	T (F)	BP _{max} (psi)	TMP (psi)
$ALCR = 170 * Y * \text{Sqrt}[(P_{test} - BP)(P_{test} + P_{atm})] / ((460 + T) * TMP)$	24.32	0.630	14.7	25.0	90	0	35

LRV _{DIT} Sensitivity (Equation 4.9)	LRV _{DIT}	Q_p L/min	P_{atm} (psia)	DP _{test} (psi/min)	VCF	V_{sys} (L)
$LRV_{DIT} = \log((Q_p * ALCR * P_{atm}) / (DP_{test} * V_{sys} * VCF))$	4.07	3998.43	14.7	0.06	1.08	1875.14

UCL (Equation 4.17)	UCL psi/min	Q_p L/min	P_{atm} (psia)	LRC	VCF	V_{sys} (L)
$UCL = (Q_p * ALCR * P_{atm}) / (10^{LRC} * V_{sys} * VCF)$	0.07	3998.43	14.7	4	1.08	1875.14

Conversion Factors	L/gal	min/day	L/ft3
	3.78541	1440	28.3168

Flux rate (gal/sf-day)*	sf*	modules**	# of Units **
37.20	538	76	2

*from pilot study
** confirmed by plant

Enclosure B -2 78 modules per rack
 CRMWD Big Spring Reclamation facility - PWS 1140038
 WATER RECLAMATION PLANT - TCEQ ID 21710
 Pall Microza UNA-620A

P_{test} (psi)	LRC_{DIT}	UCL psi/min
25.0	4.00	0.07

Q_p L/min	V_{sys} (L)
4103.65	1875.14

P_{test}	P_{test} (psi)	k Pore Shape Correction Factor	s Surface Tension	cos q liquid-- membrane contact angle	BP_{max}
Minimum Pressure Test (Equation 4.1) $P_{test} = (0.193 * k * s * \cos q) + BP_{max}$	17.5	1	74.9	0	3

ALCR	ALCR	Y	P_{atm} (psia)	P_{test} used (psi)	T (F)	BP_{max} (psi)	TMP (psi)
Turbulent Flow (Equation C.9) $ALCR = 170 * Y * \text{Sqrt}[(P_{test} - BP)(P_{test} + P_{atm})]/((460 + T) * TMP)$	24.32	0.630	14.7	25.0	90	0	35

LRV _{DIT}	LRV _{DIT}	Q_p L/min	P_{atm} (psia)	DP_{test} (psi/min)	VCF	V_{sys} (L)
Sensitivity (Equation 4.9) $LRV_{DIT} = \log((Q_p * ALCR * P_{atm}) / (DP_{test} * V_{sys} * VCF))$	4.08	4103.65	14.7	0.06	1.08	1875.14

UCL	UCL psi/min	Q_p L/min	P_{atm} (psia)	LRC	VCF	V_{sys} (L)
(Equation 4.17) $UCL = (Q_p * ALCR * P_{atm}) / (10^{LRV_{DIT}} * V_{sys} * VCF)$	0.07	4103.65	14.7	4	1.08	1875.14

	L/gal	min/day	L/ft3
Conversion Factors	3.78541	1440	28.3168

Flux rate (gal/sf-day)*	sf*	modules**	# of Units **	*from pilot study ** confirmed by plant
37.20	538	78	2	

**Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence
Reservoir Sample Results**

Table C-1: Inorganics with Maximum Contaminant Levels (MCL)			
Contaminant	CRMWD Reclamation Facility Effluent January 31, 2013 (mg/L)	MCL (mg/L)	EV Spence Raw Water Pipeline 2009 (mg/L)
Antimony, Total	<0.001	0.006	<0.002
Arsenic	<0.002	0.01	<0.00695
Asbestos	<0.1987 million fiber/liter (MFL)	7 MFL	0 MFL
Barium	<0.001	2	0.264
Beryllium, Total	<0.0008	0.004	<0.001
Cadmium	<0.001	0.005	<0.001
Chromium	<0.01	0.1	<0.001
Cyanide	<0.01	0.2	Not provided
Fluoride	<0.1	4	0.558
Mercury	<0.0004	0.002	<0.000150
Nitrate (as Nitrogen)	0.26	10	<0.05
Nitrite (as Nitrogen)	0.02	1	<0.05
Nitrate & Nitrite (Total)	0.28	10	<0.100
Selenium	<0.003	0.05	0.00794
Thallium	<0.0004	0.002	<0.001

Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence Reservoir Sample Results

Table C-2: Volatile Organic Compounds with MCLs			
	CRMWD Reclamation Facility Effluent January 31, 2013	MCL	EV Spence Raw Water Pipeline 2009
Contaminant	(mg/L)	(mg/L)	(mg/L)
1,1-Dichloroethylene	<0.0005	0.007	<0.001
1,1,1-Trichloroethane	<0.0005	0.2	<0.001
1,1,2-Trichloroethane	<0.0005	0.005	<0.001
1,2-Dichloroethane	<0.0005	0.005	<0.001
1,2-Dichloropropane	<0.0005	0.005	<0.001
1,2,4-Trichlorobenzene	<0.0005	0.07	<0.001
Benzene	<0.0005	0.005	<0.001
Carbon tetrachloride	<0.0005	0.005	<0.001
cis-1,2-Dichloroethylene	<0.0005	0.07	not provided
Dichloromethane	<0.0005	0.005	not provided
Ethylbenzene	<0.0005	0.7	<0.001
Monochlorobenzene	<0.0005	0.1	not provided
o-Dichlorobenzene	<0.0005	0.6	not provided
para-Dichlorobenzene	<0.0005	0.075	not provided
Styrene	<0.0005	0.1	<0.001
Tetrachloroethylene	<0.0005	0.005	<0.001
Toluene	<0.0005	1	<0.001
trans-1,2-Dichloroethylene	<0.0005	0.1	not provided
Trichloroethylene	<0.0005	0.005	<0.001
Vinyl Chloride	<0.0005	0.002	<0.001
Xylenes (total)	<0.0005	10	<0.001

Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence Reservoir Sample Results

Table C-3: Synthetic Organic Compounds with MCLs			
	CRMWD Reclamation Facility Effluent January 31, 2013	MCL	EV Spence Raw Water Pipeline 2009
Contaminant	(mg/L)	(mg/L)	(mg/L)
Alachlor	<0.0002	0.002	<0.000111
Atrazine	<0.0001	0.003	<0.000111
Benzopyrene	<0.00002	0.0002	<0.000111
Carbofuran	<0.0009	0.04	<0.01
Chlordane	<0.0002	0.002	<0.000111
Dalapon	<0.001	0.2	<0.00206
Di(2-ethylhexyl)adipate	<0.0006	0.4	not provided
Di(2-ethylhexyl)phthalate	<0.0006	0.006	not provided
Dinoseb	<0.0002	0.007	<0.000515
Endrin	<0.00001	0.002	<0.000111
Ethylene Dibromide	<0.00001	0.00005	not provided
Heptachlor	<0.00004	0.0004	<0.000111
Haptachlor epoxide	<0.00002	0.0002	<0.000111
Hexachlorobenzene	<0.0001	0.001	<0.000111
Hexachlorocyclopentadiene	<0.0001	0.05	<0.000111
Lindane	<0.00002	0.0002	<0.000111
Methoxychlor	<0.0001	0.04	<0.000111
Oxamyl (Bydate)	<0.002	0.2	<0.01
Pentachlorophenol	<0.00004	0.001	<0.000111
Picloram	<0.0001	0.5	<0.000515
Polychlorinated biphenyls(PCB)	Not Detected	0.0005	<0.000111
Simazine	<0.00007	0.004	<0.000111
Toxaphene	<0.001	0.003	<0.000111
2,4,5-TP	<0.0002	0.05	<0.000515
2,4-D	<0.0001	0.07	<0.000515

Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence Reservoir Sample Results

Table C-4: Radionuclides with MCLs		
Contaminant	CRMWD Reclamation Facility Effluent January 31, 2013	MCL
Combined radium-226 and radium-228	<1 pCi/L	5 pCi/L
Gross alpha particle activity	<2 pCi/L	15 pCi/L
Gross beta particle activity	<4 pCi/L	50 pCi/L
38-Strontium-90	<2 pCi/L	8 pCi/L
Tritium	<500 pCi/L	20000 pCi/L
Uranium	<1 µg/L	30 µg/L

Table C-5: Disinfectant By-Products with MCLs		
Contaminant	CRMWD Reclamation Facility Effluent January 31, 2013 (mg/L)	MCL (mg/L)
Total Trihalomethane (TTHMs)	<0.004	0.080
Haloacetic acids (HAA ₅)	<0.006	0.060

Table C-6: Contaminants with Secondary Contaminant Levels (SCL)			
Contaminant	CRMWD Reclamation Facility Effluent January 31, 2013 (mg/L)	SCL (mg/L)	EV Spence Raw Water December, 2012 (mg/L)
Aluminum	<0.02	0.05-0.2	not provided
Chloride	7	300	391-414
Copper	0.0027	1	not provided
Fluoride	<0.1	2	not provided
Iron	<0.01	0.3	not provided
Manganese	0.0032	0.05	not provided
Silver	<0.01	0.1	not provided
Sulfate	<1	300	231-236
Total Dissolved Solids	18	1,000	1,222-1,248
Zinc	0.0826	5	not provided

Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence Reservoir Sample Results

Table C-7: Other Sampled Inorganic Contaminants			
Contaminant	CRMWD Reclamation Facility Effluent January 31, 2013 (mg/L)	MCL (mg/L)	EV Spence Raw Water December, 2012 (mg/L)
Alkalinity, Bicarbonate	7	none	not provided
Alkalinity, Carbonate	<2	none	not provided
Alkalinity, Phenolphthalein	<2	none	not provided
Alkalinity, Total	6	none	not provided
Calcium	<1	none	not provided
Conductivity @ 25 C	40	none	1,880-1,920
Hardness	<2.5	none	700
Lead	<0.001	none	not provided
Magnesium	<1	none	not provided
Nickel	<0.001	none	not provided
Sodium	6.82	none	not provided

Table C-8: Radionuclides without MCLs		
Contaminant	CRMWD Reclamation Facility Effluent January 31, 2013 (pCi/L)	MCL
38-Strontium-89	<5	none
53-Iodine-131	<2.3	none
55-Cesium-134	<1.7	none
55-Cesium-137	<1.8	none
82-Lead-212	2.4	none

**Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence
Reservoir Sample Results**

Table C-9: Other Sampled Compounds		
	CRMWD Reclamation Facility Effluent - January 31, 2013	MCL
Contaminant	(µg/L)	
1,1,1,2-Tetrachloroethane	<1	none
1,1,2,2-Tetrachloroethane	<1	none
1,1-Dichloropropene	<1	none
1,1-Dichloroethane	<1	none
1,2,3-Trichlorobenzene	<1	none
1,2,3-Trichloropropane	<1	none
1,2,4-Trimethylbenzene	<1	none
1,2-Dibromo-3-Chloropropane	<0.02	none
1,3,5-Trimethylbenzene	<1	none
1,3-Butadiene	<1	none
1,3-Dichloropropane	<1	none
17-Alpha-Ethynylestradiol	<1	none
2,2,3,3,4,4,6-Heptachlorobipheny	<0.5	none
2,2,3,3,4,5,6,6-Octachlorpbiphen	<0.5	none
2,2,3,4,6-Pentachlorobiphenyl	<0.2	none
2,2,4,4,5,6-Hexachlorobiphenyl	<0.2	none
2,2,4,4-Tetrachlorobiphenyl	<0.2	none
2,2-Dichloropropane	<1	none
2,3-Dichlorobiphenyl	<0.2	none
2,4,5-T	<0.5	none
2,4,5-Trichlorobiphenyl	<0.2	none
2,4,-DB	<2	none
2-Chlorobiphenyl	<0.2	none
2-Hexanone	<1	none
3,5-Dichlorobenzoic Acid	<1	none
3-Hydroxycarbofuran	<2	none
Acenaphthene	<0.2	none
Acenaphthylene	<0.2	none
Acetone	<10	none
Acifluorfen	<1	none
Acrylonitrile	<10	none
Aldicarb	<0.5	none
Aldicarb Sulfone	<0.8	none
Aldicarb Sulfoxide	<0.5	none
Aldrin	<0.2	none
Alpha-Chlordane	<0.2	none
Ahthracene	<0.2	none
Baygon	<2	none

**Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence
Reservoir Sample Results**

Table C-9 continued: Other Sampled Compounds		
	CRMWD Reclamation Facility Effluent - January 31, 2013	MCL
Contaminant	(µg/L)	
Bentazon	<2	none
Benzo(A)Anthracene	<0.2	none
Benzo(B)Fluoranthene	<0.2	none
Benzo(G,H,I)Perylene	<0.2	none
Benzo(K)Fluoranthene	<0.2	none
BHC-Gamma	<0.02	none
Bromacil	<0.2	none
Bromobenzene	<1	none
Bromochloroacetic Acid	<1	none
Bromochloromethane	<1	none
Bromodichloromethane	<1	none
Bromoform	<1	none
Bromomethane	<2	none
Butachlor	<0.2	none
Butylbenzyl Phthalate	<2	none
Carbaryl	<2	none
Carbon Disulfide	<1	none
Chloramben	<1	none
Chlorodifluoromethane	<1	none
Chloroethane	<2	none
Chloroform	<1	none
Chloromethane	<2	none
Chrysene	<0.2	none
cis-1,3-Dichloropropene	<1	none
Dibenzo(A,H)Anthracene	<0.2	none
Dibromoacetic Acid	<1	none
Dibromochlormethane	<1	none
Dibromemethane	<1	none
Dicamba	<1	none
Dichloroacetic Acid	<1	none
Dichlorodifluoromethane	<2	none
Dichlorprop	<2	none
Dieldrin	<0.2	none
Diethyl Phthalate	<2	none
Dimethyl Phthalate	<2	none
Di-N-Butyl Phthalate	<2	none
Ethyl Methacrylate	<1	none
Fluorene	<0.2	none

**Enclosure C: Comparison of CRMWD Reclamation Facility and EV Spence
Reservoir Sample Results**

Table C-9 continued: Other Sampled Compounds		
	CRMWD Reclamation Facility Effluent - January 31, 2013	MCL
Contaminant	(µg/L)	
Gamma-Chlordane	<0.2	none
Hexachlorobutadiene	<1	none
Ideno(1,2,3-CD)Pyrene	<0.2	none
Isopropylbenzene	<1	none
M-Dichlorobenzene	<1	none
Methiocarb	<4	none
Methomyl	<2	none
Methyl Ethyl Ketone	<10	none
Methyl Iodine	<2	none
Methyl Isobutyl Ketone	<2	none
Methyl Methacrylate	<1	none
Methyl Tert-Butyl Ether	<2	none
Metolachlor	<0.2	none
Metribuzin	<0.2	none
Monobromoacetic Acid	<1	none
Monochloroacetic Acid	<2	none
Naphthalene	<1	none
N-Butylbenzene	<1	none
N-Propylbenzene	<1	none
O-Chlorotoluene	<1	none
P-Chlorotoluene	<1	none
Phenanthrene	<0.2	none
Picloram	<0.1	none
P-Isopropyltoluene	<1	none
Prometon	<0.2	none
Propachlor	<0.2	none
Pyrene	<0.2	none
Quinclorac	<1	none
SEC-Butylbenzene	<1	none
Tert-Butylbenzene	<1	none
Tertrahydrofuran	<5	none
Trans-1,3-Dichloropropene	<1	none
Trans-Nonachlor	<0.2	none
Trichloroacetic Acid	<1	none
Trichlorofluoromethane	<2	none
Trifluralin	<0.2	none
Vinyl Acetate	<10	none

Enclosure D:Unregulated Contaminants of Concern

Tables D-1 and D-2 contain are currently unregulated chemical and microbiological contaminants of concern that the TCEQ recommends the system monitor quarterly.

For monitoring of unregulated contaminants — Table D-1: Microbials and Table D-2: Chemicals—the system should identify the analytical methods that they wish to use, and propose those to the TCEQ. If you have any questions concerning this enclosure, please contact Ms. Alicia Diehl by email at Alicia.Diehl@tceq.texas.gov or by telephone at (210) 403-4053.

Table D-1: Microbals

MICROBIALS	Analytical Methods ¹	Regulated
Viruses²		
*Enterovirus	1615	UCMR ³
*Norovirus		
Rotavirus	1	No ²
Poliovirus	1	No ²
Echoviruses	1	No ²
Coxsackie viruses group A and B	1	No ²
Adenovirus	1	No ²
Hepatitis A	1	No ²
Protozoans		
Naegleria fowleri	4	No
Cyclospora	4	No
Microsporidia (fungus)	4	No
Bacteria		
Enterococci	1600, 1106	No
Salmonella (and / or Shigella, Campylobacter, Pseudomonas ⁵)	1200	No
Aeromonas	1605	No
Heterotrophic plate count (indicator)	9215	No

* Highly recommended for sampling

- 1 Method listed is an EPA method unless otherwise noted. List of methods is not exhaustive, but is included for reference only. If a method is not listed, CRMWD will need to research and propose a method to TCEQ.
- 2 Viruses are regulated as a group through treatment technique requirements at treatment plants for the EPA's Surface Water Treatment Rules and Ground Water Rule
- 3 Unregulated Contaminant Monitoring Rule (UCMR) 3. Regulations cover distribution levels and removal requirements. Regulatory monitoring required, but not an individual health-based standard set.
- 4 Methods are in development.

Unregulated Contaminants of Concern

Table D-2: Chemicals

CHEMICALS	Method ¹	Regulated
Disinfection byproducts		
*Nitroso-dimethylamine (NDMA)	521	UCMR ₃ ³
*Nitroso-pyrrolidine (NPYR)		
Organic chemicals		
* Pharmaceutical indicators: 17- α -ethynylestradiol (ethinyl estradiol), 16- α -hydroxyestradiol (estriol), equilin, estrone, testosterone, 4-androstene-3,17-dione	539	UCMR ₃ ³
* Chemicals of human origin: Perfluorooctanesulfonic sulfonate (PFOS), perfluorooctanoic acid (PFOA) perfluorononanoic acid (PFNA) perfluorohexanesulfonic acid (PFHxS) perfluoroheptanoic acid (PFHpA) perfluorobutanesulfonic acid (PFBS)	537	UCMR ₃ ³
*Sucralose	2	No
1,4 dioxane	522	No
Caffeine	1694	No
N,N-Diethyl-meta-toluamide (DEET)	633	No
Gemfibrozil	1694	No
Iopromide	1694	No
Inorganic chemicals		
Perchlorate ⁴	314	UCMR ₂ ³

* Highly recommended for sampling.

1 Method listed is an EPA method unless otherwise noted. List of methods is not exhaustive, but is included for reference only.

2 Acceptable methods exist but have not yet been approved by the EPA. CRMWD should propose the method they plan to use.

3 Regulatory monitoring required, but not a health-based standard set.

4 The EPA has indicated that a maximum contaminant level will be promulgated for perchlorate. EPA will be working with stakeholders to develop a maximum contaminant level.