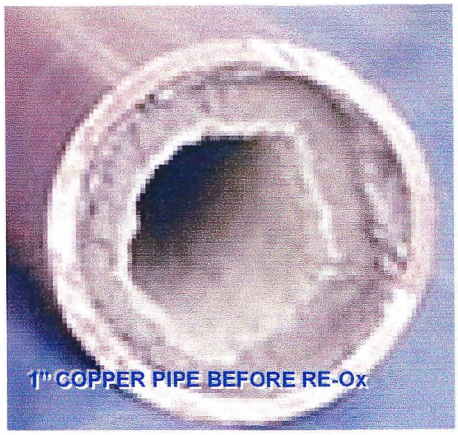
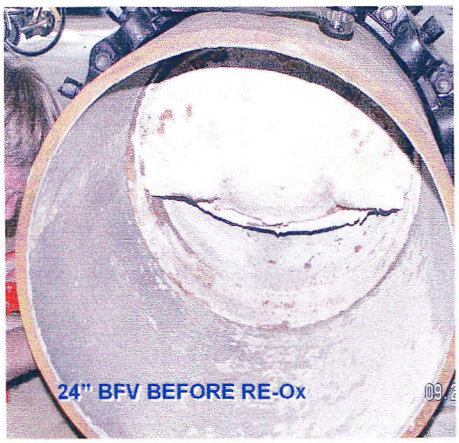
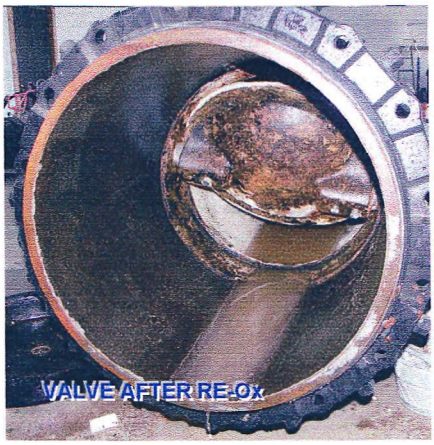
RE-Ox®

A breakthrough technology that removes and prevents scale and film deposits.
RE-Ox is a non-hazardous, neutral pH solution that is odorless and tasteless in water.
RE-Ox is NSF Standard 60 registered for use in drinking water.







Pipes can now be cleaned during normal operations, while maintaining water quality.

- Improves & Extends System Performance & Life
- Restores Flow Rates
- Cleans and Maintains Pipe, Valves Meters, Backflow Preventers, & Appurtenances.
- Eliminates the Need for other Pipe Cleaning Expenditures
- Superior Results vs. Inhibitors
- Reduces Chlorine Demand which Lowers DBPs
- Facilitates Chlorine Residual to End Points
- Helps Clarify Red Water

NSF®
Certified to ANSI/NSF 60
Spicer-Randolph LLC

NRWA Corporate Partner

AWWA MEMBER

"RE-Ox disrupts the organic matrix of mineral scales and other deposit constituents in water systems, as can no other known chemical approved and certified by the NSF for potable water applications."

"RE-Ox is a unique, proprietary product that represents a paradigm shift in the field of water treatment." *Puckorius and Associates, Inc.*

Uses for *RE-Ox*

RE-Ox is used in **water distribution systems** to **eliminate scales, films and other deposits** to obtain cost savings by extending system life and performance, regain flow, prevent lost revenue, minimize labor and equipment costs, help comply with regulations and provide the highest quality of water. *Case studies available*

Meat, produce, ice packing, dairy, bakeries and other food processors are using *RE-Ox* to eliminate deposition as part of their **HACCP** plan for, superior cleaning results, shelf life increases, reduction of labor, reduction of chemical usage, etc.

For example, in a **chicken cook plant**, *RE-Ox* was staged into the plant water supply that resulted in all hot and cold water lines, and even an ozonated water line being **cleared of deposits** by the fourth week. Also, scale was noticeably reduced from processing equipment in many areas. Specialized testing showed **previously resistant deposits were eliminated**. Chemical usage was able to be reduced. Management reported a **noticeable increase in product shelf life.** *Case study available*

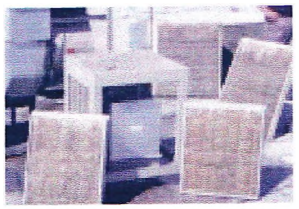
In a **plant producing frankfurters**, one of the results after only 3 weeks, was a significant **improvement in the level of clean** in the smokehouse brine chill system.

In **pork and red meet processing plants**, *RE-Ox* treatment in the CIP for the brine injector system resulted in the needles and system surfaces being **significantly cleaner than with previous cleaning regimens**.

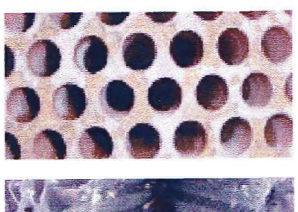
In a **sausage processing plant,** RE-Ox treatment was effective in **cleaning metal surfaces and floors** to an extent not achievable previously. The need for a corrosive cleaning chemical on the floor was eliminated. RE-Ox'idized water is used in the sausage and to clean food as it is removed from casings. As a side benefit, the plant no longer needs separate cooling tower chemicals.

In **poultry hatchery and production facilities**, *RE-Ox* treated water **eliminated scales, films and residues from, nozzles, piping and surfaces.** *Case study available*

In **produce processing facilities**, *RE-Ox* treated water **eliminates and prevents scale in rotary and plate type industrial ice making**.



RE-Ox use in a **hospital** **eliminated scales / films** in hospital faucets, showerheads, and kitchen equipment, cooling towers, chillers and other equipment. *Case study available*

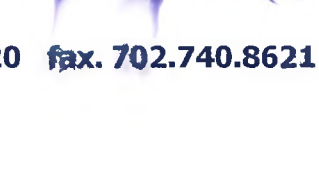


RE-Ox use in a **hotel** has eliminated scale from their entire water distribution system and **prevented the need for facility shut down for hazardous acid treatment or piping removal and replacement.**

RE-Ox use in **restaurant / tavern** water has produced the following results:

- **Scales and films were reduced** in fixtures, dishwasher, icemaker, and other equipment.
- The **taste** of the beverages was excellent.
- **Ice** made from RE-Ox treated water was **clearer and harder** than previously.
- Silverware and glasses had **less spots**.
- Drain lines **remained open and clearer**
- Cooler pads for makeup air showed **no scale deposits.** *Case study available*

RE-Ox use in **cooling towers / chillers / HVAC equipment** **results in a virtually** scale free systems. **Scale elimination** substantially reduces the electricity needed **to power chillers. Additional savings accrue as RE-Ox treatment enables** cycles to increase, dramatically reducing water use. *Case study available*



RE-Ox removes deposits because it is made with a unique **proprietary process** that produces a unique cleaning bleach **engineered to penetrate and eliminate the nucleation sites** (the attachment mechanisms) that hold inorganic and organic matrices together and to surfaces. Traditionally fabricated chlorine compounds do not release scale and, in fact, like other treatments, actually contribute to scale deposits.

RE-Ox is the leading deposit control technology on the market today. As a **non-hazardous solution**, *RE-Ox* is completely safe and easy to work with. Protective gear (eye goggles, gloves, protective clothing, respirators, masks, etc.) is **NOT** required. Storage and handling **requires no hazmat, containment, or precautionary system for OSHA site requirements**. Injection systems require simple, easily installed, easily maintained, reliable, typical chemical pumps, readily installed on ½" to over 12" domestic water supply lines.

RE-Ox LLC DEPOSITION CONTROL **www.RE-Ox.com**

9179 W. Flamingo Road, Suite 110 Las Vegas, NV 89147 tel. 702.360.3520 fax. 702.740.8621

TCEQ Trials

Average Results Each System

System	Baseline Cl2 avg. ppm Results RE-Ox Treatment	Baseline TTHM Results RE-Ox Treatment	Total Volume Treated Total RE-Ox
Bluebonnet WSC 9/28/07 1	8 City Systems avg. 2.2 After RE-Ox avg. 2.6	8 City System avg. 84.5 ppb After RE-Ox avg. 17.0 ppb	2.738 MGD 45 day trial 164.3 MG treated 2,053 (45 GPD) RE-Ox
Crystal Clear WSC 3/12/2008 2	5 Tank re-press sites .78 After RE-Ox avg. 2.06	4 Sample Sites avg. 65.2 ppb After RE-Ox avg. 17.8 ppb	440,000 GPD 84 day trial 37 MG treated 425 (5 GPD) RE-Ox
Green Valley SUD 6/2/08 3	3 Sample Sites 5 tanks, Baseline Cl2 avg. 2.1 After RE-Ox avg. 2.36	3 Sample Sites avg. 61.2 ppb After RE-Ox avg. 51.3 ppb	1.3 MGD 32 day trial 41 MG treated 620 (19 GPD) RE-Ox
City of Marlin WSC 3/28/08 4	6 Sample Sites avg. .07 After RE-Ox avg. 2.1	2 Sample Sites avg. 82.5 ppb After RE-Ox avg. 47.6 ppb	1.3 MGD 25 day trial 32.5 MG treated 650 (26 GPD) RE-Ox
City of Killeen WSC 10/23/08 5	5 Sample Sites avg. 1.3 After RE-Ox avg. 2.5	No Data Special Test Validation by TCEQ Hach Company Free NH3* / Cl2 Obtain Hach Opinion of RE-Ox	7.3 MGD 15 day trial 109 MG treated 1,100 (73 GPD) RE-Ox
City of Kerrville SUD 9/8/08 6	3 Sample Sites avg. 1.15 After RE-Ox avg. 1.75	3 Sample Sites avg. 76.8 ppb After RE-Ox avg. 65.7 ppb Surface Water on Free Cl2	2.6 MGD 176 day trial 457 MG treated 2,614 (15 GPD) RE-Ox
City of Lancaster WSC 9/2/08 7	2 Sample Sites ,03 After RE-Ox .64	2 Sample Sites 114 ppb After RE-Ox avg. 35 ppb	3.5 MGD 45 day trial 157 MG treated 3,750 (83 GPD) RE-Ox
East Texas Cities 2/3/09 8	3 City Sample Sites .07 After RE-Ox 1.7 Tannin, Color,	3 City Sample Sites 180 ppb After RE-Ox avg. 25 ppb Discontinued NH3	50K GD 45 day trial 2.3 MG treated 65 (1.5 GPD) RE-Ox

TCEQ Results Summary:

1. Conditional use permitting allowed for evaluation of RE-Ox treatment to be assessed over a wide range of water treatment systems, such as surface water, ground water, flocculants, advanced filtration, combined and free chlorination systems.
2. Chlorine residuals increased in each application without exception.
3. DBP's both TTHM's and HAA5's were dramatically reduced in each trial.
4. Confusing data reported by the city of Killeen allowed TCEQ to have 3rd party opinion concerning RE-Ox chemical composition with supporting data that proved the product did not have adverse effects on chemistry reagents used in the industry.
5. RE-Ox Scale Deposit Control Disinfectant controls DBP formation replacing NH3 (ammonia) in all forms rendering Stage II USEPA TOC and DBP rules more easily attainable.

Composite of Trials Using RE-Ox® Treatment

Texas Commission on Environmental Quality Conditional Use Permitting

As of: January 19, 2009

(In Pounds of Chlorine)

System	Trial Days	Total Volume Treated (Millions of Gallons)	Primary Cl_2 Treatment (Pounds)	RE-Ox Treatment (Pounds of Cl_2 Added)
1 Bluebonnet SUD	60	204	5,962	2.75
2 Crystal Clear	90	46	1,341	2.95
3 Green Valley SUD	60	42	1,575	2.78
4 City of Marlin	45	54	1,800	1.37
5 City of Killeen	20	600	17,493	4.5
6 Kerrville	225	1,192	29,812	24.3
7 Lancaster	45	193	4,837	19.28
TOTAL		**2,331**	**62,550**	**70.26**

Restoration of Residuals and Reduction of Disinfection By-products (DBP) as a Result of RE-Ox® use in Chloraminated Wholesale Water

Damon B. Boniface
Chief of Operations
Bluebonnet Water Supply Corporation
Temple, Texas

March 5, 2008

File PWS 0140162(CO)
RN 101202729
CN 600647259

September 28, 2007

Mr. Damon B. Boniface, Chief of Operations
Bluebonnet Water Supply Corporation
6100 Water Supply Road
Temple, Texas 76502

Subject: Notification of Proposed Change
Bluebonnet WSC - PWS I.D. No. 0140162
Bell County, Texas

Dear Mr. Boniface:

We received your faxed letter regarding the notification of your public water system's proposed temporary change on September 14, 2007. This notice was submitted in accordance with the Texas Commission on Environmental Quality's (TCEQ) requirements specified in 30 TAC §290.39(l). The proposed project will involve the temporary installation of equipment to feed RE Ox®, a chlorine chemical, into the distribution system for a study period of 60 days. Based on our review, this project is **not considered a significant change** under 30 TAC §290.39(l)(1) and will not require the submittal of engineering plans and specifications for TCEQ review and approval prior to construction beginning as long as all chemical storage and feed facilities comply with TCEQ requirements specified in 30 TAC §290.42(d)(6) and (7). Please be aware that these rules require adequate spill containment. If the Re OX® is to be stored in the spill containment area referenced in our June 9, 1998 letter (granting an exception for spill containment), and if that area has not been significantly modified since, that is acceptable containment. Otherwise, adequate spill containment must be provided for the RE-Ox®.

To better understand RE-Ox®, TCEQ requests that you take the samples specified in your letter and submit the results to the Technical Review and Oversight Team (MC-155) after the completion of the project. To receive approval to permanently use this compound, the following must be provided. If you choose to discontinue use, please provide the following for TCEQ's education so we may better understand RE-Ox®.

- The daily flow of the water and amount of RE Ox® added.
- The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during normal operating conditions before beginning the temporary feed of RE-Ox®.
- The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during the temporary RE-Ox® application.
- A narrative description of the daily visual color inspections and any leaks, flaking, or other distribution disturbances found during the RE-Ox® application period.

We note that RE-Ox® is NSF Standard 60 certified and will be injected into the system using a Stenner peristaltic pump and that the RE-Ox® will be stored in 55 gallon drums located in a spill containment area. We note that this installation will be at set up to inject RE-Ox at the combined clarifier effluent and combined filter effluent at a maximum rate of one gallon per 100,000 gallons of water per day, and that the project is expected to last 60 days. The purpose of this study is to determine whether the use of RE-Ox® will increase disinfection residuals at the far ends of the distribution system, reduce chlorine and liquid ammonium sulfate expense, and/or reduce TTHMs and HAA5 levels within the distribution system.

Please note that RE-Ox® is not a substitute for any part of the current disinfection protocol at the plant. You must continue to use your current approved CT study for your disinfection protocol.

If you have questions concerning this letter, or if we can be of additional assistance, please contact me at the letterhead's address or by telephone at (512) 239-6006.

Sincerely,

Amanda Jigmond
Technical Review & Oversight Team
Public Drinking Water Section (MC 155)
Water Supply Division

AWJ

cc: TCEQ Waco Regional Office – R9
Mr. David Laughlin, P.E., TCEQ Utility Technical Review Team (MC 153)
Ms. Marlo Wanielista Berg, P.E., TCEQ Technical Review & Oversight Team (MC 155)
Ms. Alicia Diehl, PhD, TCEQ Drinking Water Quality Team (MC 155)

Raw Data

Date	Moffat B.P. Meter	Elm Creek Payne Branch	Moody Meter	Elm Creek Hwy 107 Meter	Liberty Hill Meter	Eddy Meter	Spring Valley Meter	McGregor 9th Street Plant	Average System Residual
09/01/07	2.8	2.6	2.4	2.2	2.0	2.1	1.8	1.6	2.2
09/09/07	3.2	2.6	2.5	2.3	2.0	2.6	2.2	1.8	2.4
09/15/07	2.8	2.2	2.0	1.9	1.9	1.9	1.9	2.1	2.1
09/22/07	3.0	2.3	2.1	2.0	2.1	2.1	2.0	1.9	2.2
Monthly Average	3.0	2.4	2.3	2.1	2.0	2.2	2.0	1.9	

Objective

The objective was to determine if RE-Ox® could reduce chlorine demand in the entire wholesale distribution system as well as the retail distribution systems and thereby increase total chlorine residuals and lower disinfection by-products (DBP), particularly total trihalomethanes (TTHM).

Conditional Use Permit

September 28, 2007

From Texas Commission on Environmental Quality
File PWS/0140162/CO
RN 101202729
CN 600647259

To Bluebonnet Water Supply Corporation

This notice was submitted in accordance with the Texas Commission on Environmental Quality's requirements specified in 30 TAC §290.39(j). The proposed project will involve the temporary installation of equipment to feed RE-Ox®, a chlorine chemical, into the distribution system for a study period of 60 days. Based on our review, this project is not considered a significant change under 30 TAC §290.39(j) (1) and will not require the submittal of engineering plans and specifications.

To better understand RE-Ox, TCEQ requests that you take the samples specified in your letter and submit the results to the Technical Review and Oversight Team (MC-155) after the completion of the project. To receive approval to permanently use this compound, the following must be provided.

- *The daily flow of the water and amount of RE-Ox added.*
- *The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during normal operating conditions before beginning the temporary feed of RE-Ox.*
- *The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during normal operating conditions during the temporary feed of RE-Ox.*
- *A narrative description of the daily visual color inspection and any leaks, flaking or other distribution disturbances found during the RE-Ox application period.*

We note that RE-Ox is NSF Standard 60 certified and will be injected into the system using a Stenner peristaltic pump and that the RE-Ox will be stored in 55 gallon drums. We note that this installation will be set up to inject RE-Ox at the combined clarifier effluent and combined filter effluent at a maximum rate of one gallon per 100,000 gallons of water per day, and that the project is expected to last 60 days. The purpose of this study is to determine whether the use of RE-Ox will increase disinfection residuals at the far ends of the distribution system, reduce chlorine and liquid ammonia sulfate expense, and/or reduce TTHM and HAA5 levels within the distribution system.

Please note that RE-Ox is not a substitute for any part of the current disinfection protocol at the plant. You must continue to use your current approved CT study for you disinfection protocol.

Technical Review & Oversight Team
Public Drinking Water Section (MC-155)
Water Supply Division

Narrative

Bluebonnet Water Supply Corporation serves the towns of Moffat, Elm Creek, Moody, Bruceville, Pendleton, Eddy, Spring Valley, and McGregor. In all, Bluebonnet WSC serves 29,641 people with 10,859 service connections. Its total production is 8.64 million gallons per day. Bluebonnet's customers consume an average of 2.738 million gallons of water daily. This translates to 82.14 million gallons per month and 985.68 million gallons per year.

After receiving the water from Bluebonnet, the residuals drop significantly in the distribution system. For example, Moffat's residuals ranged from nondetectable to 0.02 ppm in its distal sampling points. Normally the water operators would add chlorine and liquid ammonium sulfate (LAS) in an attempt to restore residuals.

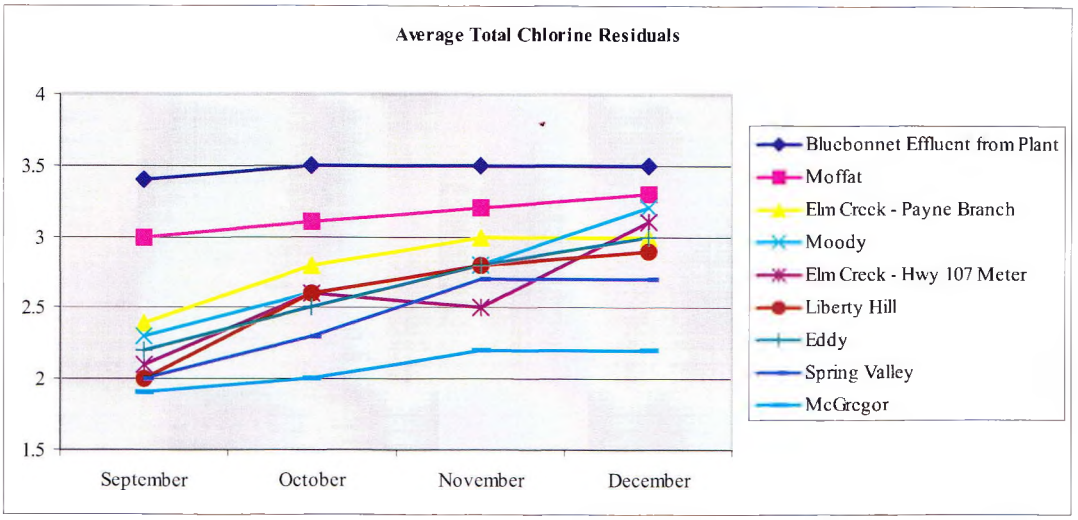
The operators at Moffat asked their wholesaler, Bluebonnet, to use RE-Ox to determine if it could reduce chlorine demand in the entire wholesale distribution system as well as the retail distribution systems and thereby increase total chlorine residuals and lower DBP, particularly trihalomethanes (THM). Bluebonnet submitted a request to the Texas Commission on Environmental Quality (TCEQ) and was permitted to use RE-Ox for a trial. Baseline chlorine data was obtained prior to RE-Ox use at nine sampling locations where water is delivered to the retail water systems. Chlorine residuals were tracked at these sites four times per month through November and three times in December 2007. Samples for THM testing were also taken at those sites on October 8, 2007, prior to the start of the RE-Ox treatment and on January 10, 2008, after the trial. Average high temperatures for the area were 83°F in October, 70°F in November, and 63°F in December.

RE-Ox dosing contributed approximately 0.1 ppm total chlorine to the 3.4 parts ppm average from Bluebonnet's normal chlorine treatment. This dosing was relatively constant throughout the trial. The first three weeks, starting October 8, 2007, RE-Ox was injected into the influent to the clear well. Treatment injection was changed to the influent to the distribution system on October 29, 2007, and continued to December 7, 2007.

Results – Chlorine Residuals

Wholesale system-wide sampling showed a consistent increase of residuals throughout the system. There was an overall 24% average increase of residuals (up 0.69 ppm from 2.24 to 2.93 ppm) while the dosing at the effluent remained constant.

Average Total Chlorine Residuals	September	October	November	December
Bluebonnet Effluent from Plant	3.4	3.5	3.5	3.5
Moffat	3.0	3.1	3.2	3.3
Elm Creek Payne Branch	2.4	2.8	3.0	3.0
Moody	2.3	2.6	2.8	3.2
Elm Creek - Hwy 107 Meter	2.1	2.6	2.5	3.1
Liberty Hill	2.0	2.6	2.8	2.9
Eddy	2.2	2.5	2.8	3.0
Spring Valley	2.0	2.3	2.7	2.7
McGregor	1.9	2.0	2.2	2.2
System Average	**2.24**	**2.56**	**2.75**	**2.93**

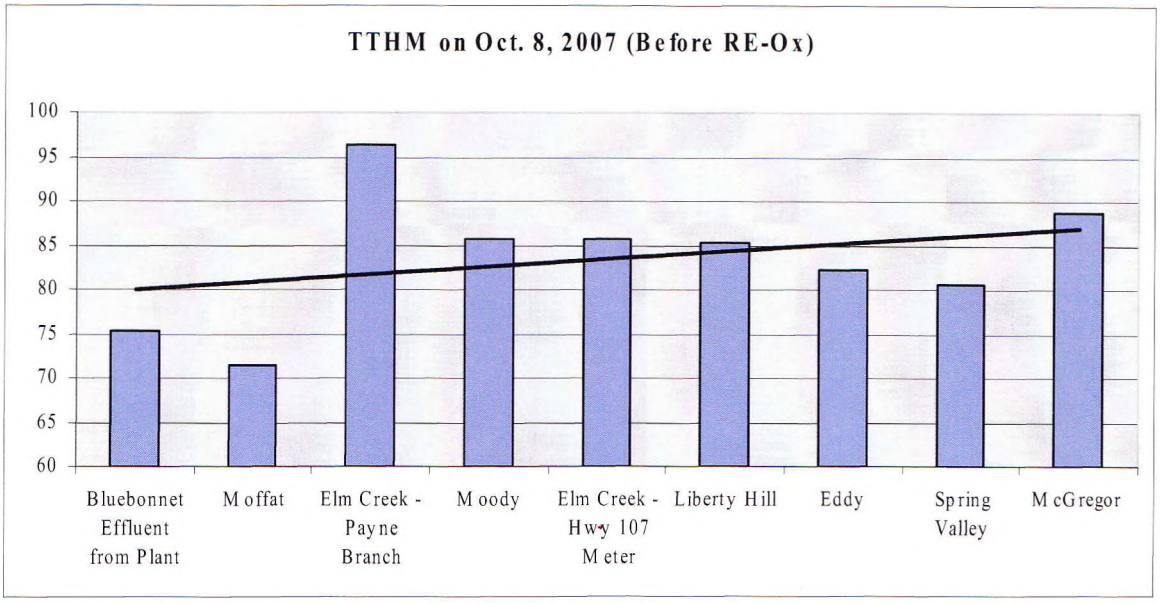


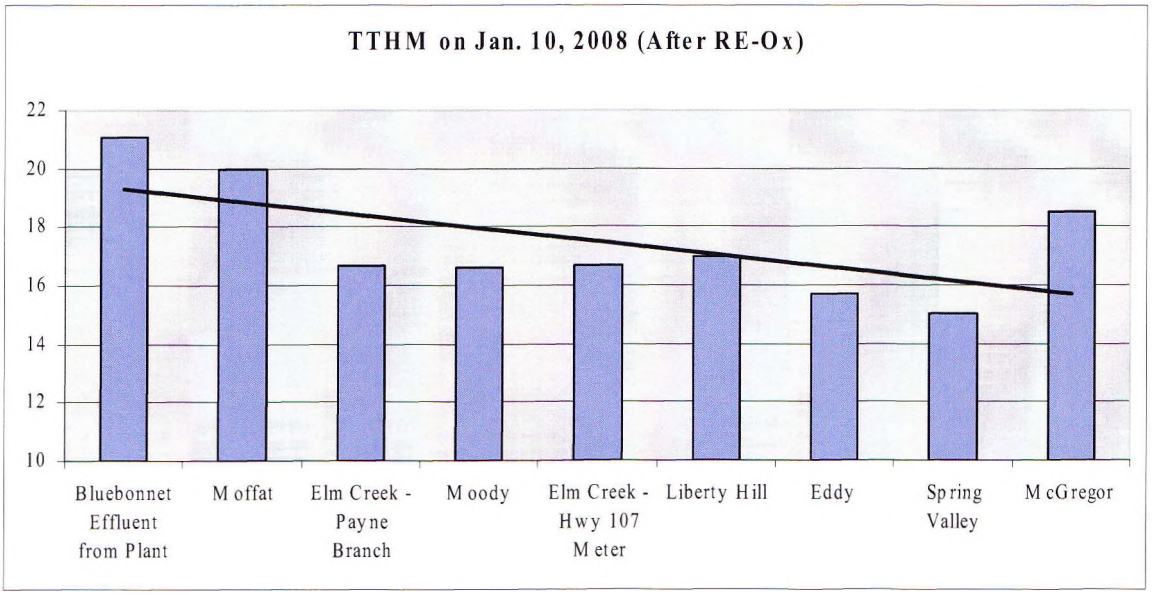
Operators from each of the individual retail water systems reported that their chlorine residuals had substantially increased over the three months. None were required to add additional chlorine or LAS to establish or maintain desired residuals to their end-use customers.

TTHM Results	Oct. 8, 2007	Jan. 10, 2008
Bluebonnet Effluent from Plant	75.4	21.1
Moffat	71.5	20.0
Elm Creek Payne Branch	96.4	16.7
Moody	85.7	16.6
Elm Creek - Hwy 107 Meter	85.7	16.7
Liberty Hill	85.3	17.0
Eddy	82.2	15.7
Spring Valley	80.7	15.0
McGregor	88.8	18.5
Average in System	**84.5**	**17.0**

Results – Total Trihalomethanes

TTHM results revealed that the deposit reduction from the RE-Ox arrested THM creation in the distribution system. Prior to RE-Ox, the TTHM in the water increased an average of 11% (75.4 µg/L to 84.5 µg/L) as it traveled through the distribution piping. After RE-Ox there was no increase in TTHM in any part of the system.





Results – Daily Visual Color Inspection

No changes to the color of the water were noted during the test period.

Conclusions

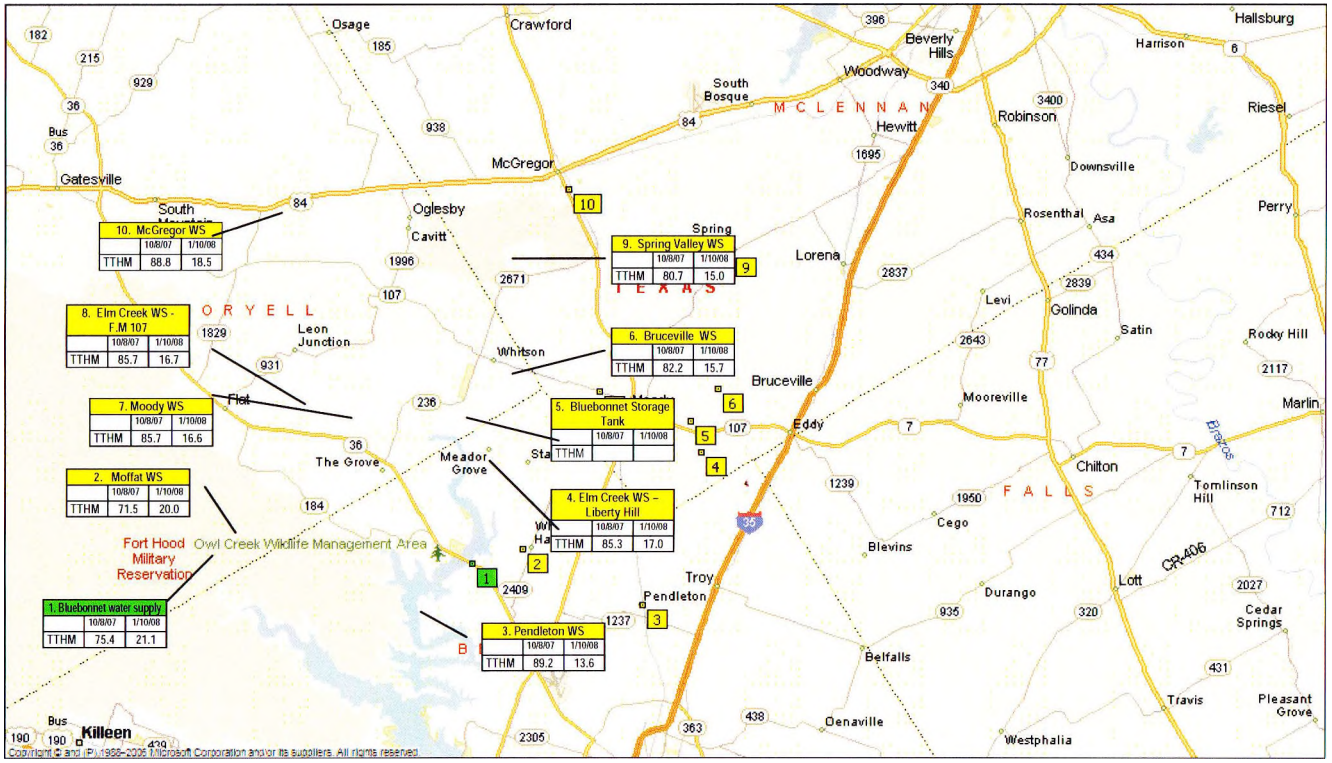
1. During the RE-Ox treatment period, overall chlorine residuals increased not only to the retail systems but also through to the end users without added chlorine or ammonia.

2. After the RE-Ox treatment period, TTHM did not increase in the distributed water as was the case previously.

3. RE-Ox treatment did not cause any adverse changes to the water color.

Sampling Results for Bluebonnet Wholesale Water Distribution System

Bell & McLennan Counties, Texas



	Sampling Location	10/8/07	1/10/08
1 Bluebonnet Water Supply	EC #1	79.6	21.3
1 Bluebonnet Water Supply	EC #2	89.9	23.8
1 Bluebonnet Water Supply	EC #3	86.5	20.4
1 Bluebonnet Water Supply	EC #4	96.0	24.7
1 Bluebonnet Water Supply	MWSC #1	75.4	21.1
2 Moffat	MWSC #2	71.5	20.0
3 Pendleton	POE	89.2	13.6
Not on map	Branch Meter – Elm Creek Payne Branch	96.4	16.7
7 City of Moody	Moody Meter	85.7	16.6
8 Elm Creek Water Supply F.M. 107	107 Meter – Elm Creek Hwy	85.7	16.7
4 Elm Creek Water Supply Liberty Hill	Liberty Hill Meter	85.3	17.0
6 Bruceville	Eddy Meter	82.2	15.7
9 Spring Valley Water Supply	Spring Valley Meter	80.7	15.0
10 City of McGregor	McGregor 9th St. Plant Meter	88.8	18.5

Restoration of Residuals and Reduction of Total Trihalomethanes (TTHM) as a Result of RE-Ox® Use in Chloraminated Wholesale Water and in Blended Chloraminated Water and Well Water

Mark Speed
General Manager
Crystal Clear Water Supply Corporation
Guadalupe County, Texas

March 12, 2008

Objectives

The objective was to determine if RE-Ox® could reduce chlorine demand in a portion of a retail distribution system that distributes chloramine treated water received from a wholesale water company as well as blended water periodically that is made up of the wholesale chloraminated water blended with well water. Another objective was to determine if chlorine demand reduction, by RE-Ox, increases total chlorine residuals and lowers disinfection by-products (DBP), particularly total trihalomethanes (TTHM).

Conditional Use Permit (portion)

November 27, 2007

From Texas Commission on Environmental Quality
File PWS/0940015/CO
RN 101437994
CN 600642268

To Southwest Engineers, Inc.

This notice was submitted in accordance with the Texas Commission on Environmental Quality's (TCEQ) requirements specified in 30 TAC §290.39(j). The proposed project will involve the temporary installation of equipment to feed RE-Ox®, a chlorine chemical, into the distribution system in order to remove... contaminates and lower the concentrations of disinfection byproducts. Based on our review, this project is not considered a significant change under 30 TAC §290.39(j)(1) and will not require the submittal of engineering plans and specifications for TCEQ review and approval prior to construction beginning as long as the following conditions are met:

1. *All chemical storage and feed facilities must comply with TCEQ requirements specified in 30 TAC §290.42(d)(6) and (7).*
2. *Crystal Clear WSC must sample for disinfection byproducts both before and during the temporary feed of RE-Ox.*
3. *The temporary feed of RE-Ox may not last longer than 90 days from the date of first application, at which time the use of RE-Ox must cease. If Crystal Clear WSC wishes to use RE-Ox on a permanent basis, they must first obtain TCEQ approval.*
4. *After completion of the study, the following must be submitted to the Technical Review and Oversight Team (MC-155).*
    - *The daily flow of the water and amount of RE-Ox added.*
    - *The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during normal operating conditions before beginning the temporary feed of RE-Ox.*
    - *The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during the temporary RE-Ox application; and.*
    - *A narrative description of the daily visual color inspection and any leaks, flaking or other distribution disturbances found during the RE-Ox application period.*

We note that RE-Ox is NSF Standard 60 certified and will be stored in 55 gallon drums or 330 gallon totes. We note that the product will be applied at the rate of 1 gallon per 50,000 gallons of water or a dosage rate of 0.002 mg/l of RE-Ox/liter of water.

Please note that RE-Ox is not a substitute for any part of the current disinfection procedures for the water system.

Technical Review & Oversight Team
Public Drinking Water Section (MC-155)
Water Supply Division

Narrative

Crystal Clear Water Supply Corporation is a member owned, not-for-profit utility established in 1964, serving areas of Hays, Comal, and Guadalupe counties in Texas.

Water sources are both ground and surface water. Crystal Clear has seven (7) wells in the Edwards Aquifer which is known to have fluctuating levels. Therefore the state is cutting back on the quantity allowed to be taken from the aquifer. Consequently, Crystal Clear is depending more on chloramine treated surface water obtained from a wholesale source. This water is blended with free chlorine treated well/ground water periodically as needed, desired, and allowed.

Residuals are difficult to maintain in the southeast section of Crystal Clear's distribution system. Normally the retail water operators would add chlorine and/or liquid ammonium sulfate (LAS) in an attempt to elevate residuals. Texas Commission on Environmental Quality (TCEQ) issued a conditional use permit allowing 90 days of monitored treatment with RE-Ox to reduce chlorine demand to elevate total chlorine residuals and lower DBP development.

RE-Ox treatment started on November 5, 2007. RE-Ox was dosed into the water going into the Windmill tank. Over the 12 week treatment period, 425 gallons of RE-Ox was used to treat 37 million gallons of water (440,000 gallons per day). The dosing rate was approximately 1:100,000 RE-Ox to treated water. This contributed approximately 0.005 ppm on top of the total chlorine treatment provided by the wholesaler. The RE-Ox dosing was constant throughout the treatment period.

Baseline data was obtained prior to RE-Ox use at Windmill tank, the sampling location where water is delivered to Crystal Clear, and downstream at four other locations on that portion of the distribution system. Chlorine residuals and water quality data were tracked at these sites periodically throughout the treatment. Samples for trihalomethanes (THM) testing were also taken at selected sites in August and October prior to the test and then in December 2007, 38 days after starting RE-Ox.

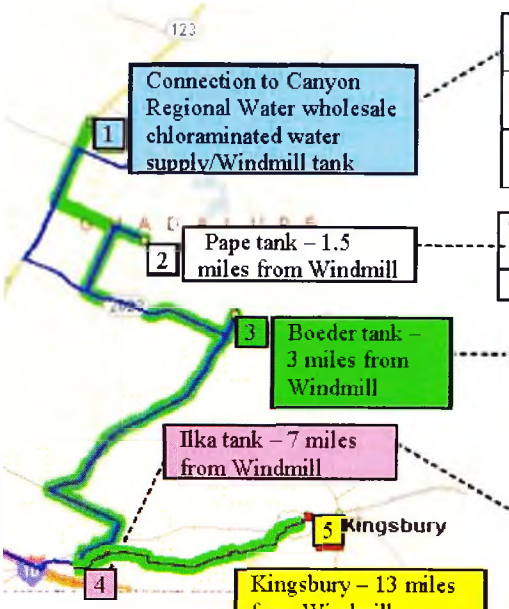
Results – Chlorine Residuals

RE-Ox was able to reduce organic and inorganic deposits (chlorine demand) in the distribution system to bring about a consistent increase of total chlorine residuals. Well water was blended in periodically without the need to add additional chlorine or LAS to establish or maintain desired residuals. Residuals from the wholesaler were sufficient to carry throughout the southwest section of Crystal Clear's system as the cleaning mechanism of RE-Ox demonstrates.

Water to and from Ilka tank (4th tank in a series of tank and pressure facilities) routinely had insignificant total chlorine levels. After seven days of RE-Ox treatment, a residual was obtained

and increased continuously. Water to and from Kingsbury (the last pressure and tank facility in the line) rarely saw any total chlorine residual. After 57 days of RE-Ox treatment, residual developed and continued to increase as the water was turned over.

Water in Windmill tank had a longer storage time due to ground water use from November 15-23, which lowered chlorine values for that period. Some of the tank levels were lowered due to periodic Supervisory Control and Data Acquisition (SCADA) adjustments during the test period. Tank sizes vary from 300,000 to 500,000 gallons. As the tank levels were reduced, the outbound chlorine levels from the tanks increased more rapidly than when operated at capacity. It was noted that "drawing" RE-Ox through the system with flushing elevated residuals more rapidly.



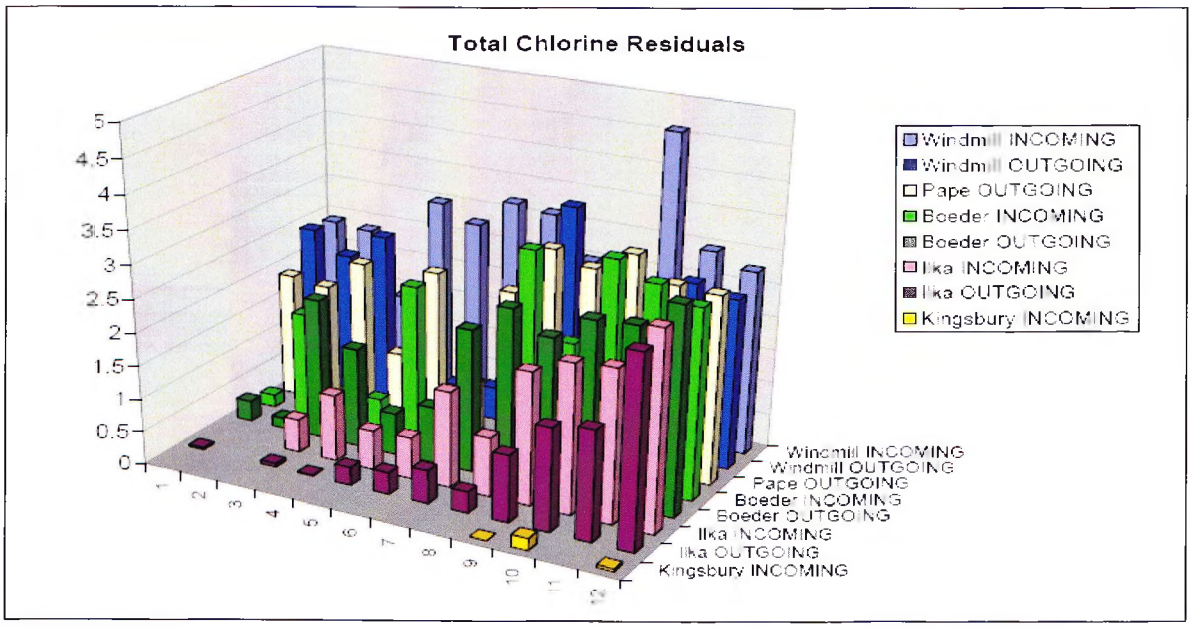
Total Cl_2 at	11/2	11/5	11/12	11/15	11/20	11/23	12/6	12/11	12/27	1/2	1/14	1/29
Incoming from CRW before RE-Ox	2.41	2.37	1.4	3.00	2.77	3.19	3.12	2.5	2.62	4.6	2.97	2.77
Outgoing with RE-Ox as noted	2.46	2.14	2.54	1.01	0.42	0.5	2.68	3.5			2.69	2.56

Total Cl_2 at #2	11/2	11/5	11/12	11/15	11/20	11/23	12/6	12/11	12/27	1/2	1/14	1/29
Outgoing	1.9	1.84	2.31	1.0	2.38	0.78	2.31	3.06	2.88	3.19	2.85	2.82

Total Cl_2 at #3	11/2	11/5	11/12	11/15	11/20	11/23	12/6	12/11	12/27	1/2	1/14	1/29
Incoming	0.19	1.59	0.16	0.5	2.36	0.27		3.23	1.97	3.31	3.06	2.85
Outgoing	0.31	0.16	2.13	1.5	0.63	0.85	2.15	2.58	2.27	2.64	2.68	3.09

Total Cl_2 at	11/2	11/5	11/12	11/15	11/20	11/23	12/6	12/11	12/27	1/2	1/14	1/29
Incoming			0.5	1.0	0.59	0.62	1.44	0.89	1.99	2.24	2.29	2.97
Outgoing	0.03		0.05	0.01	0.27	0.33	0.5	0.32	1.01	1.54	1.64	2.85

Total Cl_2 at #5	11/2	11/5	11/12	11/15	11/20	11/23	12/6	12/11	12/27	1/2	1/14	1/29
Incoming									0.0	0.18		0.04



Water Testing Data

SAMPLING LOCATION	CRITERIA	11/2/2007 Baseline prior to RE-Ox	11/5/2007 Baseline prior to RE-Ox	11/12/2007 With RE-Ox Treatment	11/15/2007 With RE-Ox Treatment	11/20/2007 With RE-Ox Treatment	11/23/2007 With RE-Ox Treatment	12/6/2007 With RE-Ox Treatment	12/11/2007 With RE-Ox Treatment	12/27/2007 With RE-Ox Treatment	1/2/2008 With RE-Ox Treatment	1/14/2008 With RE-Ox Treatment	1/29/2008 With RE-Ox Treatment
Windmill INCOMING	Total CL2	2.41	2.37	1.4	3	2.77	2.19	3.12	2.5	2.62	4.6	2.97	2.77
	Monochloramines	1.52	1.03	0.62	2.76	3.48	2.17		2.1	2.44	3.52	3.08	2.67
	Free Ammonia	0.26	0.22	0.02	0.26	0	0.08		0.05	0	0.26	0	0.24
	pH	7.8	8.4	7.6	7.6	7.8	7.8		7.6			7.8	7.8
	Hardness	400	400		400	400	400		240				
	Alkalinity	240+	240+	230	280	260	230			190	170	220	
Windmill OUTGOING	Total CL2	2.46	2.14	2.54	1.01	0.42	0.5	2.68	3.5			2.69	2.56
	Monochloramines	1.05	2.07	2.33	1.19	0.53	0.21		2.55			2.07	2.57
	Free Ammonia	0.26	0.11	0.19	0.37	0.48	0.36		0.04			0.62	0.23
	pH	7.8	8.4	7.8	7.8	7.4	7.7		7.6			7.8	7.8
	Hardness	400	400		400	400	400		230				
	Alkalinity	240+	240+	230	270	250	230						
Pape OUTGOING (no incoming data for Pape)	Total CL2	1.9	1.84	2.31	1	2.38	0.78	2.31	3.06	2.88	3.19	2.85	2.82
	Monochloramines	0.42	1.04	1.34	0.88	1.99	0.27		2.85	1.99	2.7	1.51	2.8
	Free Ammonia	0.28	0.24	0.2	0.38	0.47	0.44		0.3	0.23	0.3	0.5	0.19
	pH	7.5	7.8	8	7.8	7.9	7.8		7.4			7.6	7.9
	Hardness	400	400		400	1000	400						
	Alkalinity	240+	240+	270	250	230			210	200	200	220	
Boeder INCOMING	Total CL2	0.19	1.59	0.16	0.5	2.36	0.27		3.23	1.97	3.31	3.06	2.85
	Monochloramines	0.21	0.73	0.34	0.01	1.77	0.29		3.68	1.76	2.73	2.13	2.29
	Free Ammonia	0.12	0.14	0.07	0.4	0.45	0.41		0.18	0.37	0.34	0.26	0.24
	pH	7.5	7.8	7.1	7.2	8	7.8		7.4			7.7	7.8
	Hardness	400	400		400	400	400						
	Alkalinity	240+	240+	280	290	230			210	240	210	240	
Boeder OUTGOING	Total CL2	0.31	0.16	2.13	1.5	0.63	0.85	2.15	2.58	2.27	2.64	2.66	3.09
	Monochloramines	0.5	0.35	1.5	1.1	0.7	0.63		1.91	1.84	1.78	2.36	2.43
	Free Ammonia	0.28	0.26	0.18	0.33	0.49	0.35		0.3	0.24	0.43	0.48	0.19
	pH	7.5	7.8	7.8	7.8	7.6	7.6		7.4			7.7	7.8
	Hardness	400	400		400	400	400						
	Alkalinity	240+	240+	230	260	270			230	220	230	240	
Ilka INCOMING	Total CL2			0.5	1	0.59	0.62	1.44	0.89	1.99	2.24	2.29	2.97
	Monochloramines			0.58	0.55	0.57	0.2		0.43	1.49	1.56	1.92	2.5
	Free Ammonia			0.22	0.37	0.51	0.38		0.12	0.3	0.41	0	0.19
	pH			7.6	8	7.5	7.6		7.6			7.6	7.8
	Hardness				400	400	400						
	Alkalinity			280	240	220			230	220	230		
Ilka OUTGOING	Total CL2	0.03		0.05	0.01	0.27	0.33	0.5	0.32	1.01	1.54	1.64	2.85
	Monochloramines	0.2		0.26	0	0	0.24		0.14	0.6	1.52		2.3
	Free Ammonia	0.04		0.06	0.22	0.32	0.27		0.18	0.27	0.32		0.21
	pH	8		7.8	7.6	7.7	7.6		7.6			7.8	7.8
	Hardness	1000			400	400	400						
	Alkalinity	240+		270	240	220			220	210	240		
Kingsbury INCOMING	Total CL2									0	0.18		0.04
	Monochloramines									0			

Results – TTHM

Testing results of total trihalomethanes revealed that the deposit reduction from the RE-Ox helped reduce THM creation in the distribution system.

Date	Sample	Boeder Plant	Ilka Plant	FM 1104	Avg.
8/9/2007	Total Trihalomethanes	65.0	64.7	65.9	**65.2**
10/18/2007	Total Trihalomethanes	31.3	26.5	235.6	**28.5**
12/13/2007	Total Trihalomethanes	19.8	14.6	19.2	**17.8**

Results – Daily Visual Color Inspection

No changes to the color of the water were noted during the test period.

Conclusions

1. During the RE-Ox treatment period, total chlorine residuals increased throughout the distribution system without additional treatment other than the total chlorine and ammonia delivered with the wholesale water. The blended chloramines treated water and ground water was kept on a total basis, and breakpoint on monochloramines was avoided.

2. The reduction of chlorine demand in the distribution system with RE-Ox resulted in a decrease in TTHM values during treatment without the need for a burnout.

3. RE-Ox treatment did not cause any adverse changes to the water turbidity.

Fm #TR402-031209

Restoration of Residuals and Control of Total Trihalomethanes (TTHM) as a Result of RE-Ox® use

Monroe Zuehl, Jr.
Systems Operator
Green Valley Special Utility District
Marion, Texas

June 2, 2008

File PWS 0940020/CO
RN 101435840
CN 600684294

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

February 4, 2008

Mr. Pat Allen, General Manager
Green Valley SUD
P.O. Box 99
Marion, Texas 78124-0099

Subject: Notification of Proposed Change
Green Valley SUD – PWS I.D. 0940020
Guadalupe County, Texas

Dear Mr. Allen:

We received your letter dated October 16, 2007 regarding the notification of Green Valley SUD's (GVSUD) proposed change. This notice was submitted in accordance with the Texas Commission on Environmental Quality's (TCEQ) requirements specified in 30 TAC §290.39(j). The proposed project will involve a change in disinfectant to Re-Ox®, a chlorine chemical, to provide a disinfectant residual into the distribution system. Based on our review, this project is **not considered a significant change** under 30 TAC §290.39(j)(1) and will **not** require the submittal of engineering plans and specifications for TCEQ review and approval prior to construction beginning as long as all chemical storage and feed facilities comply with TCEQ requirements specified in 30 TAC §290.42(d)(6) and (7). Please be aware that these rules require adequate spill containment.

To better understand Re-Ox®, TCEQ requests that you perform a pilot project injection of Re-Ox® into the part of the GVSUD distribution system depicted by the map in your letter, then take samples from the distribution system and submit the results to the Technical Review and Oversight Team (MC 155) after the completion of the project. To receive approval to permanently use this compound, the following must be provided. If GVSUD chooses to discontinue use, please provide the following information for TCEQ's education so we may better understand Re-Ox®:

- The daily flow of the water and amount of Re-Ox® added.
- The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during normal operating conditions before beginning the temporary injection of Re-Ox®.
- The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during the temporary Re-Ox® application.
- A narrative description of the daily visual color inspections and any leaks, flaking, or other distribution disturbances found during the Re-Ox® application period.

P.O. Box 13087 • Austin, Texas 78711-3087 • 512-239-1000 • Internet address: www.tceq.state.tx.us

Objective

The objective was to determine if RE-Ox® treatment applied in a portion of Green Valley Special Utility District (SUD) water system would enable the primary treatment residuals to survive unassisted to the end of the system and not increase total trihalomethanes (TTHM) while doing so. RE-Ox is an electrochemically processed, extremely dilute product (sodium hypochlorite), so the amount of supplemental oxidant is well below that which is needed for antimicrobial activity in surface water systems treated by chloramination.

Narrative

Green Valley SUD is a utility that serves areas of Guadalupe, Bexar, and Comal counties in Texas. Green Valley is a member of the Canyon Regional Water Authority (CRWA) and distributes the surface water obtained, treated, and provided by them. Permission was obtained from the Texas Commission on Environmental Quality (TCEQ), which issued a conditional use permit requesting data from the pilot project to be submitted to the technical review and oversight team when completed.

Historically residuals have been difficult to maintain in the distal outlets of certain sections of the distribution system. Disinfection by-products (DBP) ranged higher while total chlorine residuals remained low at various maximum residency sites in the summer months.

Green Valley SUD wanted to control DBP formation while retaining acceptable levels of total chlorine residuals. Previously, attempts to accomplish this were by the use of elevated chlorination for a period of time to eliminate biofilm development in those areas.

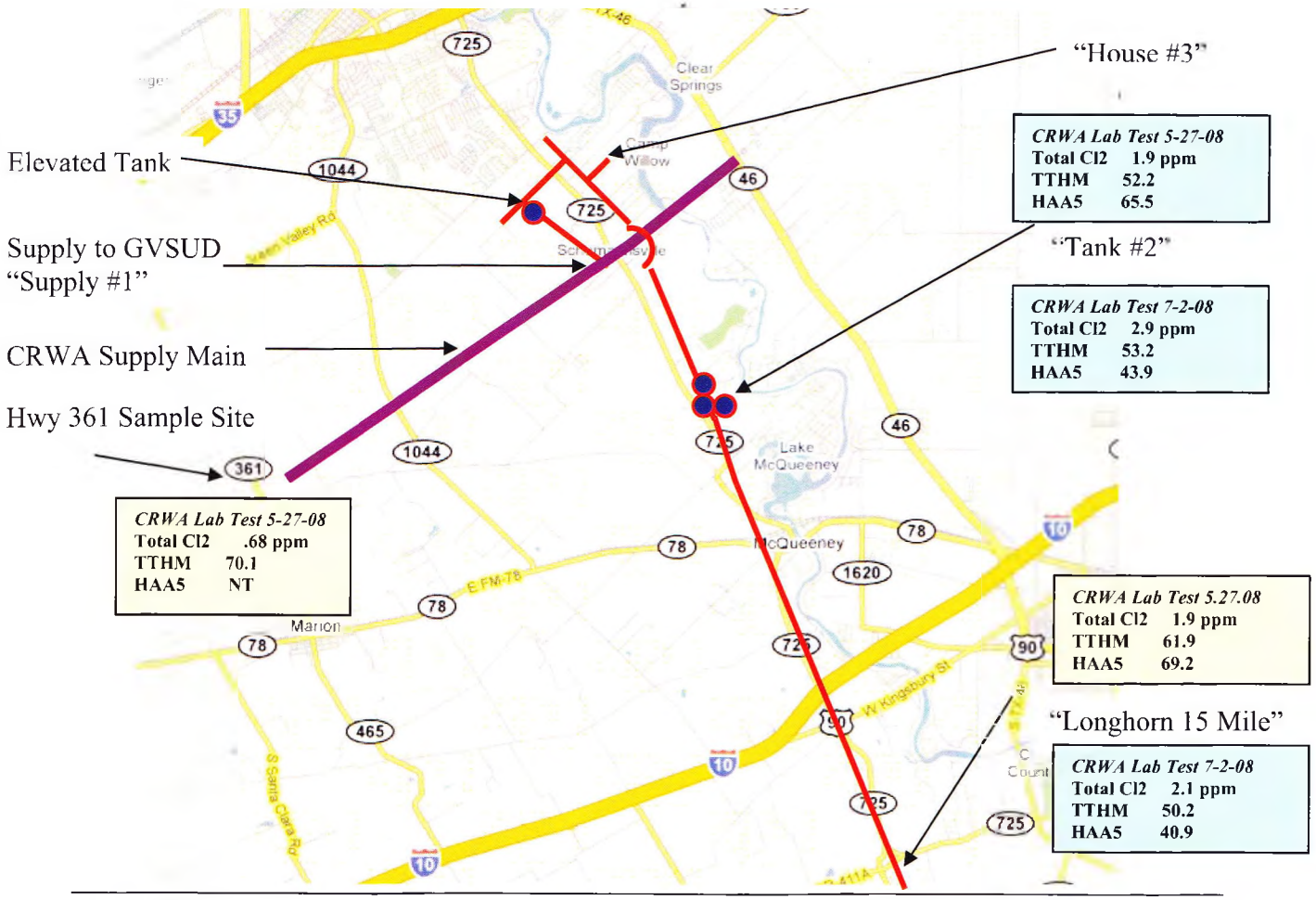
RE-Ox proposed to accomplish these objectives by adding its proprietary sodium hypochlorite at a level below that which is required for antimicrobial activity without affecting ambient pH in water with a temperature above 26° Celsius. Taste and odor issues were represented to not be affected during treatment. (Example: RE-Ox solution is delivered at 500 mg/L (total chlorine). Dosing levels are initially one gallon of RE-Ox to 50,000 gallons of water (considered an initial treatment dose), which would contribute less than .01 ppm of total chlorine. (This amount is less than half of the lower detectable limit of a standard DPD chlorine test.) Once the system is cleaned, maintenance dosing can be reduced to
1: 200,000 or .002 ppm.

A section of the distribution system considered the most difficult to retain residuals was selected with consideration given to the retention time and storage volume being the main cause of persistently low residuals.

RE-Ox treatment started on April 23, 2008. RE-Ox was dosed into the water after reception from the 30" CRWA supply main. Over the 32 day treatment period, 620 gallons of RE-Ox was used to treat 41 million gallons of water (1M-1.3M gallons per day). The dosing rate was approximately 1:66,000 RE-Ox to treated water. This contributed approximately 0.01 ppm to the amount of the total chlorine treatment provided by CRWA.

Sampling for residual chlorine, TTHM and other data was obtained prior to and during RE-Ox use. This data was compared to another site (Highway 361) within the water district to see if RE-Ox treatment was actually lowering DBP levels compared with non-treated areas.

As shown on the map, the sampling locations selected were: 1, (Supply) the GVWSUD supply from CRWA; 2, (House 3) four miles from the supply after a 500,000 gallon elevated tank from an external faucet at a house on a dead end; 3, (Tank #2) about four miles further (or eight miles from supply) after two 250,000 gallon tanks and a 10,000 gallon pressure tank; 4, (Longhorn 15 mile) 15 miles further (or 23 miles from supply).



Results

Residuals: The treatment program resulted in restoring chlorine levels to 79.2 % of the primary treatment level from CRWA, which was over 35 miles distant from the primary treatment plant. These levels were three times higher than the Highway 361 sampling site.

TTHM: TCEQ was interested in DBP development of this treatment as the program was underway. Additional tests were collected during six weeks with three tests conducted by an area lab and the final 3 tests processed through CRWA. The TTHM test line was 44% lower than the average of the surrounding sampling sites while the treatment was underway.

Water Quality: Water quality was considered normal with no complaints being registered during the trial. Free ammonia remained below <1ppm, pH and total alkalinity were unaffected. Water temperature averaged 25° degrees Celsius.

Test Line Data Results

SAMPLING LOCATION	CRITERIA	4/22/2008 Cl2 by operator, other by SATL lab Prior to RE-Ox	4/29/2008 Cl2 by operator, other by SATL lab With RE-Ox Treatment	5/9/2008 Cl2 by operator, other by SATL lab With RE-Ox Treatment	5/13/2008 Cl2 by operator, other by CRWA lab With RE-Ox Treatment	5/25/2008 Cl2 by operator, other by CRWA lab With RE-Ox Treatment	7/16/08* Cl2 by operator, other by CRWA lab With RE-Ox Treatment
"Supply 1": Before RE-Ox is added	Total Cl2	3.3	2.4	3.8	3.7	3.9	2.4
	TTHM	43.3	39	60	66.1	65.2	
	HAA5					48.4	
"House 3": +/- 4 miles from supply	Total Cl2	2.1	2.1	on 5/5 2.9	3.5	3.1	
	TTHM	34.1	47		62.4	76.1	
	HAA5					61.2	
"Tank #2": +/- 8 miles from supply	Total Cl2	2.5	2.3	2.2	2.2	1.9	2.3
	TTHM	44.1	67	58.2	63.5	55.2	53.3
	HAA5					65.5	43.5
"Long Horn - 15 miles": +/- 35 miles from primary treatment.	Total Cl2	1.7	1.5	2.5	2.1	2.1	1.9
	TTHM			65.5	64.2	61.9	50.2
	HAA5					69.2	40.9

* Additional CRWA testing for TTHM and HAA5 levels were conducted about six weeks after completion of the test. HAA5's increased during treatment as scale was removed due to the background bromine level which may have accumulated over time. The lower maintenance dosage of 1:200,000 resulted in maintaining residuals with lower DBP development.

RE-Ox® Instead of Burnout – Chlorine Residuals and Filters Maintained in the City of Marlin, Texas

Note: The use of RE-Ox by the City of Marlin, Texas, was allowed without a conditional use permit.

James Glenn
Treatment Superintendent
City of Marlin, Texas

March 28, 2008

3-26-08

To: Doug Vineyard / RE-Ox

During the later part of summer 2007 the water system in the City of Marlin, Texas experienced serious chlorine demand problems. To fix this we did the general practice of turning off our Liquid Ammonium Sulfate feed and reverting to Free Chlorine. This requires feeding about five times as much chlorine as usual and causes taste and odor problems throughout the water system. After four weeks of this procedure, the chlorine residuals indicated we had removed the buildup in the water mains.

Due to the weather patterns during the fall of 2007, the water system again had demand problems. Wanting a more permanent solution to this I decided to try your RE-Ox deposit control product. In October, November, and December 2007, RE-Ox was co-applied with our regular chlorine and ammonia treatment. Using RE-Ox, the chlorine demand was substantially cleared in the water system in town within one week. Reducing the deposits from the ends of the water system took two more weeks.

We are now feeding 25% of the original dosage of one gallon of RE-OX to 50,000 gallons of water as a kind of maintenance feed.

Every system has its own unique requirements, and will take some trials and testing. The RE-OX product can be a cost-effective option for many water systems.

James Glenn
Treatment Superintendent
City of Marlin, Texas

Background

The water utility for the city of Marlin, Texas, distributes an average of 1.5 million gallons of water per day. Surface water is taken and filtered with conventional sand and anthracite filters. Coagulation is then used: a trace of copper sulfate, to precipitate organic carbons, is added along with caustic, to increase the pH, and water is treated with chlorines and ammonia (to make chloramines).

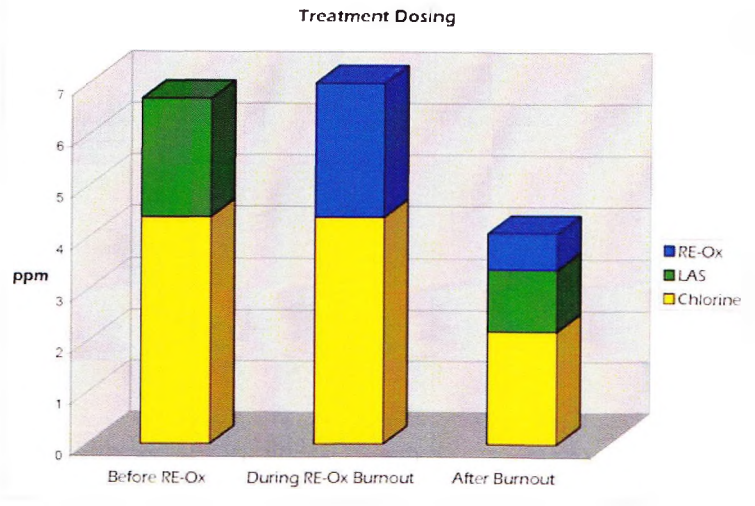
During the later part of summer 2007, the utility experienced serious nitrification problems. To address the problems, they did the standard burnout; they turned off the liquid ammonium sulfate (LAS) feed and reverted to free chlorine. This required feeding about five times as much chlorine as usual and caused taste and odor problems throughout the water system. After four weeks of this procedure, the chlorine residuals indicated that nitrate buildup in the water mains was eliminated.

RE-Ox® Treatment

Due to the weather patterns during the fall of 2007, the water system again had nitrification problems. Wanting a more permanent solution, the operator decided to try RE-OX. RE-Ox is a specialty cleaning bleach engineered to penetrate and remove inorganic and organic deposits in distribution systems during normal operations while water quality is maintained.

Using RE-OX, the water distribution system in the main part of town was cleared of nitrates within one week. The ends of the water system required two additional weeks to clean. The cost of using RE-Ox was the same as if a regular burnout was performed.

The operator then continued RE-Ox treatment as a permanent nitrate control. This maintenance dosage was reduced to 1:200,000 (RE-Ox to treated water), 25% of the original cleaning dosage of 1:50,000. The regular gas chlorine and LAS treatment continued, but as RE-Ox prevented buildup of chlorine demand, less of the former was required to maintain the desired residuals than was the case prior to RE-Ox use.



Results

The operator said, "Every system has its own requirements and will take some trials and testing. The RE-OX product can be a cost effective option for many water systems."

The operator then went one step further and moved the RE-Ox feed to the influent to the filters. He found that RE-Ox kept the filters cleaner, increased their run rate, and cleaned up the turbidity meters, all while still providing deposit control to maintain the desired chlorine residuals in the distribution system beyond. He stopped moving the feed to the influent to the filters after 45 days. The operator noticed that RE-Ox was transferring with the coagulant in the filters, so he relocated the RE-Ox feed to after the filters.

Extending Total Chlorine Residuals by Means of Scale Deposit Control

Robert White
Director of Water & Sewer Services
City of Killeen, Texas

February 2009

Robert White

From: Marlo Wanielista Berg [MBerg@tceq.state.tx.us]
Sent: Thursday, October 23, 2008 1:48 PM
To: Robert White
Cc: Alicia Diehl; Reyna Holmes
Subject: Re-Ox use
Attachments: 0140061c.xls

Robert,

I am finalizing your approval to use Re-Ox permanently and I need a few more pieces of information from you. The first piece I need is to see if you will need to submit Engineering Plans and Specifications.

- What is the feed rate or dose of Re-Ox at each site?
- What is the max water flow rate at each Re-Ox injection point?
- You say that you would like to use Re-Ox in place of free chlorine burn. How long do you propose to use Re-Ox during each use? You had mentioned possibly a month. Is this correct?
- What are the sizes of the pumps for each size (feed rate).

I will be approving the use of Re-Ox because it is an NSF approved chemical, but I am a bit concerned based on the data you presented. I have attached an excel document containing graphs of your data to illustrate my points. My concerns are as follows.

- First off, let me check my assumptions. You measured Residual, PH, Ammonia, and Free at your pump stations. I am assuming that the Free is Free Chlorine and the Residual is Total Chlorine. Also I am assuming that you are still receiving chloraminated water and NOT breakpoint chlorinating at water (you have chloramines in your distribution system). Are these correct assumptions?
- I am concerned because throughout your test when you are adding Re-Ox , you have fairly high free ammonia levels. I am first and foremost concerned because of nitrification. The data shows the ammonia levels very low at haybranch along with low total chlorine. Where did the ammonia go? I am concerned it is being eaten by nitrifying bacteria.
- These high ammonia levels should not even be possible because you also have high free chlorine levels. This generally is not possible as the chlorine and ammonia at the levels shown combine to form total chlorine.
- After your Re-Ox test (9/21 to 9/25) we see free chlorine levels that match or exceed the total chlorine (at Tripp and Lazy Ridge). The free samples that exceed the total ones should not be possible, and the rest suggest you are no longer chloraminating. This again should not be possible because the ammonia levels continue to be high after the Re-Ox test is completed.

Please send me the methods you used to measure residual, free and ammonia. Also a confirmation of the dose of re-ox you were using. If you have any ideas about what else could be cause the oddities documented above, let me know.

Best Regards,

Marlo Wanielista Berg. P.E.
Texas Commission on
Environmental Quality
Public Drinking Water
(512) 239-6967
fax (512) 239-6050

You forwarded this message on 1/27/2009 1:21 PM.

Douglas Vineyard

From: Marlo Wanielista Berg [MBerg@tceq.state.tx.us] **Sent:** Tue 1/27/2009 11:13 AM
To: Douglas Vineyard
Cc: rhorgen@satx.rr.com; Mike Owens; Alicia Diehl
Subject: Re: TCEQ Killeen, Lancaster, Hospital Initiative
Attachments:

Doug and Mike,

Thank you for your calls today. Unfortunately Severe Weather is scheduled to hit Texas tonight and I am on team that deals with this type of emergency for the entire state, therefore I can not meet with you this week. But I can give you some direction on each of the below

1. For Killeen, please have them send an email and follow up hard copy letter with their request for the exception to be modified. Please include all the information you have discussed below. Most importantly please include the HACH information. We would need a letter directly from the company explaining how the test method is influenced by the Re-Ox product. Plus the information provided in the below email.

2. Alicia has received your request and it is in line to be responded to.

3. I have not received the Lancaster report yet, but I am looking forward to getting it.

Thank you,

Marlo Wanielista Berg, P.E.
Texas Commission on
Environmental Quality
Public Drinking Water
(512) 239-6967
fax (512) 239-6050

>>> "Douglas Vineyard" <dvine@spicerand.com> 1/22/2009 4:11 PM >>>
Marlo:
Would you be able to direct us on the following request?

1. City of Killeen, Texas. Is requesting consideration of lowering frequency of testing requirement for permanent use of RE-Ox in their system. Would it be possible for the City of Killeen to request this in an e-mail followed by a letter for expedited approval?

Permit requirements include: Free Available Chlorine, Free Ammonia, Nitrates, Nitrites.

For consideration of lessening the number of tests and the frequency of testing, would data from the Lancaster Water trial with lab data from Dallas Water Utilities, Green Valley Water SUV, and Crystal Clear Water trials be sufficient in determining that RE-Ox does not contribute to development of Nitrification in chloraminated systems as justification for lowering the testing requirements? Based on DWU's information, Free Ammonia, Nitrates and Nitrites were virtually unaffected. Also, dosing rates as a sodium hypochlorite are less than .02 mg/L which would have minimal impact on the monochloramine.

Free Chlorine Testing could be waived: Hach Company, Loveland, Colorado has a statement concerning testing for FAC on chloraminated systems.... "The reaction of DPD with free chlorine is rapid. If the color is measured within one minute, the monochloramine breakthrough will be minimal. A concentration of 3.0 mg/L monochloramine (as Cl2) will cause an increase of less than 0.1 mg/L free chlorine when using Hach DPD colorimetric tests." - (Current Technology of Chlorine Analysis for Water and Wastewater Technical Information Series - Booklet No.17 By Danial L. Harp p.15) Also, Chloramination, A Specific and Effective Method for Controlling Chloramination of Waters mentions this is a more specific Device that works in chloraminated systems, and also, in a conversation with the Hach Tech, the company now has information that the reaction with Free chlorine actually takes place much quicker, less than 15 seconds for the nonochloramin breakthrough to occur.

2. Hospital Facility treatment: A letter requesting the division's permission for facilities to treat with RE-Ox as a Scale Deposit Control Disinfectant without becoming a SWU was sent to Dr. Diehl just before the Christmas Holidays. We are working with several hospitals one of which is Scott Edwards in Temple, Tx. We are looking

for direction from the Commission on this request. Again, would it be possible for the facility administrator to request a conditional permit for treatment in the expedited manner?

3. Lancaster Trial Data, Field Report has been mailed to your office. We make this available as additional support data on effectiveness of scale deposit removal in extending DWU residuals into the farthest reaches of LWU's water system. The CD also includes the raw daily field notes for verification. For unknown reasons to us, the trial was terminated pre-maturely. This is just for your files.

Thank you

D. Vineyard
913-205-4773

Main Identity

From: "Douglas Vineyard" <dvine@spicerand.com>
To: "Jackie" <jsp@kc.rr.com>
Sent: Thursday, March 12, 2009 11:45 AM
Attach: Copy of Data Sheet for RE-Ox Hach.xls; TCEQ RE-Ox.doc; TCEQ RE-Ox Killeen Hach.doc; Data Sheet for RE-Ox.xls, TCEQ Email Killeen.pdf
Subject: FW: Hach Inserts for City of Killeen

D. Vineyard
913-205-4773

From: Douglas Vineyard
Sent: Thu 3/12/2009 10:31 AM
To: Jackie; Douglas Vineyard
Subject: Hach Inserts for City of Killeen

Jackie; Please also include the following emails in sequence;

Pat,

Thank you for taking the time to test the product with your analytical methods. Since your tests show no interference with the test equipment, then the Killeen situation becomes even stranger.

Thank you for your time. We will do an in-depth review of your submitted documents.

Thank you,

Marlo Wanielista Berg, P.E.
Texas Commission on
Environmental Quality
Public Drinking Water
(512) 239-6967

fax (512) 239-6050

>>> "Wiese, Pat" <PWIESE@hach.com> 2/23/2009 4:14 PM >>>

Marlo,

Attached please find a letter describing my summary of the work that was completed using the Hach DPD Chlorine Chemistries as well as a new experimental method for Free Chlorine in the presence of the RE-Ox product. Also attached is the data for the work completed. A second hardcopy will also be sent.

Please advise if you need anything else from Hach Company.

Best regards,

Pat Wiese
Application Scientist
Hach Company
P.O. Box 389
Loveland, CO 80539-0389 USA
1-800-227-4224 x 2609

<<TCEQ RE-Ox.doc>> <<Data Sheet for RE-Ox.xls>>

D. Vineyard
913-205-4773

HACH
Be Right™

February 23, 2009

Marlo Wanielista Berg, P.E.
Texas Commission on
Environmental Quality
Public Drinking Water Section

Dear Ms. Berg:

I have evaluated the RE-Ox product received from RE-Ox, LLC for its reaction with the Hach DPD Free and DPD Total Chlorine Reagents. I also studied its interactions with free chlorine and with monochloramine and any influence the RE-Ox product may have on determining the residual free chlorine and monochloramine concentrations. The tests were run at the prescribed 1:50,000 and 1:100,000 recommended dilution ratios for treatment. I also ran the RE-Ox product at a 1:1000 dilution rate to investigate the product's response at higher levels in order to be able to detect a response that could be more easily detected with a spectrophotometer.

The RE-Ox product reacts with DPD Chlorine Reagents in a direct manner as if it were residual free chlorine. This conclusion was based on the chlorine value of 720 ppm supplied with the product received. At the dilution levels of 1:50,000 and 1:100,000 the product is barely detectable. When used in combination with added free chlorine or with monochloramine at the 1:1000 dilution ratio no interference was found in measuring free chlorine or monochloramine concentrations. The monochloramine solution included additional free ammonia in order to prevent the RE-Ox from converting the monochloramine to dichloramine. The RE-Ox quantitatively converted the free ammonia into additional monochloramine based on the amount of RE-Ox added. The pH of the RE-Ox product is listed as having a pH range of 6.5 – 7.5. The product sample received had a pH value of 7.14. The product will not have a pH effect on the DPD Chlorine Reagents in this pH range.

Based on the test results on this single sample of product, no problems were found in using DPD Free Chlorine or DPD Total Chlorine Reagents to determine free chlorine or chloramine residuals in the presence of the RE-Ox product.

Best regards,

Pat Wiese
Application Scientist
Hach Company
P.O. Box 389
Loveland, CO 80539-0389 USA
1-800-227-4224 x 2609

Date: 2/19/09
Pat Wiese

Received Sample from Re-Ox LLC; Product is Cold Re-Ox, pH 7.14, 720 ppm Cl2. This is an "activated" NaOCl solution used as a scale inhibitor in DW distribution. NSF Approved; feed rate is 1:50,000 or 1: 100,000. Texas Commission of Environmental Quality (TCEQ) has been requiring utilities who are feeding this product to monitor for free chlorine to control. One utility, Lake Killeen, has gotten values all over the board. TCEQ is concerned as is the manufacturer. This is a chloraminated system which always has difficulty which poses problems for DPD Free Chlorine measurements anyway. TCEP and Re-Ox LLC wants to know if Re-OX product interferes with the DPD measurements. I am also interested in developing a communications link with TCEQ and also seeing how this product works with the modified Monochlor F method for determining free chlorine.

Experiment: RE-Ox and Free Chlorine Combinations

Method	Analyte	Sample	mg/L as Cl2	Observations
DPD Free	Free Chlorine	RE-Ox 1:1000	0.71	DPD Color stable and immediate
DPD Total	Total Chlorine	RE-Ox 1:1000	0.71	DPD Color stable and immediate
Exp. Free Chlorine	Free Chlorine	RE-Ox 1:1000	0.71	0.72 @ 15 minutes
Monochlor F	Monochloramine	RE-Ox 1:1000	0.02	No monochloramine detected
DPD Free	Free Chlorine	Free Chlorine Soln	0.74	Made from Hach Free Cl2 Ampule Std
DPD Total	Total Chlorine	Free Chlorine Soln	0.78	Made from Hach Free Cl2 Ampule Std
Exp. Free Chlorine	Free Chlorine	Free Chlorine Soln	0.73	Made from Hach Free Cl2 Ampule Std
DPD Free	Free Chlorine	RE-Ox 1:1000 spiked to same Free Cl2 conc.as above (0.73 - 0.78)	**1.26**	0.71 mg/L RE-Ox + 0.74 mg/L F-Cl2 = **1.45** mg/L as Cl2
DPD Total	Total Chlorine	RE-Ox 1:1000 spiked to same Free Cl2 conc.as above (0.73 - 0.78)	**1.41**	0.71 mg/L RE-Ox + 0.78 mg/L F-Cl2 = **1.49** mg/L as Cl2
Exp. Free Chlorine	Free Chlorine	RE-Ox 1:1000 spiked to same Free Cl2 conc.as above (0.73 - 0.78)	**1.43**	0.71 mg/L RE-Ox + 0.73 mg/L F-Cl2 = **1.44** mg/L as Cl2

Experiment: RE-Ox and Monochloramine Combinations

Method	Analyte	Sample
DPD Free	Free Chlorine	Re-Ox 1:1000 (4 hours old)
DPD Total	Total Chlorine	Re-Ox 1:1000 (4 hours old)
Exp. Free Chlorine	Free Chlorine	Re-Ox 1:1000 (4 hours old)
DPD Free	Free Chlorine	New Free Chlorine Dilution
DPD Total	Total Chlorine	New Free Chlorine Dilution
Exp. Free Chlorine	Free Chlorine	New Free Chlorine Dilution
Monochlor F	Monochloramine	Monochloramine solution
DPD Free	Free Chlorine	Monochloramine solution
DPD Total	Total Chlorine	Monochloramine solution
Exp Free Chlorine	**Free Chlorine + Monochloramine**	Monochloramine solution
Monochlor F	Monochloramine	50 ml monochloramine soln with excess free ammonia+ 50 ml 1:1000 RE-Ox
Monochlor F	Monochloramine	Same - Monochloramine + 1:1000 RE-Ox
DPD Free	Free Chlorine	Same - Monochloramine + 1:1000 RE-Ox
Exp. Free Chlorine	**Free Chlorine + Monochloramine**	Same - Monochloramine + 1:1000 RE-Ox
DPD Total	Free Chlorine	Same - Monochloramine + 1:1000 RE-Ox

mg/L as Cl2	Observations
0.69	
0.70	Stable immediately
0.67	
0.80	
0.80	
0.75	
1.95	
	0.13 mg/L @ 1 minute;
0.07	**monochloramine breakthrough**
1.82	Less than monochloramine; investigate
1.93	No free chlorine present when Exp. Free Chlorine Method = Monochlor F value
	50% dilution of monochloramine and RE-Ox 1:1000; 0.975 mg/L Cl2 from
1.32	monochloramine + 0.40 mg/L from RE-Ox that was converted to monochloramine = 1.38 mg/L as Cl2
1.31	Same should equal ~ 1.38 mg/L Cl2
0.05	**Increased to 0.11 mg/L @ 1 minute due to monochloramine breakthrough**
1.30	Did not compensate for monochloramine background; F-Cl2 + Monochloramine
1.26	Same should equal ~ 1.38 mg/L Cl2

Experiment: RE-Ox reaction with DPD Free Chlorine & DPD Total Chlorine Reagent plus an Experimental Free Chlorine method for

Method	Dilution	mg/L Cl2
DPD Free Chlorine Rgt	Re-Ox 1:1000	0.68
DPD Total Chlorine Rgt	Re-Ox 1:1000	0.69
Exp Free Chlorine Rgt	Re-Ox 1:1000	0.67
DPD Free Chlorine Rgt	Re-Ox	0.00
DPD Total Chlorine Rgt	Re-Ox	0.00
Exp Free Chlorine Rgt	Re-Ox	0.00
DPD Free Chlorine Rgt	Re-Ox	0.01
DPD Total Chlorine Rgt	Re-Ox	0.00
Exp Free Chlorine Rgt	Re-Ox	0.00

HACH
Be Right™

February 23, 2009

Marlo Wanielista Berg, P.E.
Texas Commission on
Environmental Quality
Public Drinking Water

Dear Ms. Berg:

This communication is in reference to the data you had sent from the Killeen, Texas utility that is investigating the use of RE-Ox. I spoke with Randy Tucker (254-462-6376) this morning about the data and their treatment process.

This sounds like a very challenging water. I do not know if I can make a fair appraisal of the situation, but based upon the conversation this morning there are a number of issues that could be contributing to the erratic data. These issues may be independent of the use of the RE-Ox product.

- Killeen is purchasing a variable chloraminated water.
- Nitrification appears to be taking place in their storage reservoir based on influent and effluent total chlorine measurements.
- Several troublesome areas of low residual were noted within the distribution system.
- The pumps used to feed the RE-Ox may not be sufficient or properly set to maintain the correct feed rate of the RE-Ox product.

It would be my recommendation that one will need a full description of their process with established background data of the water before the use of RE-Ox. This would help establish if the data variability is due to RE-Ox use or if it is the normal variability in their supplied water or data gathering process. I am the middleman in this situation so I'm not sure how to further proceed with this. For me to further comment on the data variability would be speculation on my part; however based on the lab experiments with the RE-Ox product, I found no indication that the variability in the data is due to interference from RE-Ox in the test methods being used.

Best regards,

Pat Wiese
Application Scientist
Hach Company
P.O. Box 389
Loveland, CO 80539-0389 USA
1-800-227-4224 x 2609

Reply Reply to all Forward Close Help

You forwarded this message on 2/26/2009 9:16 AM.
Attachments can contain viruses that may harm your computer. Attachments may not display correctly.

From: Wiese, Pat [PWIESE@hach.com] Sent: Thu 2/26/2009 8:45 AM

To: Marlo Wanielista Berg

Cc: Jason Peters

Subject: RE-Ox

Attachments: Data Modifications Killeen0140061 re-ox (3).xls(141KB)

View As Web Page

Marlo,

I went back and looked at the Killeen data again after my conversations with Randy Tucker at Killeen and some input from RE-Ox. I plotted the data again (Sheet Two - Hach Data) which for me shows things a little more clearly. There where a couple of data points that were not included on the Sheet One graphs. There does appear to be a significant impact of water quality test results after the addition of RE-Ox as you had noted. My work to date has all been on the direct reaction of the DPD chemistries with RE-Ox in the presence of chlorine or monochloramine. I am not able to study the impact of the action of RE-Ox on the biofilm or other distribution system deposits and that impact on test results.

As TCEQ reviews the data, there are two things that should be noted. The test results for free and total chlorine were obtained by Killeen using two different DPD methods for both free and total. Results listed as < 2.00 mg/L and expressed as x.xx mg/L were obtained using the Low Range Methods; results listed as > 2.0 mg/L and expressed only to one decimal, x.x mg/L, would have been determined using the High Range Method. This is important to note as the level of chloramine and organochloramine breakthrough in the HR DPD Free Chlorine method is significantly higher than in the LR method. This is due to the increased amount of indicator used in the HR method. If the RE-Ox is successfully reducing or eliminating the biofilm present, one would have to suspect that the background organic chloramines will temporarily increase significantly until the system re-establishes equilibrium with the RE-Ox feed. I would suspect this time interval would depend on the initial condition of the distribution system. I believe the free chlorine values are likely all false positives due to background interference and the fact already noted that free chlorine and free ammonia can not co-exist at those reported concentrations.

The increase in free ammonia levels after the RE-Ox feed could also be explained if the biofilm is being released or being made more reactive in the presence of the RE-Ox. This would allow the monochloramine to react with the organic carbon which would free up additional free ammonia from the monochloramine reaction.

Also, please note that the scale on the y-axis changes as we go further into the distribution system sampling sites.

I hope my explanations are of use to you as you sort through this situation. This may be a site where we could evaluate the Exp. Free Chlorine method to see if my theory that the free chlorine values as determined by DPD are really false positives in this particular situation.

Best regards,

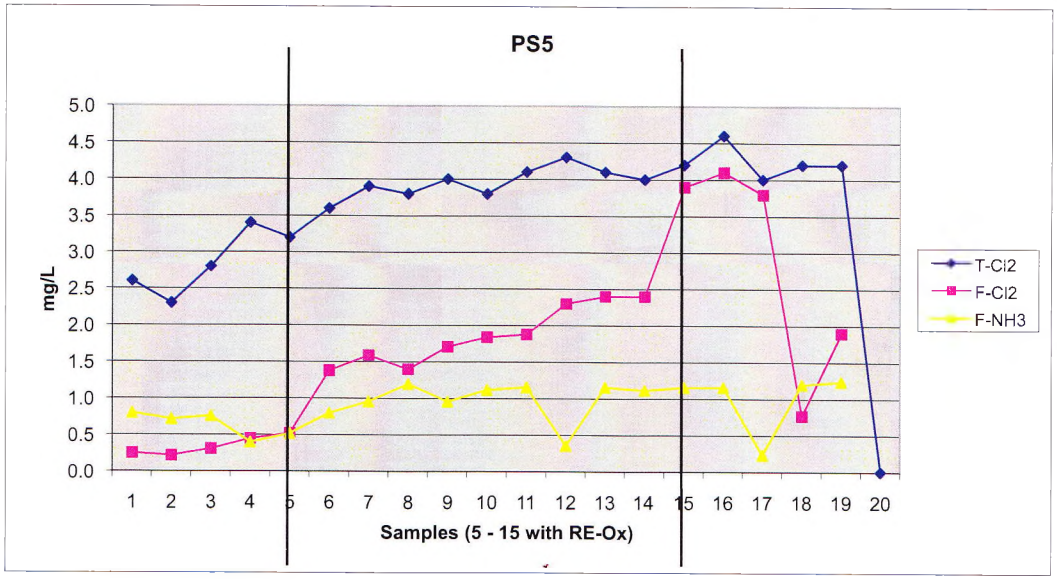
Pat Wiese
Application Scientist
Hach Company
P.O. Box 389
Loveland, CO 80539-0389 USA
1-800-227-4224 x 2609

pwiese@hach.com
www.hach.com

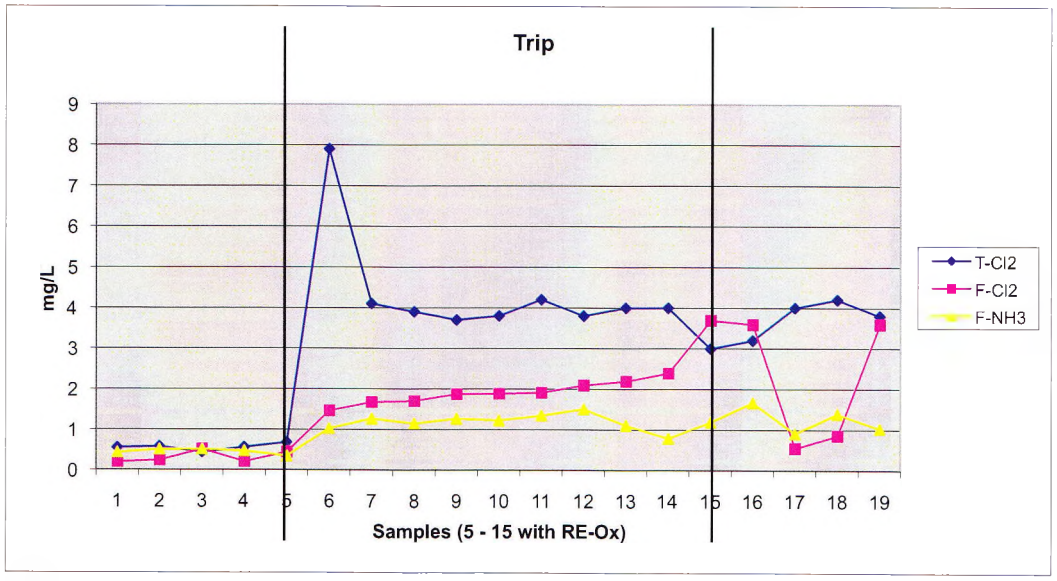
<<Data Modifications Killeen0140061 re-ox (3).xls>>

Data Analysis by Sampling Site - Killeen, Texas

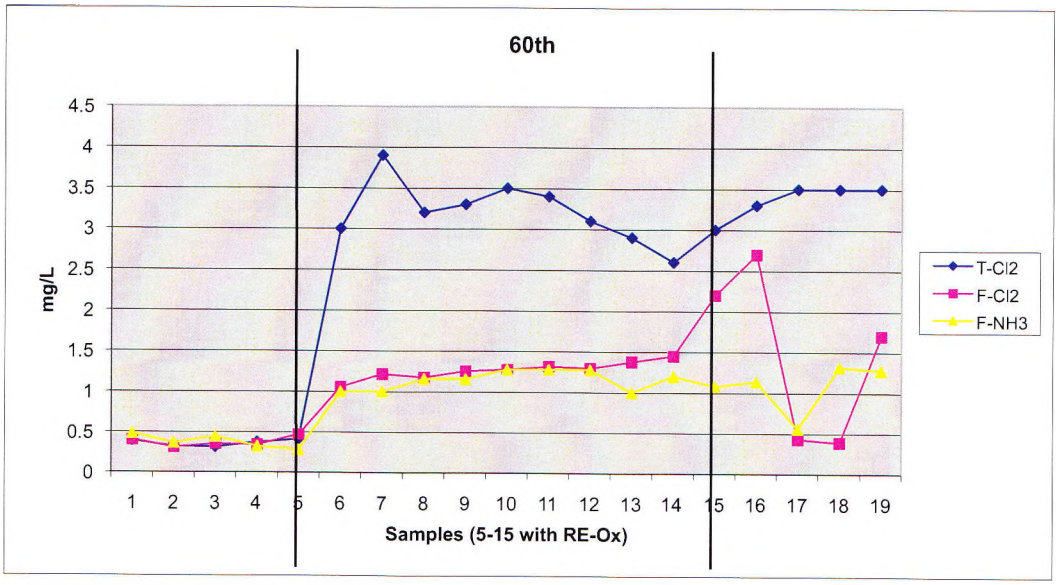
Site																				
PS5	T-Cl2	2.6	2.3	2.8	3.4	3.2	3.6	3.9	3.8	4.0	3.8	4.1	4.3	4.1	4.0	4.2	4.6	4.0	4.2	4.2
PS5	F-Cl2	0.25	0.22	0.31	0.45	0.52	1.38	1.59	1.4	1.71	1.84	1.88	2.3	2.4	2.4	3.9	4.1	3.8	0.77	1.9
PS5	F-NH3	0.8	0.72	0.76	0.4	0.52	0.8	0.96	1.2	0.96	1.12	1.16	0.36	1.16	1.12	1.16	1.16	0.24	1.2	1.24



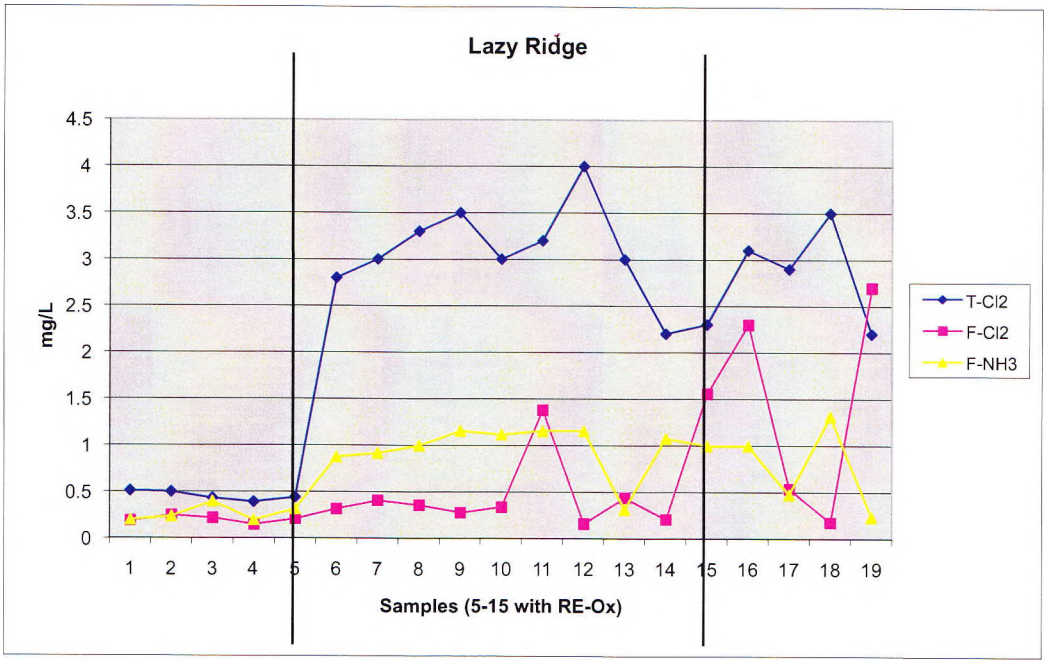
Tripp	T-Cl2	0.55	0.58	0.44	0.56	0.68	7.9	4.1	3.9	3.7	3.8	4.2	3.8	4	4	3	3.2	4	4.2	3.8
Tripp	F-Cl2	0.2	0.25	0.52	0.21	0.45	1.47	1.68	1.71	1.88	1.89	1.92	2.1	2.2	2.4	3.7	3.6	0.55	0.86	3.6
Tripp	F-NH3	0.44	0.52	0.52	0.48	0.36	1.04	1.28	1.16	1.28	1.24	1.36	1.52	1.12	0.8	1.2	1.68	0.92	1.4	1.04



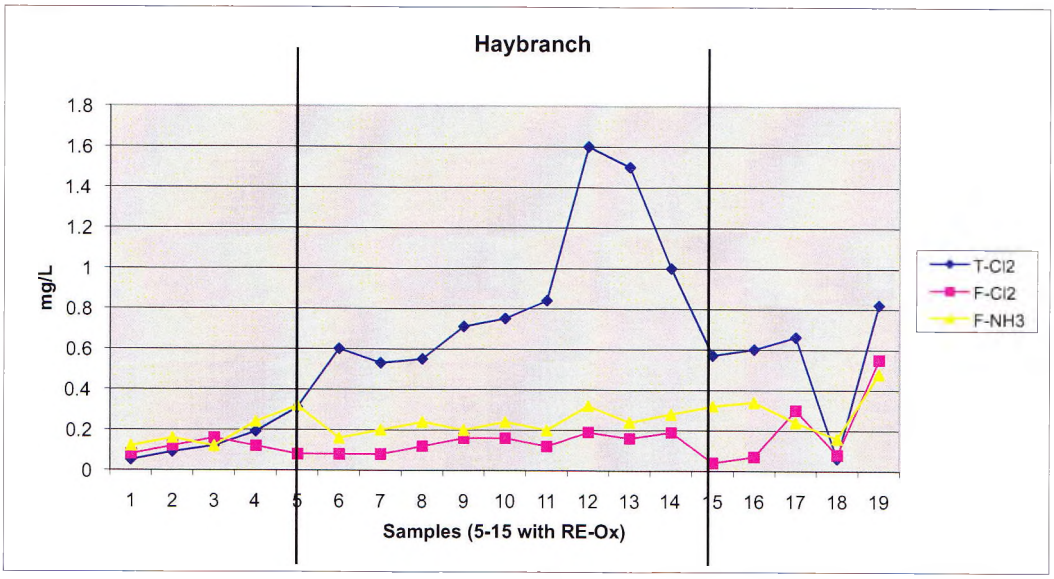
60th	T-Cl2	0.39	0.32	0.31	0.37	0.41	3	3.9	3.2	3.3	3.5	3.4	3.1	2.9	2.6	3	3.3	3.5	3.5	3.5
60th	F-Cl2	0.4	0.31	0.35	0.34	0.47	1.06	1.22	1.18	1.26	1.28	1.32	1.3	1.38	1.45	2.2	2.7	0.43	0.39	1.7
60th	F-NH3	0.48	0.36	0.44	0.32	0.28	1	1	1.16	1.16	1.28	1.28	1.28	1	1.2	1.08	1.14	0.56	1.32	1.28

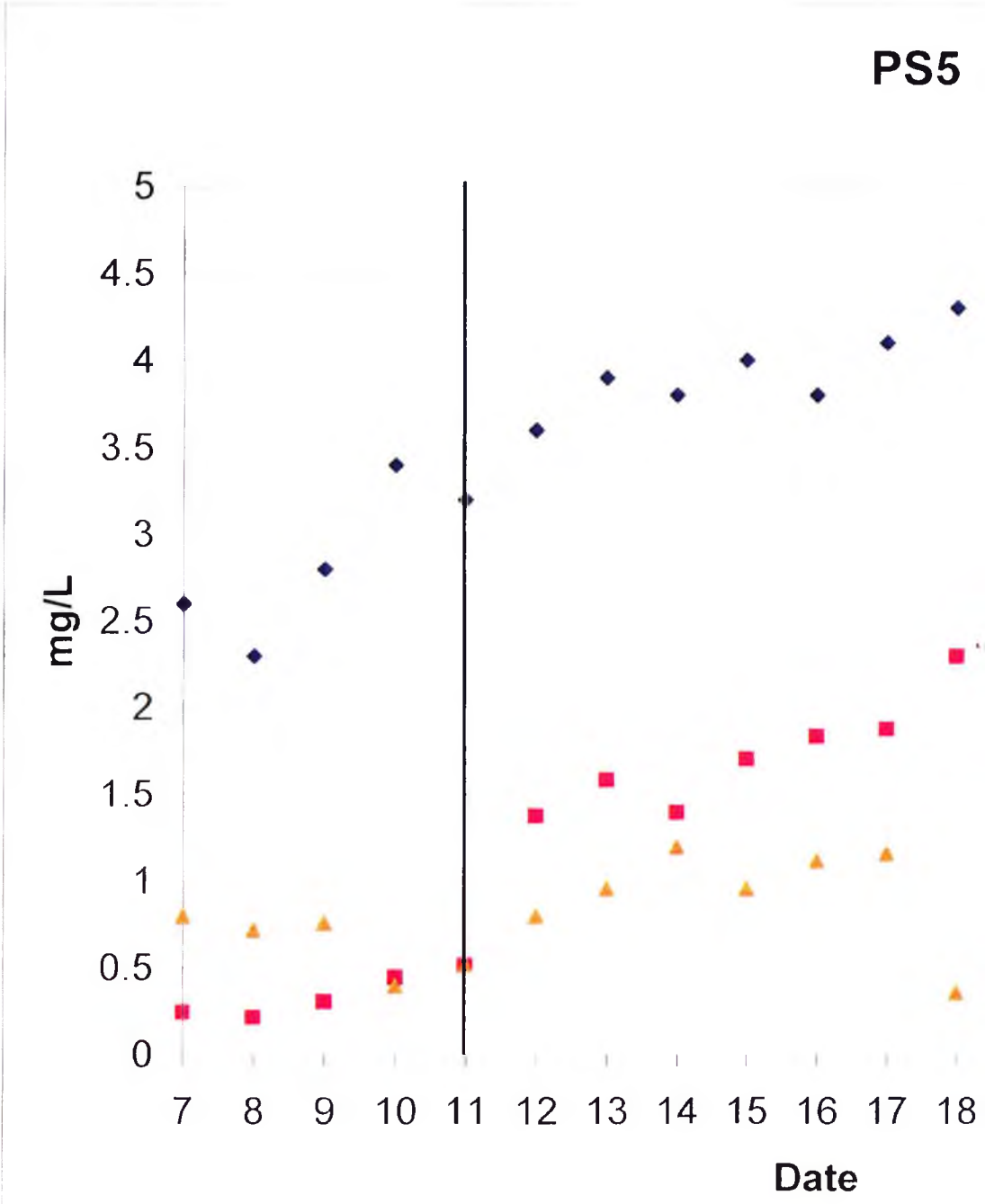


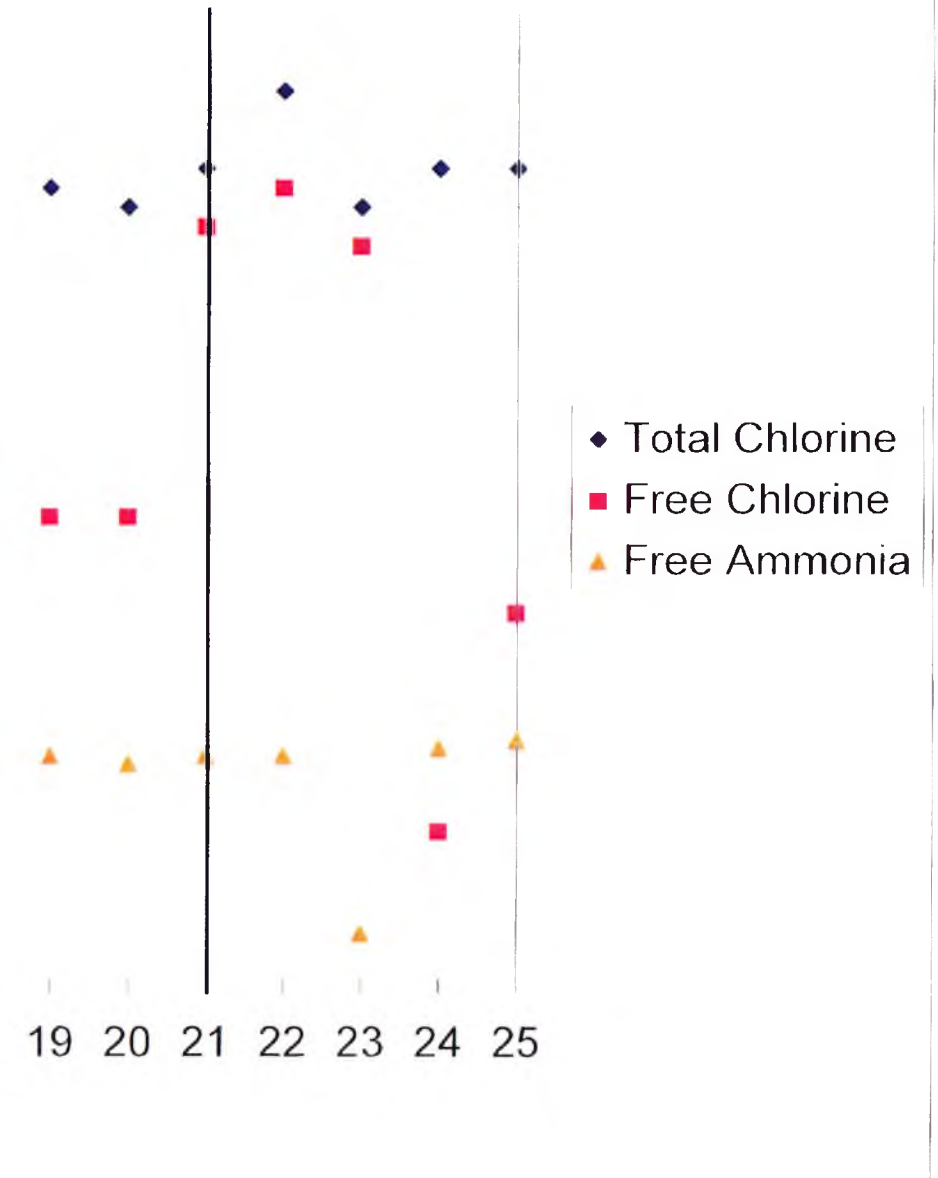
Lazy Ridge	T-Cl2	0.51	0.5	0.43	0.39	0.44	2.8	3	3.3	3.5	3	3.2	4	3	2.2	2.3	3.1	2.9	3.5	2.2
Lazy Ridge	F-Cl2	0.19	0.25	0.22	0.15	0.21	0.32	0.41	0.36	0.28	0.34	1.38	0.16	0.44	0.21	1.56	2.3	0.54	0.18	2.7
Lazy Ridge	F-NH3	0.2	0.24	0.4	0.2	0.32	0.88	0.92	1	1.16	1.12	1.16	1.16	0.32	1.08	1	1	0.48	1.32	0.24

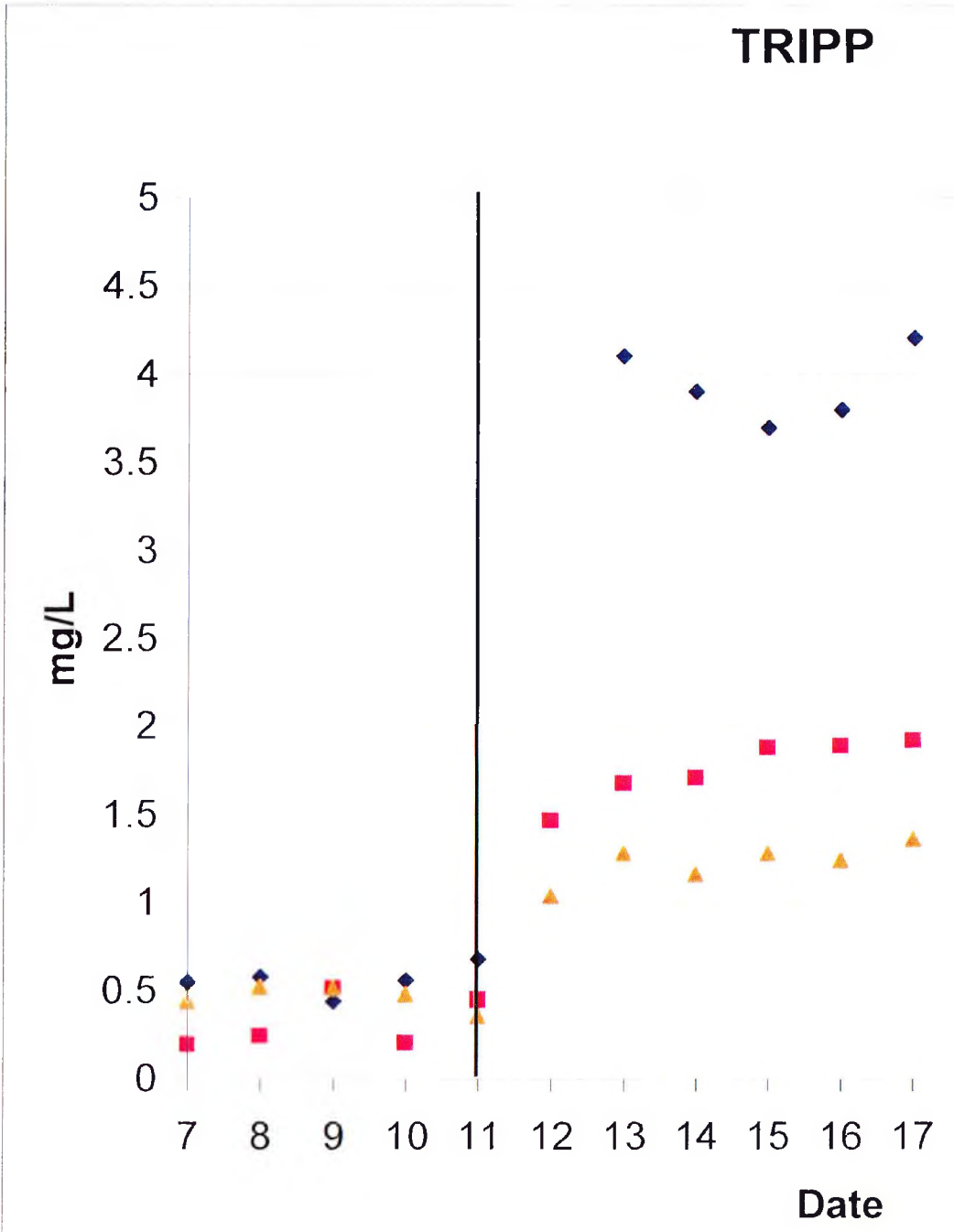


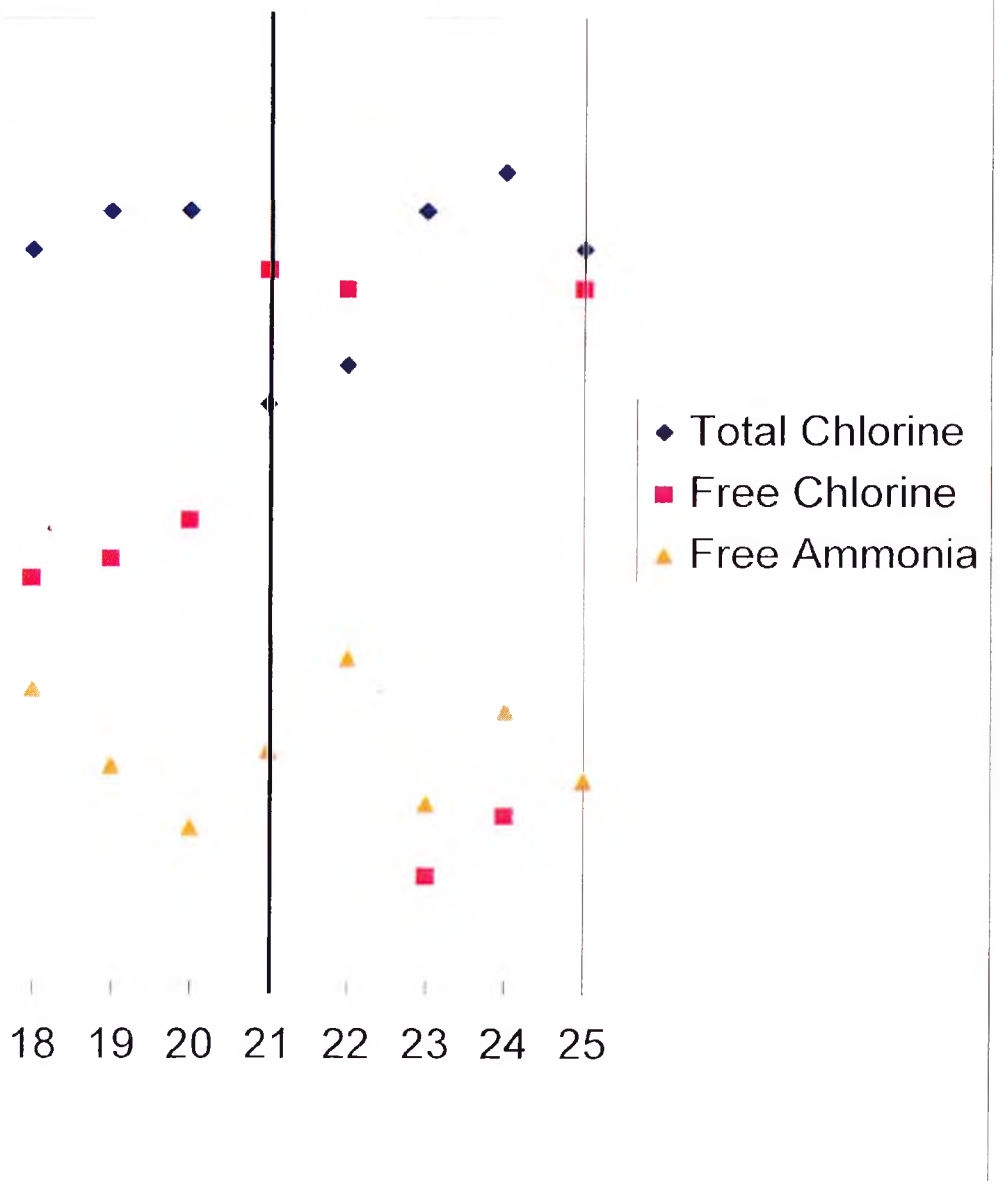
Haybranch	T-Cl2	0.05	0.09	0.12	0.19	0.31	0.6	0.53	0.55	0.71	0.75	0.84	1.6	1.5	1	0.57	0.6	0.66	0.06	0.82
Haybranch	F-Cl2	0.08	0.12	0.16	0.12	0.08	0.08	0.08	0.12	0.16	0.16	0.12	0.19	0.16	0.19	0.04	0.07	0.3	0.08	0.55
Haybranch	F-NH3	0.12	0.16	0.12	0.24	0.32	0.16	0.2	0.24	0.2	0.24	0.2	0.32	0.24	0.28	0.32	0.34	0.24	0.16	0.48

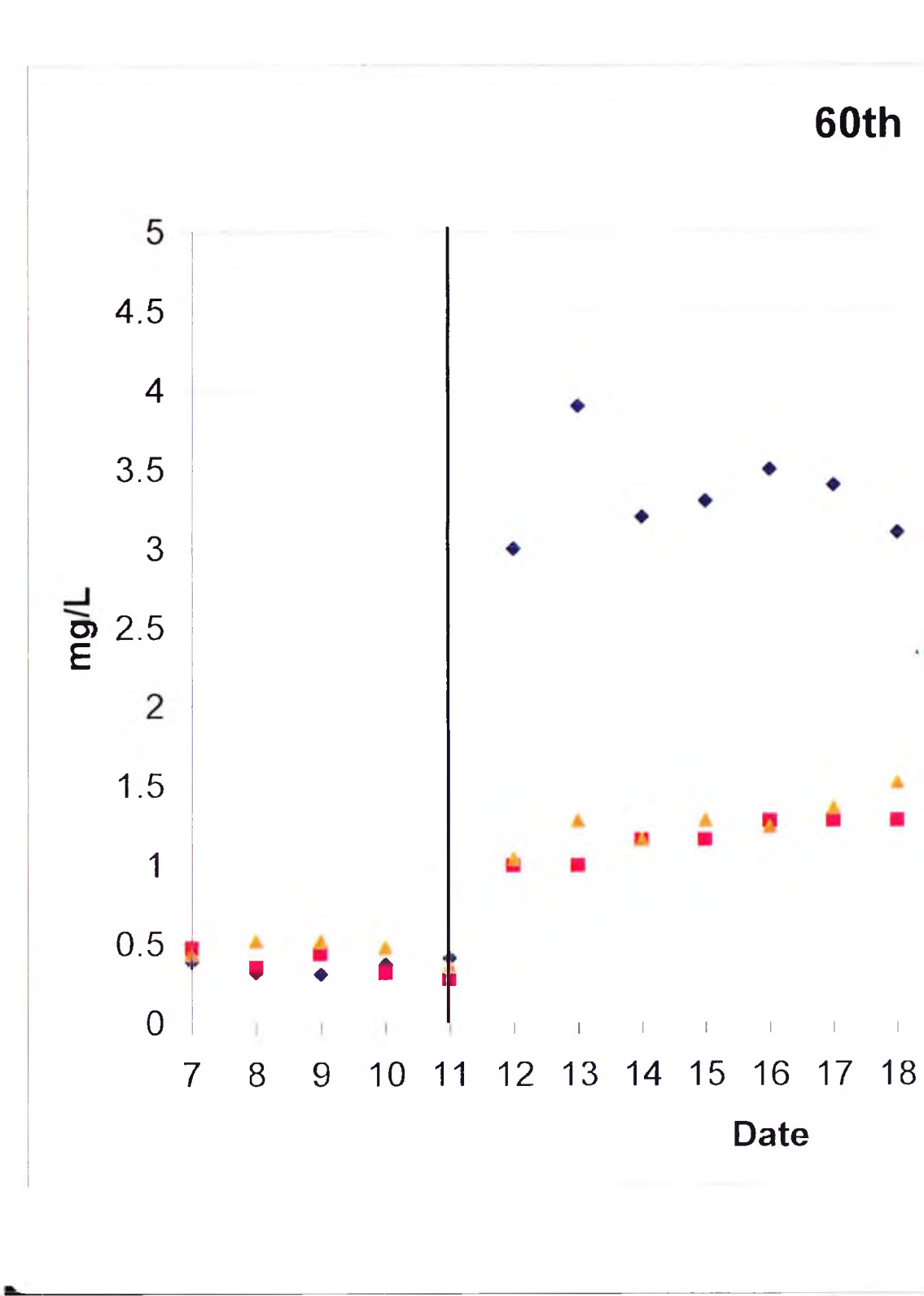


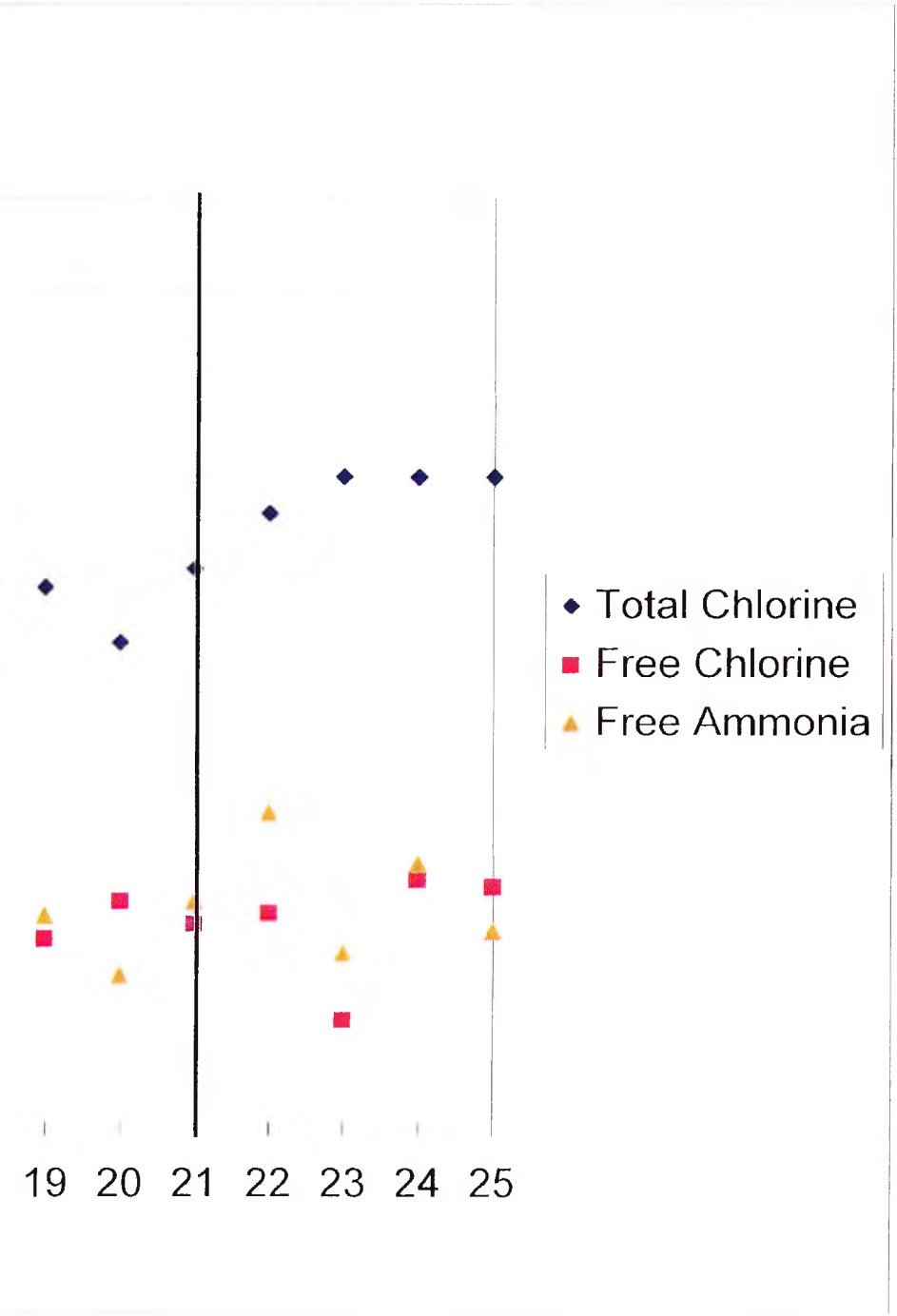

PS5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
7
8
9
10
11
12
13
14
15
16
17
18
Date

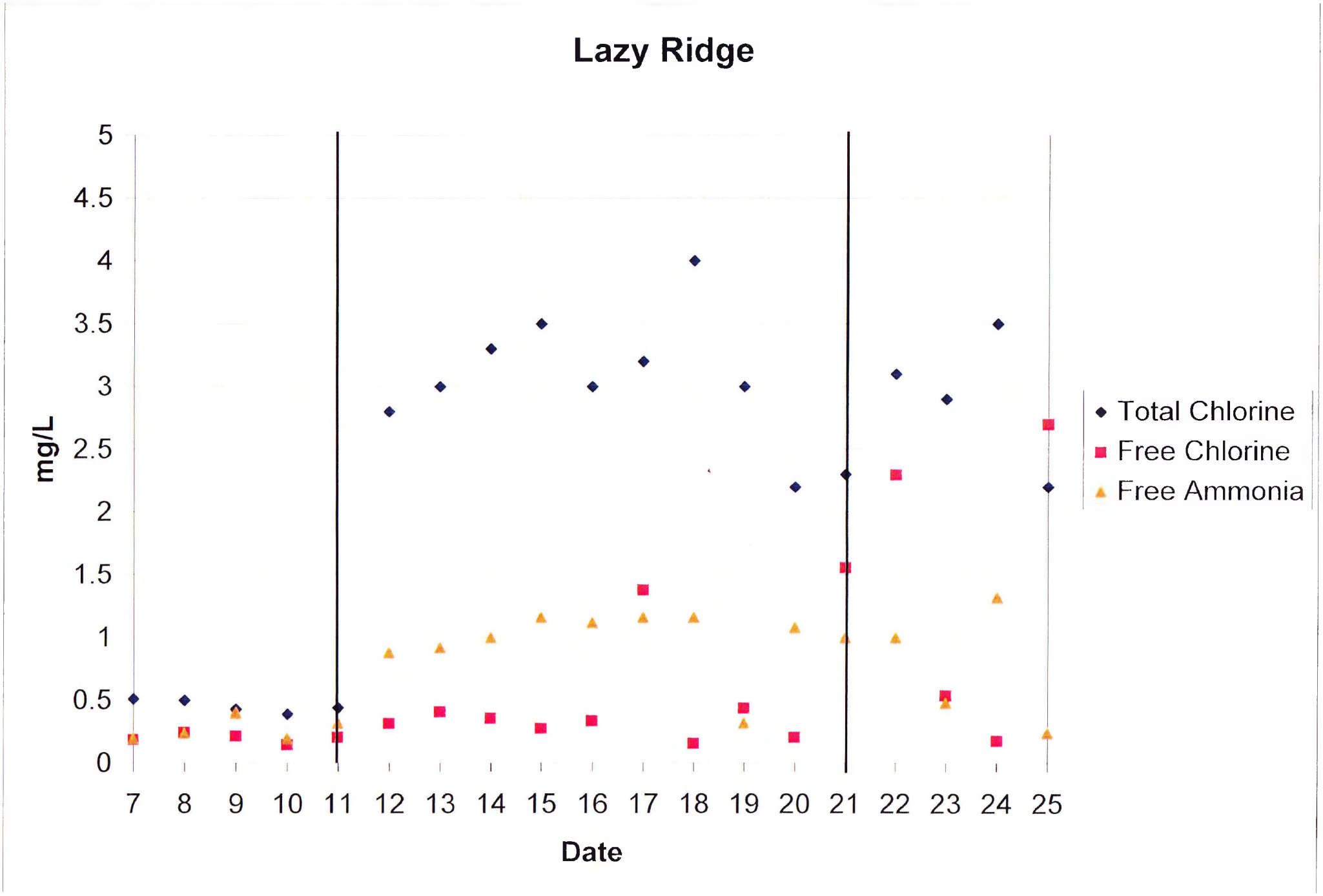

Total Chlorine
Free Chlorine
Free Ammonia
19
20
21
22
23
24
25

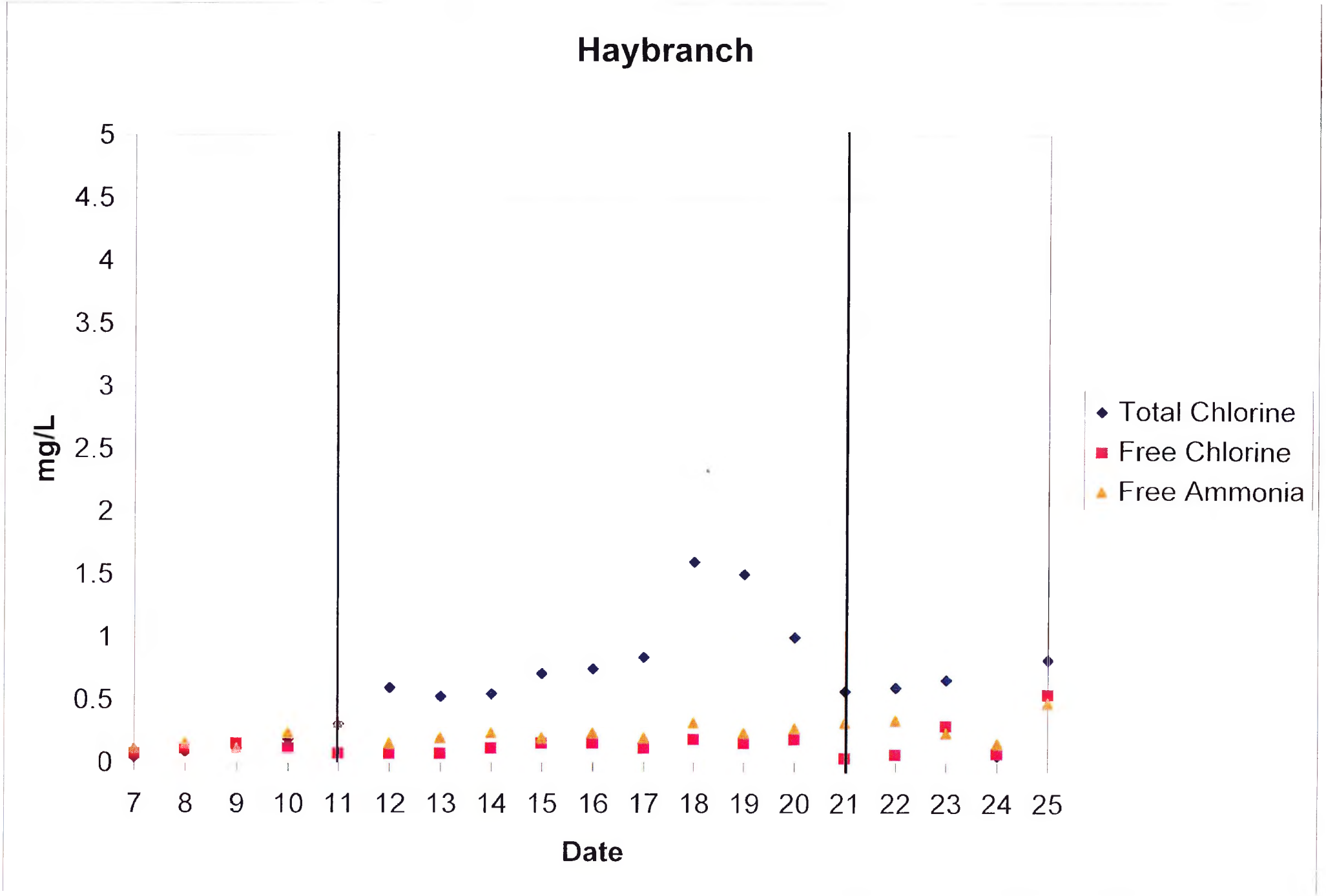

TRIPP
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
7
8
9
10
11
12
13
14
15
16
17
Date


Total Chlorine
Free Chlorine
Free Ammonia
18
19
20
21
22
23
24
25


60th
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
7
8
9
10
11
12
13
14
15
16
17
18
Date


Total Chlorine
Free Chlorine
Free Ammonia
19
20
21
22
23
24
25


Lazy Ridge
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
Date
Total Chlorine
Free Chlorine
Free Ammonia


Haybranch
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
mg/L
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
Date
Total Chlorine
Free Chlorine
Free Ammonia

Extending Free Chlorine Residuals in Surface Water/Well Water System

Grant Terry
Water Production Superintendent
City of Kerrville, Texas

November 2008

PWS 1330001 CO
RN 101425206
CN 600522888

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

August 8, 2008

Mr. Grant Terry, Water Production Superintendent
City of Kerrville
800 Junction Hwy
Kerrville, TX 78028-2215

Subject: Notification of Proposed Change
City of Kerrville – PWS I.D. 1330001
Kerr County, Texas

Dear Mr. Terry:

We received your fax dated June 12, 2008 regarding the notification of the City of Kerrville's proposed temporary injection of RE-OX® into the water supply. This notice was submitted in accordance with the Texas Commission on Environmental Quality's (TCEQ) requirements specified in 30 TAC §290.39(j). The proposed project will involve the temporary installation of equipment to feed RE-OX®, a chlorine chemical, into the distribution system for 60 days in order to remove biofilm and other contaminants and lower the concentrations of disinfection byproducts. Based on our review, this project is **not considered a significant change** under 30 TAC §290.39(j)(1) and will **not** require the submittal of engineering plans and specifications for TCEQ review and approval prior to construction beginning as long as the following conditions are met:

1. All chemical storage and feed facilities must comply with TCEQ requirements specified in 30 TAC §290.42(d)(6) and (7). Please be aware that these rules require adequate spill containment.

2. Sampling for disinfection byproducts must be conducted both before and during the temporary feed of Re-Ox®.

3. The temporary feed of RE-OX® may not last longer than 90 days from the date of first application. If the City wishes to use RE-OX® on a permanent basis, they must first obtain TCEQ approval.

4. After completion of the study, the following must be submitted to the Technical Review and Oversight Team (MC-155).

   - The daily flow of the water and amount of RE-OX® added.

- The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during normal operating conditions before beginning the temporary feed of RE-Ox®;
- The pH, free chlorine, total chlorine & free ammonia measurements at all sample sites during the temporary RE-Ox® application; and
- A narrative description of the daily visual color inspections and any leaks, flaking, or other distribution disturbances found during the RE-Ox® application period.

We note that RE-Ox® is NSF Standard 60 certified and that the product will be applied at a rate of 1 gallon per 50,000 gallons of water during the proposed 60-day study. We note that you plan to take two samples twenty days apart for THM's and HAA5's during the RE-Ox® application period and that you plan to sample at several locations in the distribution system.

Please note that RE-Ox® is not a substitute for any part of the current disinfection procedures for the water system.

If you have questions concerning this letter, or if we can be of additional assistance, please contact me at the letterhead's address or by telephone at (512) 239-6967.

Sincerely,

Marlo Wanielista Berg, P.E.
Technical Review & Oversight Team
Public Drinking Water Section (MC 155)
Water Supply Division

MEW/CMO

cc: TCEQ San Antonio Regional Office – R13
Ms. Vera Poe P.E., TCEQ Utility Technical Review Team (MC 153)
Ms. Alicia Diehl, PhD, TCEQ Drinking Water Quality Team (MC 155)

CITY OF KERRVILLE
REOX STUDY
SAMPLE RESULTS

SAMPLE TESTED	SITE NO.	First Set Samples 6/10/08	Second Set Samples 9/23/08	Third Set Samples 12/10/08
pH	SITE #1	7.6	7.2	7.9
Free Chlorine Residual		1.0	0.6	0.9
Total Chlorine Residual		3.8	1.9	1.0
Free Ammonia		N/A	N/A	N/A
TOC @ Site #1		2.121	1.126	1.901
UV-254 @ Site #1		0.010	0.080	0.022
TTHM @ Site #1		70.8	75.0	47.0
pH	SITE #2	7.7	7.5	7.9
Free Chlorine Residual		1.6	1.1	1.9
Total Chlorine Residual		4.4	2.3	2.0
Free Ammonia		N/A	N/A	N/A
TOC @ Site #2		1.557	1.155	1.413
UV-254 @ Site #2		0.011	0.019	0.012
TTHM @ Site #2		44.6	44.0	31.0
pH	SITE #3	7.6	7.2	7.9
Free Chlorine Residual		1.4	1.2	0.9
Total Chlorine Residual		4.0	2.4	1.0
Free Ammonia		N/A	N/A	N/A
TOC @ Site #3		2.265	1.557	1.681
UV @ Site #3		0.019	0.023	0.014
TTHM @ Site #3		61.7	41.0	42.0

SAMPLE SITES
Site #1 Guadalupe RV Park Office
Site #2 Comanche Trace 3706 Club View Ct.
Site #3 Stone Ridge 505 Loma Vuelta

CITY OF KERRVILLE
LT-1 QUARTERLY TTHM SAMPLE RESULTS

LOCATION	1st QUARTER 2006	2nd QUARTER 2006	3rd QUARTER 2006	4th QUARTER 2006	1st QUARTER 2007	2nd QUARTER 2007	3rd QUARTER 2007	4th QUARTER 2007	1st QUARTER 2008	2nd QUARTER 2008	3rd QUARTER 2008	4th QUARTER 2008
2001 LIME CREEK	11.60	54.70	63.20	65.00	30.50	23.50	69.90	49.50	37.60	53.70	56.80	
2020 VISTA RIDGE	46.50	**82.30**	**84.60**	**93.10**	45.40	**80.20**	**152.90**	**95.60**	50.00	0.00	**118.80**	
2307 TRAILS END	8.90	1.10	0.00	64.90	32.00	**86.70**	**84.90**	0.00	3.60	**80.40**	2.70	
2801 COMANCHE TRACE	10.30	6.70	33.30	70.60	33.40	72.20	**98.30**	1.00	20.90	57.70	4.10	
518 WINGED FOOT	31.20	40.10	25.50	66.70	10.70	72.90	**101.90**	47.80	38.90	42.20	**80.20**	
725 MOORE	6.90	52.10	78.30	55.20	20.40	**82.20**	**103.60**	33.70	34.60	8.50	**93.80**	
QUARTERLY AVG	19.23	39.50	47.48	69.25	28.73	69.62	**101.92**	37.93	30.93	40.42	59.40	
RUNNING ANNUAL AVG	19.23	29.37	35.41	43.87	46.24	53.77	67.38	59.55	60.10	52.80	42.17	

READINGS ARE IN UG/L - MCL=80.0 UG/L or Parts Per Billion

CITY OF KERRVILLE
LT-2 SAMPLE RESULTS
IDSE-TTHM
YEAR 08-09

LOCATION	Feb-08	Apr-08	Jun-08	Aug-08	Oct-08	Dec-08	Feb-09	Apr-09	Jun-09	Aug-09	Oct-09	Dec-09
201- A MANOR	33 8	51 7	42 6	50 5	23 9							
209 STEPHANIE	27 6	57 0	36 3	49.6	22 5							
426 FLORIAN DR	39 7	52 7	**95.7**	**81.9**	36 3							
124 CARIBOU LN	34 8	56 8	73 0	45 4	28 4							
451 GUADALUPE ST	30 1	60 8	76 4	59 5	34 8							
2200 SAN JACINTO DR	43 2	**90.1**	**142.9**	**135.0**	79 1							
1796 ARCADIA LP	49 9	67 2	70 9	57 2	43.4							
1877 AIRPORT LP	65 7	66 3	56 7	**112.4**	68 3							
QUARTERLY AVG	40 6	62 8	74 3	73 9								
RUNNING ANNUAL AVG				62 9								

READINGS ARE IN UG/L - MCL=80.0 UG/L or Parts Per Billion

CITY OF KERRVILLE DISTRIBUTION SYSTEM
CHLORINE RESIDUAL LOG

Month	SEPTEMBER			Year	2008												
	Field Operator on Duty	Stadium #1	Stadium #2	Lois St Tank	Site No	& Residual	Site No	& Residual	Methodist Enc	Travis	Summit	Kerrville North	College Cove	Comanche Trace	Spur 100	Riverhill Elevated	Riverhill Standpipe
1	RD	1.8	1.8	1.9	24	1.5	10	1.3									
2	RD	1.7	1.7	1.7	2	1.4	4	1.5									
3	MB	1.7	1.7	1.9	17	1.3	28	1.2	1.2	1.4	1.4	1.7	0.9	1.4	0.7	1.1	0.7
4	MB	1.6	1.6	1.6	6	1.4	5	1.3									
5	MB	1.7	1.7	1.9	7	1.2	25	1.5									
6	MB	1.5	1.5	1.7	26	1.0	12	1.2									
7	Zeke	1.6	1.6	1.8	25	1.2	20	1.4									
8	J L	1.7	1.7	2.0	19	1.3	21	1.1									
9	RD	1.9	1.9	1.9	9	1.5	10	1.4									
10	RD	1.8	1.8	1.9	16	1.4	4	1.5	1.1	1.6	1.5	1.6	0.8	1.5	0.8	1.3	0.9
11	MB	1.7	1.7	1.8	14	1.1	13	1.5									
12	MB	1.6	1.6	1.6	23	1.4	12	1.3									
13	MB	1.5	1.5	1.4	8	1.4	31	1.0									
14	RD	1.6	1.6	1.7	6	1.5	20	1.3									
15	RD	1.7	1.7	1.8	25	1.3	28	1.2									
16	RD	1.7	1.7	1.7	17	1.1	18	1.3									
17	MB	1.7	1.7	1.6	12	1.3	9	1.0	1.3	1.5	1.6	1.7	1.1	1.1	0.9	1.8	1.1
18	MB	2.1	2.1	1.8	24	1.5	23	1.9									
19	MB	1.9	1.9	1.8	4	1.7	3	1.1									
20	MB	1.7	1.7	1.7	15	1.3	11	1.5									
21	MB	1.7	1.7	1.7	14	1.4	31	1.3									
22	RD	1.8	1.8	1.9	16	1.5	4	1.5									
23	RD	1.9	1.9	1.8	25	1.3	27	1.6									
24	RD	1.8	1.8	1.8	3	1.4	22	1.3	1.2	1.7	1.9	1.9	1.0	1.3	0.8	1.7	0.7
25	MB	1.9	1.9	2.0	32	1.7	29	1.8									
26	MB	1.7	1.7	1.9	5	1.3	20	1.6									
27	MB	1.5	1.5	1.8	21	1.5	13	1.4									
28	MB	1.6	1.6	1.8	10	1.1	12	1.3									
29	MB	1.7	1.7	1.7	24	1.5	26	1.5									
30	MB	1.7	1.7	1.9	14	1.6	23	1.2									
AVERAGE		1.7	1.7	1.8		1.4		1.4	STORAGE TANK AVG		1.3				MONTHLY AVERAGE		1.5

CITY OF KERRVILLE DISTRIBUTION SYSTEM
CHLORINE RESIDUAL LOG

Month	OCTOBER			Year	2008															
	Field Operator on Duty	Stadium #1	Stadium #2	Lois St. Tank	Site No. & Residual		Site No. & Residual		Methodist Enc.	Travis	Summit	Kerrville North	College Cove	Comanche Trace	Spur 100	The Heights	Keystone	Ridgewood Elevated	Riverhill Elevated	Riverhill Standpipe
1	MB	1.7	1.7	1.8	15	1.4	19	1.2	1.6	1.5	1.5	1.7	1.2	1.4	0.8	N/A	0.5	1.0	1.6	1.0
2	RD	1.8	1.8	1.8	1	0.8	3	1.3												
3	RD	1.8	1.8	1.7	6	1.5	4	1.5												
4	RD	1.9	1.9	1.8	2	1.4	16	1.6												
5	RD	1.8	1.8	1.8	24	1.5	22	1.6												
6	MB	1.8	1.8	1.7	20	1.7	29	1.5												
7	MB	1.9	1.9	1.9	10	1.4	12	1.1												
8	RD	1.8	1.8	1.8	29	1.5	8	1.7	1.5	1.6	1.7	1.7	1.4	1.3	0.7	n/a	0.6	1.2	1.7	1.4
9	RD	1.8	1.8	1.9	5	1.3	7	1.0												
10	RD	1.7	1.7	1.9	18	1.2	24	1.5												
11	RD	1.8	1.8	1.8	16	1.5	31	0.8												
12	MB	1.7	1.7	1.7	27	1.6	17	1.1												
13	MB	1.8	1.8	1.9	19	1.2	30	1.4												
14	MB	1.5	1.5	1.8	15	1.1	13	1.3												
15	MB	1.5	1.5	1.7	11	1.5	32	1.6	1.3	1.4	1.0	1.2	1.0	1.3	0.9	n/a	0.5	0.3	1.4	1.2
16	JL	1.7	1.7	1.6	17	1.5	20	1.7												
17	JL	1.6	1.6	1.4	6	1.3	27	1.2												
18	ZH	1.9	1.9	1.7	4	1.7	25	1.5												
19	ZH	1.7	1.7	1.9	20	1.5	23	1.3												
20	ZH	2.1	2.1	1.9	7	1.5	26	1.5												
21	MB	2.0	2.0	1.7	21	2.0	22	0.9												
22	RD	1.9	1.9	1.8	16	1.5	2	1.4	1.2	1.6	1.3	1.4	1.1	1.4	0.7	na	0.7	0.5	1.5	1.3
23	RD	2.0	2.0	1.8	24	1.5	25	1.3												
24	ZH	1.8	1.8	1.6	4	1.3	19	0.8												
25	MB	1.7	1.7	1.7	32	1.5	4	1.6												
26	MB	1.6	1.6	1.6	14	1.2	18	1.5												
27	MB	1.7	1.7	1.7	3	1.3	27	1.6												
28	MB	2.0	2.0	1.9	29	1.5	28	1.8												
29	MB	1.9	1.9	1.9	8	1.8	20	1.8	1.4	1.3	1.4	1.6	1.0	1.4	0.9	2.3	1.3	0.5	1.7	1.5
30	Zeke	1.8	1.8	1.9	6	1.8	30	1.6												
31	Zeke	1.8	1.8	1.8	19	1.0	7	1.0												
AVERAGE		1.8	1.8	1.8		1.4		1.4	STORAGE TANK AVG		1.3				MONTHLY AVERAGE					1.6

CITY OF KERRVILLE DISTRIBUTION SYSTEM
CHLORINE RESIDUAL LOG

Month	NOVEMBER			Year	2008															
	Field Operator on Duty	Stadium #1	Stadium #2	Lois St Tank	Site No.	& Residual	Site No.	& Residual	Methodist Enc	Travis	Summit	Kerrville North	College Cove	Comanche Trace	Spur 100	The Heights	Keystone	Ridgewood Elevated	Riverhill Elevated	Riverhill Standpipe
1	Zeke	1.8	1.8	1.9	15	1.3	4	1.8												
2	MB	2.1	2.1	2.0	16	1.9	20	2.0												
3	MB	1.7	1.7	2.2	24	1.7	17	1.3												
4	MB	1.9	1.9	2.0	1	1.1	3	1.5												
5	Zeke/Joe	1.8	1.8	1.9	4	1.5	6	1.7	1.3	1.6	1.5	1.5	1.6	1.3	0.9	2.0	1.7	1.6	1.7	1.6
6	JL	1.9	1.9	2.0	5	1.9	8	1.7												
7	RD	1.8	1.8	1.9	2	1.5	28	1.6												
8	RD	1.9	1.9	1.8	6	1.6	19	1.4												
9	MB	1.7	1.7	2.0	7	1.3	25	1.5												
10	MB	1.8	1.8	1.9	29	1.5	17	1.2												
11	MB	1.9	1.9	1.7	32	1.6	26	1.4												
12	MB	1.8	1.8	1.9	11	1.6	12	1.0	1.4	1.5	1.3	1.7	1.2	1.6	0.8	1.6	1.6	1.4	1.8	1.5
13	RD	1.9	1.9	2.0	13	1.5	15	1.3												
14	RD	1.9	1.9	1.9	31	1.1	29	1.5												
15	RD	1.8	1.8	1.9	22	1.6	2	1.4												
16	ZEKE	1.8	1.8	1.9	6	1.5	20	1.7												
17	MB	1.9	1.9	1.6	24	1.5	4	1.8												
18	JL	1.4	1.4	1.7	18	1.4	20	1.4												
19	RD	1.8	1.8	1.6	25	1.3	11	1.4	1.5	1.7	1.5	1.6	1.3	1.5	1.0	1.4	1.3	1.6	1.8	1.6
20	RD	1.8	1.8	1.6	21	1.2	23	1.1									1.2			
21	RD	1.9	1.9	1.7	16	1.6	19	1.2												
22	RD	2.0	2.0	1.7	2	1.4	12	1.3												
23	MB	2.2	2.2	1.6	7	1.3	26	1.6												
24	MB	1.7	1.7	1.5	10	1.5	27	1.8												
25	MB	2.2	2.2	1.7	28	1.8	25	1.5												
26	MB	2.1	2.1	1.9	20	1.9	5	1.8	1.7	1.7	1.8	2.1	1.2	1.6	1.0	1.5	1.8	1.1	1.5	1.1
27	RD	1.9	1.9	1.8	29	1.5	32	1.4												
28	RD	2.0	2.0	2.0	31	1.0	17	1.3												
29	RD	1.9	1.9	1.8	16	1.6	2	1.3												
30	MB	2.1	2.1	1.9	4	1.9	11	1.5												
AVERAGE		1.9	1.9	1.8		1.5		1.5	STORAGE TANK AVG		1.5				MONTHLY AVERAGE					1.7

Restoring Total Chlorine Residuals at Lancaster Water Utility

Lancaster, Texas
August – November 2008

By
Mike Owens
RE-Ox LLC

Lancaster is a suburban community, approximately 17.5 miles southeast of Dallas, Texas. Lancaster Water Utility (LWU) purchases an average of 4.5 million gallons per day (MGD) of fresh water from Dallas Water Utilities (DWU) and has experienced difficulty extending total chlorine residuals to the ends of its system for the past four years. In an effort to more effectively address this problem, DWU and LWU agreed to a trial of the RE-Ox® scale deposition control product. Previous treatment efforts have been centered on a variety of flushing programs. Unlike simple flushing, the addition of RE-Ox provides the key benefit of breaking up the persistent elements of chlorine demand residing in the water/scale/pipe wall interface.

Within the trial, RE-Ox would be considered fully effective if the chlorine demand and the level of disinfection by-products (DBP) were reduced at both the Bonnie View Storage Tank discharge and the maximum residency sites (MRS) of the Lancaster system. These expected results were to be obtained without altering (i.e., without a measurable additional chlorine contribution) the chloramination chemistry of the incoming water.

At the conclusion of the trial, RE-Ox proved to be effective in reducing chlorine demand and DBP levels at the Bonnie View Storage Tank. However, the trial concluded prior to the high residual "front" reaching the maximum residency sites. It is the recommendation of RE-Ox LLC that the trial period be extended to allow the MRS to enjoy the same water quality improvement as observed in the bulk of the distribution system during the trial.

Background

Large wholesale utility systems experience nitrification development in long supply lines especially during the warm water months. This problem continues into the smaller retail

systems, such as LWU, making difficult the delivery of a strong chlorine residual to the end customer. By eliminating both the chlorine reducing demand and the development of DBP without addition or modification of the chlorine chemistry, a fully effective RE-Ox treatment would provide a substantial advantage over other treatment options such as rechlorination.

After the collection of baseline data, the initial trial design called for a 30-day treatment of an isolated section of the system (approximately 10% of total water used – 0.5 MGD) comprising Lancaster Vault II, the Bonnie View Storage Tank, and two maximum residency sites (MRS) – Lancaster Municipal Utility District (MUD) and 933 Waynelee Drive. These testing guidelines were developed by DWU, LWU, and RE-Ox LLC to ascertain the capabilities of the RE-Ox product, and to evaluate any potential effects on water quality. DWU's lab agreed to perform biweekly testing at the chosen sites.

Trial Execution

Prior to the start of the trial, the Bonnie View Storage Tank, Lancaster Vault II, and the DWU supply line to the tank were off-line for at least a year. The system was restarted and baseline data was taken in mid-August. After the baseline period, DWU determined that a hypochlorination of the supply line and the tank were required in order to maintain a consistent water quality. Immediately after hypo-chlorination, bacteria counts in the Bonnie View Storage Tank were <2; however, they returned to TNTC (too numerous to count) within a week. As source water quality stabilized, RE-Ox treatment was initiated (August 26th).

Within days after the RE-Ox treatment began, the actual flow rate was measured at 2.4 MGD (five times the expected value), RE-Ox dosing was elevated from 20 gallons per day (GPD) to 120 GPD to maintain a ratio of 1:20,000.

In the following 28 days, chlorine demand in the tank and the DBP levels were significantly reduced from the source water at the Bonnie View Storage Tank discharge; however, little change occurred in the MRS. Flushing tests revealed that the test section was not isolated from the rest of the system. At this point, LWU and DWU agreed to extend the trial by treating the entire Lancaster distribution system while maintaining biweekly testing at the MRS.

The RE-Ox dosage ratio was reduced to approximately 1:41,000 due to the high volume of water (4.5 MGD) to be treated at the Lancaster Vault I (Houston School Road) location. As observed

on the attached residual maps, residuals in much of the system were restored within a few days with the addition of RE-Ox at Lancaster Vault I, otherwise known as the "high pressure" side of the system. The movement of the high/low residual "front" was tracked over the following weeks by extensive field measurement of chlorine residuals and low volume flushes of particulate matter.

As an appendix to this report the following data sets are included:

1. RE-Ox personnel maps of residual progression for both the "low pressure" (Vault II) and "high pressure" (Vault I) RE-Ox treatment.
2. DWU laboratory test results for the chosen sampling points.
3. RE-Ox personnel spreadsheets of chlorine residual sampling data.

RE-Ox field logs are available in PDF format on CD-ROM upon request.

Post Termination Summary

Daily logs reflect well over one half of the LWU system had developed 1.5 ppm residuals prior to termination of the trial.

During the trial:

1. DWU provided LWU with an average chlorine residual of approximately 2.0 ppm at Lancaster Vault II and approximately 3.0 ppm at Lancaster Vault I.
2. High and low pressure zones could not be effectively separated (valves in unknown presentation, opened or closed). Flushing direction was unknown due to blending of high and low pressure zones. Therefore, treatment was moved to Lancaster Vault I and continued another month and a half.
3. Prior to the initial RE-Ox injection, the DWU line to the Bonnie View Storage Tank (6 million gallon storage tank at Lancaster Vault II), was hypochlorinated to make possible sustained chlorine residuals in the source water.
4. MRS sampling site heterotrophic plate counts (HPC) and trihalomethanes (THM) were lowered.
5. The Saturation Index (corrosivity) was not affected by RE-Ox treatment.

6. The average system-wide water flow (water used plus flushing water) for the combined years of 2006 and 2007 was 131.9 million gallons (MG) for October and 117.5 MG for November. During the RE-Ox trial in 2008, 151.0 MG and 125.6 MG flowed through the system in October and November respectively. This represents an increase of 14% and 7% for October and November respectively. The RE-Ox field data was collected with brief low volume flushes amounting to a small fraction of the extra water flow. The majority of flush water was exported at the MRS sites.
7. Significant particulate matter was exported from the system in the downtown areas of the city.

Conclusion

The combination of RE-Ox scale deposit control and higher water flows allowed DWU residuals to extend further and at a more pronounced level than the other programs instituted over the previous four years prior to the termination of the trial.

The RE-Ox treatment was shown to be effective in reducing chlorine demand and DBP levels at the Bonnie View Storage Tank and throughout much of the distribution system. However, the trial concluded prior to the high residual "front" reaching the maximum residency sites. It is the recommendation of RE-Ox LLC that the trial period be extended to allow the MRS to enjoy the same water quality improvement as observed in the bulk of the distribution system during the trial.

Contact Information

Mike Owens
RE-Ox LLC
432 Donaldson Lane
Waco, TX 76706
Phone: 254.709.5049

Appendix 1

RE-Ox® Personnel Maps of Residual Progression for Both the "Low Pressure" (Vault II) and "High Pressure" (Vault I) RE-Ox Treatment

Lancaster / RE-Ox Chlorine Demand Removal Trial - Low Pressure Side

Period 1
8/26 to 8/28 (3days)
2008

Time line
8/26 8/31 9/5 9/10 9/15 9/20 9/25 9/30

1

NOTES:

TANK WAS SHOCKED 1 WEEK PRIOR TO START OF TREATMENT.

RESIDUAL LOW AT START.

* RESIDUALS NONEXISTENT IN LOW PRESSURE SIDE.

* WATER VOLUME WAS 2.3 MGD NOTIFIED BY DWU

* RE-OX PUMP SET FOR 0.5 MGD.

* ORDERED NEW PRODUCT FOR 2.5x MORE WATER VOLUME.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

>1.99 ppm Total Cl2

1.5 ppm Total Cl2

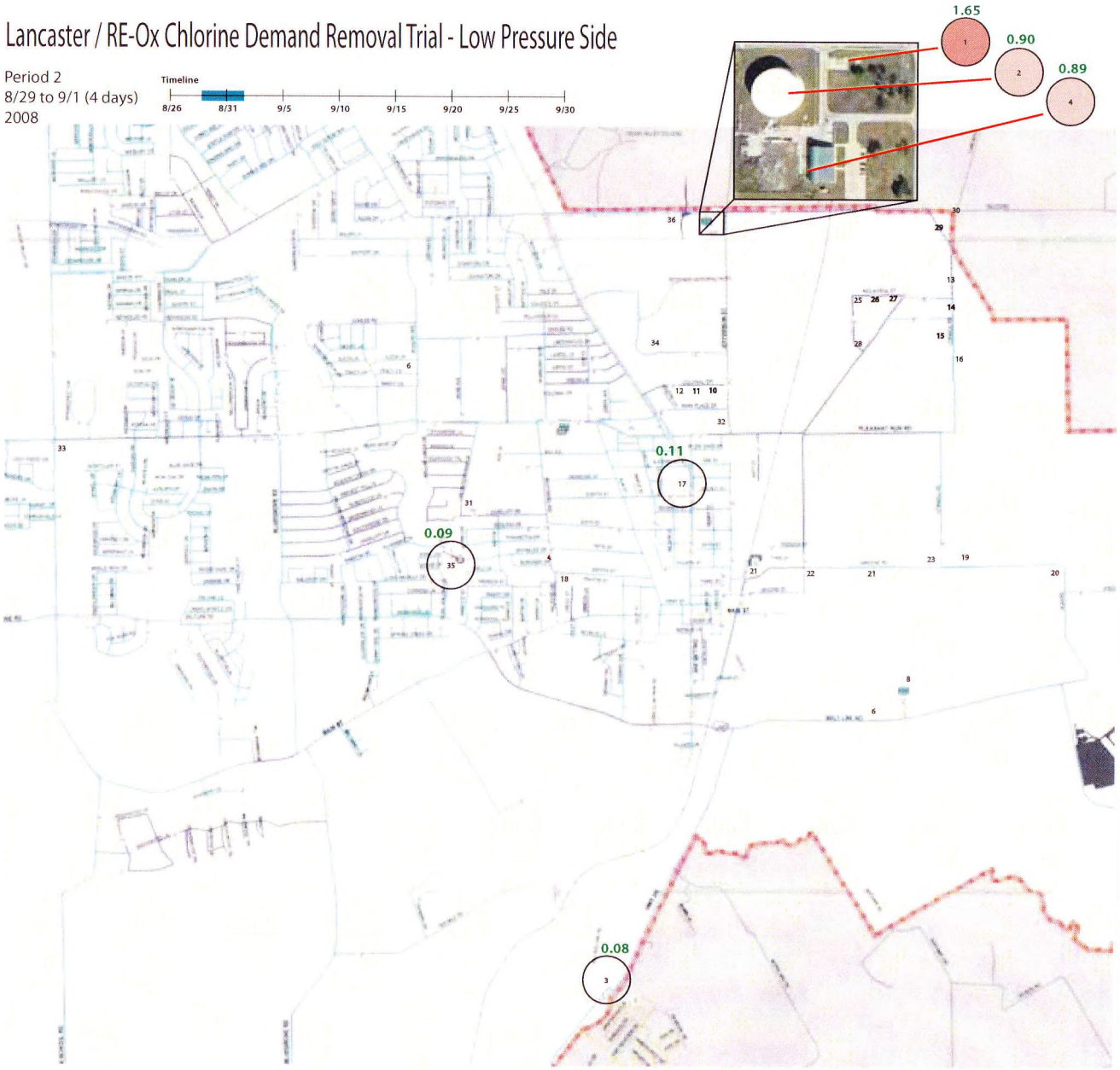
1.0 ppm Total Cl2

0.5 ppm Total Cl2

0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - Low Pressure Side

Period 2
8/29 to 9/1 (4 days)
2008



2

NOTES:

* PUMP DISCHARGE IS SHOWING PROGRESS

Legend

19 — Sampling location number (see data spreadsheet)

0.08 — Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

- 1.99 ppm Total Cl2
- 1.5 ppm Total Cl2
- 1.0 ppm Total Cl2
- 0.5 ppm Total Cl2
- 0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - Low Pressure Side

Period 3
9/2 to 9/8 (7 days)
2008

3

NOTES:

' RE-OX FEED RATIO RESET TO 1:20,000 GAL ON 2.3 MGD

* RE-OX FEED RATE OF 120 GPD

* VAULT TO TANK RESIDUALS CLOSING.

* RESIDUALS AT COLONIAL & PARK PLACE.

* NO CHANGE AT MUD

' WAYNELEE COMES THROUGH TOWER.

Legend

Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period (Total Cl2)

>1.99 ppm Total Cl2

1.5 ppm Total Cl2

1.0 ppm Total Cl2

0.5 ppm Total Cl2

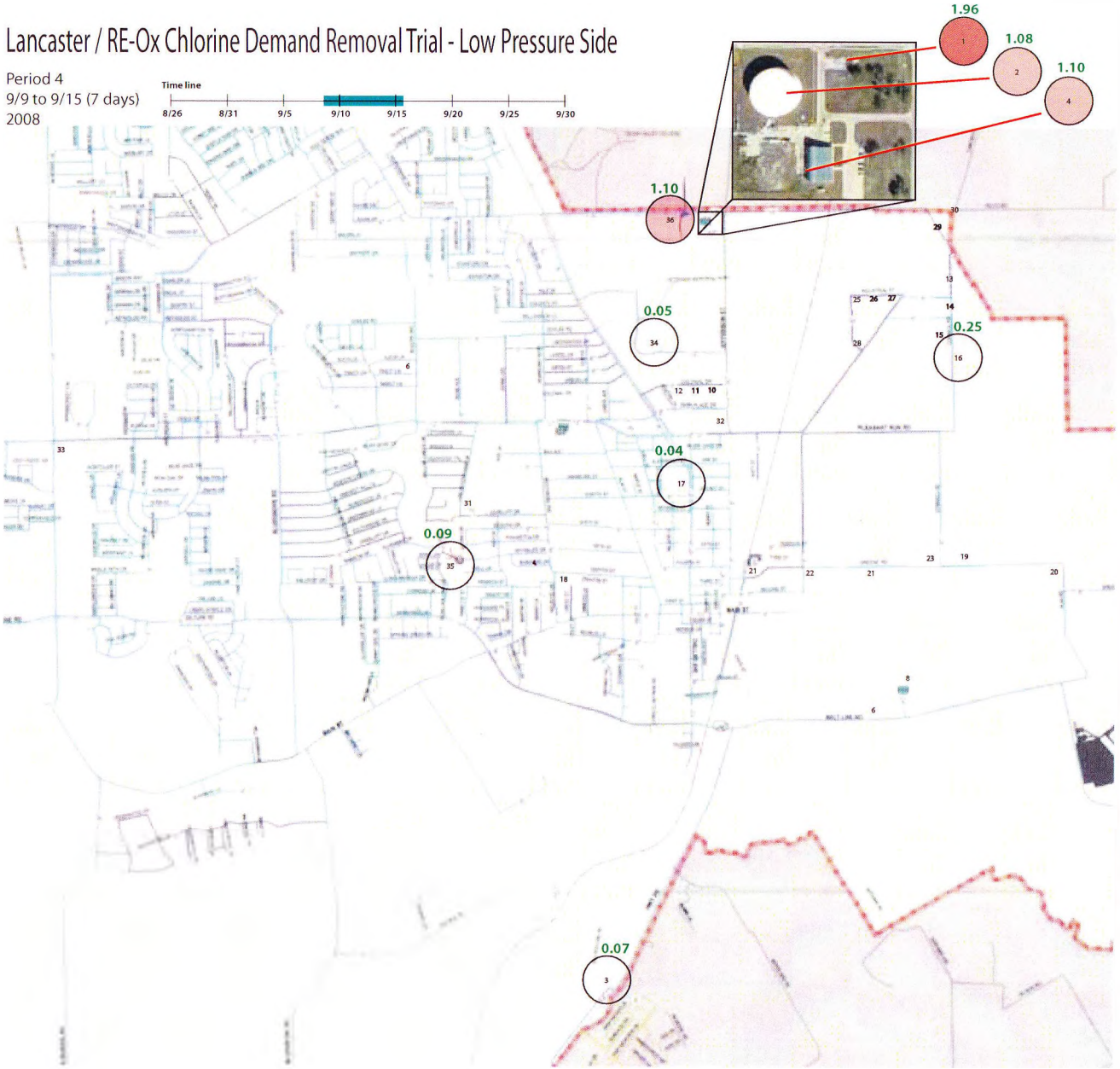
0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - Low Pressure Side

Period 4
9/9 to 9/15 (7 days)
2008

Time line
8/26 8/31 9/5 9/10 9/15 9/20 9/25 9/30

4



NOTES:

* TANK & DISCHARGE IMPROVING.

*LOW PRESSURE SIDE - NO RESIDUAL

* CORNELL FLUSHED TO 0.25 PPM TOTAL CL2.

Legend

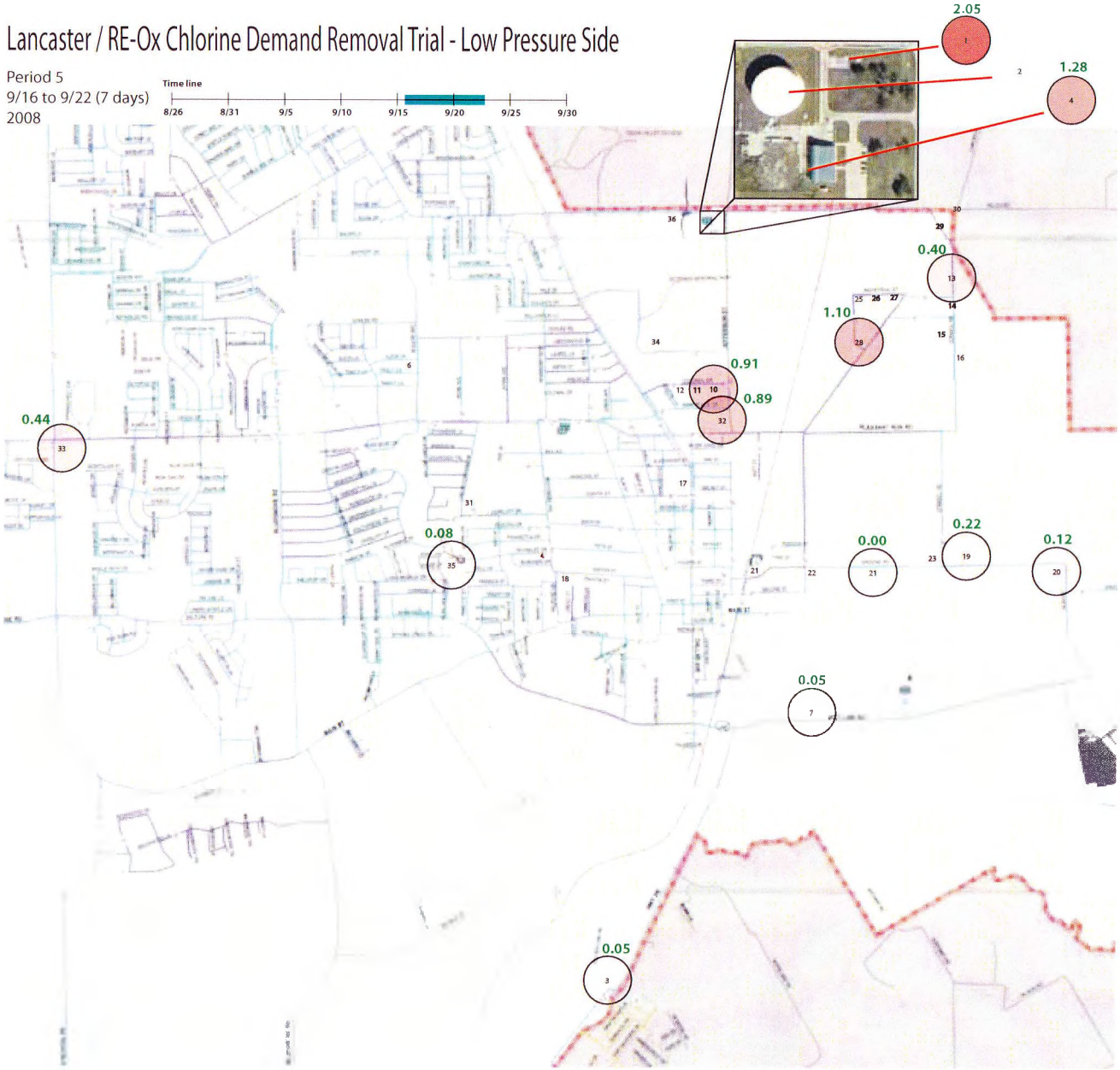
- Sampling location number (see data spreadsheet)
- 0.08 — Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)
- > 1.99 ppm Total Cl2
- 1.5 ppm Total Cl2
- 1.0 ppm Total Cl2
- 0.5 ppm Total Cl2
- 0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - Low Pressure Side

Period 5
9/16 to 9/22 (7 days)
2008

Time line
8/26 8/31 9/5 9/10 9/15 9/20 9/25 9/30

5



NOTES:

* PUMP DISCHARGE STILL IMPROVING

* BY END OF PERIOD 5: 2700 GAL OF RE-OX TREATED 64 MG OF WATER.

* TOTAL RE-OX CHLORINE REQUIRED = 9.6 LBS (5.5 OZ/DAY).

* 48% REDUCTION IN PUMP DISCHARGE DEMAND.

BLENDING!!!

* HIGH PRESSURE SIDE CAN NOT BE SEPARATED FROM HIGH PRESSURE SIDE.

* CORNELL/GREEN FLUSHED 7 HRS. WITH NO CHANGE.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period (Total Cl2)

>1.99 ppm Total Cl2

1.5 ppm Total Cl2

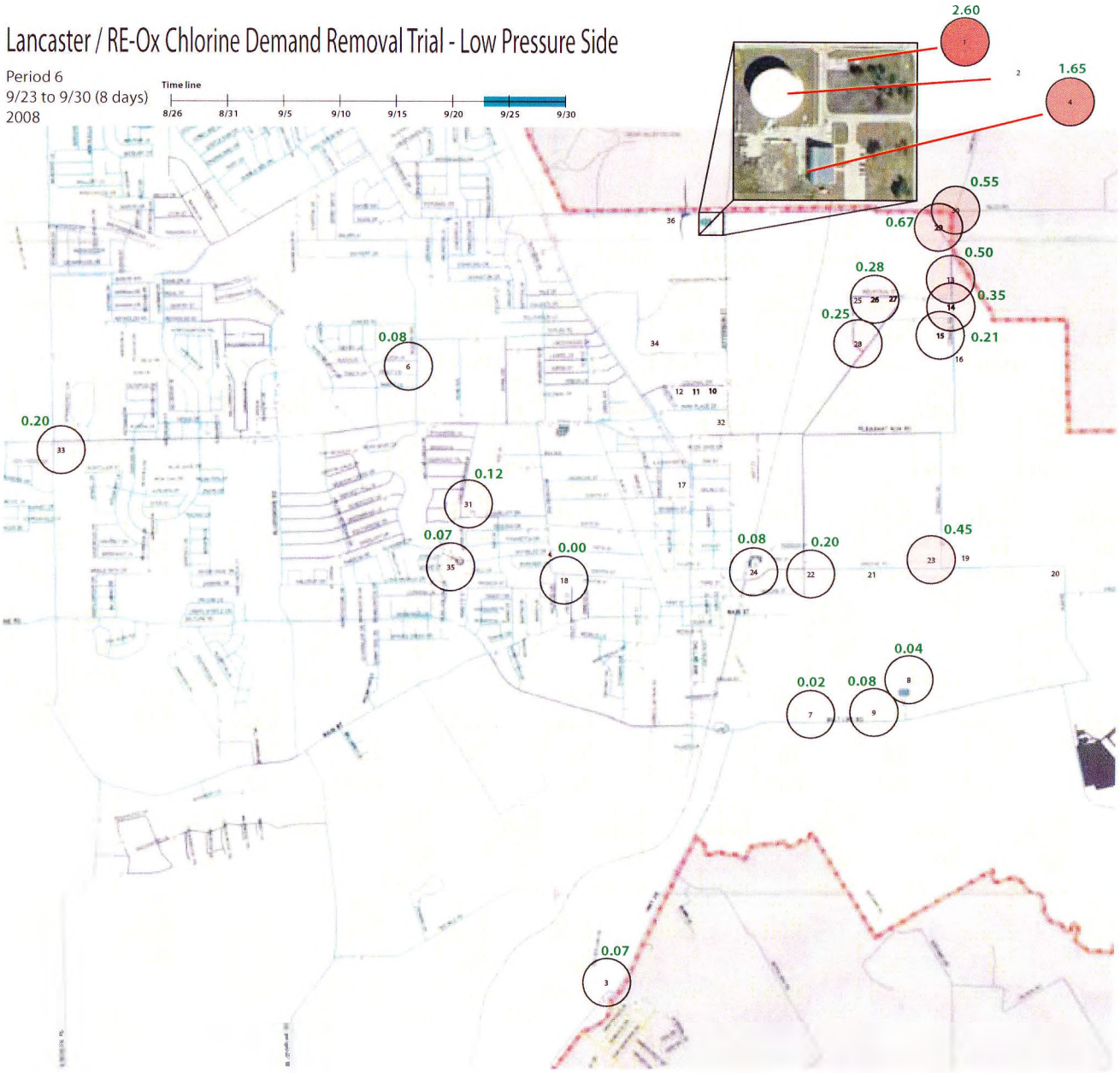
1.0 ppm Total Cl2

0.5 ppm Total Cl2

0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - Low Pressure Side

Period 6
9/23 to 9/30 (8 days)
2008



6

NOTES:

* HIGH PRESSURE BLENDING FOUND INTO GREEN, CORNELL OFF INDUSTRIAL ST.

* 24 HR. FLUSHING TEST ON GREEN RESULTED IN NO CHANGE.

* ENTIRE SYSTEM NEEDS TO BE TREATED

Legend

19 — Sampling location number (see data spreadsheet)

0.08 — Average of all data taken (both RE-Ox and DWU) at a single location during the current period (Total Cl2)

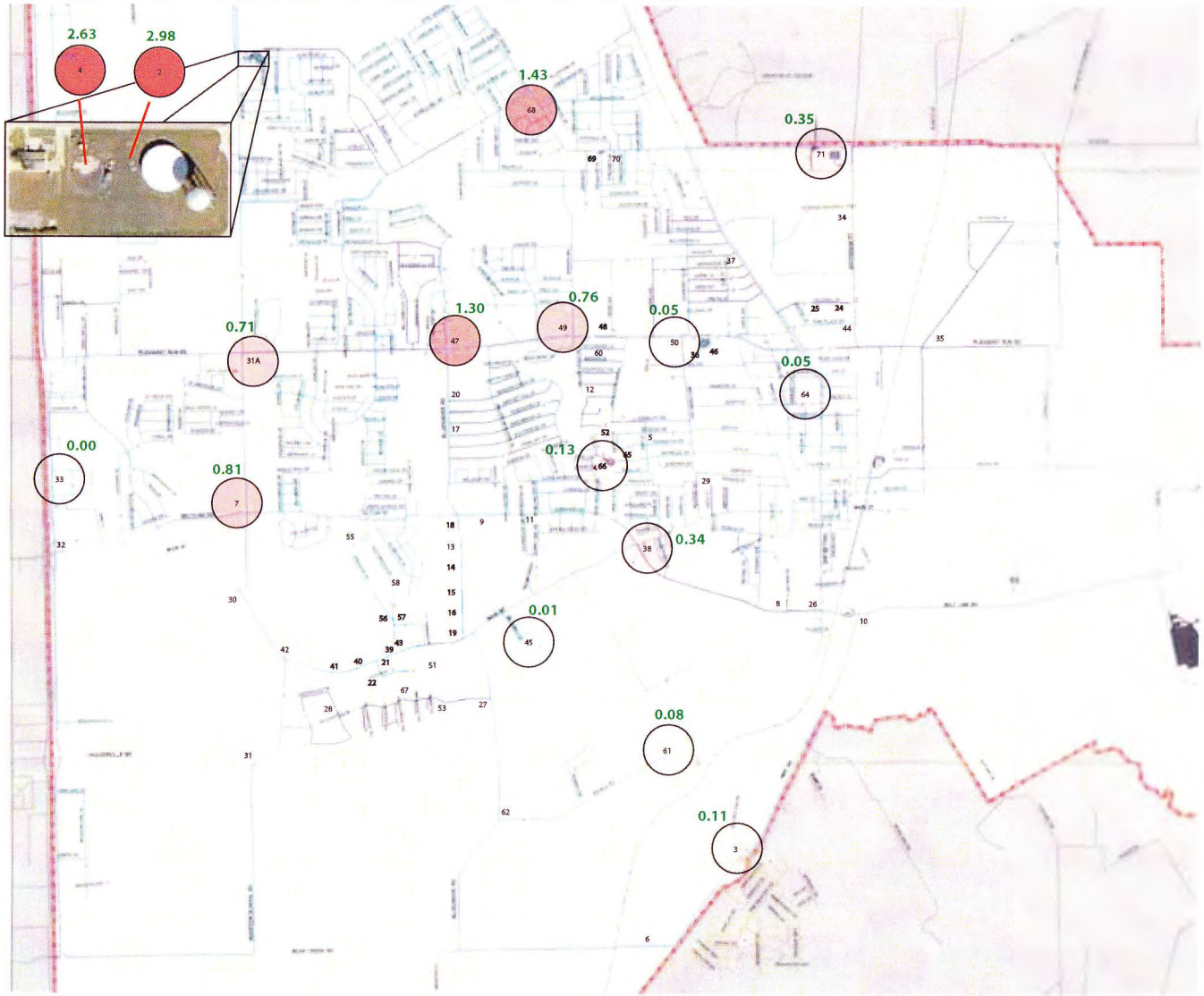
- >1.99 ppm Total Cl2
- 1.5 ppm Total Cl2
- 1.0 ppm Total Cl2
- 0.5 ppm Total Cl2
- 0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - High Pressure Side

Period 1 HP
10/1 to 10/3/08 (3 days)

Time line
10/1 10/6 10/11 10/16 10/21 10/26 10/31 11/5 11/10

1 HP



NOTES:

START NOV. 1ST - EASY TRANSFER OF PRODUCT AND PUMP.

* PUMP SET AT ~ 120 GPD TREATING 4.3 MGD (~1:30,000 RATIO)

* WINTERGREEN AND HOUSTON SCHOOL ROAD SHOW RAPID INCREASE.

* DWU LINE TO AMES SHOWS HIGHER RESIDUALS (2.5-3.0 PPM CL2) THAN LOW PRESSURE SIDE.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

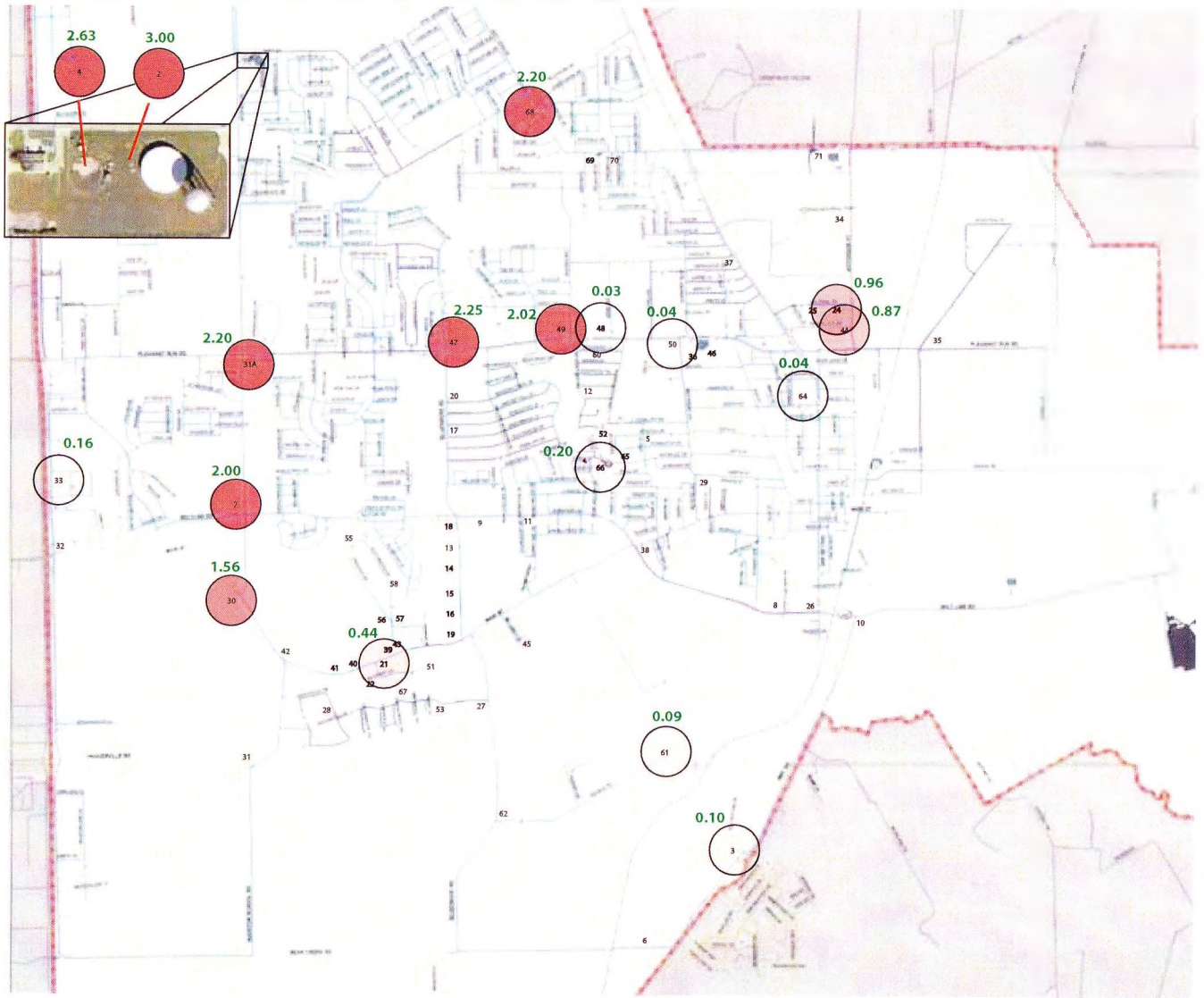
- >1.99 ppm Total Cl2
- 1.5 ppm Total Cl2
- 1.0 ppm Total Cl2
- 0.5 ppm Total Cl2
- 0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - High Pressure Side

Period 2 HP
10/4 to 10/9/08 (6 days)

Time line
10/1 10/6 10/11 10/16 10/21 10/26 10/31 11/5 11/10

2HP



NOTES:

* DWU - GOOD RESIDUALS, RE-OX FEED RATE AVG. 120 GPD.

* HOUSTON SCHOOL TO BELTLINE HAS OVER 1.5 PPM CL2 RESIDUAL.

* PLEASANT RUN AND ROGERS HAS OVER 2.0 PPM CL2 RESIDUAL.

* 24/7 2" FLUSH ON END OF TEN MILE.

* LANCASTER TANK HAD NO RESIDUAL DESPITE EFFORT TO PULL RESIDUAL FROM PLEASANT RUN OR N. DALLAS ROAD.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

- >1.99 ppm Total Cl2
- 1.5 ppm Total Cl2
- 1.0 ppm Total Cl2
- 0.5 ppm Total Cl2
- 0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - High Pressure Side

3HP

Period 3 HP
10/10 to 10/16/08 (7 days)

Time line
10/1 10/6 10/11 10/16 10/21 10/26 10/31 11/5 11/10

NOTES:

* DWU STRONG RESIDUAL

* START FOCUSING ON BRINGING RESIDUALS TO MUD VIA BLUE-GROVE AND ENCHANTED.

* WAYNELEE SURROUNDED BY NO RESIDUALS.

Legend

Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period (Total Cl2)

> 1.99 ppm Total Cl2

1.5 ppm Total Cl2

1.0 ppm Total Cl2

0.5 ppm Total Cl2

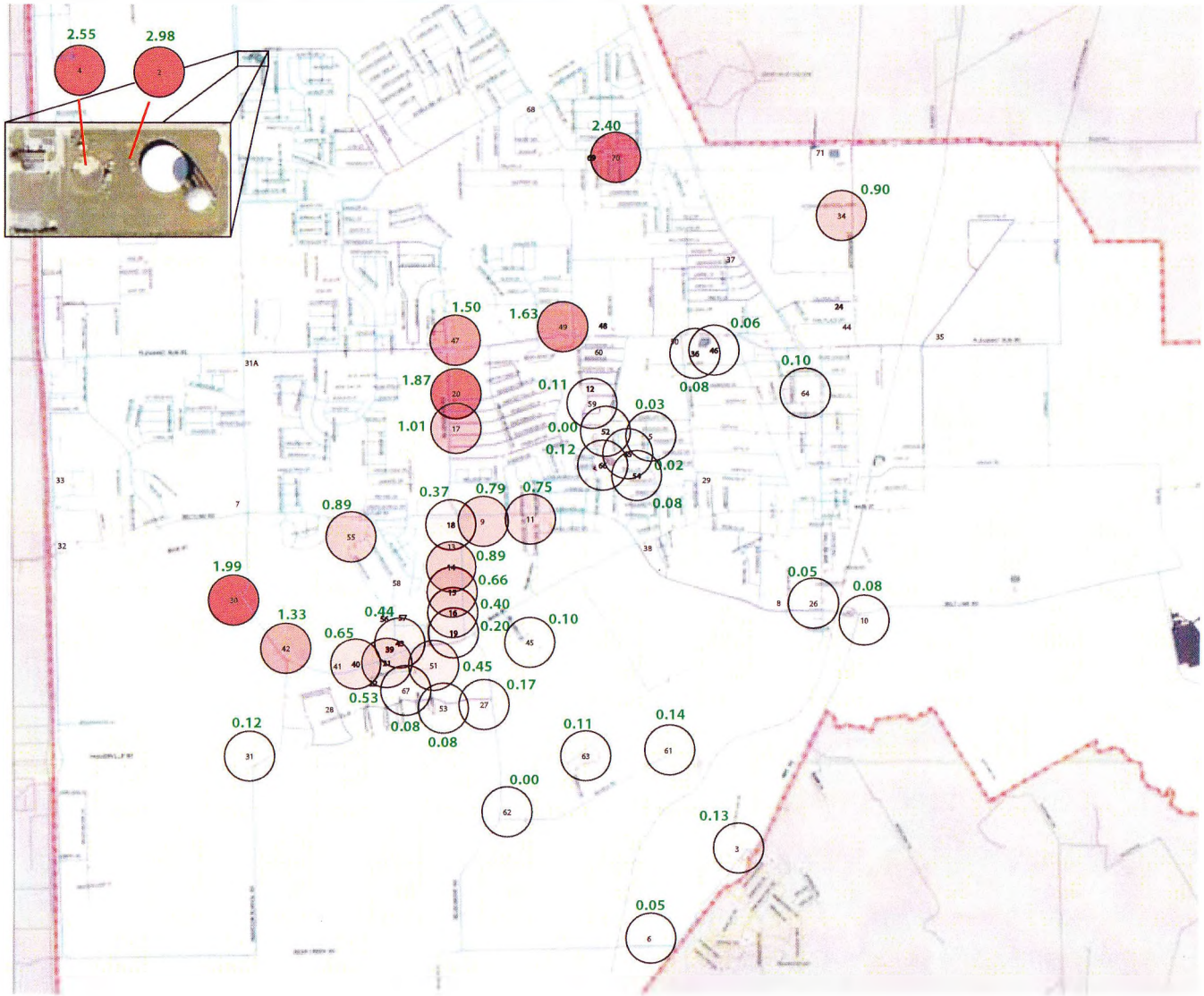
0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - High Pressure Side

Period 4 HP
10/17 to 10/23/08 (7 days)

Time line
10/1 10/6 10/11 10/16 10/21 10/26 10/31 11/5 11/10

4HP



NOTES:

* DWU GOOD - TANK CLOSING ON RESIDUAL GAP FROM DWU.

- RESIDUALS EXTENDING FROM PLEASANT RUN & BLUEGROVE DOWN TO MAIN.

^ ENCHANTED STILL HAS HIGH DEMAND.

* WAYNELEE / LANCASTER TOWER STILL HAS NO RESIDUALS.

^ LOOKING FOR ALTERNATIVE WATER SOURCE - 2 OLD WELLS?

* NO CHANGE OR IMPROVEMENT OF RESIDUALS OFF PLEASANT RUN OR MAIN.

* HOUSTON SCHOOL / MAIN HAS 2.0 PPM CL2.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

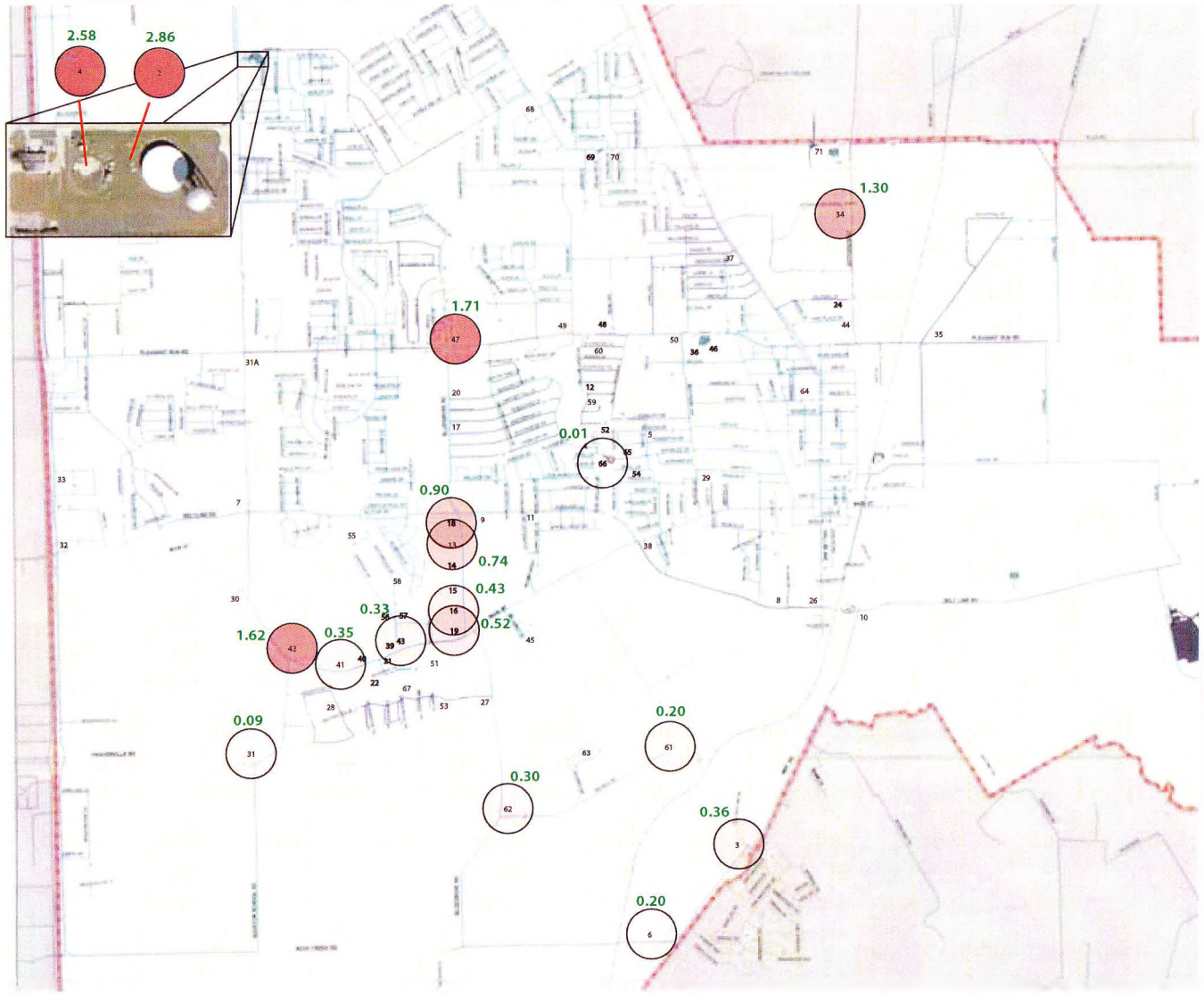
- >1.99 ppm Total Cl2
- 1.5 ppm Total Cl2
- 1.0 ppm Total Cl2
- 0.5 ppm Total Cl2
- 0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - High Pressure Side

5HP

Period 5 HP
10/24 to 10/30/08 (7 days)

Time line
10/1 10/6 10/11 10/16 10/21 10/26 10/31 11/5 11/10



NOTES:

* WINTERGREEN / JEFFERSON / AMES AREAS 2+ PPM RESIDUALS.

* LWU WANTS MUD TO BE FED FROM N. DALLAS LINE & LOW PRESSURE OFF JEFFERSON.

* FULL FLUSH GREENE RD HAS NO EFFECT.

* NOTICED "FOULED" FLUSHES ON OLDER TOWN / WAYNELEE AREAS.

* PHIL CURTIS ASKED FOR PICTURES.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

> 1.99 ppm Total Cl2

1.5 ppm Total Cl2

1.0 ppm Total Cl2

0.5 ppm Total Cl2

0.0 ppm Total Cl2

Lancaster / RE-Ox Chlorine Demand Removal Trial - High Pressure Side

Period 6 HP
10/31 to 11/10/08 (11 days)

Time line
10/1 10/6 10/11 10/16 10/21 10/26 10/31 11/5 11/10

6HP

NOTES:

* VIDEO OF DOWNTOWN FLUSHES SHOWING DEMAND, NITRIFYING MATERIAL REMOVAL WITH HIGHER RESIDUALS AFTER EACH FLUSH

* ASKED TO STOP TREATMENT BY DWU 11/19/08.

* MEETING WITH JIM SMITH LWU 11/21/08.

Legend

19 Sampling location number (see data spreadsheet)

0.08 Average of all data taken (both RE-Ox and DWU) at a single location during the current period. (Total Cl2)

≥1.99 ppm Total Cl2

1.5 ppm Total Cl2

1.0 ppm Total Cl2

0.5 ppm Total Cl2

0.0 ppm Total Cl2

Appendix 2

Dallas Water Utilities' (DWU) Laboratory Test Results for the Chosen Sampling Points

LANCASTER VAULT II (Bonnieview)

	FIELD MEASUREMENTS			EAST SIDE LABORATORY MEASUREMENTS											XENCO LABORATORIES								
															Metals				THMs				
Parameter	Total Chlorine	pH	T	Total Chlorine	pH	T	Alkalinity	Total Hardness	Ca Hardness	Mg Hardness	Saturation Index	HPC	Free NH3	Nitrate	Nitrite	Cu	Fe	Pb	Mn	BrCl2CH	Br3CH	Cl3CH	Br2ClCH	Total THMs
Units	mg/L		°C	mg/L		°C	mg/L $CaCO_3$	mg/L $CaCO_3$	mg/L $CaCO_3$	mg/L $CaCO_3$	(corrosivity)	cfu/100mL	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/MCLG	0.5-4.0	>7.0		0.5-4.0	>7.0									10	1	1.3		/0		0	0	0.07	0.06	0.08
AL																		0.015						
2ary MCL*		6.5-8.5			6.5-8.5						Noncorrosive	<500				1.000	0.300		0.050					
21-Aug-08	2.7	8.6	28.7	2.35	8.3	28	44	87	75	12	0.03	< 2	0.20	0.43	0.110	<0.010	<0.030	<0.012	<0.010	0.005	<0.001	0.103	<0.001	0.108
26-Aug-08	1.8	8.2	27.9	1.60	8.2	28	48	82	69	13	-0.09	< 2	0.30	0.46	0.180	<0.010	<0.030	<0.012	<0.010	0.005	<0.001	0.111	<0.001	0.116
28-Aug-08	2.3	8.4	29.2	2.15	8.4	28	48	81	70	11	0.15	< 2	0.05	0.38	0.110	<0.010	<0.030	<0.012	<0.010	0.005	<0.001	0.097	<0.001	0.102
2-Sep-08	2.0	8.2	28.5	1.70	8.2	28	45	84	66	18	-0.12	< 2	0.25	0.35	0.120	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.081	<0.001	0.085
4-Sep-08	2.1	8.4	27.9	2.10	8.3	28	43	78	69	9	-0.04	< 2	0.28	0.40	0.100	<0.010	<0.030	<0.012	<0.010	0.005	<0.001	0.097	<0.001	0.102
9-Sep-08	2.2	8.5	26.6	1.85	8.4	26	44	74	63	11	0.01	< 20	0.24	0.49	0.050	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.047	<0.001	0.051
11-Sep-08	2.2	8.4	27.0	1.55	8.4	27	45	75	65	10	0.04	< 2	0.28	0.50	0.130	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.039	<0.001	0.041
16-Sep-08	2.3	8.3	27.0	2.30	8.7		53	81	75	6	0.48	< 2	0.41	0.43	0.085	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.024	<0.001	0.025
18-Sep-08	1.8	8.4	24.8	1.25	7.9	25	47	76	68	8	-0.47	< 2	0.29	0.38	0.130	<0.010	<0.050	<0.012	<0.010	0.003	<0.001	0.040	<0.001	0.043
23-Sep-08	2.5	8.8	26.3	2.15	8.4	26	49	92	80	12	0.15	2	0.25	0.35	0.100	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.033	<0.001	0.036
25-Sep-08	2.7	8.7	24.7	2.25	8.7	26	45	83	73	10	0.34	< 2	0.19	0.41	0.050	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.026	<0.001	0.028
2-Oct-08																								
9-Oct-08																								
16-Oct-08																								
23-Oct-08																								

MCL : Maximum Contaminant Level
MCLG : Maximum Contaminant Level Goal
AL : Action Level
ND : Non-detected
* : Non-enforceable

BONNIEVIEW TANK DISCHARGE

	FIELD MEASUREMENTS			EAST SIDE LABORATORY MEASUREMENTS											XENCO LABORATORIES								
															Metals				THMs				
Parameter	Total Chlorine	pH	T	Total Chlorine	pH	T	Alkalinity	Total Hardness	Ca Hardness	Mg Hardness	Saturation Index	HPC	Free NH3	Nitrate	Nitrite	Cu	Fe	Pb	Mn	BrCl2CH	Br3CH	Cl3CH	Br2ClCH	Total THMs
Units	mg/L		°C	mg/L		°C	mg/L CaCO3	mg/L CaCO3	mg/L CaCO3	mg/L CaCO3	(corrosivity)	cfu/100mL	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/MCLG	0.5-4.0	>7.0		0.5-4.0	>7.0									10	1	1.3		/0		0	0	0.07	0.06	0.08
AL																		0.015						
2ary MCL*		6.5-8.5			6.5-8.5						Noncorrosive	<500				1.000	0.300		0.050					
21-Aug-08	1.40	8.4	28.4	1.10	8.4	28	44	82	72	10	0.10	< 2	0.35	0.44	0.160	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.066	<0.001	0.069
26-Aug-08	0.63	8.0	27.7	1.55	8.1	28	47	80	73	7	-0.18	413	0.30	0.45	0.170	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.084	<0.001	0.087
28-Aug-08	0.85	8.2	28.3	0.60	8.1	28	48	82	71	11	-0.17	> 738	0.07	0.41	0.180	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.084	<0.001	0.088
2-Sep-08	1.04	8.1	28.4	0.90	8.1	28	45	76	68	8	-0.21	505	0.33	0.35	0.150	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.070	<0.001	0.074
4-Sep-08	1.13	8.1	28.0	1.00	7.6	28	44	79	70	9	-0.72	136	0.41	0.4	0.090	<0.010	<0.030	<0.012	<0.010	0.005	<0.001	0.053	<0.001	0.058
9-Sep-08	1.14	7.9	27.3	0.95	8.0	26	45	74	62	12	-0.37	40	0.33	0.53	0.080	<0.010	0.076	<0.012	<0.010	0.004	<0.001	0.065	<0.001	0.069
11-Sep-08	1.19	8.0	26.8	1.00	8.1	27	46	75	65	10	-0.26	100	0.35	0.53	0.120	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.041	<0.001	0.043
16-Sep-08	1.16	8.6	26.2	1.15	8.2		46	78	70	8	-0.14	6	0.52	0.45	0.145	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.024	<0.001	0.026
18-Sep-08	1.40	8.2	25.1	1.05	8.0	25	46	78	66	12	-0.38	70	0.31	0.44	0.175	<0.010	<0.050	<0.012	<0.010	0.002	<0.001	0.030	<0.001	0.032
23-Sep-08	1.50	8.4	26.3	1.15	8.1	26	49	91	79	12	-0.15	375	0.19	0.42	0.140	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.031	<0.001	0.034
25-Sep-08	1.80	8.6	26.1	1.75	8.4	26	47	85	74	11	0.1	< 20	0.22	0.46	0.050	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.029	<0.001	0.032
2-Oct-08																								
9-Oct-08																								
16-Oct-08																								
23-Oct-08																								

MCL : Maximum Contaminant Level
MCLG : Maximum Contaminant Level Goal
AL : Action Level
ND : Non-detected
* : Non-enforceable

LANCASTER VAULT I (Houston Sch)

	FIELD MEASUREMENTS			EAST SIDE LABORATORY MEASUREMENTS												XENCO LABORATORIES								
																Metals				THMs				
Parameter	Total Chlorine	pH	T	Total Chlorine	pH	T	Alkalinity	Total Hardness	Ca Hardness	Mg Hardness	Saturation Index	HPC	Free NH3	Nitrate	Nitrite	Cu	Fe	Pb	Mn	BrCl2CH	Br3CH	Cl3CH	Br2ClCH	Total THMs
Units	mg/L		°C	mg/L		°C	mg/L $CaCO_3$	mg/L $CaCO_3$	mg/L $CaCO_3$	mg/L $CaCO_3$	(corrosivity)	cfu/100mL	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/MCLG	0.5-4.0	>7.0		0.5-4.0	>7.0									10	1	1.3		/0		0	0	0.07	0.06	0.08
AL																		0.015						
2ary MCL*		6.5-8.5			6.5-8.5						Noncorrosive	<500				1.000	0.300		0.050					
21-Aug-08																								
26-Aug-08																								
28-Aug-08																								
2-Sep-08																								
4-Sep-08																								
9-Sep-08																								
11-Sep-08																								
16-Sep-08																								
18-Sep-08																								
23-Sep-08																								
25-Sep-08																								
2-Oct-08	3.1	8.6	25.7	2.70	8.3	32	57	83	68	15	0.03	< 2	0.17	0.33	0.058	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.024	<0.001	0.029
9-Oct-08	3.5	8.4	25.3	2.95	8.6	24	49	84	72	12	0.28	< 2	0.17	0.46	0.025	<0.010	<0.050	<0.012	<0.010	0.002	<0.001	0.022	<0.001	0.025
16-Oct-08	3.2	8.1	23.8	2.85	8.5	24	51	91	79	12	0.22	< 2	0.42	0.37	0.060	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.015	<0.001	0.016
23-Oct-08	3.2	8.4	22.1	2.80	8.6	24	50	93	79	14	-0.45	< 2	0.16	0.29	0.060	<0.010	<0.030	<0.012	<0.010	0.007	<0.001	0.029	0.003	0.039

MCL : Maximum Contaminant Level
MCLG : Maximum Contaminant Level Goal
AL : Action Level
ND : Non-detected
* : Non-enforceable

933 WAYNELEE

	FIELD MEASUREMENTS			EAST SIDE LABORATORY MEASUREMENTS												XENCO LABORATORIES								
																Metals				THMs				
Parameter	Total Chlorine	pH	T	Total Chlorine	pH	T	Alkalinity	Total Hardness	Ca Hardness	Mg Hardness	Saturation Index	HPC	Free NH3	Nitrate	Nitrite	Cu	Fe	Pb	Mn	BrCl2CH	Br3CH	Cl3CH	Br2ClCH	Total THMs
Units	mg/L		°C	mg/L		°C	mg/L CaCO3	mg/L CaCO3	mg/L CaCO3	mg/L CaCO3	(corrosivity)	cfu/100mL	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/MCLG	0.5-4.0	>7.0		0.5-4.0	>7.0									10	1	1.3		/0		0	0	0.07	0.06	0.08
AL																		0.015						
2ary MCL*		6.5-8.5			6.5-8.5						Noncorrosive	<500				1.000	0.300		0.050					
21-Aug-08	ND	8.0	28.5	<0.10	8.1	28	54	86	76	10	-0.08	> 738	<0.04	1.3	<0.006	<0.010	0.118	<0.012	<0.010	0.002	<0.001	0.040	<0.001	0.042
26-Aug-08	0.13	7.2	30.1	0.10	7.9	28	53	84	76	8	-0.26	> 738	0.04	1.4	0.01	<0.010	0.118	<0.012	<0.010	0.003	<0.001	0.088	<0.001	0.091
28-Aug-08	0.12	7.8	29.0	<0.10	8.0	28	51	90	80	10	-0.17	> 738	0.06	0.85	0.35	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.080	<0.001	0.084
2-Sep-08	0.04	7.8	29.0	<0.10	8.0	83	51	88	77	11	-0.19	2765	<0.04	1.14	0.006	<0.010	0.118	<0.012	<0.010	0.004	<0.001	0.081	<0.001	0.085
4-Sep-08	0.08	7.8	27.9	<0.10	7.9	28	48	84	79	5	-0.33	155	<0.04	1.2	0.003	0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.057	<0.001	0.061
9-Sep-08	0.11	7.7	26.9	0.15	7.6	26	45	79	72	7	-0.72	760	0.16	1.2	<0.006	<0.010	0.118	<0.012	<0.010	0.004	<0.001	0.047	<0.001	0.051
11-Sep-08	0.08	8.0	28.4	0.10	8.2	27	49	79	68	11	-0.07	710	<0.04	1.27	0.007	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.047	<0.001	0.050
16-Sep-08	0.13	8.0	27.6	<0.10	7.9		49	89	75	14	-0.34	455	0.13	1.16	<0.006	0.014	<0.030	<0.012	<0.010	0.002	<0.001	0.027	<0.001	0.029
18-Sep-08	0.03	8.2	27.2	<0.10	8.0	25	50	84	73	11	-0.26	520	0.19	1.21	<0.006	<0.010	0.054	<0.012	<0.010	0.002	<0.001	0.024	<0.001	0.025
23-Sep-08	0.02	8.0	27.8	0.10	7.9	26	48	90	79	11	-0.33	650	<0.04	1.09	<0.006	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.031	<0.001	0.034
25-Sep-08	0.13	8.0	28.1	0.15	7.8	26	54	90	81	9	-0.36	290	<0.04	1.21	<0.006	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.031	<0.001	0.033
2-Oct-08	0.13	7.6	28.0	<0.10	7.9	27	51	82	72	10	-0.34	220	<0.04	1.2	<0.006	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.019	<0.001	0.021
9-Oct-08	0.24	7.6	27.1	0.10	7.6	24	45	90	78	12	-0.68	> 738	<0.04	1.08	0.006	<0.010	0.071	<0.012	<0.010	0.003	<0.001	0.025	<0.001	0.028
16-Oct-08	0.01	7.6	24.6	<0.10	7.7	24	51	91	80	11	-0.57	255	0.15	0.25	<0.006	<0.010	0.096	<0.012	<0.010	0.002	<0.001	0.018	<0.001	0.021
23-Oct-08	0.26	7.8	24.3	0.12	7.9	24	48	89	76	13	-1.15	770	0.16	0.69	0.13	<0.010	<0.030	<0.012	<0.010	0.007	<0.001	0.024	0.003	0.033

MCL : Maximum Contaminant Level
MCLG : Maximum Contaminant Level Goal
AL : Action Level
ND : Non-detected
* : Non-enforceable

LANCASTER MUD

	FIELD MEASUREMENTS			EAST SIDE LABORATORY MEASUREMENTS												XENCO LABORATORIES								
																Metals				THMs				
Parameter	Total Chlorine	pH	T	Total Chlorine	pH	T	Alkalinity	Total Hardness	Ca Hardness	Mg Hardness	Saturation Index	HPC	Free NH3	Nitrate	Nitrite	Cu	Fe	Pb	Mn	BrCl2CH	Br3CH	Cl3CH	Br2ClCH	Total THMs
Units	mg/L		°C	mg/L		°C	mg/L CaCO3	mg/L CaCO3	mg/L CaCO3	mg/L CaCO3	(corrosivity)	cfu/100mL	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/MCLG	0.5-4.0	>7.0		0.5-4.0	>7.0									10	1	1.3		/0		0	0	0.07	0.06	0.08
AL																		0.015						
2ary MCL*		6.5-8.5			6.5-8.5						Noncorrosive	<500				1.000	0.300		0.050					
21-Aug-08	ND	7.4	27.4	<0.10	7.7	27.2	42	83	71	12	-0.64	> 738	0.05	0.94	0.250	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.045	<0.001	0.048
26-Aug-08	0.08	7.4	28.7	0.10	7.6	28	49	83	71	12	-0.65	> 738	0.06	0.94	0.360	<0.010	0.045	<0.012	<0.010	0.004	<0.001	0.082	<0.001	0.086
28-Aug-08	0.08	7.3	27.5	0.10	7.5	28	43	81	71	10	-0.83	> 738	0.08	1.34	<0.006	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.088	<0.001	0.092
2-Sep-08	0.08	7.3	27.5	0.10	7.6	28	43	78	70	8	-0.74	> 7380	0.04	0.88	0.190	<0.010	0.045	<0.012	<0.010	0.004	<0.001	0.076	<0.001	0.080
4-Sep-08	0.09	7.3	27.2	0.10	7.5	28	41	80	69	11	-0.86	> 738	<0.04	1.00	0.055	<0.010	0.039	<0.012	<0.010	0.005	<0.001	0.066	<0.001	0.071
9-Sep-08	0.09	7.4	26.4	0.10	7.8	26	49	82	70	12	-0.50	3765	0.05	1.20	<0.006	<0.010	0.045	<0.012	<0.010	0.004	<0.001	0.044	<0.001	0.048
11-Sep-08	0.07	7.8	26.8	0.10	7.6	27	43	75	67	8	-0.77	<2130	0.07	1.15	0.032	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.043	<0.001	0.046
16-Sep-08	0.09	7.9	26.4	0.10	7.6		43	82	71	11	-0.76	620	0.13	1.11	0.020	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.029	<0.001	0.031
18-Sep-08	0.01	8	25.4	0.10	7.5	25	44	78	67	11	-0.89	2815	0.11	1.20	<0.006	<0.010	<0.050	<0.012	<0.010	0.001	<0.001	0.022	<0.001	0.023
23-Sep-08	0.09	8	26.4	0.15	7.6	26	47	91	81	10	-0.66	2720	<0.04	1.04	0.020	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.032	<0.001	0.035
25-Sep-08	0.07	7.9	25.9	0.15	7.5	26	49	87	75	12	-0.78	1010	<0.04	1.14	0.007	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.030	<0.001	0.033
2-Oct-08	0.09	7.6	26.3	0.15	7.6	25	46	76	68	8	-0.75	> 7380	<0.04	1.00	0.125	<0.010	<0.030	<0.012	<0.010	0.004	<0.001	0.023	<0.001	0.026
9-Oct-08	0.08	7.6	25.9	0.20	7.6	24	45	89	75	14	-0.72	> 738	<0.04	1.02	0.018	<0.010	<0.030	<0.012	<0.010	0.003	<0.001	0.025	<0.001	0.027
16-Oct-08	0.03	7.6	23.8	0.15	7.5	24	48	82	76	6	-0.82	285	0.16	1.07	0.007	<0.010	<0.030	<0.012	<0.010	0.002	<0.001	0.018	<0.001	0.020
23-Oct-08	0.09	7.8	21.9	0.10	7.8	24	48	87	75	12	-1.29	935	0.19	0.71	0.080	<0.010	0.038	<0.012	<0.010	0.006	<0.001	0.023	0.003	0.033

MCL : Maximum Contaminant Level
MCLG : Maximum Contaminant Level Goal
AL : Action Level
ND : Non-detected
* : Non-enforceable

Appendix 3

RE-Ox® Personnel Spreadsheets of Chlorine Residual Sampling Data

Lancaster, Texas
"Low Pressure" Trial
Cl2 Residuals / RE-Ox Treatment
Aug. 26 to Sept. 30, '08

		Bonnie View Vault																									
Sampling Point	**Loc #**	**8/26/08 Tues. 10:05 AM**	**8/27/08 Wed.**	**8/28/08 Thurs. 8:45 AM**	**8/29/08 Fri.**	**8/30/08 Sat.**	**8/31/08 Sun.**	**9/1/08 Mon.**	**9/2/08 Tues.**	**9/3/08 Wed.**	**9/5/08 Fri.**	**9/6/08 Sat.**	**9/7/08 Sun.**	**9/8/2008 Mon.**	**9/9/08 Tues.**	**9/11/08 Thurs.**	**9/12/08 Fri.**	**9/13/08 Sat.**	**9/14/08 Sun. 8:45 AM**	**9/15/08 Mon. 9:06 AM**	**9/16/08 Tues.**	**9/17/08 Wed. 8:00 AM**	**9/18/2008 Thurs.**	**9/19/08 Fri.**	**9/23/08 Tues. 10:00 AM Flush Wk**	**9/24/08 Wed.**	**9/25/08 Thurs.**	**9/30/08 Tues.**
RE-Ox Used; Dosage 1:20,000 gals. (Pump Rate gal/day of RE-Ox)		**20.0**	**20.0**	**20.0**	**20.0**	**19.0**	**20.0**	**20.0**	**120.7**	**120.0**	**113.6**	**127.8**	**120.7**	**113.6**	**120.0**	**120.0**	**150 Turned pmp up to 150 due to low Cl2 from DWU on weekend.**	**156.2**	**134.9**	**127.8**	**124.3**	**120.7**	**120.7**	**149.1**	**156.2**	**142.0**	**149.1**	**149.1**
Lancaster Vault II, Bonnie View	1	1.60	1.70	1.82	2.00	1.60	1.50	1.50		1.80	1.90	1.70	1.20	1.70		2.00	2.40	1.70 Avg.	1.60	1.90								
Lancaster Tank	2					0.95	0.85	0.90		1.05	1.10	1.10	0.65	0.85		1.15	1.15	0.95		1.05								
Lancaster MUD	3				0.08					0.05		0.05		0.07				0.05										0.05
Bonnie View Tank Discharge	4	0.60	0.75	0.60	0.85	0.90	0.90	0.85		1.05	1.10	1.09	0.60	0.80		1.15	1.20	0.93		1.00								
Alicia Ln./Rogers Rd.	6																									0.08		
Beltline Rd.	7																							0.05	0.02			
Beltline Rd. (elevated storage tank)	8																								0.02		0.05 fire hydrant	
Beltline Rd. (near lower)	9																											0.08
Colonial Dr.	10								0.60												0.90 0.92							
Colonial Dr. (280)	11										0.80																	
Colonial Dr. (301)	12										0.60																	
Cornell Rd.	13																						0.45	0.35	0.16	0.70 0.65		
Cornell Rd. #3	14																								0.35			
Cornell Rd. (AT&T)	15																								0.21			
Cornell Rd., Middle of	16														0.25													
Dallas Rd/W. 8th St., (corner Valero Store)	17		0.05		0.11				0.08		0.08 Avg.			0.04				0.04		0.04								
Francis St./Melrose Ln. (flushed three times)	18																								0 Dk/blk/brn 15 min.			
Greene Rd.	19																						0.23	0.20				
Greene Rd./Alba Rd.	20																							0.12				
Greene Rd. Fire Hydrant	21																					0.00						
Greene Rd./Highway 342	22																											0.20
Greene Rd./Cornell Rd.(between)	23																											0.45
Hilda Circle/Greene Rd.	24																								0.08			
Industrial Street	25																									0.05		
Industrial Street #2	26																									0.14		
Industrial St./Lancaster Hutchins Rd.	27																								0.00	0.92		
Lancaster Hutchins Rd.	28																						1.30 10:15 AM	0.90		1.30 Start 0.25		
Lancaster Hutchins Rd./Cornell Rd.	29																											0.67
Lancaster Hutchins Rd./Wintergreen Rd.	30																								0.55			
Oak Bluff/Lancaster Park Dr.	31																								0.12			
Park Place Dr.	32								0.40												0.90 0.88							
Pleasant Run Rd.	33																					0.23	0.98 0.23	0.30	0.20			
West Main Street (220), Public Library	34										0.04									0.05								
Waynelee Dr. (933)	35				0.09					0.06				0.09				0.08							0.05			
Wintergreen Rd.	36														1.10													

Lancaster, Texas
"High Pressure" Trial
Cl2 Resid./RE-Ox Treatment
Oct 1 - Nov 10, 2008

		AMES DWU																														
Sampling Point	**Loc #**	**10/1/08 Wed.**	**10/2/08 Thurs.**	**10/03/08 Fri.**	**10/6/08 Mon. (rain)**	**10/7/08 Tues.**	**10/8/08 Wed.**	**10/9/08 Thurs.**	**10/10/08 Fri.**	**10/13/08 Mon.**	**10/14/08 Tues.**	**10/15/08 Wed.**	**10/16/08 Thurs.**	**10/17/08 Fri.**	**10/18/08 Sat.**	**10/19/08 Sun.**	**10/20/08 Mon.**	**10/21/08 Tues.**	**10/22/08 Wed.**	**10/23/08 Thurs.**	**10/24/08 Fri.**	**10/25/08 Sat.**	**10/27/08 Mon.**	**10/28/08 Tues.**	**10/29/08 Wed.**	**10/30/08 Thurs.**	**10/31/08 Fri.**	**11/01/08 Sat.**	**11/3/08 Mon.**	**11/4/08 Tues.**	**11/5/08 Wed.**	**11/6/08 Thurs.**	**11/7/08 Fri.**	**11/10/08 Mon.**
RE-Ox Used; Dosage 1:20,000 gals.		**78.1**	**85.2**	**82.0**	**120.7**	**81.6**	**99.4**	**78.1**	**100 Avg.**	**120.7**	**120.7**	**51.0**	**99.4**	**213.0**	**149.1**	**127.8**	**192.0**	**106.5**	**127.8**	**127.8**	**127.8**	**135.0**	**127.8**	**128.0**	**92.3**	**106.5**	**127.8**	**128.0**	**128.0**	**pump off**	**?**	**?**	**107.0**	**?**
Bonnie View Pump	1																																	
Lancaster Vault II	2	2.90	3.00	2.90	3.00	2.70	3.10	2.70		3.00	3.10	3.00	3.10	2.60	2.50	2.60	3.10	3.40	3.50	2.90	2.80	2.90	3.00	2.70	3.00	2.80	3.00	3.00	3.00	3.00	2.60	?	2.80	3.00
Lancaster MUD	3	0.09 Avg.	0.13 Avg.	0.11	0.11	0.11	0.10			0.00					0.13		0.11			0.20	0.36 Avg.	0.38	0.38			0.32 Avg.	0.20			0.27				
Tank	4	2.50	2.70	2.70	2.80	2.40	2.80	2.50		2.60	2.70	2.80	2.50	2.50	2.10	2.50	2.40	2.60	2.90	2.90	2.60	2.50	2.60	2.40	2.80	2.60	2.90	2.80	2.80	2.80	2.40	?	2.60	2.80
Ash Ln./Poinsettia Dr. (Waynelee Dr. area)	5																0.06	0.00	0.04														0.17	
Bear Creek Rd.	6															0.05							0.21		0.12 middle	0.26 Avg.	0.20				0.08			
Beltline Rd./Houston School Rd.	7	0.81				2.00																												
Beltline Rd. (City Park)	8												0.08 flush																					
Beltline Rd. (200 N.) 2nd fire hydrant	9																		0.79															
Beltline Rd./Hwy. 342 (RN Stables)	10															0.08																		
Beltline Rd./Cloverleaf Ln. (Waynelee Dr. area)	11																		0.75															
Birchwood Dr./Willow Creek Dr.	12																																0.03	
Bluegrove Dr. (247)	13																							0.74	0.74									
Bluegrove Dr. (307)	14																			0.89														
Bluegrove Dr. (next down fire hydrant)	15																			0.66														
Bluegrove Dr. (600)	16																			0.40			0.40		0.52									
Bluegrove Dr./Greenbrier Ln.	17																	0.23	1.80															
Bluegrove Dr./Beltline Rd. (Cross Road's Church)	18										0.10						0.13	0.06	0.08	1.20					0.90				1.00					
Bluegrove Dr./Main Street	19													0.10 0.06		0.13 Avg.	0.29	0.08	0.13	0.59			0.34 Avg.	0.63	43.00	0.69			0.41			0.08	0.11
Bluegrove Dr./Meadowcreek Dr.	20																	1.53	2.20															
Briarwood Ln.	21						0.44 Flushed line. Deep coloration. Draw for 15 min.						0.58				0.67	0.38									0.29			0.27 Avg.			0.61	
Briarwood Ln./Riverway Ln.	22										0.08																							
Cici's Pizza (Pleasant Run Road)	23																												1.28					
Colonial Dr. (house faucet)	24					0.96																												
Colonial Dr. (326) (house faucet)	25										0.73																							
Dallas Rd./Beltline Rd. (house faucet)	26															0.05																		
Enchanted Ln./Bluegrove Dr.	27																0.32	0.00		0.18														
Creekwood Drive (241)	28												0.08																					
Francis St./Melrose Ln. (flush)	29										0.05																							
Houston School Rd./Main St.	30					1.40	1.71				1.90		1.41			1.58		2.20	2.20															
Houston School Rd./Parkerville	31																	0.12		0.12				0.09			0.07		0.16				
Houston School Rd./Pleasant Run Rd.	31A	0.71				2.28																												
Intersate 35/Beltline Rd.	32																													0.08				
Interstate 35/Chiles Restaurant	33	0.00				0.16					0.12																							
Jefferson St. (Park)	34																0.76		1.03					1.30									
Lancaster Hutchins Rd./Pleasant Run Rd.	35												0.03																					
Lancaster Tank (Waynelee Dr. area)	36										0.03			0.10			0.04	0.10														0.23		
Lindenwood Dr./Elm St. (flush)	37										0.26 Avg.																							
Main St.	38	0.34																																
Main St. (1675)	39																													0.67				
Main St. (1730)	40													0.65																				
Main St. (1763)	41																						0.27	0.49	0.28		0.22			0.31 Avg.	0.92		0.89	0.62
Main St. (2100)	42																1.12	1.53					1.49 Avg.	1.68	1.69		1.90			2.03 Avg.	1.74			
Main St./Briarwood Ln.	43													0.18					0.83	0.50			0.16	0.42	0.41						0.66			
Park Place Dr. (house faucet)	44					0.87																												
Pecos Ct./Big Sandy Ln.	45	0.01													0.10																			
Pleasant Run Rd. (elevated tank)	46											0.09			0.06																0.34			
Pleasant Run Rd./Bluegrove (McDonald's)	47		1.30			2.25									1.80				1.19				1.71											
Pleasant Run Rd./Irene Ave.	48					0.03																												
Pleasant Run Rd./Rogers Ave. (What-A-Burger)	49		0.76			2.02					1.20						1.40		1.86															
Pleasant Run Rd./Westridge Ave. (Seven Eleven)	50		0.05			0.04																												
Riverway Lane	51												0.48 both ends		0.48 Avg. flushing	South End .19 Avg.																0.53		
Sequoia St./Kiowa Cr. (Waynelee Dr. area)	52																1.00 Shocked fire hydrant (not included)	0.00																
Shady Ln./Enchanted Ln.	53																0.08												0.40					
Shell Ln. (942)	54																0.08																	
Southwood Dr./Oakwood Dr.	55													0.70			1.08																	
Southwood "V"	56																													0.12				
Southwood (236)	57																													0.07				
Southwood (326)	58																													0.07				
Spruce Wood Circle	59																0.11															0.09		
Sycamore Ln. (913)	60																															0.03		
Ten Mile Rd.	61	0.06	0.10			0.07	0.10			0.02	0.06 0.04	0.07	0.10		0.13 0.10	0.03	0.05 opaque 0.08	0.01 0.13		0.57 Avg.				0.20										
Ten Mile Rd./Bluegrove Dr.	62																		0.00				0.20 0.32	0.30	0.23	0.47	0.20	0.38	0.48	0.45	0.12			
Truman Circle (857)	63															11 Avg.																		
W. 8th St./N. Dallas Rd. (Valero store)	64	0.05				0.04				0.00	0.04				0.10	0.11 fire hydrant Taquena Shp. Ctr.	0.10															0.06				
Waynelee Dr. (809)	65																		0.02															
Waynelee Dr. (933)	66	0.11	0.14			0.15				0.00			0.01	0.06	0.10	0.11	0.08		0.00	26.00			0.01		0.00						0.05			
Wildwood Tr./Enchanted Ln.	67																0.08																	
Wintergreen Rd.	68	1.43			2.20																													
Wintergreen Rd./Arlington Ln.	69										0.00																							
Wintergreen Rd./Concord Ln.	70																		2.40															
Wintergreen Rd./Jefferson St.	71	0.35																																

TEXAS DEPARTMENT OF AGRICULTURE
TODD STAPLES, COMMISSIONER
P. O. BOX 12847 AUSTIN, TX 78711-2847
(877) LIC-AGRI (877-542-2474)
For the hearing impaired: (800) 735-2989 TDD (800) 735-2988 VOICE
www.tda.state.tx.us

Certificate of Registration

TDA Client No: 00379504

SPICER RANDOLF LLC

TDA Product License No.	EPA Registration No. (Company Product Distribution)	TDA Product Name	Registration Date	SLU	RU	RH	Expiration Date
0495660	074321-00002-000000	RE-OX DEPOSIT CONTROL DISINFECTANT DISINFECTAN, SANATIZER AND CLEANER	06/23/2008	N	N	N	09/30/2009

Confidential

RE-Ox® Technical Information & Applications Studies

Section 1 - Technical Information:

01.100 Specification Sheet

01.101 Material Safety Data Sheet

01.102 EPA Reg. No. 74321-2 Label
Issued: October 30, 2007

01.103 "National Sanitation Foundation (NSF) International – RE-Ox NSF/ANSI Standard 60 Certification Corrosion & Scale Category"
Issued: November 15, 2005

01.104 "National Sanitation Foundation (NSF) International Registration - FDA 21 CFE, Category G4 Meat, Poultry, Other Food Processing Areas"
Issued: May 3, 2005

01.105 Canadian Food Inspection Agency Approval
Issued: July 23, 2004

01.106 RE-Ox Product Label

01.107 Letter of Assurance

01.108 How to Install a RE-Ox Injection System

01.109 How to Use RE-Ox, Standard Operating Procedures, Treatment Flow Chart

01.110 "RE-Ox / NB105 – Preliminary Analysis"
Author: Shannon G. Auge - Galbraith Laboratories, Inc.
Knoxville, Tennessee
Report Date: June 8, 2005

01.111 "RE-Ox / NB 105 – Product Chemistry"
Author: Mel Kaminsky, Ph.D. - Stillmeadow Incorporated
Sugar Land, Texas
Report Date: July 21, 2006

Section 2 – Product Efficacy Application Studies:

02.200 "Superior Microbiological Control from a New Technologically Advanced Method of Deposit Removal and Prevention in Water Systems" Technical Bulletin 165
Authors: Paul R. Puckorius, Robert T. Hess,
Puckorius & Associates, Evergreen, Colorado
Report Date: October 2007

02.201 Efficacy of RE-Ox Treated Water in Removing Listeria Monocytognes from Stainless Steel Surfaces"
Author: ABC Research Corporation
Report Date: November 11, 2004

02.202 **"Efficacy of Re-oxidized (RE-Ox treated) Water in the Cleaning and Removal of Listeria Monocytogenes from Inoculated Fruit and Vegetable Surfaces"**
Authors: Robert A. LaBudde, Least Cost Formulations, Ltd.
Virginia Beach, Virginia -
O. Peter Snyder, Jr., PhD- Hospitality Institute of Technology and Management
St. Paul, Minnesota
Report Date: November 4, 2004

02.203 **"Bacterial activity of HOCL Solution: Effects of HOCL on Salmonella Typhimurium"**
KLA Report 10545b
Author: KLA Environmental Consulting, Inc., Las Vegas, Nevada
Report Date: August 22, 2001

02.204 **"Bacterial activity of HOCL Solution: Effects of HOCL on E-coli"**
KLA Report 10545a
Author: KLA Environmental Consulting, Inc., Las Vegas, Nevada
Report Date: August 22, 2001

02.205 **"Sporocidal Activity of HOCl Solution"**
Author: California-Pacific lab & Consulting
Ramin Najafi, Ph.D.
Report Date: January 2, 1996

02.206 **"Disinfectant Efficacy of Neutral Bleach Compared to Household Bleach on Escherichia Coli O157:H7, Salmonella Enterica and Listeria Monocytogenes"**
Author: Davis Fresh Technologies LLC, Aptos, California
Report Date: March 15, 2002

02.207 **"Legionella and Other Pathogens in Potable Water: Requirements for a Real Resolution"**
Presentation at 6th International Conference on Legionella, Chicago, IL
Authors: Eric Christensen, Paul Puckorius
Report Date: October 2005

02.208 **"Why RE-Ox Works"**
Author: R. A. LaBudde, Least Cost Formulations, Ltd
Virginia Beach, Virginia
Report Date: June 16, 2006

Section 3 - Product Efficacy Submissions for EPA Registration 74321-2 OPPTS Protocols

03.300 **"A Chlorine Equivalency Evaluation of One Disinfectant Formulation"** *OPPTS* Protocol 060204-204
Test Organisms: Salmonella enterica enterica, serovar Typhi (ATCC #6539)
Staphylococcus aureus aureus (ATCC #6538)
Final Report
Author: Jennifer Jill Lawrence, Microbiologist
BioScience Laboratories, Inc.
Report Date: July 26, 2006

03-301 **"Hard Surface Disinfection Evaluation of One (1) Product Versus Three (3) Microorganism Strains"** *OPPTS* Protocol 060203-204
Test Organisms: Pseudomonas aerugiosa (ATCC #15442)
Salmonella enterica Serovar Choleraesuis (ATCC 10708)
Staphylococcus aureus aureus (ATCC #6538)
Final Report
Author: Jennifer Jill Lawrence, Microbiologist
BioScience Laboratories, Inc.
Report Date: August 2, 2006

03.302 **"Hard Surface Disinfection Evaluation of One (1) Product Versus Two (2) Microorganism Strains"** *OPPTS* Protocol 060835-204
Test Organisms: Salmonella enterica Serovar Chloeraesuis (ATCC 10708)
Staphylococcus aureus aureus (ATCC #6538)
Final Report
Author: Jennifer Jill Lawrence, Microbiologist
BioScience Laboratories, Inc.
Report Date: November 30 2006

03.303 **"Hard Surface Disinfection Evaluation of One (1) Product Versus Three (3) Microorganism Strains"** *OPPTS* Protocol 061124-204
Test Organisms: Pseudomonas aerugiosa (ATCC #15442)
Salmonella enterica Serovar Chloeraesuis (ATCC 10708)
Staphylococcus aureus aureus (ATCC #6538)
Final Report
Author: Jennifer Jill Lawrence, Microbiologist
BioScience Laboratories, Inc.
Report Date: January 8, 2007

03.304 **"Hard Surface Disinfection Evaluation of Three (3) Batches One (1) Disinfectant Versus Three (3) Microorganism Strains"** *OPPTS* Protocol 061032-204
Test Organisms: Pseudomonas aerugiosa (ATCC #15442)
Salmonella enterica Serovar Choleraesuis (ATCC 10708)
Staphylococcus aureus aureus (ATCC #6538)
Final Report
Author: Jennifer Jill Lawrence, Microbiologist
BioScience Laboratories, Inc. –
Report Date: January 16, 2007

Section 4 - Case Histories / Pilot Trials:

04.401 **"Restoring Chlorine Residuals by Reducing Distribution System Iron Deposits"**
(Cleaning Utility Water Distribution System Improves Water Quality & Restores Residuals)
Roy Rider, Board Member & Operator
Tri-County Water District, Earlsboro, Oklahoma
Report Date: February 19, 2007

04.402 **"RE-Ox Use by Suburban Water Co., Basehor, Kansas"**
(Chlorine Demand & TTHM Reduce in Utility Water System)
Michael Bruer, Water System Manager – Class Operator II
Basehor, Kansas
Report Date: August 10, 2006

Confidential

RE-Ox® Technical Information & Applications Studies

04.403 **"Results of RE-Ox Water Treatment on Water Meters & Galvanized Pipe in Chloraminated Water"** (Scale & Tuberculation Removed from Water Meters & Galvanized Pipe in Chloraminated Water)

Author: Scott Hiatt, Distribution System Operator in cooperation with Kansas City, Kansas, area water utilities: Suburban Water Co. and Kansas City Board of Public Utilities (BPU)

Report Date: May 16, 2006

04.404 **"Results of RE-Ox Water Treatment Pilot Trial on Water Distribution Pipes Retrieved From Service"** (Solids Removed from Utility Water Distribution System Tuberculated Pipes Retrieved from Service)

Michael Bruer, Water System Manager, Class Operator II, Suburban Water Company, Basehor, Kansas, in cooperation with Kansas City, Kansas, area water utilities:

- *Suburban Water Company*
- *BPU, Water Utility*
- *Rural Water District #9*

Report Date: November 20, 2005

04.405 **"Results of RE-Ox Treatment on Deposit-Laden Pipes Retrieved from Service"** (Deposits Reduced in Pipe Retrieved from Utility Water System)

Annie Chiodo, Water System Manager - Water Department
City of Waynesboro, Tennessee
Report Date: August 11, 2006

04.406 **"RE-Ox Deposit Control Chemistry Evaluation in a University Hospital Campus"** Sacramento, California

Author: Hazard Control Solutions
Report Date: September 29, 2007

04.407 **"Results of RE-Ox Water Treatment Trial Conducted at a Las Vegas Area Metropolitan Hospital"**

Authors: Eric Christensen
In consultation with
Judy A. Scott, RN, MSN, Las Vegas, Nevada and
Puckorius & Associates, Evergreen, Colorado –
Report Date: March 11, 2004

04.408 **"Test of RE-Ox in Poultry Applications"**

Authors: Doug Vineyard
Eric Christensen
Report Date: June 14, 2004

04.409 **"Cook Plant Sanitation Trial; RE-Ox Treatment in Facility Water"**

Authors: Eric Christensen & Doug Vineyard
Report Date: June 8, 2004

04.410 **Food Processing Applications Evaluations:**
"Loin Pickle Injection System
"Continuous Smokehouse Brine Chill System"
"Cooked Poultry Ready-to-Eat Packing Room"
"Scale & Deposition Removal in the Supply System"

Author: R. A. LaBudde - Least Cost Formulations, Ltd. Virginia Beach, Virginia
Report Date: September 4, 2004

04.411 "Bacteria and Deposition Control, Taste & Other Observations at Las Vegas Restaurant and Lounge"
Author: Eric W. Christensen
Report Date: May 10, 2002

04.412 "Report on the RE-Ox Trial on the Cooling Tower & Condensing Systems at Harrah's Hotel & Casino, Las Vegas, Nevada"
Authors: Paul R. Puckorius, Robert Hess, Gary Loretitsch
Puckorius & Associates, Inc., Evergreen, Colorado
Report Date: April 7, 2004

04.413 "Report on the Lone Star Bakery Evaporative Condenser Cleaning Evaluation of RE-Ox as an Effective Descalent"
Authors: Paul R. Puckorius, Robert Hess, Gary Loretitsch
Puckorius & Associates, Inc., Evergreen, Colorado
Report Date: April 7, 2004

04.414 "Scale Removal Study - Cooling Tower #2, MountainView Hospital Las Vegas, Nevada
Authors: Eric Christensen
Activated Systems, LLC
Report Date: October 7, 2002

04.415 "Eisenhower Medical Center Cooling Tower Descale Pilot Trial"
Rancho Mirage, California
Author: Eric Christensen
Report Date: February 8, 2007

Section 5 – RE-Ox Related Documents:

05.500 "Health Risks From Microbial Growth and Biofilms in Drinking Water Distribution Systems"
US EPA

05.501 "Attachment (Scale) as a Factor in the Protection of *Enterobacter cloacae* from Chlorination"
Diane S. Herson, Brian McGonigle, Mary Anne Payer and Katherine H. Baker

05.502 "Bacterial Colonization of a Drinking Water Distribution System"
H. F. Ridgway and B. H. Olson

05.503 "Factors Promoting Survival of Bacteria in Chlorinated Water Supplies"
Mark W. LeChevallier, Cheryl D. Cawthon and Ramon G. Lee

05.504 "Organic Matter as Loose Deposits in a Drinking Water Distribution System"
Vincent Gauthier, Bernadette Geá Rard and Jean-Marie Portal, Jean-Claude Block and Dominique Gatel

05.505 "Reducing Chlorine Demand with Chemical Cleaning"
Journal, American Water Works Association

05.506 "Chlorine Dioxide: Pros and cons in Kansas"
The Kansas Lifeline, Kansas Rural Water Association

Confidential

RE-Ox® Technical Information & Applications Studies

05.507 "Review of Chloramines"
US EPA

05.508 "Risk Assessment of Chloramines"
Canadian Water Association

05.509 "Biofilms in Systems with Combined Chlorine"
The Kansas Lifeline, Kansas Rural Water Association

05.510 "Biofilms Affected by Phosphorus Availability"
AS for Microbiology

05.511 "Disinfectants and Disinfection By-products: The Suspicions, the Truth and the Solutions"
The Kansas Lifeline, Kansas Rural Water Association

05.512 "Emergency Water Utility Remediation Guidelines"
US EPA

05.513 "Cleaned wells and pipes improve water quality at Burdett"
The Kansas Lifeline, Kansas Rural Water Association

05.514 "Literature review—efficacy of various disinfectants against Legionella in water systems"
Water Research, Ford

05.515 "Preventing Legionellosis"
Water 21 IWA

05.516 "Legionellosis: Why the Problem Continues"
American Society of Heating, Refrigerating, Air Conditioning Engineers (ASHRAE)Journal

05.517 "Preventing Legionellosis in Healthcare Facilities"
American Society of Heating, Refrigerating, Air Conditioning Engineers (ASHRAE)Journal

05.518 "Legionella in Water Distribution Systems"
Journal, American Water Works Association

05.519 "Controlling ***Legionella*** in Hospital Water Systems: Facts vs. Folklore"
Janet Stout

05.520 "Legionnaires – How Will the New JCAHO EC 1.7 Guidelines Impact HealthCare?"
American Society for Healthcare Engineering

05.521 "Water as a Reservoir of Nosocomial Pathogens"
Healthcare Epidemiology - Infection Control and Hospital Epidemiology

05.522 "Danger on Tap in Hospital"
Pulmonary Review

05.523 "Emerging Issues in Water and Infectious Disease"
World Health Organization

05.524 "Comparison of Dental Water Quality Management Procedures
Journal of the American Dental Association

05.525 "Significance of Microbial Biofilms in Food Industry: A Review"
International Journal of Food Microbiology

05.526 Miscellaneous collected articles from 2002 to 2007 regarding waterborne pathogen issues.