

ICR Treatment Study Summary Report

Evaluation of Granular Activated Carbon Adsorption of Disinfection Byproduct Precursors for Compliance with the Information Collection Rule

Conducted during the period of 3/9/98 through 3/31/99

Rend Lake Intercity Water System, IL0555100
1600 Marcum Branch Rd.
Benton, IL 62812
(618) 439-4394
(618) 439-4398 (fax)

Rend Lake Intercity Water System, 358

In March 2000

Attachment: 1 diskette containing *Data Collection Spreadsheet*, *Treatment Study Summary Report Spreadsheet*, and this report in portable document format (PDF)

Table of Contents

1	Conclusions and Recommendations	1
2	Background Information.....	2
2.1	<i>Treatment Plant Description</i>	2
2.2	<i>Summary of Source and Finished Water Quality Data.....</i>	2
3	Materials and Methods	6
3.1	<i>Treatment Study Influent Sampling Procedures.....</i>	6
3.2	<i>Pretreatment Processes to the Advanced Treatment Processes</i>	6
3.3	<i>Advanced Treatment Process Information.....</i>	6
3.3.1	<i>Descriptions of the Process Equipment Used.....</i>	6
3.4	<i>Experimental Design.....</i>	7
3.5	<i>Simulated Distribution System (SDS) Chlorination Conditions.....</i>	7
3.6	<i>Analytical Methods.....</i>	7
4	Results and Discussion.....	13
4.1	<i>Pretreated Influent Water Quality Data.....</i>	13
4.2	<i>Problems Encountered</i>	13
4.3	<i>Summary of Significant Results.....</i>	14
5	QA/QC Summary.....	15

Appendix A: ICR Database Reports

Appendix B: Summary of GAC Breakthrough Curves

Appendix C: Data Collection Spreadsheet

Appendix D: Treatment Study Summary Report Spreadsheet

1 Conclusions and Recommendations

As required by the Information Collection Rule (ICR), a treatment study was conducted by Rend Lake Intercity Water System to evaluate the removal of disinfection byproduct (DBP) precursors by granular activated carbon (GAC). The rapid small-scale column test (RSSCT) was utilized as the bench-scale method to simulate full-scale GAC performance. The treatment study was designed and conducted as required by section 141.141(3) of the ICR, published in the May 14, 1996 Federal Register. A bituminous coal-based GAC, F-400, manufactured by Calgon Carbon Corporation was investigated. DBP formation by disinfection with free chlorine was simulated by utilizing site-specific chlorination conditions designed to match distribution system conditions. The procedures followed were those contained in the *GAC Precursor Removal Studies* section of the *ICR Manual for Bench- and Pilot-Scale Treatment Studies*, and all analyses were conducted following approved methods and as required by the *ICR/DBP Analytical Methods Manual*. After the completion of bench-scale testing conducted by Rend Lake Intercity Water System, Summers & Hooper, Inc. was contracted to write this report. Summers & Hooper, Inc. was not involved in the design or operation of the experimental portion of this project.

An electronic deliverable is included as an attachment to this report. It includes: this report in portable document format (PDF), the *ICR Treatment Studies Data Collection Spreadsheet*, with all data input as required by EPA, and the *Treatment Study Summary Report Spreadsheet*, with all data input as required by EPA. Hardcopies of these spreadsheet files are also included as attachments to this report.

Four quarterly sessions were conducted to evaluate the impact of seasonal variability in source water quality on DBP precursor control by GAC. During each session, two empty-bed contact times (EBCTs) were evaluated (10 and 20 minutes). The primary source water to the Rend Lake Intercity Water System is Rend Lake.

Based on the SDS chlorination conditions used in this study, which included a 24-hour target free chlorine residual of 0.5 mg/L, formed trihalomethanes (THMs) and haloacetic acids (HAAs) were measured at or below Stage 2 placeholder maximum contaminant limits (MCLs). However, based on 18 months of ICR monitoring data, average THM4 levels exceeded the Stage 2 THM4 placeholder MCL, but were in compliance with the Stage 1 THM4 MCL of 80 µg/L.

During the first session, GAC breakthrough occurred to a limited extent at the very end of the experimental run time, after approximately 150 days of scaled operation time. During the remaining quarters of testing, TOC levels did not increase above the MRL for either the 10 or 20 minute EBCT contactors. During the second and third quarters, the RSSCTs were operated for over 200 full-scale equivalent days, and during the fourth quarter, the RSSCTs were operated for over 140 full-scale equivalent days. These results were also observed for most of the UV-254 and SDS-DBP data during all sessions: no breakthrough was achieved. Due to intermittent operation of the columns, as explained in Section 4.2, the run times prior to breakthrough may have been longer than those expected under constant operation.

2 Background Information

2.1 Treatment Plant Description

The Rend Lake Intercity Water System (RLIWS) provides water for a population of 125,000 in Franklin, Jefferson, Hamilton, Williamson, and Perry Counties in southern Illinois. The cities of Mt. Vernon, DuQuoin, Herrin, West Frankfort, Benton, and McLeansboro are served by the RLIWS. The state approved plant capacity is 20 MGD.

The primary source water for the treatment plant is the Rend Lake. Potassium permanganate is added to control algal growth. Powdered activated carbon is added for taste and odor control. Alum is used as coagulant and the typical alum dose is 17 to 21 mg/L. A cationic polymer coagulant aid is also used, at a dose of 0.4 to 2.0 mg/L.

A summary of the plant engineering design data and chemical parameters is provided in Table 1. Tables A1 through A4 from the ICR database are included in Appendix A.

The principal challenge faced by the RLIWS is to provide water that meets USEPA DBP and microbial regulations, controlling taste and odor, and treating water under freezing temperature conditions during winter months.

2.2 Summary of Source and Finished Water Quality Data

Tables 2 and 3 summarize average source and finished water quality at the RLIWS, based on sampling between July 1997 and December 1998. These data constitute preliminary ICR monitoring results and have not yet undergone EPA review. The source water is characterized by high TOC levels, averaging 5.6 mg/L. Bromide levels are moderate, averaging 84 µg/L. The RLIWS averaged a 28 percent TOC removal, yielding an average treated water TOC concentration of 4.1 mg/L. UV₂₅₄ removal averaged 32 percent. The average source water UV₂₅₄ was 0.147 1/cm, while that for the finished water was 0.068 1/cm. The source water specific UV absorbance (TSUVA, defined as UV₂₅₄/TOC) averaged 2.7 L/mg-m. After treatment, the measured TSUVA was decreased to 1.7 L/mg-m. Normally, dissolved organic carbon (DOC) is used to calculate SUVA, defined as UV₂₅₄/DOC. Since DOC is always less than or equal to TOC, TSUVA will always be greater than or equal to SUVA as defined in the Interim Enhanced Surface Water Treatment Rule.

Chloramination is practiced at RLIWS. Distribution system (DS) THM4 levels ranged from 34 to 109 µg/L and averaged 58 µg/L, below the Stage 1 MCL of 80 µg/L or 64 µg/L with a 20 percent safety factor, but exceeding the placeholder for Stage 2 MCL of 40 µg/L or 32 µg/L with a 20 percent safety factor. DS-HAA5 averaged 23 µg/L, lower than the Stage 1 MCL of 60 µg/L or 48 µg/L with a 20 percent safety factor, and the placeholder for Stage 2 MCL of 30 or 24 µg/L with a 20 percent safety factor. DS-HAA5 concentrations also showed a wide seasonal variability.

Unit Process	Process Description
Rapid Mix	Type of Mixer: Mechanical Baffling Type: Average Liquid Volume (gal): 17,952 Short Circuiting Factor: 0.0 Mean Velocity Gradient (sec ⁻¹): 114 Chemical Addition: Potassium permanganate Chemical Dose (mg/L): 2.30 Chemical Addition: Powdered activated carbon Chemical Dose (mg/L): 0.30 Chemical Addition: Calcium hydroxide Chemical Dose (mg/L): 50.0 Chemical Addition: Aluminum sulfate (Alum) Chemical Dose (mg/L): 18.0 Chemical Addition: Organic polymer - coagulant aid Chemical Dose (mg/L): 0.60
Flocculation	Type of Mixer: Mechanical Liquid Volume (gal): 162,344 Short Circuiting Factor: NA Baffling Type: Average Stage Sequence Number: 1 Stage Mean Velocity Gradient (sec ⁻¹): 22 Stage Liquid Volume (gal): 162,344
Sedimentation	Surface Area (ft ²): 4,299 Liquid Volume (gal): 578,772 Baffling Type: Average Short Circuiting Factor: NA Tube Settler Surface Area (ft ²): 4,299 Tube Settler Brand Name: Munter
Disinfection Addition	Chemical: Anhydrous ammonia Chemical Code: NH3A Measurement Formula: NH ₃ Dose rate (mg/L): 0.90
Disinfection Addition	Chemical: Chlorine gas Chemical Code: CL2 Measurement Formula: Cl ₂ Dose rate (mg/L): 6.00
Filtration	Surface Area (ft ²): 4,360 Liquid Volume (gal): 247,313 Total Media Depth (in): 42 Media Type: DUAL Minimum Water Depth To Top of Media (ft): 5.8 Depth From Top of Media to Top of Backwash Trough (ft): 4.3
Clearwell	Surface Area (ft ²): 160,000 Liquid Volume (gal): 4,000,000 Minimum Liquid Volume (gal): 1,600,000 Baffling Type: Average Short Circuiting Factor: NA Covered Indicator Code: Yes

NA: Not available

Table 1 Summary of treatment plant design data

Water quality parameter	Mean	Standard deviation	Minimum	Maximum	Count
Temperature (°C)	18	8	5	28	18
pH	7.9	0.1	7.8	8.2	18
Turbidity (ntu)	3.9	2.4	0.1	8.6	18
Alkalinity (mg/L as CaCO ₃)	57	34	10	186	18
Total hardness (mg/L as CaCO ₃)	105	6	93	114	18
Calcium hardness (mg/L as CaCO ₃)	58	17	27	76	18
TOC (mg/L)	5.6	1.3	4.8	10.4	18
UV ₂₅₄ (1/cm)	0.147	0.037	0.013	0.188	18
TSUVA (L/mg-m)	2.7	0.8	0.2	3.6	18
Bromide (µg/L)	84	16	56	111	18

Table 2 Summary of source water quality between July 1997 and December 1998

Water quality parameter	Mean	Standard deviation	Minimum	Maximum	Count
Temperature (°C)	18	8	5	28	18
pH	9.1	0.2	8.7	9.3	18
Turbidity (ntu)	0.07	0.02	0.02	0.1	18
TOC (mg/L)	4.1	1.1	3.0	7.9	18
UV ₂₅₄ (1/cm)	0.068	0.011	0.052	0.088	18
TSUVA (L/mg-m)	1.7	0.3	0.9	2.0	18
DS-THM4 (µg/L)	58	20	34	109	24
DS-HAA5 (µg/L)	23	7	14	38	24
DS-HAA6 (µg/L)	27	7	17	43	24

DS: distribution system; average of all distribution system sampling points

Table 3 Summary of finished and distribution system water quality between July 1997 and December 1998

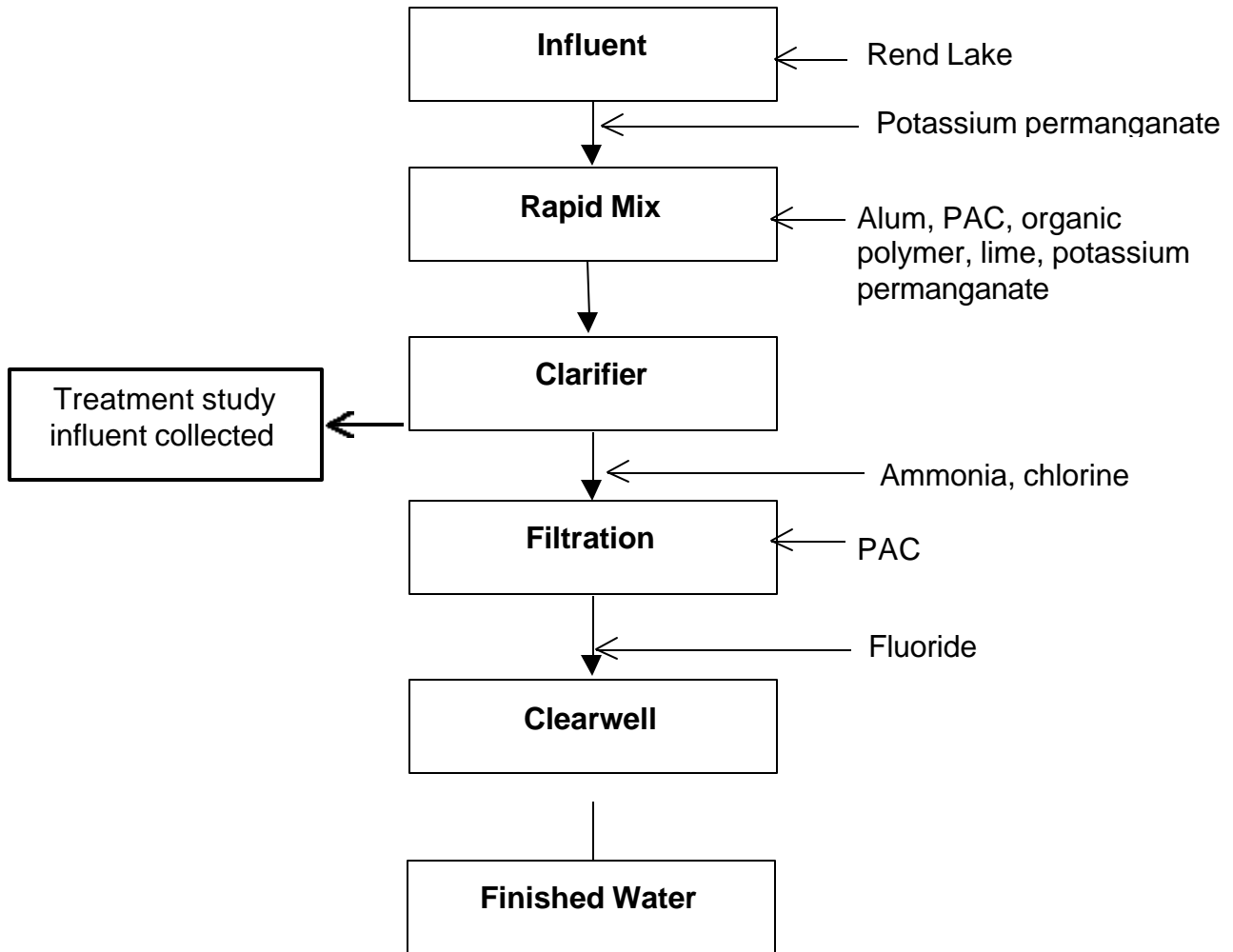


Figure 1 Treatment plant schematic

3 Materials and Methods

3.1 Treatment Study Influent Sampling Procedures

Four bench-scale GAC studies were performed throughout the year to capture seasonal variability. The influent to each bench-scale study was taken from the clarifier effluent as needed (usually once weekly) throughout testing. Therefore, variability in clarifier effluent water quality may have impacted the study results. Table 4 summarizes the time periods over which each quarterly session was conducted.

3.2 Pretreatment Processes to the Advanced Treatment Processes

The full-scale and bench-scale pretreatment processes in place prior to bench-scale GAC during all sessions are described in Figure 2. Bench-scale filtration through a 1.0- μ m cartridge filter, which simulates full-scale sand filtration, was performed as a required pretreatment step prior to RSSCT testing.

Table 5 summarizes the design data for each pretreatment process prior to GAC adsorption. Bench-scale cartridge filtration was employed as bench-scale pretreatment during all sessions.

3.3 Advanced Treatment Process Information

3.3.1 Descriptions of the Process Equipment Used

Glass columns and Teflon tubing was used as construction material for the RSSCTs. The design data for the RSSCTs conducted during each session are summarized in Table 6. During each session, two RSSCTs were operated to simulate full-scale equivalent EBCTs of 10 and 20 minutes. Other than the EBCT, the design for the two RSSCTs operated during each session was identical. The scaling factor used for all sessions, based on the ratio of full-scale to bench-scale GAC particle size, was 9.8. Therefore, 9.8 days of full-scale operation were simulated with each day of RSSCT operation. The column inner diameter was 11.0 mm. A minimum Reynolds number of 0.50 was used. The RSSCT design during all quarters was based on a full-scale temperature of 20°C.

A representative sample of Filtrasorb 400 (F-400), a bituminous-coal based GAC, was obtained from the manufacturer, Calgon Carbon Corporation. The GAC is a 12x40 mesh size (average particle diameter, $d_p = 1.1$ mm). The GAC was ground to a 100x200 mesh size, which yielded GAC with average particle diameter, d_p , of 0.112 mm.

The RSSCTs were operated intermittently. Specifically, the RSSCTs were operated 8 hours per day, and shut off at the end of the day and on weekends and holidays. Therefore, the actual time of operation used to calculate full-scale operation time, approximately 25 percent of the total experimental time. The shutdown periods were taken into account when calculating full-scale equivalent run times.

3.4 Experimental Design

The treatment study was designed to evaluate the impact of seasonal variability on the performance of bituminous coal-based GAC at two EBCTs, 10 and 20 minutes. Four sessions were conducted to perform this evaluation. The experimental design is summarized in Table 6. The RSSCT design utilized during each quarter of testing was identical. Due to a miscalculation, the mass of GAC determined for the 10 minute EBCT contactor was 4 percent below the design value. However, since the subsequent EBCT tested, 9.6 minutes, is within 5 percent of the design EBCT of 10 minutes, the design EBCT can be used for data analysis.

3.5 Simulated Distribution System (SDS) Chlorination Conditions

The target simulated distribution system (SDS) conditions are summarized in Table 7. During all sessions, a 24-hour holding time was targeted. The samples were not buffered. The target free chlorine residual after 24 hours was 0.5 to 1.5 mg/L as Cl₂. The incubation temperature varied within each study, based on plant water temperature.

3.6 Analytical Methods

All analyses were conducted following the QA/QC guidelines listed in the *DBP/ICR Analytical Methods* Manual. A list of all analytical methods used during the study is shown in Table 8. A summary listing the laboratories involved for analytical support and the period over which analyses were conducted by each laboratory is shown in Table 9. Contact information for the laboratories involved is summarized in Table 10.

Session	Testing period
1	March 9, 1998 - May 27, 1998
2	June 16, 1998 - September 15, 1998
3	September 29, 1998 - January 5, 1999
4	January 26, 1999 - March 31, 1999

Table 4 Sampling dates for quarterly GAC bench-scale treatment study sessions

Unit Process	Process Description
Full-Scale Rapid Mix	<p>Type of Mixer: Mechanical Baffling Type: Average Liquid Volume (gal): 17,952 Short Circuiting Factor: 0.0 Mean Velocity Gradient (sec^{-1}): 114</p> <p>Chemical Addition: Potassium permanganate Chemical Dose (mg/L): 2.30 Chemical Addition: Powdered activated carbon Chemical Dose (mg/L): 0.30 Chemical Addition: Calcium hydroxide Chemical Dose (mg/L): 50.0 Chemical Addition: Aluminum sulfate (Alum) Chemical Dose (mg/L): 18.0 Chemical Addition: Organic polymer - coagulant aid Chemical Dose (mg/L): 0.60</p>
Full-Scale Flocculation	<p>Type of Mixer: Mechanical Liquid Volume (gal): 162,344 Short Circuiting Factor: NA Baffling Type: Average</p> <p>Stage Sequence Number: 1 Stage Mean Velocity Gradient (sec^{-1}): 22 Stage Liquid Volume (gal): 162,344</p>
Full-Scale Sedimentation	<p>Surface Area (ft^2): 4,299 Liquid Volume (gal): 578,772 Baffling Type: Average Short Circuiting Factor: NA Tube Settler Surface Area (ft^2): 4,299 Tube Settler Brand Name: Munter</p>
Bench-Scale Cartridge Filtration	<p>Surface Area (ft^2): NA Nominal Pore Size (μm): NA Filter Material: NA Filter Life (gallons of processed water): NA</p>

NA: Not available

Table 5 Summary of design data for each pretreatment process prior to GAC

Design parameter	Design value
GAC manufacturer	Calgon Carbon Co.
GAC brand name	F-400
GAC type	Bituminous
GAC mesh size	12x40
Average particle diameter, d_{LC} (mm)	1.1
General design parameters	
Minimum Reynold's number, $Re_{SC, min}$ (-)	0.50
Full-scale operating temperature ($^{\circ}C$)	20
Kinematic viscosity, ν_{LC} (m^2/s)	1.00E-06
Bed porosity, ϵ_{LC} (-)	0.45
Measured dry bed density, ρ_{SC} (g/cm^3)	0.5
RSSCT design parameters	
RSSCT mesh size	100x200
Particle diameter, d_{SC} (mm)	0.112
Scaling factor, SF	9.82
Hydraulic loading rate, ν_{SC} (m/hr)	7.23
Column diameter, D_{SC} (mm)	11.0
Flow rate, Q_{SC} (mL/min)	11.5
Estimated run length	
RSSCT Influent TOC concentration (mg/L)	4.0
Bed volumes to 50% TOC breakthrough, BV_{50}	3,579
Estimated total run time, BV_T	12,527
RSSCT 1	
Full-scale empty-bed contact time, $EBCT_{LC}$ (min)	9.6
Estimated full-scale run time, t_{LC}^T (days)	83
Estimated RSSCT run time, t_{SC}^T (days)	8.5
Volume water required, V_{SC} (L)	140
Mass GAC required, m_{SC} (g)	5.59
RSSCT empty-bed contact time, $EBCT_{SC}$ (min)	0.98
Bed length, l_{SC} (cm)	11.8
RSSCT 2	
Full-scale empty-bed contact time, $EBCT_{LC}$ (min)	20
Estimated full-scale run time, t_{LC}^T (days)	174
Estimated RSSCT run time, t_{SC}^T (days)	17.7
Volume water required, V_{SC} (L)	292
Mass GAC required, m_{SC} (g)	11.66
RSSCT empty-bed contact time, $EBCT_{SC}$ (min)	2.04
Bed length, l_{SC} (cm)	24.5

Table 6 Summary of RSSCT design parameters

Water quality parameter	Value during testing period			
	1 (Spring)	2 (Summer)	3 (Fall-Winter)	4 (Winter-Spring)
Incubation time (hr) [*]	24	24	24	24
Incubation temperature (°C) [†]	8 - 23	24 - 28	19 - 26	20 - 27
Incubation pH [†]	7.9 - 10.0	8.0 - 9.4	8.2 - 9.6	8.1 - 8.9
Free chlorine residual (mg/L) [*]	0.5	0.5	0.5	0.5

^{*}Target

[†]Measured range

Table 7 Summary of SDS chlorination conditions

Analyte	Session	Method	Minimum reporting level (MRL)
Alkalinity	All	SM 2320 B	NA
Ammonia-Nitrogen	All	EPA 350.1	0.01 mg/L as NH ₃ -N
Bromide	2	EPA 300	0.02 mg/L
Bromide	3	EPA 300.0	0.02 mg/L
Calcium hardness	All	SM 3500-Ca D	NA
Chlorine residual	All	SM 4500-Cl F	NA
HAA (DCAA, TCAA, MBAA, DBAA, BCAA)	All	EPA 552.2	1.0 µg/L (each analyte)
HAA (MCAA)	All	EPA 552.2	2.0 µg/L (each analyte)
pH	All	4500-H ⁺ B	NAp
Temperature	All	SM 2550 B	NAp
Total hardness	All	SM 2340 B	NA
Total organic carbon (TOC)	All	SM 5310 C	0.70 mg/L
Total organic halide (TOX)	All	SM 5320 B	50 µg/L as Cl ⁻ (1)
THM (CHCl ₃ , BDCM, DBCM, CHBr ₃)	All	EPA 502.2	1.0 µg/L (each analyte)
Turbidity	All	SM 2130 B	NA
UV absorbance at 254 nm (UV ₂₅₄)	All	SM 5910	0.002 cm ⁻¹ ?

(1) For 1 sample during each of the second and third quarters, an MRL of 25 µg/L as Cl⁻ was used. For all other samples, the MRL was 50 µg/L as Cl⁻.

SM: *Standard Methods*

NA: Not available

NAp: Not applicable

Table 8 Summary of analytical methods and MRLs

Analyses performed	Quarters of service	Laboratory
Alkalinity, calcium hardness, chlorine residual, pH, temperature, total hardness, turbidity	All	Rend Lake Lab
TOC, UV ₂₅₄ , TOX, ammonia	All	Illinois EPA Champaign Inorganic Laboratory
THM4, HAA6	All	Illinois EPA Springfield Organic Laboratory
TOX	All (1 to 3 samples per quarter only)	Environmental Health Laboratories
Bromide	3	Illinois EPA Champaign Inorganic Laboratory
Bromide	2	Environmental Health Laboratories
TOC	1, 3 (1 sample per quarter only)	Environmental Health Laboratories

Table 9 Summary of laboratories conducting analyses

	Rend Lake Lab	Illinois EPA Champaign Inorganic Laboratory	Illinois EPA Springfield Organic Laboratory	Environmental Health Laboratories
ICR lab ID number	ICRIL014	ICRIL003	ICRIL004	ICRIN004
Contact name:	Paul E. Adams	Chris Ooms, Laboratory QAO	Patricia Kloppenburger, Laboratory QAO	Diane L. Harper Wet Chemistry Section Manager
Contact phone number	(618) 439-4394	(217) 333-6907	(217) 782-9780	(219) 233-4777
Contact fax number	(618) 439-4398	(217) 244-3798	(217) 524-6375	(219) 233-8207

Table 10 Laboratory contact information

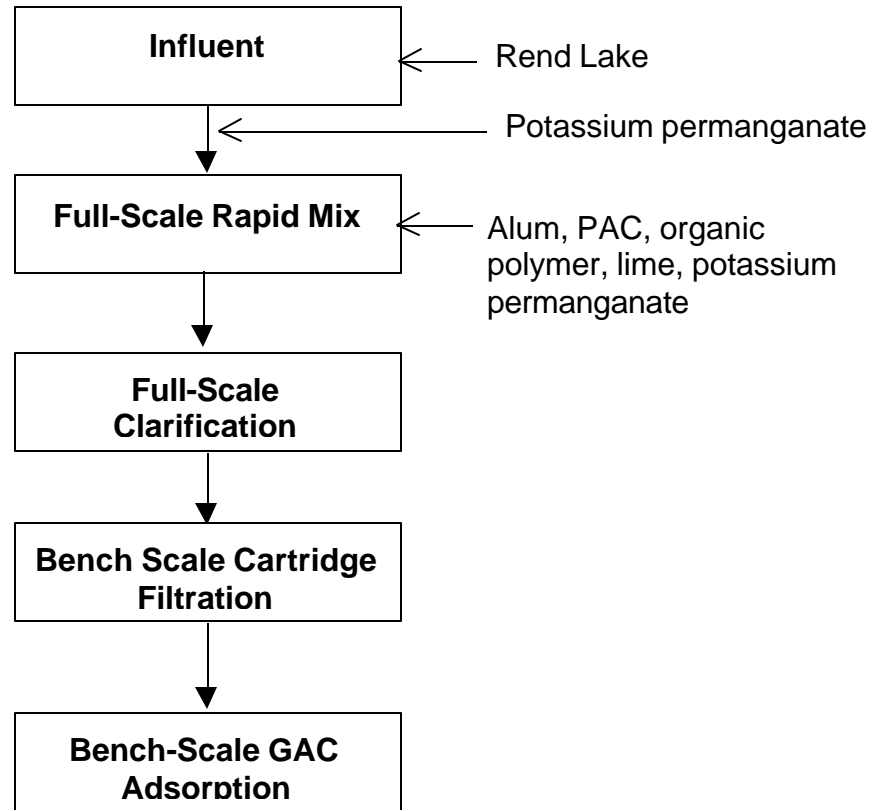


Figure 2 Schematic of pretreatment processes prior to bench-scale GAC

4 Results and Discussion

4.1 Pretreated Influent Water Quality Data

Table 11 summarizes the average influent water quality measured during each quarter of testing. The mean GAC influent TOC concentration ranged between 3.6 and 5.0 mg/L. Influent SDS-DBPs were low, usually below the Stage 2 placeholder MCLs for THM4 and HAA5.

Water quality parameter	Mean value during testing period			
	1 (Spring)	2 (Summer)	3 (Fall-Winter)	4 (Winter-Spring)
Temperature (°C)	15	26	15	7
pH	10.1	9.9	9.9	9.4
Turbidity (ntu)	0.06	0.04	0.04	0.07
Alkalinity (mg/L as CaCO ₃)	26	30	40	44
Total hardness (mg/L as CaCO ₃)	80	71	77	90
Calcium hardness (mg/L as CaCO ₃)	59	52	48	55
Ammonia (mg/L as N)	NA	0.2	0.01	NA
Bromide (µg/L)	NA	58	79	NA
TOC (mg/L)	3.7	3.6	4.4	5.0
UV ₂₅₄ (1/cm)	0.059	0.060	0.080	0.091
TSUVA (L/mg-m)	1.6	1.6	1.8	1.8
SDS-chlorine demand (mg/L)	1.6	2.0	1.8	1.9
<i>SDS DBPs</i>				
SDS-THM4 (µg/L)	23	33	40	11
SDS-HAA5 (µg/L)	13	17	21	6
SDS-HAA6 (µg/L)	15	22	25	8
SDS-TOX (µg/L as Cl ⁻)	155	139	163	166
<i>SDS incubation conditions</i>				
Incubation time (hr)	24	24	24	24
Incubation temperature (°C)	15	26	23	25
Incubation pH	9.6	9.0	9.4	8.6
Free chlorine residual (mg/L)	0.43	0.20	0.20	0.1

NA: not analyzed

Table 11 Summary of GAC influent water quality

4.2 Problems Encountered

The RSSCTs were operated intermittently: they were run for about 8 hours per day, and shut off on weekends and holidays. It is not clear what the impact of this mode of operation may have been on the experimental results. Based on the breakthrough data, described in Section 4.3, TOC

breakthrough did not occur above the MRL for three of the four runs. This behavior is highly unusual given the average influent TOC concentration ranging between 3.6 and 5.0 mg/L. Based on the schedule of intermittent operation of the RSSCTs, the columns were in flow mode (operating) for about 25 percent of the total experimental time. Therefore, for 75 percent of the experimental run, no flow of water occurred through the columns. This extensive downtime period may have allowed for more efficient adsorption of natural organic matter to the GAC during flow conditions, yielding longer than normal run times prior to TOC breakthrough.

4.3 Summary of Significant Results

Appendix B contains a summary of the GAC effluent data obtained in graphical format. During the first session, GAC breakthrough occurred to a limited extent at the very end of the experimental run time, after approximately 150 days of scaled operation time. During the remaining quarters of testing, TOC levels did not increase above the MRL for either the 10 or 20 minute EBCT contactors. During the second and third quarters, the RSSCTs were operated for over 200 full-scale equivalent days, and during the fourth quarter, the RSSCTs were operated for over 140 full-scale equivalent days. These results were also observed for most of the UV-254 and SDS-DBP data during all sessions: no breakthrough was achieved. Due to intermittent operation of the columns, as explained in Section 4.2, the run times prior to breakthrough may have been longer than those expected under constant operation. The *Data Collection Spreadsheets* are included in Appendix C.

5 QA/QC Summary

All analyses performed during the treatment study followed the methods and QA/QC procedures required by the *DBP/ICR Analytical Methods Manual*. The EPA has requested that the results of laboratory duplicate analyses, laboratory fortified matrix spike analyses, and any performance evaluation (PE) analyses be reported in the *Treatment Study Summary Report Spreadsheet*, an electronic Excel workbook supplied by EPA. The required data has been input into this file, and an electronic version of it is included as an attachment to this report. Appendix D contains the *Treatment Study Summary Report Spreadsheet* in hard copy format.

Appendix A: ICR Database Reports

A.1 -- Initial Sampling Plan by Location

Date: 10/20/99

PWS Name: Rend Lake Intercity Water System

PWS ID: IL0555100

WIDB:

ICR Contact Person: Mr. Paul Adams

Sampling Period: Design

Design Sampling Start Date: 7/14/97

Design Sampling End Date: 12/16/98

Seq. No.	Sample Location Name	Sample Location Type	Sample Loc. No.	Sample ID Number	Laboratory Name	Laboratory ICR ID
Treatment Plant Name: Rend Lake Intercity Water System						
ICR Treatment Plant ID No: 358						
Treatment Plant Category: CONV						
	Influent	INF	1	358009601BACT	Carbondale Lab	ICRIL022
				358009601Br	IEPA Champaign	ICRIL003
				358009601CLD	Rend Lake Lab	ICRIL014
				358009601NH3	IEPA Champaign	ICRIL003
				358009601PROT	BioVir	ICRCA200
				358009601TOC	IEPA Champaign	ICRIL003
				358009601TOX	IEPA Springfield	ICRIL004
				358009601UV-254	IEPA Champaign	ICRIL003
				358009601VIRU	BioVir	ICRCA200
				358009601WQP	Rend Lake Lab	ICRIL014

Process Train Name: Rend Lake Water Plant

Process Train Category: CONV

Seq. No.	Sample Location Name	Sample Location Type	Sample Loc. No.	Sample ID Number	Laboratory Name	Laboratory ICR ID
1	Rapid Mix	Rapid Mix	2			
2	Flocculation	Flocculation Basin	3			
3	Sedimentation	Sedimentation	4			
				358009604TOC	IEPA Champaign	ICRIL003
				358009604UV-254	IEPA Champaign	ICRIL003
				358009604WQP	Rend Lake Lab	ICRIL014
4	Anhydrous ammon	Disinfectant Addition	8			
5	Chlorine gas	Disinfectant Addition	5			
6	Filtration	Filtration	6			
				358009606CH	IEPA Springfield	ICRIL004
				358009606CL2	Rend Lake Lab	ICRIL014
				358009606HAA	IEPA Springfield	ICRIL004
				358009606TOC	IEPA Champaign	ICRIL003
				358009606TOX	IEPA Springfield	ICRIL004
				358009606UV-254	IEPA Champaign	ICRIL003
				358009606WQP	Rend Lake Lab	ICRIL014
				358009706HAN	IEPA Springfield	ICRIL004
				358009706THM	IEPA Springfield	ICRIL004
7	Clearwell	Clearwell	7			
	Finished Water	FIN	9			
				358009609BACT	Carbondale Lab	ICRIL022
				358009609CH	IEPA Springfield	ICRIL004

Seq. No.	Sample Location Name	Sample Location Type	Sample Loc. No.	Sample ID Number	Laboratory Name	Laboratory ICR ID
				358009609CL2	Rend Lake Lab	ICRIL014
				358009609CNCI	USEPA	ICROH031
				358009609HAA	IEPA Springfield	ICRIL004
				358009609PROT	BioVir	ICRCA200
				358009609TOC	IEPA Champaign	ICRIL003
				358009609TOX	IEPA Springfield	ICRIL004
				358009609UV-254	IEPA Champaign	ICRIL003
				358009609VIRU	BioVir	ICRCA200
				358009609WQP	Rend Lake Lab	ICRIL014
				358009709HAN	IEPA Springfield	ICRIL004
				358009709THM	IEPA Springfield	ICRIL004

Seq. No.	Sample Location Name	Sample Location Type	Sample Loc. No.	Sample ID Number	Laboratory Name	Laboratory ICR ID
Distribution System Samples for Non-Blending Plants						
Treatment Plant Name: Rend Lake Intercity Water System						
ICR Treatment Plant ID No: 358						
	Rend Lake Intercity Plant	SDS	10			
				358009610CH	IEPA Springfield	ICRIL004
				358009610CL2	Rend Lake Lab	ICRIL014
				358009610HAA	IEPA Springfield	ICRIL004
				358009610TOX	IEPA Springfield	ICRIL004
				358009610WQP	Rend Lake Lab	ICRIL014
				358009710HAN	IEPA Springfield	ICRIL004
				358009710THM	IEPA Springfield	ICRIL004
	Rend Lake Maintenance Shop	DSE	11			
				358009611CH	IEPA Springfield	ICRIL004
				358009611CL2	Rend Lake Lab	ICRIL014
				358009611HAA	IEPA Springfield	ICRIL004
				358009611TOX	IEPA Springfield	ICRIL004
				358009611WQP	Rend Lake Lab	ICRIL014
				358009711HAN	IEPA Springfield	ICRIL004
				358009711THM	IEPA Springfield	ICRIL004
	Mt. Vernon Booster Station	AVG	12			
				358009612CH	IEPA Springfield	ICRIL004
				358009612CL2	Rend Lake Lab	ICRIL014
				358009612HAA	IEPA Springfield	ICRIL004
				358009612TOX	IEPA Springfield	ICRIL004

Seq. No.	Sample Location Name	Sample Location Type	Sample Loc. No.	Sample ID Number	Laboratory Name	Laboratory ICR ID
				358009612WQP	Rend Lake Lab	ICRIL014
				358009712HAN	IEPA Springfield	ICRIL004
				358009712THM	IEPA Springfield	ICRIL004
	West Frankfort Booster Station	AVG	13			
				358009613CH	IEPA Springfield	ICRIL004
				358009613CL2	Rend Lake Lab	ICRIL014
				358009613HAA	IEPA Springfield	ICRIL004
				358009613TOX	IEPA Springfield	ICRIL004
				358009613WQP	Rend Lake Lab	ICRIL014
				358009713HAN	IEPA Springfield	ICRIL004
				358009713THM	IEPA Springfield	ICRIL004
	Herrin Booster Station	MAX	14			
				358009614CH	IEPA Springfield	ICRIL004
				358009614CL2	Rend Lake Lab	ICRIL014
				358009614CNCI	USEPA	ICROH031
				358009614HAA	IEPA Springfield	ICRIL004
				358009614TOX	IEPA Springfield	ICRIL004
				358009614WQP	Rend Lake Lab	ICRIL014
				358009714HAN	IEPA Springfield	ICRIL004
				358009714THM	IEPA Springfield	ICRIL004

End of Report A.1 --Initial Sampling Plan By Location

A.2 -- Design Plant Parameters

Date: 10/20/99

PWS Name: Rend Lake Intercity Water System

PWS ID: IL0555100

WIDB:

ICR Contact Person: Mr. Paul Adams

Sampling Period: Design

Design Sampling Start Date: 7/14/97

Design Sampling End Date: 12/16/98

Treatment Plant Name: Rend Lake Intercity Water System

ICR Treatment Plant ID: 358

Treatment Plant PWS ID:

Treatment Plant Category: CONV

State Approved Plant Capacity (MGD): 20.0

Historical Min. Water Temperature (deg C): 2.0

Installed Sludge Handling Capacity (DPD): 2,000.00

Blending Indicator: N

Water Resource Name: Rend Lake

Water Resource Type: Reservoir/lake

Average Residence Time (Days): 858

Intake Name: Rend Lake Intake

Watershed Control: Y

Hydrologic Unit Code: 07140106

River Reach:

Latitude (degrees, minutes, seconds): +38°3'10"

Longitude (degrees, minutes, seconds): -88°57'20"

River Reach Miles:

Seq. Sample No. Location Name	Sample Location Type	Sample Loc. No.
-------------------------------------	----------------------------	-----------------------

Influent

INF

1

Process Train Name: Rend Lake Water Plant

Process Train Category: CONV

Seq. Sample No. Location Name	Sample Location Type	Sample Loc. No.	
1 Rapid Mix	Rapid Mix	2	Type of Mixer: ME Baffling Type: AV Liquid Volume (gal): 17,952 Short Circuiting Factor: 0.0 Mean Velocity Gradient (sec-1): 114.0
2 Flocculation	Flocculation Basin	3	Type of Mixer: ME Liquid Volume (gal): 162,344 Short Circuiting Factor: Baffling Type: AV Stage Sequence Number: 1 Stage Mean Velocity Gradient (sec-1): 22 Stage Liquid Volume (gal): 162,344
3 Sedimentation	Sedimentation	4	Surface Area (ft2): 4,299 Liquid Volume (gal): 578,772 Baffling Type: AV Short Circuiting Factor: Plate Settler Surface Area (ft2): Plate Settler Brand Name: Tube Settler Surface Area (ft2): 4,299 Tube Settler Brand Name: Munter
4 Anhydrous ammon	Disinfectant Addition	8	Chemical Code: NH3A Measurement Formula: NH3

Seq. Sample No. Location Name	Sample Location Type	Sample Loc. No.	
			Dose Rate (mg/L): 0.90
5 Chlorine gas	Disinfectant Addition	5	Chemical Code: CL2 Measurement Formula: CL2 Dose Rate (mg/L): 6.00
6 Filtration	Filtration	6	Surface Area (ft2): 4,360 Liquid Volume (gal): 247,313 Total Media Depth (in): 42 Depth of GAC (in): Media Type: DUAL Type of Activated Carbon: Minimum Water Depth To Top of Media (ft): 5.8 Depth From Top of Media to Top of Backwash Trough (ft): 4.3
7 Clearwell	Clearwell	7	Surface Area (ft2): 160,000 Liquid Volume (gal): 4,000,000 Minimum Liquid Volume (gal): 1,600,000 Baffling Type: AV Short Circuiting Factor: Covered Indicator Code: Y
Finished Water	FIN	9	

End of Report A.2 -Design Plant Parameters

A.3 -- Design Plant Chemical Parameters

Date: 10/20/99

PWS Name: Rend Lake Intercity Water System

PWS ID: IL0555100

WIDB:

ICR Contact Person: Mr. Paul Adams

Sampling Period: Design

Sampling Start Date: 7/14/97

Sampling End Date: 12/16/98

Sep. No.	Sample Location Name	Sample Location Type	Sample Location Number	Chemical Name	Measurement Formula	Dose (mg/L)
----------	----------------------	----------------------	------------------------	---------------	---------------------	-------------

Treatment Plant Name: Rend Lake Intercity Water System

ICR Treatment Plant ID No: 358

Treatment Plant Category: CONV

Process Train Name: Rend Lake Water Plant

Process Train Category: CONV

1	Rapid Mix	Rapid Mix	2	Potassium permanganate	KMNO4	2.30
				Powdered activated carbon	C	0.30
				Calcium hydroxide	CAOH	50.00
				Aluminum sulfate (Alum)	Al2(SO4)3.14H2O	18.00
				Organic polymer - coagulant aid	Polydimethyldialylamon ium CLO2	0.60
2	Flocculation	Flocculation Basin	3			
3	Sedimentation	Sedimentation	4			
4	Anhydrous ammon	Disinfectant Addition	8			

Sep. No.	Sample Location Name	Sample Location Type	Sample Location Number	Chemical Name	Measurement Formula	Dose (mg/L)
5	Chlorine gas	Disinfectant Addition	5	Anhydrous ammonia	NH3	0.90
6	Filtration	Filtration	6	Chlorine gas	CL2	6.00
7	Clearwell	Clearwell	7	Powdered activated carbon	C	0.05
				Hydrofluorosilic acid	H2SiF6	0.42

End of Report A.3 --Design Plant Chemical Parameters

A.4 -- Design Distribution System Information

Date: 10/20/99

PWS Name: Rend Lake Intercity Water System

PWS ID: IL0555100

WIDB:

ICR Contact Person: Mr. Paul Adams

Sampling Period: Design

Design Sampling Start Date: 7/14/97

Design Sampling End Date: 12/16/98

Distribution System General Information

Typical Maximum Residence Time (days): 5.0

Storage Volume (MG): 10.0

Average Residence Time (days): 2.00

Open Storage Surface Area (ft2):

Disinfectant Booster Stations

Type	Count	High Dosage (mg/L)	Low Dosage (mg/L)
CL2			
CLNH			
CLO2			
HYP0			

Sample Location Number	Sample Location Name	Sample Location Type	Confidence Level	Contact Time from Effluent (hours)
Distribution System Sample Locations for Non-Blending Treatment Plants				
Treatment Plant Name: Rend Lake Intercity Water System				
ICR Treatment Plant ID No: 358				
10	Rend Lake Intercity Plant	SDS		1
11	Rend Lake Maintenance Shop	DSE	H	1
12	Mt. Vernon Booster Station	AVG	H	48
13	West Frankfort Booster Station	AVG	H	42
14	Herrin Booster Station	MAX	H	120

Distribution System Sample Locations for Blending Treatment Plants

End of Report A.4 -Design Distribution System Information

Appendix B: Summary of GAC Breakthrough Curves

ICR Information

ID / ICR#: IL0555100 / 358
 ICR Contact: Paul Adams
 Phone No.: 618-439-4394
 Period: 3/9/98 - 5/27/98 (79 B-S days)

Design Information

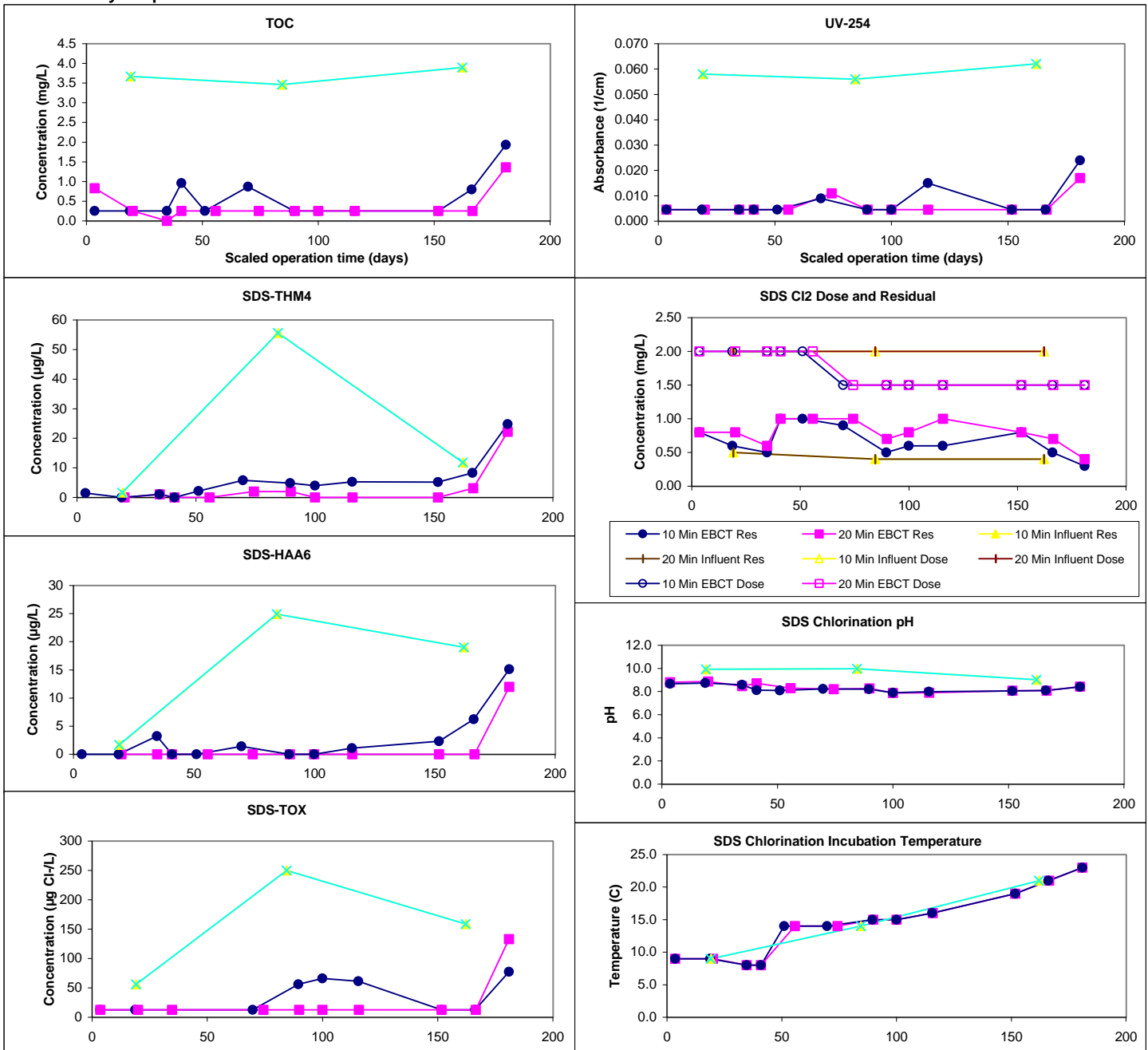
Design TOC: 3.0 mg/L
 Col Diameter: 11.0 mm
 Min Reynolds#: 0.50
 Full-Scale Temp: 21.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 100x200
 Scaling Factor: 9.36
 Meas Dry Bed Density: 0.50 g/cm3

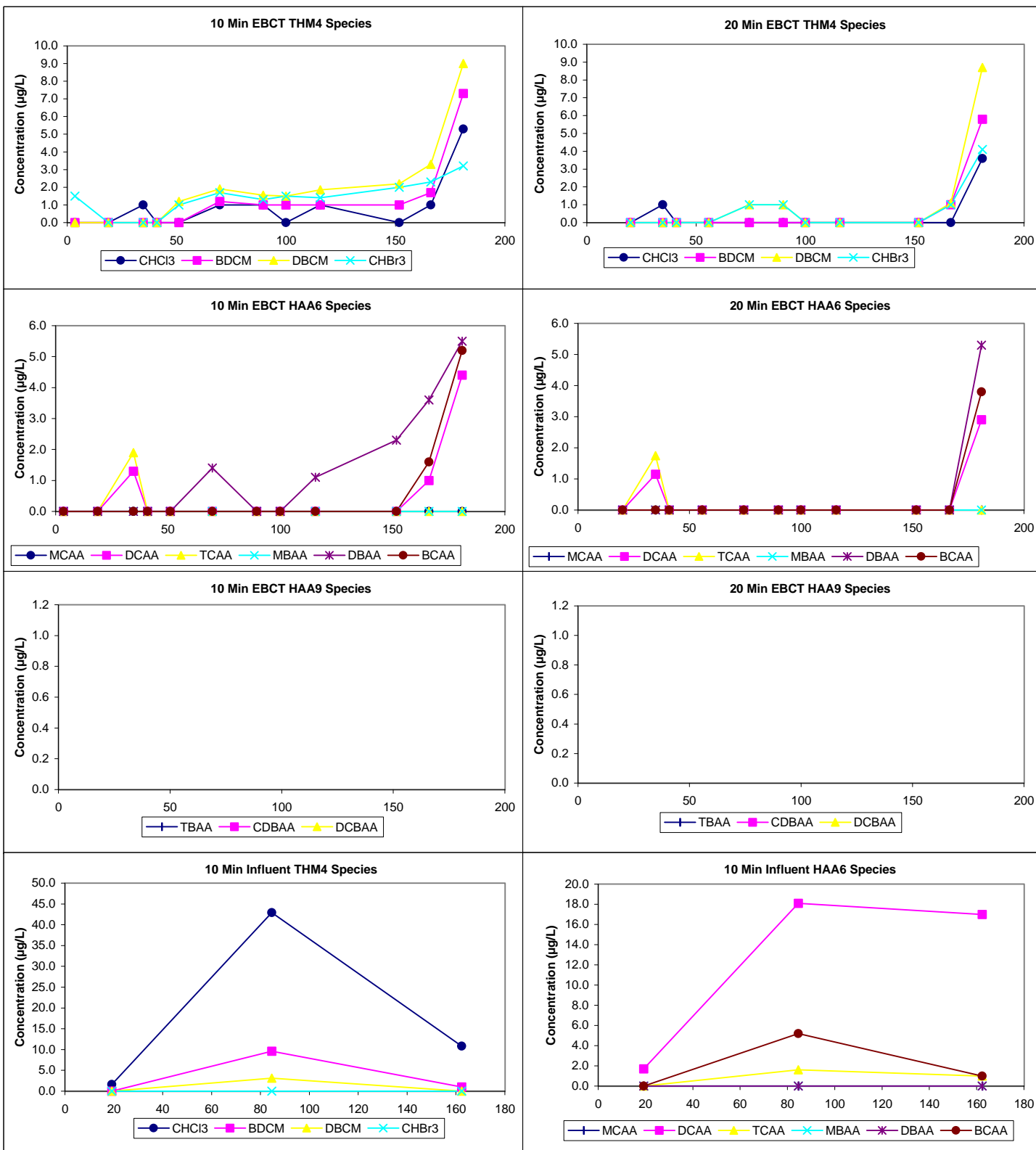
Water Quality Summary

Influent	10 Min Influent				20 Min Influent				Cumulative SDS Conditions			
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max	Res (0)	Mean	SD	Count
TOC	3.7	0.2	3	3.5 - 3.9	3.7	0.2	3	3.5 - 3.9	0.68	0.23		30
pH	10.1	0.1	3	10.0 - 10.2	10.1	0.1	3	10.0 - 10.2	14.3	5.0		30
UV254	0.059	0.003	3	0.056 - 0.062	0.059	0.003	3	0.056 - 0.062	pH	8.6	0.6	30
SUVA	1.60	0.02	3	1.58 - 1.62	1.60	0.02	3	1.58 - 1.62	Time	24.0	0.0	30
Bromide	NA	0	0	0 - 0	NA	0	0	0 - 0	Comments:			
SDS-TOX	155	97	3	56 - 250	155	97	3	56 - 250				
SDS-THM4	23	29	3	2 - 56	23	29	3	2 - 56	Chart Legend:			
SDS-HAA6	15	12	3	2 - 25	15	12	3	2 - 25				
Effluent	10 Min EBCT (79 B-S days)				20 Min EBCT (79 B-S days)				Chart Legend:			
Effluent pH	9.2	0.2	12	8.8 - 9.5	8.9	0.7	12	8.1 - 10.0				
Effluent Temp	22.8	1.2	12	20.0 - 24.0	22.8	1.1	12	21.0 - 24.0				

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: IL0555100 / 358
 ICR Contact: Paul Adams
 Phone No.: 618-439-4394
 Period: 6/16/98 - 9/14/98 (90 B-S days)

Design Information

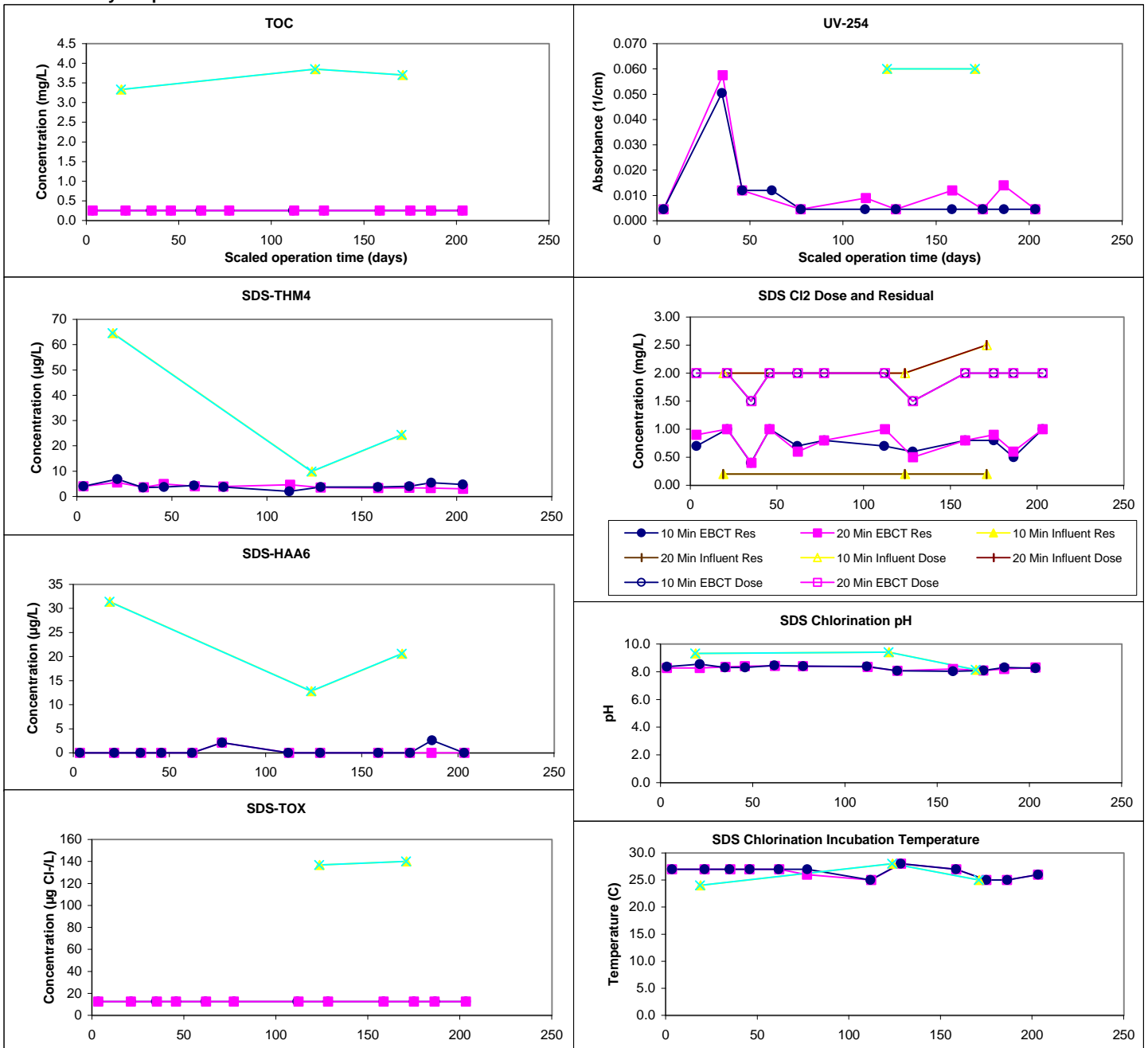
Design TOC: 3.0 mg/L
 Col Diameter: 11.0 mm
 Min Reynolds#: 0.50
 Full-Scale Temp: 21.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 100x200
 Scaling Factor: 9.36
 Meas Dry Bed Density: 0.50 g/cm3

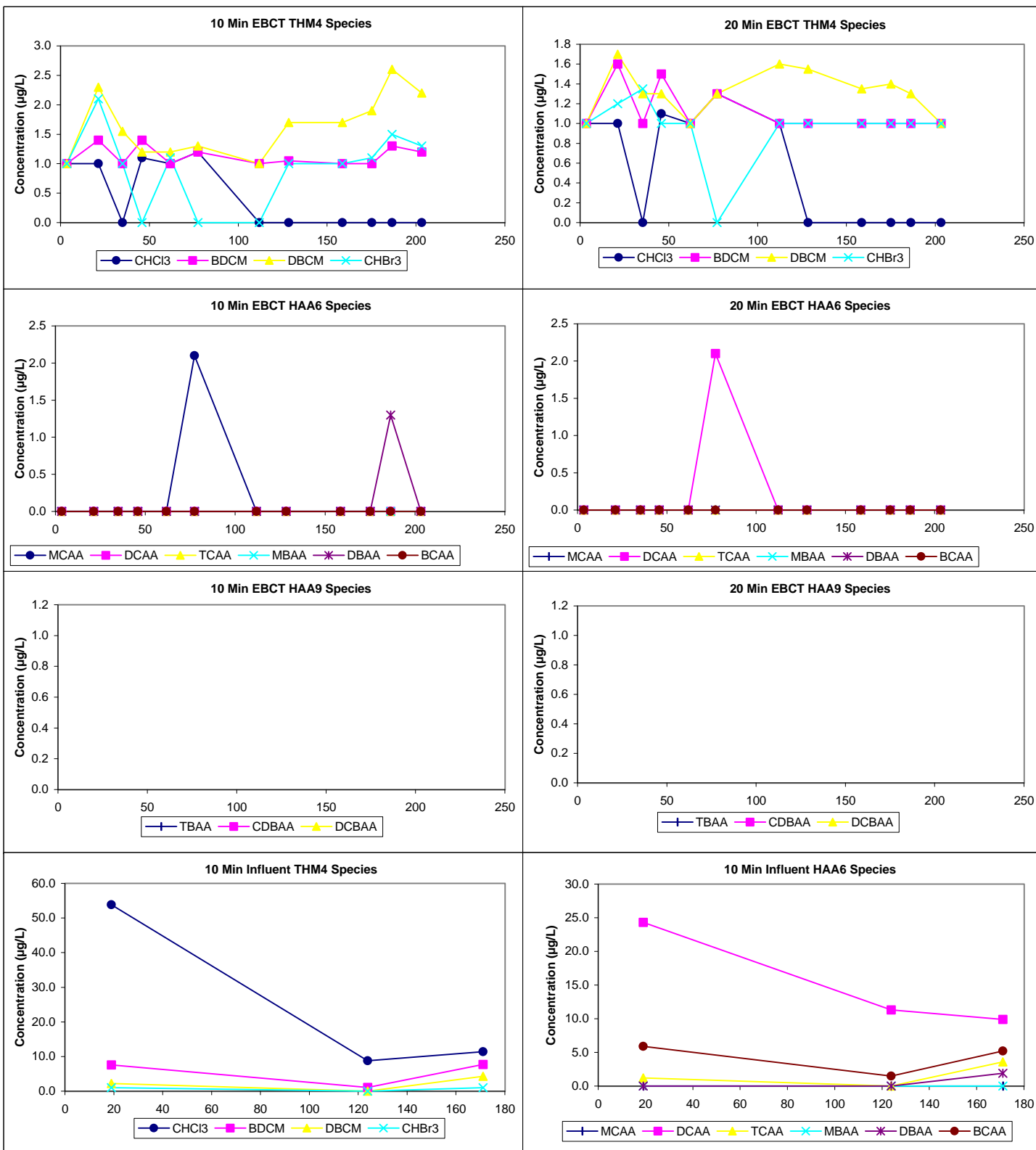
Water Quality Summary

Influent	10 Min Influent				20 Min Influent								
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max		Mean	SD	Count	Min/Max
TOC	3.6	0.3	3	3.3 - 3.9	3.6	0.3	3	3.3 - 3.9	Res (0)	0.66	0.29	30	0.20 - 1.00
pH	9.9	0.1	3	9.8 - 10.0	9.9	0.1	3	9.8 - 10.0	Temp	26.3	1.2	30	24.0 - 28.0
UV254	0.060	0.000	2	0.060 - 0.060	0.060	0.000	2	0.060 - 0.060	pH	8.4	0.4	30	8.0 - 9.4
SUVA	1.59	0.06	2	1.56 - 1.62	1.59	0.06	2	1.56 - 1.62	Time	24.0	0.0	30	24.0 - 24.0
Bromide	58	0	1	58 - 58	10	0	1	10 - 10	Comments:				
SDS-TOX	139	3	2	137 - 140	139	3	2	137 - 140					
SDS-THM4	33	28	3	10 - 65	33	28	3	10 - 65	<div><div></div>10 Min EBCT</div> <div><div></div>20 Min EBCT</div> <div><div></div>10 Min Influent</div> <div><div></div>20 Min Influent</div>				
SDS-HAA6	22	9	3	13 - 31	22	9	3	13 - 31					
Effluent	10 Min EBCT (90 B-S days)				20 Min EBCT (90 B-S days)				Chart Legend:				
Effluent pH	8.7	0.4	12	8.3 - 9.5	8.6	0.3	12	8.2 - 9.4					
Effluent Temp	26.6	2.0	12	22.0 - 30.0	26.6	2.0	12	22.0 - 30.0					

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: IL0555100 / 358
 ICR Contact: Paul Adams
 Phone No.: 618-439-4394
 Period: 9/27/98 - 1/5/99 (100 B-S days)

Design Information

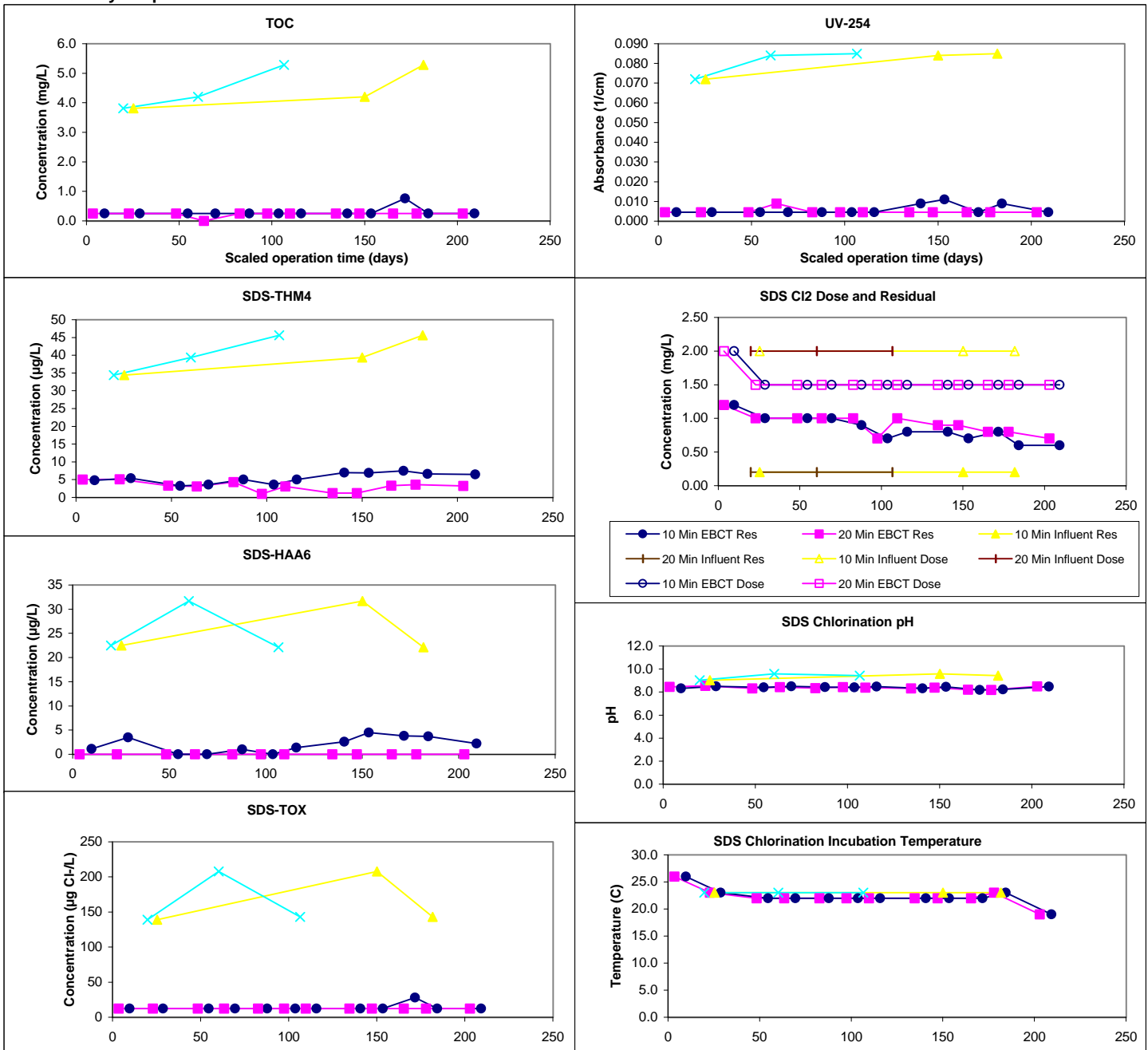
Design TOC: 3.0 mg/L
 Col Diameter: 11.0 mm
 Min Reynolds#: 0.50
 Full-Scale Temp: 21.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 100x200
 Scaling Factor: 9.36
 Meas Dry Bed Density: 0.50 g/cm3

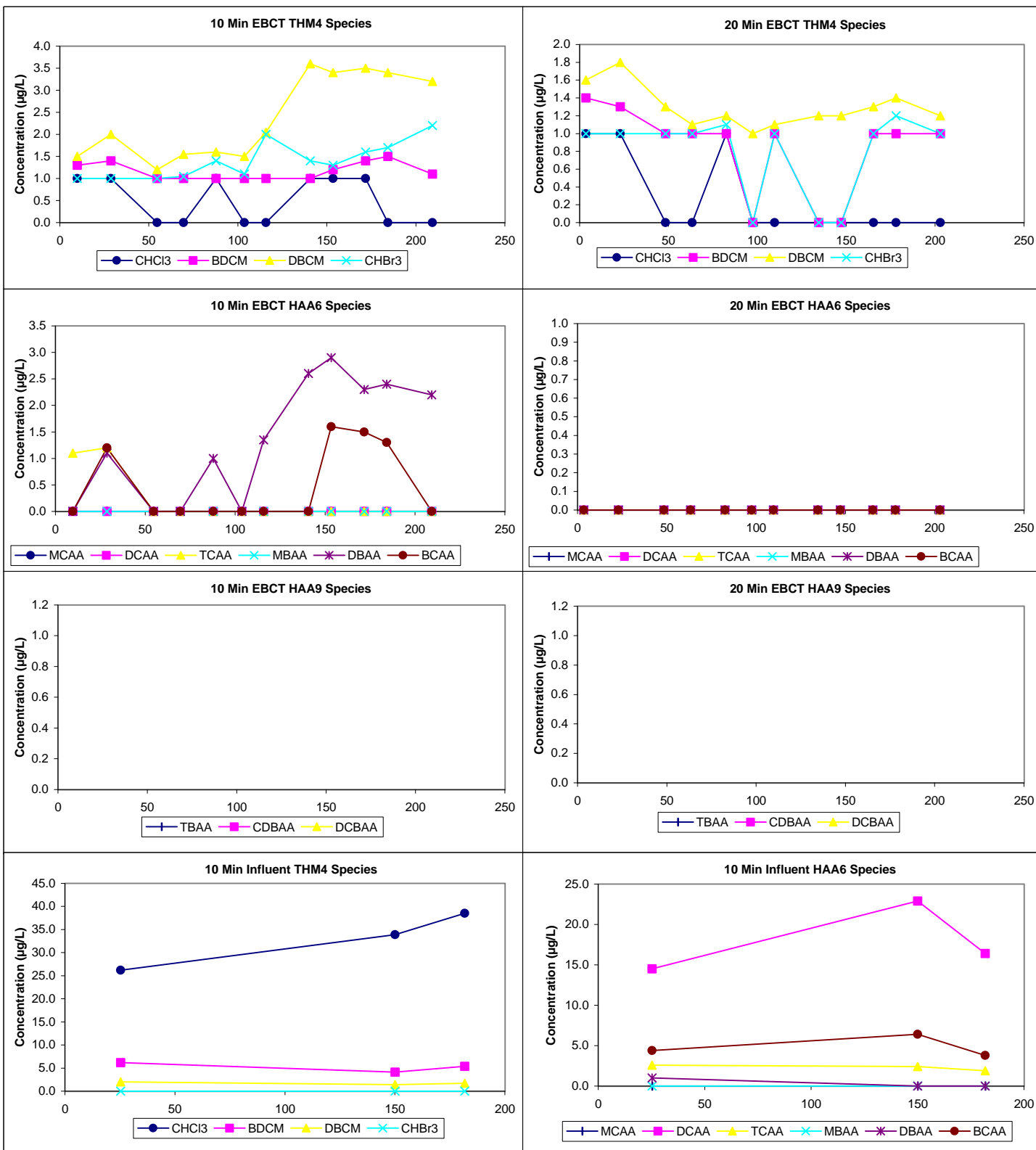
Water Quality Summary

Influent	10 Min Influent				20 Min Influent				Res (0)	Mean	SD	Count	Min/Max
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max					
TOC	4.4	0.8	3	3.8 - 5.3	4.4	0.8	3	3.8 - 5.3					
pH	9.9	0.1	3	9.8 - 10.1	9.9	0.1	3	9.8 - 10.1	Temp	22.4	1.4	30	19.0 - 26.0
UV254	0.080	0.007	3	0.072 - 0.085	0.080	0.007	3	0.072 - 0.085	pH	8.6	0.4	30	8.2 - 9.6
SUVA	1.83	0.20	3	1.61 - 2.00	1.83	0.20	3	1.61 - 2.00	Time	24.0	0.0	30	24.0 - 24.0
Bromide	NA	0	0	0 - 0	NA	0	0	0 - 0	Comments:				
SDS-TOX	163	39	3	139 - 208	163	39	3	139 - 208					
SDS-THM4	40	6	3	34 - 46	40	6	3	34 - 46	Chart Legend:				
SDS-HAA6	25	5	3	22 - 32	25	5	3	22 - 32					
Effluent	10 Min EBCT (98 B-S days)				20 Min EBCT (98 B-S days)								
Effluent pH	8.7	0.2	12	8.4 - 9.1	8.7	0.5	12	8.3 - 9.5					
Effluent Temp	22.5	0.7	12	22.0 - 24.0	22.5	0.7	12	22.0 - 24.0					

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: IL0555100 / 358
 ICR Contact: Paul Adams
 Phone No.: 618-439-4394
 Period: 1/26/99 - 3/31/99 (64 B-S days)

Design Information

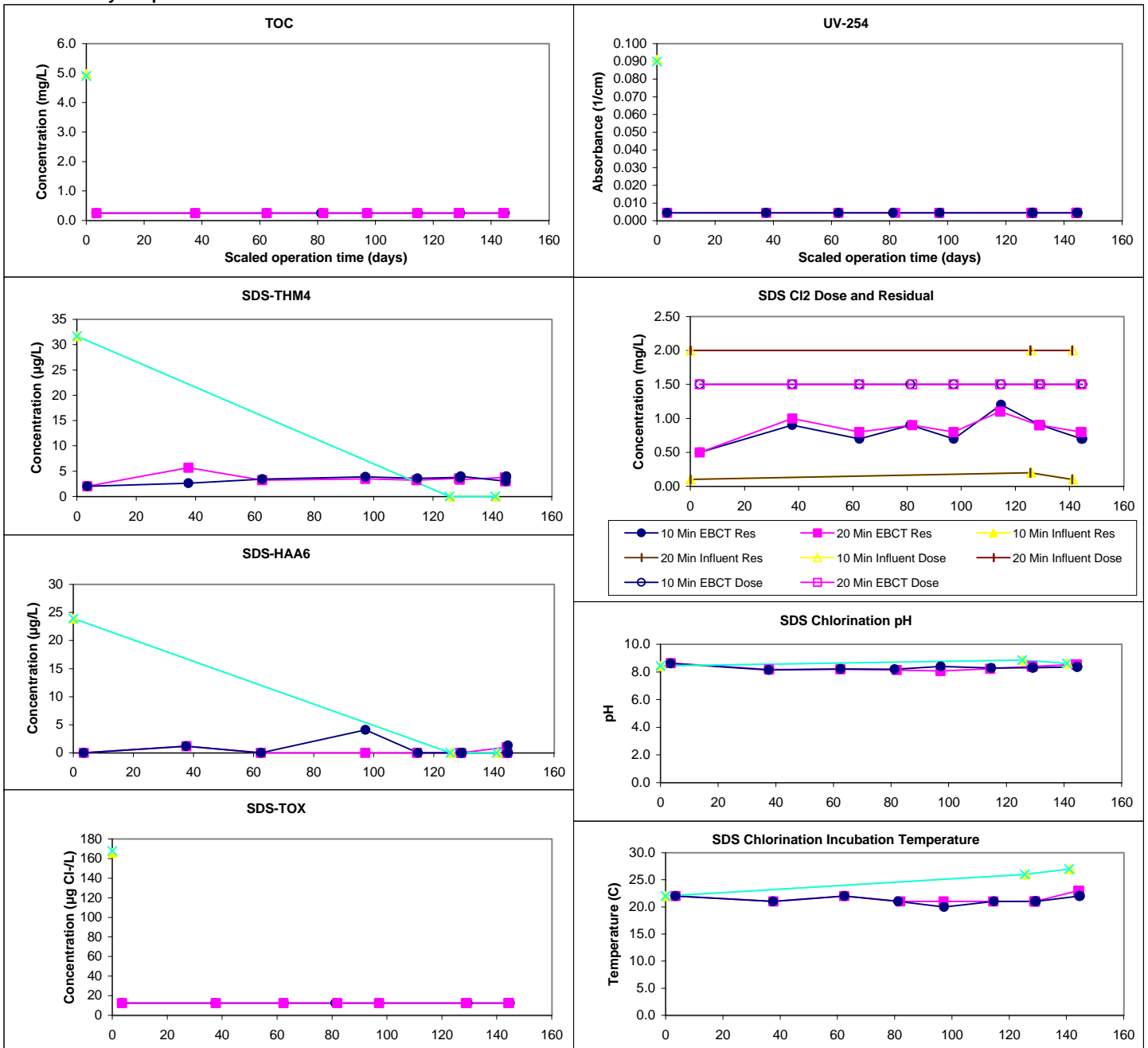
Design TOC: 3.0 mg/L
 Col Diameter: 11.0 mm
 Min Reynolds#: 0.50
 Full-Scale Temp: 21.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 100x200
 Scaling Factor: 9.36
 Meas Dry Bed Density: 0.50 g/cm3

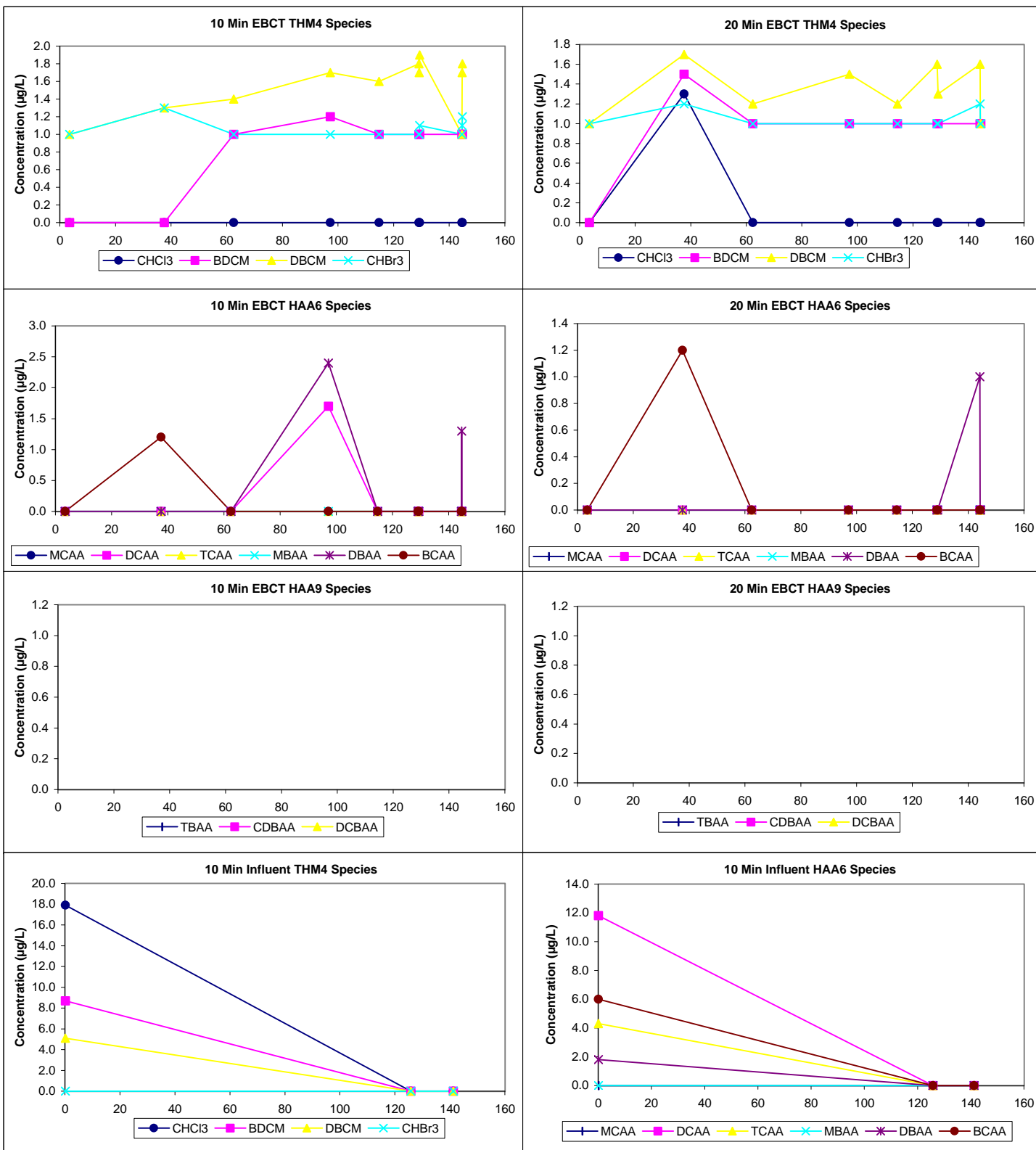
Water Quality Summary

	10 Min Influent				20 Min Influent								
Influent	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max		Mean	SD	Count	Min/Max
TOC	5.0	0.0	1	5.0 - 5.0	4.9	0.0	1	4.9 - 4.9	Res (0)	0.69	0.32	30	0.10 - 1.20
pH	9.4	0.4	3	9.0 - 9.7	9.4	0.4	3	9.0 - 9.7	Temp	22.2	1.9	30	20.0 - 27.0
UV254	0.091	0.000	1	0.091 - 0.091	0.090	0.000	1	0.090 - 0.090	pH	8.4	0.2	30	8.1 - 8.9
SUVA	1.83	0.00	1	1.83 - 1.83	1.84	0.00	1	1.84 - 1.84	Time	24.0	0.0	30	24.0 - 24.0
Bromide	NA	0	0	0 - 0	NA	0	0	0 - 0	Comments:				
SDS-TOX	166	0	1	166 - 166	168	0	1	168 - 168					
SDS-THM4	11	18	3	0 - 32	11	18	3	0 - 32					
SDS-HAA6	8	14	3	0 - 24	8	14	3	0 - 24	<div><div></div>10 Min EBCT</div> <div><div></div>20 Min EBCT</div> <div><div></div>10 Min Influent</div> <div><div></div>20 Min Influent</div> <div>Chart Legend:</div>				
Effluent	10 Min EBCT (64 B-S days)				20 Min EBCT (64 B-S days)								
Effluent pH	8.4	0.2	12	8.1 - 8.7	8.4	0.3	12	8.2 - 9.3					
Effluent Temp	21.7	1.1	12	20.0 - 23.0	21.7	1.1	12	20.0 - 23.0					

Water Quality Graphs



Water Quality Graphs (Continued)



Appendix C: Data Collection Spreadsheet

FIELD-SET 1: 1st QUARTER RSSCT RESULTS (FILE: *qacrssct.xls*)**Field 1-1: PWS And Treatment Plant Data**

PWS Name	Rend Lake Intercity Water System
Public Water System Identification Number	IL0555100
Water Industry Data Base Number (<i>optional</i>)	NA
Official ICR Contact Person	Paul Adams
Mailing Address	Box 970, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Technical ICR Contact Person	Paul Adams
Mailing Address	Box 907, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Plant Name	Rend Lake Intercity Water
Treatment Plant Category	CONV
Process Train Name	Rend Lake Water Plant
ICR Treatment Plant Identification Number	358
PWSID Number of Plant (<i>if assigned</i>)	IL0555100
Historical Minimum Water Temperature (°C)	2.0
Historical Average Water Temperature (°C)	15.0
State Approved Plant Capacity (MGD)	20.0

Field 1-2: Full-Scale GAC Characteristics¹

Carbon manufacturer	Calgon Carbon Corporation
Carbon trade name	Filltrasorb 400
Carbon type	Bituminous
Original GAC mesh size, upper (US standard mesh)	12
Original GAC mesh size, lower (US standard mesh)	40
Original carbon particle diameter, d _{LC} (mm)	1.053

1: These are the characteristics before the carbon is ground for RSSCT experiments.

Field 1-3: RSSCT Design Parameters

Input Design Parameters

RSSCT influent TOC (mg/L)	3.0
Inner diameter of the RSSCT column, D_{SC} (mm)	11.0
Minimum RSSCT Reynolds number, $Re_{SC, min}$	0.5
Full-scale operating temperature, $T^{\circ}C$ ($^{\circ}C$)	21.0
Full-scale bed porosity, ϵ_{LC}	0.45
Measured RSSCT dry bed density, ρ_{SC} (g/cm ³)	0.5
RSSCT GAC mesh size, upper (US standard mesh)	100
RSSCT GAC mesh size, lower (US standard mesh)	200

Estimated Run Length

Bed volumes to 50% TOC breakthrough, BV_{50}	5202
Estimated run length, BV_T ($= 2 \times BV_{50}$)	10405
$BV_T + 30\%$ safety factor, $BV_{T+30\%}$ ($= 2.6 \times BV_{50}$)	13526

General RSSCT Design Parameters

Kinematic viscosity at $T^{\circ}C$, ν_{LC} (m ² /s)	1.002E-06
RSSCT carbon particle diameter, d_{SC} (mm)	0.1125
Scaling factor, SF	9.36
RSSCT hydraulic loading rate, v_{SC} (m/hr)	7.21
RSSCT flow rate, Q_{SC} (mL/min)	11.43
Estimated total influent volume required, V_{SC}^I (L)	496

10-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	10
Estimated full-scale run time, t_{LC}^I (days)	94
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	1.07
Estimated RSSCT run time, t_{SC}^I (days)	10.04
RSSCT bed length, l_{SC} (cm)	12.9
Estimated volume required for 10-minute EBCT, V_{SC} (L)	165
Mass GAC required, m_{SC} (g)	6.11

20-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	20
Estimated full-scale run time, t_{LC}^I (days)	188
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	2.14
Estimated RSSCT run time, t_{SC}^I (days)	20.08
RSSCT bed length, l_{SC} (cm)	25.7
Estimated volume required for 20-minute EBCT, V_{SC} (L)	330
Mass GAC required, m_{SC} (g)	12.21

US Standard Mesh Sizes

US standard mesh size	Opening (mm)
4	4.750
6	3.350
8	2.360
10	2.000
12	1.680
16	1.180
20	0.850
30	0.600
40	0.425
50	0.300
60	0.250
70	0.210
80	0.180
100	0.150
120	0.125
140	0.106
170	0.088
200	0.075
230	0.062
270	0.053
325	0.044
400	0.037

Field 1-4: Pretreatment Used Prior To GAC¹

[illegible]

1: Design information, similar to that shown in Tables 6c and 6d of the ICR rule, must be included in the hard-copy *Treatment Study Summary Report* (see Section 10.0). The purpose of this table is to list the pretreatment processes used in this particular RSSCT run.

Field 1-5: GAC Influent Water Quality For The 10-Minute EBCT Run

10-min. EBCT Start Date	3/9/98
10-min. EBCT Start Time	6:45

Group A, 2 samples per batch

Parameter	Units	Sample A1-10	Sample A2-10	Average	RPD
Sampling date	MM/DD/YY	3/17/98	4/15/98	---	---
Sampling time	hh:mm	8:00	7:45	---	---
Operation time	hh.hh	49.25	217.00	---	---
Bed volumes	(10 minutes)	2764.6	12180.9	---	---
Alkalinity	mg/L as CaCO ₃	27.0	24.0	25.5	11.76
Total hardness	mg/L as CaCO ₃	79.0	81.0	80.0	2.50
Calcium hardness	mg/L as CaCO ₃	59.0	59.0	59.0	0.00
Ammonia	mg NH ₃ -N / L	0.2	NA	0.2	#VALUE!
Bromide	µg/L	NA	NA	#DIV/0!	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Average	%SD
Sampling date	MM/DD/YY	3/17/98	4/15/98	5/20/98	---	---
Sampling time	hh:mm	8:00	7:45	7:05	---	---
Operation time	hh.hh	49.25	217.00	416.33	---	---
Bed volumes	(10 minute)	2764.6	12180.9	23370.2	---	---
pH	---	10.17	10.10	10.04	10.10	0.64
Turbidity	ntu	0.06	0.07	0.06	0.06	9.12
Temperature	°C	9.0	14.0	21.0	14.7	41.10
Total organic carbon	mg/L	3.67	3.46	3.90	3.68	5.99
UV ₂₅₄	cm ⁻¹	0.058	0.056	0.062	0.059	5.21
SUVA	L/(mg*m)	1.58	1.62	1.59	1.60	1.24
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.00	2.00	0.00
SDS-Free Cl ₂ residual	mg/L	0.50	0.40	0.40	0.43	13.32
SDS-Cl ₂ demand	mg/L	1.50	1.60	1.60	1.57	3.69
SDS-Chlorination temp.	°C	9.0	14.0	21.0	14.7	41.10
SDS-Chlorination pH	---	9.93	9.97	9.03	9.64	5.51
SDS-Incubation time	hours	24.0	24.0	24.0	24.0	0.00
SDS-TOX	µg Cl ⁻ /L	56.00	250.00	158.60	154.87	62.67
SDS-CHCl ₃	µg/L	1.60	42.90	10.80	18.43	117.63
SDS-BDCM	µg/L	BMRL	9.60	1.00	5.30	114.74
SDS-DBCIM	µg/L	BMRL	3.10	BMRL	3.10	#DIV/0!
SDS-CHBr ₃	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-THM4	µg/L	1.60	55.60	11.80	23.00	124.74
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	1.70	18.10	17.00	12.27	74.74
SDS-TCAA*	µg/L	BMRL	1.60	1.00	1.30	32.64
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-BCAA*	µg/L	BMRL	5.20	1.00	3.10	95.80
SDS-TBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	1.70	19.70	18.00	13.13	75.67
SDS-HAA6	µg/L	1.70	24.90	19.00	15.20	79.33

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured

Field 1-6: GAC Influent Water Quality For The 20-Minute EBCT Run¹

20-min. EBCT Start Date	3/9/98
20-min. EBCT Start Time	7:15

Group A, 2 samples per batch

Parameter	Units	Sample A1-20	Sample A2-20	Average	RPD
Sampling date	MM/DD/YY	3/17/98	4/15/98	---	---
Sampling time	hh:mm	8:00	7:45	---	---
Operation time	hh.hh	48.75	216.50	---	---
Bed volumes	(20 minutes)	1368.3	6076.4	---	---
Alkalinity	mg/L as CaCO ₃	27.0	24.0	25.5	11.76
Total hardness	mg/L as CaCO ₃	79.0	81.0	80.0	2.50
Calcium hardness	mg/L as CaCO ₃	59.0	59.0	59.0	0.00
Ammonia	mg NH ₃ -N / L	NA	NA	#DIV/0!	#VALUE!
Bromide	µg/L	NA	NA	#DIV/0!	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Average	%SD
Sampling date	MM/DD/YY	3/17/98	4/15/98	5/20/98	---	---
Sampling time	hh:mm	8:00	7:45	7:05	---	---
Operation time	hh.hh	48.75	216.50	415.83	---	---
Bed volumes	(20 minute)	1368.3	6076.4	11671.1	---	---
pH	---	10.17	10.10	10.04	10.10	0.64
Turbidity	ntu	0.06	0.07	0.06	0.06	9.12
Temperature	°C	9.0	14.0	21.0	14.7	41.10
Total organic carbon	mg/L	3.67	3.46	3.90	3.68	5.99
UV ₂₅₄	cm ⁻¹	0.058	0.056	0.062	0.059	5.21
SUVA	L/(mg*m)	1.58	1.62	1.59	1.60	1.24
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.00	2.00	0.00
SDS-Free Cl ₂ residual	mg/L	0.50	0.40	0.40	0.43	13.32
SDS-Cl ₂ demand	mg/L	1.50	1.60	1.60	1.57	3.69
SDS-Chlorination temp.	°C	9.0	14.0	21.0	14.7	41.10
SDS-Chlorination pH	---	9.93	9.97	9.03	9.6	5.51
SDS-Incubation time	hours	24.0	24.0	24.0	24.0	0.00
SDS-TOX	µg Cl ⁻ / L	56.00	250.00	158.60	154.87	62.67
SDS-CHCl ₃	µg/L	1.60	42.90	10.80	18.43	117.63
SDS-BDCM	µg/L	BMRL	9.60	1.00	5.30	114.74
SDS-DBCM	µg/L	BMRL	3.10	BMRL	3.10	#DIV/0!
SDS-CHBr ₃	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-THM4	µg/L	1.60	55.60	11.80	23.00	124.74
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	1.70	18.10	17.00	12.27	74.74
SDS-TCAA*	µg/L	BMRL	1.60	1.00	1.30	32.64
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-BCAA*	µg/L	BMRL	5.20	1.00	3.10	95.80
SDS-TBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	1.70	19.70	18.00	13.13	75.67
SDS-HAA6	µg/L	1.70	24.90	19.00	15.20	79.33

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 1-7: GAC Effluent Water Quality For The 10-Minute EBCT Run¹

Field 1-7: GAC

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated?	Sampling date	Sampling time	Operation time	Bed volumes	pH	Temp.	TOC	UV ₂₅₄	SUVA	SDS Cl ₂ dose	SDS Free Cl ₂ residual	SDS Cl ₂ demand	SDS Chlorination temp.	SDS Chlorination pH	SDS Incubation time
	Y/N	MM/DD/YY	hh:mm	hh:hh	(10 minute)	---	°C	mg/L	cm ⁻¹	L/(mg*m)	mg/L	mg/L	mg/L	°C	---	hours
C1	n	3/9/98	7:45	9.00	505.2	9.42	22.0	BMRL	0.005	#VALUE!	2.00	0.80	1.20	9.0	8.68	24.0
C2	n	3/16/98	6:50	48.08	2699.1	9.46	20.0	BMRL	0.004	#VALUE!	2.00	0.60	1.40	9.0	8.74	24.0
Avg-C3	y	3/23/98	7:40	88.92	4991.2	9.45	22.0	BMRL	0.002	#VALUE!	2.00	0.50	1.50	8.0	8.58	24.0
C4	n	3/25/98	7:50	105.08	5898.7	9.37	22.0	0.96	0.004	0.42	2.00	1.00	1.00	8.0	8.11	24.0
C5	n	3/31/98	1:45	131.00	7353.5	9.06	24.0	BMRL	0.001	#VALUE!	2.00	1.00	1.00	14.0	8.10	24.0
C6	n	4/8/98	1:40	178.92	10043.2	8.95	23.0	0.87	0.009	1.03	1.50	0.90	0.60	14.0	8.22	24.0
Avg-C7	y	4/15/98	12:30	229.75	12896.6	9.26	24.0	BMRL	0.001	#VALUE!	1.50	0.50	1.00	15.0	8.20	24.0
C8	n	4/21/98	7:15	256.50	14398.2	8.78	23.0	BMRL	0.002	#VALUE!	1.50	0.60	0.90	15.0	7.90	24.0
Avg-C9	y	4/28/98	7:20	296.58	16648.2	9.26	23.0	BMRL	0.015	#VALUE!	1.50	0.60	0.90	16.0	7.98	24.0
C10	n	5/13/98	12:01	389.27	21850.8	9.10	24.0	BMRL	0.005	#VALUE!	1.50	0.80	0.70	19.0	8.05	24.0
C11	n	5/20/98	9:00	426.25	23926.8	8.88	23.0	0.80	0.001	0.13	1.50	0.50	1.00	21.0	8.10	24.0
C12	n	5/27/98	7:00	464.25	26059.9	9.14	24.0	1.93	0.024	1.24	1.50	0.30	1.20	23.0	8.41	24.0
				-204934.75	-11503670.6					#DIV/0!			0.00			
				-204934.75	-11503670.6					#DIV/0!			0.00			
				-204934.75	-11503670.6					#DIV/0!			0.00			
				-204934.75	-11503670.6					#DIV/0!			0.00			
				-204934.75	-11503670.6					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Mir

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six specie

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date	Sampling time	Operation time	Bed volumes	pH	Temp.	TOC	UV ₂₅₄	SUVA	SDS Cl ₂ dose	SDS Free Cl ₂ residual	SDS Cl ₂ demand	SDS Chlorination temp.	SDS Chlorination pH	SDS Incubation time
		MM/DD/YY	hh:mm	hh:hh	(10 minute)	---	°C	mg/L	cm ⁻¹	L/(mg*m)	mg/L	mg/L	mg/L	°C	---	hours
C3	Primary	3/23/98	7:40	88.92	4991.2	9.45	22.0	BMRL	0.002	#VALUE!	2.00	0.50	1.50	8.0	8.58	24.0
D-C3	Duplicate	3/23/98	7:40	88.92	4991.2	9.45	22.0	NA	NA	#VALUE!	2.00	0.50	1.50	8.0	8.58	24.0
Avg-C3	Average	---	---	---	---	9.45	22.0	#DIV/0!	0.002	#VALUE!	2.00	0.50	1.50	8.0	8.58	24.0
RPD-C3	RPD	---	---	---	---	0.00	0.00	#####	#####	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C7	Primary	4/15/98	12:30	229.75	12896.6	9.26	24.0	BMRL	0.001	#VALUE!	1.50	0.50	1.00	15.0	8.20	24.0
D-C7	Duplicate	4/15/98	12:30	229.75	12896.6	9.26	24.0	NA	NA	#VALUE!	1.50	0.50	1.00	15.0	8.20	24.0
Avg-C7	Average	---	---	---	---	9.26	24.0	#DIV/0!	0.001	#VALUE!	1.50	0.50	1.00	15.0	8.20	24.0
RPD-C7	RPD	---	---	---	---	0.00	0.00	#####	#####	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C9	Primary	4/28/98	7:20	296.58	16648.2	9.26	23.0	BMRL	0.015	#VALUE!	1.50	0.60	0.90	16.0	7.98	24.0
D-C9	Duplicate	4/28/98	7:20	296.58	16648.2	9.26	23.0	NA	NA	#VALUE!	1.50	0.60	0.90	16.0	7.98	24.0
Avg-C9	Average	---	---	---	---	9.26	23.0	#DIV/0!	0.015	#VALUE!	1.50	0.60	0.90	16.0	7.98	24.0
RPD-C9	RPD	---	---	---	---	0.00	0.00	#####	#####	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Mir

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six specie

AC Effluent Water Quality For The 10-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	BMRL	BMRL	BMRL	1.50	1.50	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	1.00	BMRL	BMRL	BMRL	1.00	BMRL	1.30	1.90	BMRL	BMRL	BMRL	NA	NA	NA	3.20	3.20
NA	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	BMRL	BMRL	1.20	1.00	2.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.20	1.90	1.70	5.80	BMRL	BMRL	BMRL	BMRL	1.40	BMRL	NA	NA	NA	1.40	1.40
56.00	1.00	1.00	1.55	1.30	4.85	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
66.00	BMRL	1.00	1.50	1.50	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
61.30	1.00	1.00	1.85	1.40	5.25	BMRL	BMRL	BMRL	BMRL	1.10	BMRL	NA	NA	NA	1.10	1.10
BMRL	BMRL	1.00	2.20	2.00	5.20	BMRL	BMRL	BMRL	BMRL	2.30	BMRL	NA	NA	NA	2.30	2.30
BMRL	1.00	1.70	3.30	2.30	8.30	BMRL	1.00	BMRL	BMRL	3.60	1.60	NA	NA	NA	4.60	6.20
77.20	5.30	7.30	9.00	3.20	24.80	BMRL	4.40	BMRL	BMRL	5.50	5.20	NA	NA	NA	9.90	15.10
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
NA	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	1.30	1.90	BMRL	BMRL	BMRL	NA	NA	NA	3.20	3.20
NA	1.00	BMRL	BMRL	BMRL	1.00	BMRL	1.30	1.90	BMRL	BMRL	BMRL	NA	NA	NA	3.20	3.20
#DIV/0!	1.00	#DIV/0!	#DIV/0!	#DIV/0!	0.50	#DIV/0!	1.30	1.90	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	3.20	3.20
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	200.00	#VALUE!	0.00	0.00	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	0.00	0.00
56.00	1.00	1.00	1.70	1.40	5.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	BMRL	1.00	1.40	1.20	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
56.00	1.00	1.00	1.55	1.30	4.35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	19.35	15.38	34.48	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
61.30	BMRL	1.00	1.70	1.30	4.00	BMRL	BMRL	BMRL	BMRL	1.10	BMRL	NA	NA	NA	1.10	1.10
NA	1.00	1.00	2.00	1.50	5.50	BMRL	BMRL	BMRL	BMRL	1.10	BMRL	NA	NA	NA	1.10	1.10
61.30	1.00	1.00	1.85	1.40	4.75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.10	1.10
#VALUE!	#VALUE!	0.00	16.22	14.29	31.58	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00	#VALUE!	#####	#VALUE!	#VALUE!	0.00	0.00

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 1-8: GAC Effluent Water Quality For The 20-Minute EBCT Run¹

Field 1-8: GAC Effluent Water

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated? Y/N	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:mm	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C1	n	3/9/98	8:15	9.00	252.6	9.48	22.0	0.83	0.005	0.60	2.00	0.80	1.20	9.0	8.80	24.0
C2	n	3/16/98	10:30	51.25	1438.4	9.53	21.0	BMRL	0.003	#VALUE!	2.00	0.80	1.20	9.0	8.86	24.0
Avg-C3	y	3/23/98	8:20	89.08	2500.3	9.90	22.0	BMRL	0.001	#VALUE!	2.00	0.60	1.40	8.0	8.48	24.0
C4	n	3/25/98	8:20	105.08	2949.3	10.00	21.0	BMRL	0.003	#VALUE!	2.00	1.00	1.00	8.0	8.71	24.0
C5	n	3/31/98	14:10	142.92	4011.2	8.80	24.0	BMRL	0.001	#VALUE!	2.00	1.00	1.00	14.0	8.30	24.0
C6	n	4/8/98	14:00	190.75	5353.7	8.37	23.0	BMRL	0.011	#VALUE!	1.50	1.00	0.50	14.0	8.20	24.0
Avg-C7	y	4/15/98	13:45	230.50	6469.4	8.67	24.0	BMRL	0.000	#VALUE!	1.50	0.70	0.80	15.0	8.27	24.0
C8	n	4/21/98	7:45	256.50	7199.1	8.09	23.0	BMRL	0.002	#VALUE!	1.50	0.80	0.70	15.0	7.88	24.0
Avg-C9	y	4/28/98	8:10	296.92	8333.5	8.28	23.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	16.0	7.90	24.0
C10	n	5/13/98	12:30	389.25	10925.0	8.18	24.0	BMRL	0.004	#VALUE!	1.50	0.80	0.70	19.0	8.08	24.0
C11	n	5/20/98	10:30	427.25	11991.5	8.33	23.0	BMRL	0.001	#VALUE!	1.50	0.70	0.80	21.0	8.07	24.0
C12	n	5/27/98	7:30	464.25	13030.0	8.64	24.0	1.36	0.017	1.25	1.50	0.40	1.10	23.0	8.42	24.0
				-204935.25	-5751849.4					#DIV/0!			0.00			
				-204935.25	-5751849.4					#DIV/0!			0.00			
				-204935.25	-5751849.4					#DIV/0!			0.00			
				-204935.25	-5751849.4					#DIV/0!			0.00			
				-204935.25	-5751849.4					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:mm	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C3	Primary	3/23/98	8:20	89.08	2500.3	9.90	22.0	BMRL	0.001	#VALUE!	2.00	0.60	1.40	8.0	8.48	24.0
D-C3	Duplicate	3/23/98	8:20	89.08	2500.3	9.90	22.0	NA	0.001	#VALUE!	2.00	0.60	1.40	8.0	8.48	24.0
Avg-C3	Average	---	---	---	---	9.90	22.0	#DIV/0!	0.001	#VALUE!	2.00	0.60	1.40	8.0	8.48	24.0
RPD-C3	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C7	Primary	4/15/98	13:45	230.50	6469.4	8.67	24.0	BMRL	0.000	#VALUE!	1.50	0.70	0.80	15.0	8.27	24.0
D-C7	Duplicate	4/15/98	13:45	230.50	6469.4	8.67	24.0	NA	NA	#VALUE!	1.50	0.70	0.80	15.0	8.27	24.0
Avg-C7	Average	---	---	---	---	8.67	24.0	#DIV/0!	0.000	#VALUE!	1.50	0.70	0.80	15.0	8.27	24.0
RPD-C7	RPD	---	---	---	---	0.00	0.00	#####	#VALUE!	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C9	Primary	4/28/98	8:10	296.92	8333.5	8.28	23.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	16.0	7.90	24.0
D-C9	Duplicate	4/28/98	8:10	296.92	8333.5	8.28	23.0	NA	NA	#VALUE!	1.50	1.00	0.50	16.0	7.90	24.0
Avg-C9	Average	---	---	---	---	8.28	23.0	#DIV/0!	0.001	#VALUE!	1.50	1.00	0.50	16.0	7.90	24.0
RPD-C9	RPD	---	---	---	---	0.00	0.00	#####	#VALUE!	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

er Quality For The 20-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	BMRL	BMRL	BMRL	1.00	#DIV/0!	1.15	1.75	BMRL	BMRL	BMRL	NA	NA	NA	#DIV/0!	#DIV/0!
NA	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	1.00	1.00	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	1.00	1.00	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.10	1.00	3.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
133.20	3.60	5.80	8.70	4.10	22.20	BMRL	2.90	BMRL	BMRL	5.30	3.80	NA	NA	NA	8.20	12.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	BMRL	BMRL	BMRL	1.00	BMRL	1.20	1.80	BMRL	BMRL	BMRL	NA	NA	NA	3.00	3.00
NA	1.00	BMRL	BMRL	BMRL	1.00	BMRL	1.10	1.70	BMRL	BMRL	BMRL	NA	NA	NA	2.80	2.80
#DIV/0!	1.00	#DIV/0!	#DIV/0!	#DIV/0!	1.00	#DIV/0!	1.15	1.75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.90	2.90
#VALUE!	0.00	#VALUE!	#VALUE!	#VALUE!	0.00	#VALUE!	8.70	5.71	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	6.90	6.90
BMRL	BMRL	BMRL	1.00	1.00	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	BMRL	BMRL	1.00	1.00	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	1.00	1.00	2.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	0.00	0.00	0.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	BMRL	BMRL	BMRL	BMRL	0.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 1-9: GAC Cost Parameters

Cost Parameter	Parameter value
Capital Recovery Interest Rate (%)	8
Capital Recovery Period (years)	20
Overhead & Profit Factor (% of construction costs)	15
Special Sitework Factor (% of construction costs)	5
Construction Contingencies (% of construction costs)	10
Engineering Fee Factor (% of construction costs)	15
1998 ENR Construction Cost Index (CCI base year 1913)	4965 (May 92)
1998 Producers Price Index (PPI base year 1967 = 100)	326 (May 92)
Labor Rate + Fringe (\$/work-hour)	23
Labor Overhead Factor (% of labor)	35
Electric Rate (\$/kW-h)	0.05
Fuel Oil Rate (\$/gal)	0.95
Natural Gas Rate (\$/ft ³)	0.005
Current Process Water Rate (\$/1000 gal)	0.29
Modifications to Existing Plant (% of construction costs)	20

FIELD-SET 2: 2nd QUARTER RSSCT RESULTS (FILE: *qacrssct.xls*)**Field 2-1: PWS And Treatment Plant Data**

PWS Name	Rend Lake Intercity Water System
Public Water System Identification Number	IL0555100
Water Industry Data Base Number (<i>optional</i>)	NA
Official ICR Contact Person	Paul Adams
Mailing Address	Box 970, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Technical ICR Contact Person	Paul Adams
Mailing Address	Box 907, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Plant Name	Rend Lake Intercity Water
Treatment Plant Category	CONV
Process Train Name	Rend Lake Water Plant
ICR Treatment Plant Identification Number	358
PWSID Number of Plant (<i>if assigned</i>)	IL0555100
Historical Minimum Water Temperature (°C)	2.0
Historical Average Water Temperature (°C)	15.0
State Approved Plant Capacity (MGD)	20.0

Field 2-2: Full-Scale GAC Characteristics¹

Carbon manufacturer	Calgon Carbon Corporation
Carbon trade name	Filltrasorb 400
Carbon type	Bituminous
Original GAC mesh size, upper (US standard mesh)	12
Original GAC mesh size, lower (US standard mesh)	40
Original carbon particle diameter, d _{LC} (mm)	1.053

1: These are the characteristics before the carbon is ground for RSSCT experiments.

Field 2-3: RSSCT Design Parameters**Input Design Parameters**

RSSCT influent TOC (mg/L)	3.0
Inner diameter of the RSSCT column, D_{SC} (mm)	11.0
Minimum RSSCT Reynolds number, $Re_{SC, min}$	0.5
Full-scale operating temperature, $T^{\circ}C$ ($^{\circ}C$)	21.0
Full-scale bed porosity, ϵ_{LC}	0.45
Measured RSSCT dry bed density, ρ_{SC} (g/cm ³)	0.5
RSSCT GAC mesh size, upper (US standard mesh)	100
RSSCT GAC mesh size, lower (US standard mesh)	200

Estimated Run Length

Bed volumes to 50% TOC breakthrough, BV_{50}	5202
Estimated run length, BV_T ($= 2 \times BV_{50}$)	10405
$BV_T + 30\%$ safety factor, $BV_{T+30\%}$ ($= 2.6 \times BV_{50}$)	13526

General RSSCT Design Parameters

Kinematic viscosity at $T^{\circ}C$, ν_{LC} (m ² /s)	1.002E-06
RSSCT carbon particle diameter, d_{SC} (mm)	0.1125
Scaling factor, SF	9.36
RSSCT hydraulic loading rate, v_{SC} (m/hr)	7.21
RSSCT flow rate, Q_{SC} (mL/min)	11.43
Estimated total influent volume required, V_{SC}^I (L)	496

10-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	10
Estimated full-scale run time, t_{LC}^I (days)	94
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	1.07
Estimated RSSCT run time, t_{SC}^I (days)	10.04
RSSCT bed length, l_{SC} (cm)	12.9
Estimated volume required for 10-minute EBCT, V_{SC} (L)	165
Mass GAC required, m_{SC} (g)	6.11

20-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	20
Estimated full-scale run time, t_{LC}^I (days)	188
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	2.14
Estimated RSSCT run time, t_{SC}^I (days)	20.08
RSSCT bed length, l_{SC} (cm)	25.7
Estimated volume required for 20-minute EBCT, V_{SC} (L)	330
Mass GAC required, m_{SC} (g)	12.21

US Standard Mesh Sizes

US standard mesh size	Opening (mm)
4	4.750
6	3.350
8	2.360
10	2.000
12	1.680
16	1.180
20	0.850
30	0.600
40	0.425
50	0.300
60	0.250
70	0.210
80	0.180
100	0.150
120	0.125
140	0.106
170	0.088
200	0.075
230	0.062
270	0.053
325	0.044
400	0.037

Field 2-4: Pretreatment Used Prior To GAC¹

[illegible]

1: Design information, similar to that shown in Tables 6c and 6d of the ICR rule, must be included in the hard-copy *Treatment Study Summary Report* (see Section 10.0). The purpose of this table is to list the pretreatment processes used in this particular RSSCT run.

Field 2-5: GAC Influent Water Quality For The 10-Minute EBCT Run

10-min. EBCT Start Date	6/16/98
10-min. EBCT Start Time	9:40

Group A, 2 samples per batch

Parameter	Units	Sample A1-10	Sample A2-10	Average	RPD
Sampling date	MM/DD/YY	6/24/98	8/12/98	---	---
Sampling time	hh:mm	10:30	7:20	---	---
Operation time	hh.hh	48.83	317.67	---	---
Bed volumes	(10 minutes)	2741.2	17831.7	---	---
Alkalinity	mg/L as CaCO ₃	27.0	32.0	29.5	16.95
Total hardness	mg/L as CaCO ₃	74.0	67.0	70.5	9.93
Calcium hardness	mg/L as CaCO ₃	54.0	50.0	52.0	7.69
Ammonia	mg NH ₃ -N / L	NA	0.2	0.2	#VALUE!
Bromide	µg/L	NA	58.0	58.0	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Average	%SD
Sampling date	MM/DD/YY	6/24/98	8/12/98	9/2/98	---	---
Sampling time	hh:mm	10:30	7:20	8:35	---	---
Operation time	hh.hh	48.83	317.67	438.92	---	---
Bed volumes	(10 minute)	2741.2	17831.7	24637.9	---	---
pH	---	9.97	9.85	9.84	9.89	0.73
Turbidity	ntu	0.05	0.04	0.03	0.04	25.00
Temperature	°C	24.0	27.0	28.0	26.3	7.91
Total organic carbon	mg/L	3.33	3.85	3.70	3.63	7.38
UV ₂₅₄	cm ⁻¹	NA	0.060	0.060	0.060	0.00
SUVA	L/(mg*m)	#VALUE!	1.56	1.62	#VALUE!	#VALUE!
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.50	2.17	13.32
SDS-Free Cl ₂ residual	mg/L	0.20	0.20	0.20	0.20	0.00
SDS-Cl ₂ demand	mg/L	1.80	1.80	2.30	1.97	14.68
SDS-Chlorination temp.	°C	24.0	28.0	25.0	25.7	8.11
SDS-Chlorination pH	---	9.32	9.41	8.14	8.96	7.91
SDS-Incubation time	hours	24.0	24.0	24.0	24.0	0.00
SDS-TOX	µg Cl ⁻ / L	NA	136.90	140.10	138.50	1.63
SDS-CHCl ₃	µg/L	53.80	8.80	11.40	24.67	102.42
SDS-BDCM	µg/L	7.60	1.10	7.70	5.47	69.18
SDS-DBCM	µg/L	2.20	BMRL	4.30	3.25	45.69
SDS-CHBr ₃	µg/L	1.00	BMRL	1.00	1.00	0.00
SDS-THM4	µg/L	64.60	9.90	24.40	32.97	85.96
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	24.30	11.30	9.90	15.17	52.36
SDS-TCAA*	µg/L	1.20	BMRL	3.60	2.40	70.71
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	BMRL	BMRL	1.90	1.90	#DIV/0!
SDS-BCAA*	µg/L	5.90	1.50	5.20	4.20	56.29
SDS-TBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	25.50	11.30	15.40	17.40	42.00
SDS-HAA6	µg/L	31.40	12.80	20.60	21.60	43.24

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured

Field 2-6: GAC Influent Water Quality For The 20-Minute EBCT Run¹

20-min. EBCT Start Date	6/16/98
20-min. EBCT Start Time	10:20

Group A, 2 samples per batch

Parameter	Units	Sample A1-20	Sample A2-20	Average	RPD
Sampling date	MM/DD/YY	6/24/98	8/12/98	---	---
Sampling time	hh:mm	10:30	7:20	---	---
Operation time	hh.hh	48.17	317.00	---	---
Bed volumes	(20 minutes)	1351.9	8897.1	---	---
Alkalinity	mg/L as CaCO ₃	27.0	32.0	29.5	16.95
Total hardness	mg/L as CaCO ₃	74.0	67.0	70.5	9.93
Calcium hardness	mg/L as CaCO ₃	54.0	50.0	52.0	7.69
Ammonia	mg NH ₃ -N / L	NA	0.2	0.2	#VALUE!
Bromide	µg/L	NA	0.1	0.1	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Average	%SD
Sampling date	MM/DD/YY	6/24/98	8/12/98	9/2/98	---	---
Sampling time	hh:mm	10:30	7:20	8:35	---	---
Operation time	hh.hh	48.17	317.00	438.25	---	---
Bed volumes	(20 minute)	1351.9	8897.1	12300.2	---	---
pH	---	9.97	9.85	9.84	9.89	0.73
Turbidity	ntu	0.05	0.04	0.03	0.04	25.00
Temperature	°C	24.0	27.0	28.0	26.3	7.91
Total organic carbon	mg/L	3.33	3.85	3.70	3.63	7.38
UV ₂₅₄	cm ⁻¹	NA	0.060	0.060	0.060	0.00
SUVA	L/(mg*m)	#VALUE!	1.56	1.62	#VALUE!	#VALUE!
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.50	2.17	13.32
SDS-Free Cl ₂ residual	mg/L	0.20	0.20	0.20	0.20	0.00
SDS-Cl ₂ demand	mg/L	1.80	1.80	2.30	1.97	14.68
SDS-Chlorination temp.	°C	24.0	28.0	25.0	25.7	8.11
SDS-Chlorination pH	---	9.32	9.41	8.14	9.0	7.91
SDS-Incubation time	hours	24.0	24.0	24.0	24.0	0.00
SDS-TOX	µg Cl ⁻ / L	NA	136.90	140.10	138.50	1.63
SDS-CHCl ₃	µg/L	53.80	8.80	11.40	24.67	102.42
SDS-BDCM	µg/L	7.60	1.10	7.70	5.47	69.18
SDS-DBCm	µg/L	2.20	BMRL	4.30	3.25	45.69
SDS-CHBr ₃	µg/L	1.00	BMRL	1.00	1.00	0.00
SDS-THM4	µg/L	64.60	9.90	24.40	32.97	85.96
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	24.30	11.30	9.90	15.17	52.36
SDS-TCAA*	µg/L	1.20	BMRL	3.60	2.40	70.71
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	BMRL	BMRL	1.90	1.90	#DIV/0!
SDS-BCAA*	µg/L	5.90	1.50	5.20	4.20	56.29
SDS-TBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	25.50	11.30	15.40	17.40	42.00
SDS-HAA6	µg/L	31.40	12.80	20.60	21.60	43.24

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 2-7: GAC Effluent Water Quality For The 10-Minute EBCT Run¹

Field 2-7: GAC

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated?	Sampling date	Sampling time	Operation time	Bed volumes	pH	Temp.	TOC	UV ₂₅₄	SUVA	SDS Cl ₂ dose	SDS Free Cl ₂ residual	SDS Cl ₂ demand	SDS Chlorination temp.	SDS Chlorination pH	SDS Incubation time
	Y/N	MM/DD/YY	hh:mm	hh:hh	(10 minute)	---	°C	mg/L	cm ⁻¹	L/(mg*m)	mg/L	mg/L	mg/L	°C	---	hours
C1	n	6/16/98	10:40	9.00	505.2	9.49	22.0	BMRL	0.005	#VALUE!	2.00	0.70	1.30	27.0	8.36	24.0
C2	n	6/24/98	8:15	54.58	3063.9	9.37	26.0	BMRL	NA	#VALUE!	2.00	1.00	1.00	27.0	8.54	24.0
Avg-C3	y	6/30/98	11:15	89.58	5028.6	8.44	26.0	BMRL	0.051	#VALUE!	1.50	0.40	1.10	27.0	8.31	24.0
C4	n	7/7/98	7:15	117.58	6600.3	8.43	27.0	BMRL	0.012	#VALUE!	2.00	1.00	1.00	27.0	8.31	24.0
C5	n	7/14/98	8:00	158.33	8887.8	8.49	28.0	BMRL	0.012	#VALUE!	2.00	0.70	1.30	27.0	8.45	24.0
C6	n	7/21/98	8:00	198.33	11133.1	8.40	28.0	BMRL	0.002	#VALUE!	2.00	0.80	1.20	27.0	8.40	24.0
C7	n	8/5/98	8:30	286.83	16100.9	8.74	27.0	BMRL	0.003	#VALUE!	2.00	0.70	1.30	25.0	8.38	24.0
Avg-C8	y	8/12/98	11:00	329.33	18486.6	8.37	30.0	BMRL	0.005	#VALUE!	1.50	0.60	0.90	28.0	8.07	24.0
Avg-C9	y	8/26/98	8:20	406.67	22827.6	8.32	28.0	BMRL	0.001	#VALUE!	2.00	0.80	1.20	27.0	8.04	24.0
C10	n	9/2/98	10:50	449.17	25213.2	8.56	26.0	BMRL	0.002	#VALUE!	2.00	0.80	1.20	25.0	8.09	24.0
C11	n	9/9/98	8:10	478.50	26859.8	8.90	25.0	BMRL	0.004	#VALUE!	2.00	0.50	1.50	25.0	8.30	24.0
C12	n	9/14/98	11:05	521.42	29268.9	8.35	26.0	BMRL	0.008	#VALUE!	2.00	1.00	1.00	26.0	8.26	24.0
				-205521.67	-11536616.2					#DIV/0!			0.00			
				-205521.67	-11536616.2					#DIV/0!			0.00			
				-205521.67	-11536616.2					#DIV/0!			0.00			
				-205521.67	-11536616.2					#DIV/0!			0.00			
				-205521.67	-11536616.2					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date	Sampling time	Operation time	Bed volumes	pH	Temp.	TOC	UV ₂₅₄	SUVA	SDS Cl ₂ dose	SDS Free Cl ₂ residual	SDS Cl ₂ demand	SDS Chlorination temp.	SDS Chlorination pH	SDS Incubation time
		MM/DD/YY	hh:mm	hh:hh	(10 minute)	---	°C	mg/L	cm ⁻¹	L/(mg*m)	mg/L	mg/L	mg/L	°C	---	hours
C3	Primary	6/30/98	11:15	89.58	5028.6	8.44	26.0	BMRL	0.050	#VALUE!	1.50	0.40	1.10	27.0	8.31	24.0
D-C3	Duplicate	6/30/98	11:15	89.58	5028.6	8.44	26.0	BMRL	0.051	#VALUE!	1.50	0.40	1.10	27.0	8.31	24.0
Avg-C3	Average	---	---	---	---	8.44	26.0	#DIV/0!	0.051	#VALUE!	1.50	0.40	1.10	27.0	8.31	24.0
RPD-C3	RPD	---	---	---	---	0.00	0.00	#####	1.98	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C8	Primary			-205513.67	-11536167.2	8.37	30.0	BMRL	0.005	#VALUE!	1.50	0.60	0.90	28.0	8.07	24.0
D-C8	Duplicate			-205513.67	-11536167.2	8.37	30.0	BMRL	0.005	#VALUE!	1.50	0.60	0.90	28.0	8.07	24.0
Avg-C8	Average	---	---	---	---	8.37	30.0	#DIV/0!	0.005	#VALUE!	1.50	0.60	0.90	28.0	8.07	24.0
RPD-C8	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C9	Primary			-205513.67	-11536167.2	8.32	28.0	BMRL	0.001	#VALUE!	2.00	0.80	1.20	27.0	8.04	24.0
D-C9	Duplicate			-205513.67	-11536167.2	8.32	28.0	BMRL	0.001	#VALUE!	2.00	0.80	1.20	27.0	8.04	24.0
Avg-C9	Average	---	---	---	---	8.32	28.0	#DIV/0!	0.001	#VALUE!	2.00	0.80	1.20	27.0	8.04	24.0
RPD-C9	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

AC Effluent Water Quality For The 10-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	1.00	1.00	1.00	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.40	2.30	2.10	6.80	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.55	1.00	3.55	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.10	1.40	1.20	BMRL	3.70	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.00	1.20	1.10	4.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.20	1.20	1.30	BMRL	3.70	2.10	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	2.10	2.10
BMRL	BMRL	1.00	1.00	BMRL	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.05	1.70	1.00	3.75	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.70	1.00	3.70	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.90	1.10	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.30	2.60	1.50	5.40	1.30	BMRL	BMRL	BMRL	1.30	BMRL	NA	NA	NA	2.60	2.60
BMRL	BMRL	1.20	2.20	1.30	4.70	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	BMRL	1.00	1.60	1.00	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.50	1.00	3.50	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.55	1.00	3.55	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	6.45	0.00	2.82	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	1.10	1.80	1.00	3.90	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.60	1.00	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.05	1.70	1.00	3.75	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	9.52	11.76	0.00	8.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	1.00	1.90	1.00	3.90	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.50	1.00	3.50	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.70	1.00	3.70	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	23.53	0.00	10.81	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 2-8: GAC Effluent Water Quality For The 20-Minute EBCT Run¹

Field 2-8: GAC Effluent Water

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated? Y/N	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:mm	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C1	n	6/16/98	11:20	9.00	252.6	8.73	22.0	BMRL	0.004	#VALUE!	2.00	0.90	1.10	27.0	8.28	24.0
C2	n	6/24/98	8:45	54.42	1527.3	8.73	26.0	BMRL	NA	#VALUE!	2.00	1.00	1.00	27.0	8.28	24.0
Avg-C3	y	6/30/98	12:50	90.50	2540.0	8.78	26.0	BMRL	0.058	#VALUE!	1.50	0.40	1.10	27.0	8.34	24.0
C4	n	7/7/98	7:45	117.42	3295.5	8.78	27.0	BMRL	0.012	#VALUE!	2.00	1.00	1.00	27.0	8.40	24.0
C5	n	7/14/98	9:30	159.17	4467.3	8.53	28.0	BMRL	NA	#VALUE!	2.00	0.60	1.40	27.0	8.42	24.0
C6	n	7/21/98	8:20	198.00	5557.2	8.37	28.0	BMRL	0.002	#VALUE!	2.00	0.80	1.20	26.0	8.40	24.0
C7	n	8/5/98	10:20	288.00	8083.2	9.44	27.0	BMRL	0.009	#VALUE!	2.00	1.00	1.00	25.0	8.35	24.0
Avg-C8	y	8/12/98	11:45	329.42	9245.6	8.51	30.0	BMRL	0.002	#VALUE!	1.50	0.50	1.00	28.0	8.07	24.0
Avg-C9	y	8/26/98	9:15	406.92	11420.8	8.32	28.0	BMRL	0.012	#VALUE!	2.00	0.80	1.20	27.0	8.20	24.0
C10	n	9/2/98	11:25	449.08	12604.3	8.26	26.0	BMRL	0.001	#VALUE!	2.00	0.90	1.10	25.0	8.08	24.0
C11	n	9/9/98	8:15	477.92	13413.5	8.54	25.0	BMRL	0.014	#VALUE!	2.00	0.60	1.40	25.0	8.20	24.0
C12	n	9/14/98	11:55	521.58	14639.1	8.22	26.0	BMRL	0.004	#VALUE!	2.00	1.00	1.00	26.0	8.30	24.0
				-205522.33	-5768326.8					#DIV/0!			0.00			
				-205522.33	-5768326.8					#DIV/0!			0.00			
				-205522.33	-5768326.8					#DIV/0!			0.00			
				-205522.33	-5768326.8					#DIV/0!			0.00			
				-205522.33	-5768326.8					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:mm	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C3	Primary	6/30/98	12:50	90.50	2540.0	8.78	26.0	BMRL	0.057	#VALUE!	1.50	0.40	1.10	27.0	8.34	24.0
D-C3	Duplicate	6/30/98	12:50	90.50	2540.0	8.78	26.0	BMRL	0.058	#VALUE!	1.50	0.40	1.10	27.0	8.34	24.0
Avg-C3	Average	---	---	---	---	8.78	26.0	#DIV/0!	0.058	#VALUE!	1.50	0.40	1.10	27.0	8.34	24.0
RPD-C3	RPD	---	---	---	---	0.00	0.00	#####	1.74	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C8	Primary	8/12/98	11:45	329.42	9245.6	8.51	30.0	BMRL	0.002	#VALUE!	1.50	0.50	1.00	28.0	8.07	24.0
D-C8	Duplicate	8/12/98	11:45	329.42	9245.6	8.51	30.0	BMRL	0.002	#VALUE!	1.50	0.50	1.00	28.0	8.07	24.0
Avg-C8	Average	---	---	---	---	8.51	30.0	#DIV/0!	0.002	#VALUE!	1.50	0.50	1.00	28.0	8.07	24.0
RPD-C8	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C9	Primary	8/26/98	9:15	406.92	11420.8	8.32	28.0	BMRL	0.012	#VALUE!	2.00	0.80	1.20	27.0	8.20	24.0
D-C9	Duplicate	8/26/98	9:15	406.92	11420.8	8.32	28.0	BMRL	0.012	#VALUE!	2.00	0.80	1.20	27.0	8.20	24.0
Avg-C9	Average	---	---	---	---	8.32	28.0	#DIV/0!	0.012	#VALUE!	2.00	0.80	1.20	27.0	8.20	24.0
RPD-C9	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

er Quality For The 20-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	1.00	1.00	1.00	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.60	1.70	1.20	5.50	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.35	3.65	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.10	1.50	1.30	1.00	4.90	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.00	1.00	1.00	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.30	1.30	1.30	BMRL	3.90	BMRL	2.10	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	2.10	2.10
BMRL	1.00	1.00	1.00	1.00	4.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.55	1.00	3.55	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.35	1.00	3.35	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.40	1.00	3.40	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.00	3.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.00	1.00	3.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	BMRL	1.00	1.30	1.70	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.00	3.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.30	1.35	3.65	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	0.00	51.85	19.18	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	1.00	1.40	1.00	3.40	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.70	1.00	3.70	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.55	1.00	3.55	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	19.35	0.00	8.45	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	1.00	1.40	1.00	3.40	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.00	3.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.35	1.00	3.35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	7.41	0.00	2.99	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 2-9: GAC Cost Parameters

Cost Parameter	Parameter value
Capital Recovery Interest Rate (%)	8
Capital Recovery Period (years)	20
Overhead & Profit Factor (% of construction costs)	15
Special Sitework Factor (% of construction costs)	5
Construction Contingencies (% of construction costs)	10
Engineering Fee Factor (% of construction costs)	15
1998 ENR Construction Cost Index (CCI base year 1913)	4965 (May 92)
1998 Producers Price Index (PPI base year 1967 = 100)	326 (May 92)
Labor Rate + Fringe (\$/work-hour)	23
Labor Overhead Factor (% of labor)	35
Electric Rate (\$/kW-h)	0.05
Fuel Oil Rate (\$/gal)	0.95
Natural Gas Rate (\$/ft ³)	0.005
Current Process Water Rate (\$/1000 gal)	0.29
Modifications to Existing Plant (% of construction costs)	20

FIELD-SET 3: 3rd QUARTER RSSCT RESULTS (FILE: *gacrssct.xls*)**Field 3-1: PWS And Treatment Plant Data**

PWS Name	Rend Lake Intercity Water System
Public Water System Identification Number	IL0555100
Water Industry Data Base Number (<i>optional</i>)	NA
Official ICR Contact Person	Paul Adams
Mailing Address	Box 970, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Technical ICR Contact Person	Paul Adams
Mailing Address	Box 907, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Plant Name	Rend Lake Intercity Water
Treatment Plant Category	CONV
Process Train Name	Rend Lake Water Plant
ICR Treatment Plant Identification Number	358
PWSID Number of Plant (<i>if assigned</i>)	IL0555100
Historical Minimum Water Temperature (°C)	2.0
Historical Average Water Temperature (°C)	15.0
State Approved Plant Capacity (MGD)	20.0

Field 3-2: Full-Scale GAC Characteristics¹

Carbon manufacturer	Calgon Carbon Corporation
Carbon trade name	Filltrasorb 400
Carbon type	Bituminous
Original GAC mesh size, upper (US standard mesh)	12
Original GAC mesh size, lower (US standard mesh)	40
Original carbon particle diameter, d_{LC} (mm)	1.053

1: These are the characteristics before the carbon is ground for RSSCT experiments.

Field 3-3: RSSCT Design Parameters**Input Design Parameters**

RSSCT influent TOC (mg/L)	3.0
Inner diameter of the RSSCT column, D_{SC} (mm)	11.0
Minimum RSSCT Reynolds number, $Re_{SC, min}$	0.5
Full-scale operating temperature, $T^{\circ}C$ ($^{\circ}C$)	21.0
Full-scale bed porosity, ϵ_{LC}	0.45
Measured RSSCT dry bed density, ρ_{SC} (g/cm ³)	0.5
RSSCT GAC mesh size, upper (US standard mesh)	100
RSSCT GAC mesh size, lower (US standard mesh)	200

Estimated Run Length

Bed volumes to 50% TOC breakthrough, BV_{50}	5202
Estimated run length, BV_T ($= 2 \times BV_{50}$)	10405
$BV_T + 30\%$ safety factor, $BV_{T+30\%}$ ($= 2.6 \times BV_{50}$)	13526

General RSSCT Design Parameters

Kinematic viscosity at $T^{\circ}C$, ν_{LC} (m ² /s)	1.002E-06
RSSCT carbon particle diameter, d_{SC} (mm)	0.1125
Scaling factor, SF	9.36
RSSCT hydraulic loading rate, v_{SC} (m/hr)	7.21
RSSCT flow rate, Q_{SC} (mL/min)	11.43
Estimated total influent volume required, V_{SC}^T (L)	496

10-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	10
Estimated full-scale run time, t_{LC}^T (days)	94
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	1.07
Estimated RSSCT run time, t_{SC}^T (days)	10.04
RSSCT bed length, l_{SC} (cm)	12.9
Estimated volume required for 10-minute EBCT, V_{SC} (L)	165
Mass GAC required, m_{SC} (g)	6.11

20-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	20
Estimated full-scale run time, t_{LC}^T (days)	188
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	2.14
Estimated RSSCT run time, t_{SC}^T (days)	20.08
RSSCT bed length, l_{SC} (cm)	25.7
Estimated volume required for 20-minute EBCT, V_{SC} (L)	330
Mass GAC required, m_{SC} (g)	12.21

US Standard Mesh Sizes

US standard mesh size	Opening (mm)
4	4.750
6	3.350
8	2.360
10	2.000
12	1.680
16	1.180
20	0.850
30	0.600
40	0.425
50	0.300
60	0.250
70	0.210
80	0.180
100	0.150
120	0.125
140	0.106
170	0.088
200	0.075
230	0.062
270	0.053
325	0.044
400	0.037

Field 3-4: Pretreatment Used Prior To GAC¹

Process	Description	Scale
Aeration	At plant intake	Full-Scale
Coagulation	17-21 mg/L alum, 0.4-2.0 mg/L cationic polymer	Full-Scale
Flocculation	Single-stage	Full-Scale
Sedimentation	1 hour	Full-Scale
Cartridge filtration	Pore size not available	Bench-scale

1: Design information, similar to that shown in Tables 6c and 6d of the ICR rule, must be included in the hard-copy *Treatment Study Summary Report* (see Section 10.0). The purpose of this table is to list the pretreatment processes used in this particular RSSCT run.

Field 3-5: GAC Influent Water Quality For The 10-Minute EBCT Run

10-min. EBCT Start Date	9/27/98
10-min. EBCT Start Time	6:15

Group A, 2 samples per batch

Parameter	Units	Sample A1-10	Sample A2-10	Sample A3-10	Average	RPD
Sampling date	MM/DD/YY	10/7/98	12/8/98	12/22/98	---	---
Sampling time	hh:mm	7:10	7:15	8:30	---	---
Operation time	hh.hh	64.92	385.00	466.25	---	---
Bed volumes	(10 minutes)	3644.0	21611.3	26172.2	---	---
Alkalinity	mg/L as CaCO ₃	39.0	41.0	51.0	43.7	27.48
Total hardness	mg/L as CaCO ₃	75.0	79.0	88.0	80.7	16.12
Calcium hardness	mg/L as CaCO ₃	47.0	49.0	47.0	47.7	0.00
Ammonia	mg NH ₃ -N / L	NA	NA	0.0	0.0	#VALUE!
Bromide	µg/L	NA	NA	79.0	79.0	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Sample B4-10	Average	%SD
Sampling date	MM/DD/YY	10/7/98	12/8/98	12/22/98		---	---
Sampling time	hh:mm	7:10	7:15	8:30		---	---
Operation time	hh.hh	64.92	385.00	466.25		---	---
Bed volumes	(10 minute)	3644.0	21611.3	26172.2		---	---
pH	---	9.84	10.07	9.84		9.92	1.34
Turbidity	ntu	0.03	0.04	0.05		0.04	25.00
Temperature	°C	23.0	14.0	9.0		15.3	46.27
Total organic carbon	mg/L	3.81	4.20	5.28		4.43	17.19
UV ₂₅₄	cm ⁻¹	0.072	0.084	0.085		0.080	9.01
SUVA	L/(mg*m)	1.89	2.00	1.61		1.83	10.97
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.00		2.00	0.00
SDS-Free Cl ₂ residual	mg/L	0.20	0.20	0.20		0.20	0.00
SDS-Cl ₂ demand	mg/L	1.80	1.80	1.80		1.80	0.00
SDS-Chlorination temp.	°C	23.0	23.0	23.0		23.0	0.00
SDS-Chlorination pH	---	9.03	9.59	9.42		9.35	3.07
SDS-Incubation time	hours	24.0	24.0	24.0		24.0	0.00
SDS-TOX	µg Cl ⁻ / L	138.90	207.90	143.10		163.30	23.69
SDS-CHCl ₃	µg/L	26.20	33.90	38.50		32.87	18.91
SDS-BDCM	µg/L	6.20	4.10	5.40		5.23	20.25
SDS-DBCM	µg/L	2.00	1.40	1.70		1.70	17.65
SDS-CHBr ₃	µg/L	BMRL	BMRL	BMRL		#DIV/0!	#DIV/0!
SDS-THM4	µg/L	34.40	39.40	45.60		39.80	14.10
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL		#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	14.50	22.90	16.40		17.93	24.56
SDS-TCAA*	µg/L	2.60	2.40	1.90		2.30	15.68
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL		#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	1.00	BMRL	BMRL		1.00	#DIV/0!
SDS-BCAA*	µg/L	4.40	6.40	3.80		4.87	27.97
SDS-TBAA	µg/L	NA	NA	NA		#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA		#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA		#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	18.10	25.30	18.30		20.57	19.94
SDS-HAA6	µg/L	22.50	31.70	22.10		25.43	21.35

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 3-6: GAC Influent Water Quality For The 20-Minute EBCT Run¹

20-min. EBCT Start Date	9/29/98
20-min. EBCT Start Time	7:00

Group A, 2 samples per batch

Parameter	Units	Sample A1-20	Sample A2-20	Sample A2-20	Average	RPD
Sampling date	MM/DD/YY	10/7/98	10/27/98	11/18/98	---	---
Sampling time	hh:mm	9:45	9:30	8:25	---	---
Operation time	hh:hh	50.75	154.50	273.42	---	---
Bed volumes (20 minutes)		1424.4	4336.3	7673.9	---	---
Alkalinity	mg/L as CaCO ₃	39.0	41.0	51.0	43.7	27.48
Total hardness	mg/L as CaCO ₃	75.0	79.0	88.0	80.7	16.12
Calcium hardness	mg/L as CaCO ₃	47.0	49.0	47.0	47.7	0.00
Ammonia	mg NH ₃ -N / L	NA	NA	0.0	0.0	#VALUE!
Bromide	µg/L	NA	NA	79.0	79.0	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Sample B4-10	Average	%SD
Sampling date	MM/DD/YY	10/7/98	10/27/98	11/18/98		---	---
Sampling time	hh:mm	9:45	9:30	8:25		---	---
Operation time	hh:hh	50.75	154.50	273.42		---	---
Bed volumes (20 minute)		1424.4	4336.3	7673.9		---	---
pH	---	9.84	10.07	9.84		9.92	1.34
Turbidity	ntu	0.03	0.04	0.05		0.04	25.00
Temperature	°C	23.0	14.0	9.0		15.3	46.27
Total organic carbon	mg/L	3.81	4.20	5.28		4.43	17.19
UV ₂₅₄	cm	0.072	0.084	0.085		0.080	9.01
SUVA	L/(mg*m)	1.89	2.00	1.61		1.83	10.97
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.00		2.00	0.00
SDS-Free Cl ₂ residual	mg/L	0.20	0.20	0.20		0.20	0.00
SDS-Cl ₂ demand	mg/L	1.80	1.80	1.80		1.80	0.00
SDS-Chlorination temp.	°C	23.0	23.0	23.0		23.0	0.00
SDS-Chlorination pH	---	9.03	9.59	9.42		9.3	3.07
SDS-Incubation time	hours	24.0	24.0	24.0		24.0	0.00
SDS-TOX	µg Cl ₂ /L	138.90	207.90	143.10		163.30	23.69
SDS-CHCl ₃	µg/L	26.20	33.90	38.50		32.87	18.91
SDS-BDCM	µg/L	6.20	4.10	5.40		5.23	20.25
SDS-DBCM	µg/L	2.00	1.40	1.70		1.70	17.65
SDS-CHBr ₃	µg/L	BMRL	BMRL	BMRL		#DIV/0!	#DIV/0!
SDS-THM4	µg/L	34.40	39.40	45.60		39.80	14.10
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL		#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	14.50	22.90	16.40		17.93	24.56
SDS-TCAA*	µg/L	2.60	2.40	1.90		2.30	15.68
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL		#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	1.00	BMRL	BMRL		1.00	#DIV/0!
SDS-BCAA*	µg/L	4.40	6.40	3.80		4.87	27.97
SDS-TBAA	µg/L	NA	NA	NA		#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA		#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA		#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	18.10	25.30	18.30		20.57	19.94
SDS-HAA6	µg/L	22.50	31.70	22.10		25.43	21.35

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 3-7: GAC Effluent Water Quality For The 10-Minute EBCT Run¹

Field 3-7: GAC

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated?	Sampling date	Sampling time	Operation time	Bed volumes	pH	Temp.	TOC	UV ₂₅₄	SUVA	SDS Cl ₂ dose	SDS Free Cl ₂ residual	SDS Cl ₂ demand	SDS Chlorination temp.	SDS Chlorination pH	SDS Incubation time
	Y/N	MM/DD/YY	hh:mm	hh:hh	(10 minute)	---	°C	mg/L	cm ⁻¹	L/(mg*m)	mg/L	mg/L	mg/L	°C	---	hours
C1	n	9/29/98	7:15	25.00	1403.3	8.53	24.0	BMRL	0.003	#VALUE!	2.00	1.20	0.80	26.0	8.31	24.0
Avg-C2	y	10/7/98	7:55	73.67	4135.2	8.39	23.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	23.0	8.49	24.0
C3	n	10/20/98	10:20	140.08	7863.3	8.96	23.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.40	24.0
Avg-C4	y	10/27/98	8:35	178.33	10010.4	8.57	22.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	22.0	8.50	24.0
C5	n	11/4/98	7:30	225.25	12644.0	8.38	22.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	22.0	8.42	24.0
C6	n	11/12/98	8:20	266.08	14936.1	9.13	22.0	BMRL	0.006	#VALUE!	1.50	0.70	0.80	22.0	8.40	24.0
Avg-C7	y	11/18/98	7:20	297.08	16676.3	9.06	22.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	22.0	8.47	24.0
C8	n	12/2/98	7:10	360.92	20259.5	8.50	22.0	BMRL	0.009	#VALUE!	1.50	0.80	0.70	22.0	8.31	24.0
C9	n	12/8/98	7:55	393.67	22097.8	8.68	23.0	BMRL	0.011	#VALUE!	1.50	0.70	0.80	22.0	8.46	24.0
C10	n	12/16/98	6:50	440.58	24731.4	8.63	22.0	0.76	0.008	1.05	1.50	0.80	0.70	22.0	8.18	24.0
C11	n	12/22/98	7:05	472.83	26541.7	8.60	22.0	BMRL	0.009	#VALUE!	1.50	0.60	0.90	23.0	8.23	24.0
C12	n	1/5/99	7:05	536.83	30134.2	8.56	23.0	BMRL	0.001	#VALUE!	1.50	0.60	0.90	19.0	8.47	24.0
				-206134.25	-11571002.6					#DIV/0!			0.00			
				-206134.25	-11571002.6					#DIV/0!			0.00			
				-206134.25	-11571002.6					#DIV/0!			0.00			
				-206134.25	-11571002.6					#DIV/0!			0.00			
				-206134.25	-11571002.6					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date	Sampling time	Operation time	Bed volumes	pH	Temp.	TOC	UV ₂₅₄	SUVA	SDS Cl ₂ dose	SDS Free Cl ₂ residual	SDS Cl ₂ demand	SDS Chlorination temp.	SDS Chlorination pH	SDS Incubation time
		MM/DD/YY	hh:mm	hh:hh	(10 minute)	---	°C	mg/L	cm ⁻¹	L/(mg*m)	mg/L	mg/L	mg/L	°C	---	hours
C2	Primary	10/7/98	7:55	73.67	4135.2	8.39	23.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	23.0	8.49	24.0
D-C2	Duplicate	10/7/98	7:55	73.67	4135.2	8.39	23.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	23.0	8.49	24.0
Avg-C2	Average	---	---	---	---	8.39	23.0	#DIV/0!	0.002	#VALUE!	1.50	1.00	0.50	23.0	8.49	24.0
RPD-C2	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C4	Primary	10/27/98	8:35	178.33	10010.4	8.57	22.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	22.0	8.50	24.0
D-C4	Duplicate	10/27/98	8:35	178.33	10010.4	8.57	22.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	22.0	8.50	24.0
Avg-C4	Average	---	---	---	---	8.57	22.0	#DIV/0!	0.002	#VALUE!	1.50	1.00	0.50	22.0	8.50	24.0
RPD-C4	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C7	Primary	11/18/98	7:20	297.08	16676.3	9.06	22.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	22.0	8.47	24.0
D-C7	Duplicate	11/18/98	7:20	297.08	16676.3	9.06	22.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	22.0	8.47	24.0
Avg-C7	Average	---	---	---	---	9.06	22.0	#DIV/0!	0.001	#VALUE!	1.50	0.80	0.70	22.0	8.47	24.0
RPD-C7	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

AC Effluent Water Quality For The 10-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	1.30	1.50	1.00	4.80	BMRL	BMRL	1.10	BMRL	BMRL	BMRL	NA	NA	NA	1.10	1.10
BMRL	1.00	1.40	2.00	1.00	5.40	BMRL	BMRL	1.20	BMRL	1.10	1.20	NA	NA	NA	2.30	3.50
BMRL	BMRL	1.00	1.20	1.00	3.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.55	1.05	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.00	1.60	1.40	5.00	BMRL	BMRL	BMRL	BMRL	1.00	BMRL	NA	NA	NA	1.00	1.00
BMRL	BMRL	1.00	1.50	1.10	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	2.05	2.00	5.05	BMRL	BMRL	BMRL	BMRL	1.35	BMRL	NA	NA	NA	1.35	1.35
BMRL	1.00	1.00	3.60	1.40	7.00	BMRL	BMRL	BMRL	BMRL	2.60	BMRL	NA	NA	NA	2.60	2.60
BMRL	1.00	1.20	3.40	1.30	6.90	BMRL	BMRL	BMRL	BMRL	2.90	1.60	NA	NA	NA	2.90	4.50
28.00	1.00	1.40	3.50	1.60	7.50	BMRL	BMRL	BMRL	BMRL	2.30	1.50	NA	NA	NA	2.30	3.80
BMRL	BMRL	1.50	3.40	1.70	6.60	BMRL	BMRL	BMRL	BMRL	2.40	1.30	NA	NA	NA	2.40	3.70
BMRL	BMRL	1.10	3.20	2.20	6.50	BMRL	BMRL	BMRL	BMRL	2.20	BMRL	NA	NA	NA	2.20	2.20
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	1.50	2.10	1.00	5.60	BMRL	BMRL	1.20	BMRL	1.10	1.20	NA	NA	NA	2.30	3.50
BMRL	1.00	1.30	1.90	1.00	5.20	BMRL	BMRL	1.20	BMRL	1.10	1.20	NA	NA	NA	2.30	3.50
#DIV/0!	1.00	1.40	2.00	1.00	5.40	#DIV/0!	#DIV/0!	1.20	#DIV/0!	1.10	1.20	#DIV/0!	#DIV/0!	#DIV/0!	2.30	3.50
#VALUE!	0.00	14.29	10.00	0.00	7.41	#VALUE!	#VALUE!	0.00	#VALUE!	0.00	0.00	#####	#VALUE!	#VALUE!	0.00	0.00
BMRL	BMRL	1.00	1.50	1.10	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.60	1.00	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.55	1.05	3.60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	6.45	9.52	0.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	1.00	2.00	2.00	5.00	BMRL	BMRL	BMRL	BMRL	1.40	BMRL	NA	NA	NA	1.40	1.40
BMRL	BMRL	1.00	2.10	2.00	5.10	BMRL	BMRL	BMRL	BMRL	1.30	BMRL	NA	NA	NA	1.30	1.30
#DIV/0!	#DIV/0!	1.00	2.05	2.00	5.05	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.35	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.35	1.35
#VALUE!	#VALUE!	0.00	4.88	0.00	1.98	#VALUE!	#VALUE!	#VALUE!	#VALUE!	7.41	#VALUE!	#####	#VALUE!	#VALUE!	7.41	7.41

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 3-8: GAC Effluent Water Quality For The 20-Minute EBCT Run¹

Field 3-8: GAC Effluent Water

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated? Y/N	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:hh	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C1	n	9/29/98	8:00	9.00	252.6	8.85	24.0	BMRL	0.003	#VALUE!	2.00	1.20	0.80	26.0	8.44	24.0
Avg-C2	y	10/7/98	9:45	58.75	1648.9	8.34	23.0	BMRL	0.004	#VALUE!	1.50	1.00	0.50	23.0	8.55	24.0
C3	n	10/20/98	11:05	124.08	3482.6	9.38	23.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.31	24.0
Avg-C4	y	10/27/98	9:30	162.50	4560.8	8.77	22.0	#DIV/0!	0.009	#DIV/0!	1.50	1.00	0.50	22.0	8.42	24.0
C5	n	11/4/98	10:55	211.92	5947.8	8.48	22.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.34	24.0
C6	n	11/12/98	9:00	250.00	7016.7	9.54	22.0	BMRL	0.005	#VALUE!	1.50	0.70	0.80	22.0	8.43	24.0
Avg-C7	y	11/18/98	8:25	281.42	7898.4	9.51	22.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.38	24.0
C8	n	12/2/98	8:10	345.17	9687.7	8.46	22.0	BMRL	0.003	#VALUE!	1.50	0.90	0.60	22.0	8.31	24.0
C9	n	12/8/98	8:40	377.67	10599.8	8.37	23.0	BMRL	0.006	#VALUE!	1.50	0.90	0.60	22.0	8.39	24.0
C10	n	12/16/98	7:10	424.17	11904.9	8.41	22.0	BMRL	0.003	#VALUE!	1.50	0.80	0.70	22.0	8.20	24.0
C11	n	12/22/98	7:40	456.67	12817.1	8.41	22.0	BMRL	0.004	#VALUE!	1.50	0.80	0.70	23.0	8.19	24.0
C12	n	1/5/99	7:40	520.67	14613.4	8.44	23.0	BMRL	0.001	#VALUE!	1.50	0.70	0.80	19.0	8.49	24.0
				-206151.00	-5785971.4					#DIV/0!			0.00			
				-206151.00	-5785971.4					#DIV/0!			0.00			
				-206151.00	-5785971.4					#DIV/0!			0.00			
				-206151.00	-5785971.4					#DIV/0!			0.00			
				-206151.00	-5785971.4					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:hh	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C2	Primary	10/7/98	9:45	58.75	1648.9	8.34	23.0	BMRL	0.004	#VALUE!	1.50	1.00	0.50	23.0	8.55	24.0
D-C2	Duplicate	10/7/98	9:45	58.75	1648.9	8.34	23.0	BMRL	0.004	#VALUE!	1.50	1.00	0.50	23.0	8.55	24.0
Avg-C2	Average	---	---	---	---	8.34	23.0	#DIV/0!	0.004	#VALUE!	1.50	1.00	0.50	23.0	8.55	24.0
RPD-C2	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C4	Primary	10/27/98	9:30	162.50	4560.8	8.77	22.0	BMRL	0.009	#VALUE!	1.50	1.00	0.50	22.0	8.42	24.0
D-C4	Duplicate	10/27/98	9:30	162.50	4560.8	8.77	22.0	BMRL	0.009	#VALUE!	1.50	1.00	0.50	22.0	8.42	24.0
Avg-C4	Average	---	---	---	---	8.77	22.0	#DIV/0!	0.009	#VALUE!	1.50	1.00	0.50	22.0	8.42	24.0
RPD-C4	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C7	Primary	11/18/98	8:25	281.42	7898.4	9.51	22.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.38	24.0
D-C7	Duplicate	11/18/98	8:25	281.42	7898.4	9.51	22.0	BMRL	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.38	24.0
Avg-C7	Average	---	---	---	---	9.51	22.0	#DIV/0!	0.001	#VALUE!	1.50	1.00	0.50	22.0	8.38	24.0
RPD-C7	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

er Quality For The 20-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	1.40	1.60	1.00	5.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.30	1.80	1.00	5.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.00	3.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.10	1.00	3.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.00	1.20	1.10	4.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	1.00	BMRL	1.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.10	1.00	3.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	1.20	BMRL	1.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	1.20	BMRL	1.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.00	3.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.40	1.20	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.20	1.00	3.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.00	1.30	1.80	1.00	5.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.00	1.30	1.80	1.00	5.10	BMRL	BMRL	BMRL	BMRL	1.10	1.10	NA	NA	NA	1.10	2.20
#DIV/0!	1.00	1.30	1.80	1.00	5.10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.10	1.10	#DIV/0!	#DIV/0!	#DIV/0!	0.55	1.10
#VALUE!	0.00	0.00	0.00	0.00	0.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	200.00	200.00
BMRL	BMRL	1.00	1.10	1.00	3.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.10	1.00	3.10	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.10	1.00	3.10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	0.00	0.00	0.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
BMRL	BMRL	1.00	1.20	1.00	3.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.00	1.00	3.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	1.00	1.10	1.00	3.10	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	0.00	18.18	0.00	6.45	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 3-9: GAC Cost Parameters

Cost Parameter	Parameter value
Capital Recovery Interest Rate (%)	8
Capital Recovery Period (years)	20
Overhead & Profit Factor (% of construction costs)	15
Special Sitework Factor (% of construction costs)	5
Construction Contingencies (% of construction costs)	10
Engineering Fee Factor (% of construction costs)	15
1998 ENR Construction Cost Index (CCI base year 1913)	4965 (May 92)
1998 Producers Price Index (PPI base year 1967 = 100)	326 (May 92)
Labor Rate + Fringe (\$/work-hour)	23
Labor Overhead Factor (% of labor)	35
Electric Rate (\$/kW-h)	0.05
Fuel Oil Rate (\$/gal)	0.95
Natural Gas Rate (\$/ft ³)	0.005
Current Process Water Rate (\$/1000 gal)	0.29
Modifications to Existing Plant (% of construction costs)	20

FIELD-SET 4: 4th QUARTER RSSCT RESULTS (FILE: *qacrssct.xls*)**Field 4-1: PWS And Treatment Plant Data**

PWS Name	Rend Lake Intercity Water System
Public Water System Identification Number	IL0555100
Water Industry Data Base Number (<i>optional</i>)	NA
Official ICR Contact Person	Paul Adams
Mailing Address	Box 970, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Technical ICR Contact Person	Paul Adams
Mailing Address	Box 907, 1600 Marcum Branch Road Benton, IL 62812
Phone Number	618-439-4394
FAX Number	618-439-4398
E-Mail Address (<i>optional</i>)	NA
Plant Name	Rend Lake Intercity Water
Treatment Plant Category	CONV
Process Train Name	Rend Lake Water Plant
ICR Treatment Plant Identification Number	358
PWSID Number of Plant (<i>if assigned</i>)	IL0555100
Historical Minimum Water Temperature (°C)	2.0
Historical Average Water Temperature (°C)	15.0
State Approved Plant Capacity (MGD)	20.0

Field 4-2: Full-Scale GAC Characteristics¹

Carbon manufacturer	Calgon Carbon Corporation
Carbon trade name	Filltrasorb 400
Carbon type	Bituminous
Original GAC mesh size, upper (US standard mesh)	12
Original GAC mesh size, lower (US standard mesh)	40
Original carbon particle diameter, d_{LC} (mm)	1.053

1: These are the characteristics before the carbon is ground for RSSCT experiments.

Field 4-3: RSSCT Design Parameters**Input Design Parameters**

RSSCT influent TOC (mg/L)	3.0
Inner diameter of the RSSCT column, D_{SC} (mm)	11.0
Minimum RSSCT Reynolds number, $Re_{SC, min}$	0.5
Full-scale operating temperature, $T^{\circ}C$ ($^{\circ}C$)	21.0
Full-scale bed porosity, ϵ_{LC}	0.45
Measured RSSCT dry bed density, ρ_{SC} (g/cm ³)	0.5
RSSCT GAC mesh size, upper (US standard mesh)	100
RSSCT GAC mesh size, lower (US standard mesh)	200

Estimated Run Length

Bed volumes to 50% TOC breakthrough, BV_{50}	5202
Estimated run length, BV_T ($= 2 \times BV_{50}$)	10405
$BV_T + 30\%$ safety factor, $BV_{T+30\%}$ ($= 2.6 \times BV_{50}$)	13526

General RSSCT Design Parameters

Kinematic viscosity at $T^{\circ}C$, ν_{LC} (m ² /s)	1.002E-06
RSSCT carbon particle diameter, d_{SC} (mm)	0.1125
Scaling factor, SF	9.36
RSSCT hydraulic loading rate, v_{SC} (m/hr)	7.21
RSSCT flow rate, Q_{SC} (mL/min)	11.43
Estimated total influent volume required, V_{SC}^T (L)	496

10-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	10
Estimated full-scale run time, t_{LC}^T (days)	94
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	1.07
Estimated RSSCT run time, t_{SC}^T (days)	10.04
RSSCT bed length, l_{SC} (cm)	12.9
Estimated volume required for 10-minute EBCT, V_{SC} (L)	165
Mass GAC required, m_{SC} (g)	6.11

20-Minute EBCT Run

Full-scale empty bed contact time, $EBCT_{LC}$ (min)	20
Estimated full-scale run time, t_{LC}^T (days)	188
RSSCT empty bed contact time, $EBCT_{SC}$ (min)	2.14
Estimated RSSCT run time, t_{SC}^T (days)	20.08
RSSCT bed length, l_{SC} (cm)	25.7
Estimated volume required for 20-minute EBCT, V_{SC} (L)	330
Mass GAC required, m_{SC} (g)	12.21

US Standard Mesh Sizes

US standard mesh size	Opening (mm)
4	4.750
6	3.350
8	2.360
10	2.000
12	1.680
16	1.180
20	0.850
30	0.600
40	0.425
50	0.300
60	0.250
70	0.210
80	0.180
100	0.150
120	0.125
140	0.106
170	0.088
200	0.075
230	0.062
270	0.053
325	0.044
400	0.037

Field 4-4: Pretreatment Used Prior To GAC¹

Process	Description	Scale
Aeration	At plant intake	Full-Scale
Coagulation	17-21 mg/L alum, 0.4-2.0 mg/L cationic polymer	Full-Scale
Flocculation	Single-stage	Full-Scale
Sedimentation	1 hour	Full-Scale
Cartridge filtration	Pore size not available	Bench-scale

1: Design information, similar to that shown in Tables 6c and 6d of the ICR rule, must be included in the hard-copy *Treatment Study Summary Report* (see Section 10.0). The purpose of this table is to list the pretreatment processes used in this particular RSSCT run.

Field 4-5: GAC Influent Water Quality For The 10-Minute EBCT Run

10-min. EBCT Start Date	1/26/99
10-min. EBCT Start Time	6:40

Group A, 2 samples per batch

Parameter	Units	Sample A1-10	Sample A2-10	Average	RPD
Sampling date	MM/DD/YY	1/26/99	3/24/99	---	---
Sampling time	hh:mm	7:00	9:25	---	---
Operation time	hh.hh	0.33	322.75	---	---
Bed volumes	(10 minutes)	18.7	18117.0	---	---
Alkalinity	mg/L as CaCO ₃	56.0	44.0	50.0	24.00
Total hardness	mg/L as CaCO ₃	102.0	90.0	96.0	12.50
Calcium hardness	mg/L as CaCO ₃	60.0	55.0	57.5	8.70
Ammonia	mg NH ₃ -N / L	NA	NA	#DIV/0!	#VALUE!
Bromide	µg/L	NA	NA	#DIV/0!	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Average	%SD
Sampling date	MM/DD/YY	1/26/99	3/24/99	3/31/99	---	---
Sampling time	hh:mm	7:00	9:25	9:05	---	---
Operation time	hh.hh	0.33	322.75	362.42	---	---
Bed volumes	(10 minute)	18.7	18117.0	20343.7	---	---
pH	---	9.70	8.99	9.47	9.39	3.86
Turbidity	ntu	0.04	0.07	0.10	0.07	42.86
Temperature	°C	4.0	9.0	9.0	7.3	39.36
Total organic carbon	mg/L	4.97	NA	NA	4.97	#DIV/0!
UV ₂₅₄	cm ⁻¹	0.091	NA	NA	0.091	#DIV/0!
SUVA	L/(mg*m)	1.83	#VALUE!	#VALUE!	#VALUE!	#VALUE!
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.00	2.00	0.00
SDS-Free Cl ₂ residual	mg/L	0.10	0.20	0.10	0.13	43.30
SDS-Cl ₂ demand	mg/L	1.90	1.80	1.90	1.87	3.09
SDS-Chlorination temp.	°C	22.0	26.0	27.0	25.0	10.58
SDS-Chlorination pH	---	8.43	8.86	8.61	8.63	2.50
SDS-Incubation time	hours	24.0	24.0	24.0	24.0	0.00
SDS-TOX	µg Cl ⁻ / L	165.80	NA	NA	165.80	#DIV/0!
SDS-CHCl ₃	µg/L	17.90	BMRL	BMRL	17.90	#DIV/0!
SDS-BDCM	µg/L	8.70	BMRL	BMRL	8.70	#DIV/0!
SDS-DBCm	µg/L	5.10	BMRL	BMRL	5.10	#DIV/0!
SDS-CHBr ₃	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-THM4	µg/L	31.70	0.00	0.00	10.57	173.21
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	11.80	BMRL	BMRL	11.80	#DIV/0!
SDS-TCAA*	µg/L	4.30	BMRL	BMRL	4.30	#DIV/0!
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	1.80	BMRL	BMRL	1.80	#DIV/0!
SDS-BCAA*	µg/L	6.00	BMRL	BMRL	6.00	#DIV/0!
SDS-TBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	17.90	0.00	0.00	5.97	173.21
SDS-HAA6	µg/L	23.90	0.00	0.00	7.97	173.21

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured

Field 4-6: GAC Influent Water Quality For The 20-Minute EBCT Run¹

20-min. EBCT Start Date	1/26/99
20-min. EBCT Start Time	7:30

Group A, 2 samples per batch

Parameter	Units	Sample A1-20	Sample A2-20	Average	RPD
Sampling date	MM/DD/YY	1/26/99	3/24/99	---	---
Sampling time	hh:mm	7:30	9:25	---	---
Operation time	hh.hh	0.00	321.92	---	---
Bed volumes	(20 minutes)	0.0	9035.1	---	---
Alkalinity	mg/L as CaCO ₃	56.0	44.0	50.0	24.00
Total hardness	mg/L as CaCO ₃	102.0	90.0	96.0	12.50
Calcium hardness	mg/L as CaCO ₃	60.0	55.0	57.5	8.70
Ammonia	mg NH ₃ -N / L	NA	NA	#DIV/0!	#VALUE!
Bromide	µg/L	NA	NA	#DIV/0!	#VALUE!

Group B, 3 samples per batch

Parameter	Units	Sample B1-10	Sample B2-10	Sample B3-10	Average	%SD
Sampling date	MM/DD/YY	1/26/99	3/24/99	3/31/99	---	---
Sampling time	hh:mm	7:30	9:25	9:05	---	---
Operation time	hh.hh	0.00	321.92	361.58	---	---
Bed volumes	(20 minute)	0.0	9035.1	10148.4	---	---
pH	---	9.70	8.99	9.47	9.39	3.86
Turbidity	ntu	0.04	0.07	0.10	0.07	42.86
Temperature	°C	4.0	9.0	9.0	7.3	39.36
Total organic carbon	mg/L	4.90	NA	NA	4.90	#DIV/0!
UV ₂₅₄	cm ⁻¹	0.090	NA	NA	0.090	#DIV/0!
SUVA	L/(mg*m)	1.84	#VALUE!	#VALUE!	#VALUE!	#VALUE!
SDS-Cl ₂ dose	mg/L	2.00	2.00	2.00	2.00	0.00
SDS-Free Cl ₂ residual	mg/L	0.10	0.20	0.10	0.13	43.30
SDS-Cl ₂ demand	mg/L	1.90	1.80	1.90	1.87	3.09
SDS-Chlorination temp.	°C	22.0	26.0	27.0	25.0	10.58
SDS-Chlorination pH	---	8.43	8.86	8.61	8.6	2.50
SDS-Incubation time	hours	24.0	24.0	24.0	24.0	0.00
SDS-TOX	µg Cl ⁻ /L	167.70	NA	NA	167.70	#DIV/0!
SDS-CHCl ₃	µg/L	17.90	BMRL	BMRL	17.90	#DIV/0!
SDS-BDCM	µg/L	8.70	BMRL	BMRL	8.70	#DIV/0!
SDS-DBCm	µg/L	5.10	BMRL	BMRL	5.10	#DIV/0!
SDS-CHBr ₃	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-THM4	µg/L	31.70	0.00	0.00	10.57	173.21
SDS-MCAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DCAA*	µg/L	11.80	BMRL	BMRL	11.80	#DIV/0!
SDS-TCAA*	µg/L	4.30	BMRL	BMRL	4.30	#DIV/0!
SDS-MBAA*	µg/L	BMRL	BMRL	BMRL	#DIV/0!	#DIV/0!
SDS-DBAA*	µg/L	1.80	BMRL	BMRL	1.80	#DIV/0!
SDS-BCAA*	µg/L	6.00	BMRL	BMRL	6.00	#DIV/0!
SDS-TBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-CDBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-DCBAA	µg/L	NA	NA	NA	#DIV/0!	#DIV/0!
SDS-HAA5	µg/L	17.90	0.00	0.00	5.97	173.21
SDS-HAA6	µg/L	23.90	0.00	0.00	7.97	173.21

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 4-7: GAC Effluent Water Quality For The 10-Minute EBCT Run¹

Field 4-7: GAC

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated? Y/N	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:hh	Bed volumes (10 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C1	n	1/26/99	7:40	9.00	505.2	8.72	22.0	BMRL	0.002	#VALUE!	1.50	0.50	1.00	22.0	8.62	24.0
C2	n	2/10/99	7:05	96.42	5412.2	8.15	21.0	BMRL	0.002	#VALUE!	1.50	0.90	0.60	21.0	8.14	24.0
C3	n	2/23/99	7:00	160.33	9000.0	8.30	23.0	BMRL	0.001	#VALUE!	1.50	0.70	0.80	22.0	8.21	24.0
C4	n	3/3/99	7:05	208.42	11699.1	8.12	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.20	24.0
C5	n	3/10/99	8:05	249.42	14000.6	8.26	21.0	BMRL	0.006	#VALUE!	1.50	0.70	0.80	20.0	8.40	24.0
C6	n	3/17/99	13:00	294.33	16521.9	8.31	20.0	BMRL	NA	#VALUE!	1.50	1.20	0.30	21.0	8.28	24.0
C7	n	3/24/99	9:50	331.17	18589.5	8.40	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.31	24.0
C8	n	3/24/99	10:10	331.50	18608.2	8.40	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.31	24.0
C9	n	3/24/99	10:30	331.83	18626.9	8.40	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.31	24.0
C10	n	3/31/99	9:25	370.75	20811.4	8.51	23.0	BMRL	0.002	#VALUE!	1.50	0.70	0.80	22.0	8.37	24.0
C11	n	3/31/99	9:40	371.00	20825.5	8.51	23.0	BMRL	0.002	#VALUE!	1.50	0.70	0.80	22.0	8.37	24.0
C12	n	3/31/99	10:00	371.33	20844.2	8.51	23.0	BMRL	0.002	#VALUE!	1.50	0.70	0.80	22.0	8.37	24.0
				-206790.67	-11607849.4					#DIV/0!			0.00			
				-206790.67	-11607849.4					#DIV/0!			0.00			
				-206790.67	-11607849.4					#DIV/0!			0.00			
				-206790.67	-11607849.4					#DIV/0!			0.00			
				-206790.67	-11607849.4					#DIV/0!			0.00			
				-206790.67	-11607849.4					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:hh	Bed volumes (10 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
	Primary	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Duplicate	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Average	---	---	---	---	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!
	RPD	---	---	---	---	#####	#####	#####	#####	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
	Primary	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Duplicate	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Average	---	---	---	---	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!
	RPD	---	---	---	---	#####	#####	#####	#####	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
	Primary	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Duplicate	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Average	---	---	---	---	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!
	RPD	---	---	---	---	#####	#####	#####	#####	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

AC Effluent Water Quality For The 10-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	BMRL	BMRL	1.00	1.00	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	BMRL	1.30	1.30	2.60	BMRL	BMRL	BMRL	BMRL	BMRL	1.20	NA	NA	NA	0.00	1.20
BMRL	BMRL	1.00	1.40	1.00	3.40	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.20	1.70	1.00	3.90	BMRL	1.70	BMRL	BMRL	2.40	BMRL	NA	NA	NA	4.10	4.10
NA	BMRL	1.00	1.60	1.00	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.80	1.00	3.80	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.70	1.00	3.70	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.90	1.10	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.00	1.00	3.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.70	1.10	3.80	BMRL	BMRL	BMRL	BMRL	1.30	BMRL	NA	NA	NA	1.30	1.30
BMRL	BMRL	1.00	1.80	1.20	4.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl ₃ µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr ₃ µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#####	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

es make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 4-8: GAC Effluent Water Quality For The 20-Minute EBCT Run¹

Field 4-8: GAC Effluent Water

Group C, 12 effluent samples per run

Sample ID	Was sample duplicated? Y/N	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:hh	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C1	n	1/26/99	8:30	9.00	252.6	9.34	22.0	BMRL	0.003	#VALUE!	1.50	0.50	1.00	22.0	8.64	24.0
Avg-C2	y	2/10/99	8:00	96.50	2708.4	8.18	21.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	21.0	8.18	24.0
C3	n	2/23/99	7:30	160.00	4490.7	8.45	23.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	22.0	8.20	24.0
Avg-C4	y	3/3/99	9:40	210.17	5898.7	8.22	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.14	24.0
C5	n	3/10/99	8:40	249.17	6993.3	8.40	21.0	BMRL	0.002	#VALUE!	1.50	0.80	0.70	21.0	8.06	24.0
C6	n	3/17/99	13:00	293.50	8237.6	8.34	20.0	BMRL	NA	#VALUE!	1.50	1.10	0.40	21.0	8.23	24.0
C7	n	3/24/99	9:50	330.33	9271.4	8.28	21.0	BMRL	0.005	#VALUE!	1.50	0.90	0.60	21.0	8.40	24.0
C8	n	3/24/99	10:10	330.67	9280.7	8.28	21.0	BMRL	0.005	#VALUE!	1.50	0.90	0.60	21.0	8.40	24.0
C9	n	3/24/99	10:30	331.00	9290.1	8.28	21.0	BMRL	0.005	#VALUE!	1.50	0.90	0.60	21.0	8.40	24.0
C10	n	3/31/99	9:25	369.92	10382.3	8.35	23.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	23.0	8.54	24.0
C11	n	3/31/99	9:40	370.17	10389.3	8.35	23.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	23.0	8.54	24.0
C12	n	3/31/99	10:00	370.50	10398.7	8.35	23.0	BMRL	0.001	#VALUE!	1.50	0.80	0.70	23.0	8.54	24.0
				-206791.50	-5803948.1					#DIV/0!			0.00			
				-206791.50	-5803948.1					#DIV/0!			0.00			
				-206791.50	-5803948.1					#DIV/0!			0.00			
				-206791.50	-5803948.1					#DIV/0!			0.00			
				-206791.50	-5803948.1					#DIV/0!			0.00			

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

1: Do not enter the results from duplicate samples into the table above, instead enter the average value for the primary and duplicate analyses in the above table, and enter the results for the primary and duplicate analyses below.

Group D, 3 duplicate effluent samples per run (results from primary and duplicate analyses)

Sample ID	Sample Type	Sampling date MM/DD/YY	Sampling time hh:mm	Operation time hh:hh	Bed volumes (20 minute)	pH ---	Temp. °C	TOC mg/L	UV ₂₅₄ cm ⁻¹	SUVA L/(mg*m)	SDS Cl ₂ dose mg/L	SDS Free Cl ₂ residual mg/L	SDS Cl ₂ demand mg/L	SDS Chlorination temp. °C	SDS Chlorination pH ---	SDS Incubation time hours
C2	Primary	2/10/99	8:00	96.50	2708.4	8.18	21.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	21.0	8.18	24.0
D-C2	Duplicate	2/10/99	8:00	96.50	2708.4	8.18	21.0	BMRL	0.002	#VALUE!	1.50	1.00	0.50	21.0	8.18	24.0
Avg-C2	Average	---	---	---	---	8.18	21.0	#DIV/0!	0.002	#VALUE!	1.50	1.00	0.50	21.0	8.18	24.0
RPD-C2	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
C4	Primary	3/3/99	9:40	210.17	5898.7	8.22	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.14	24.0
D-C4	Duplicate	3/3/99	9:40	210.17	5898.7	8.22	21.0	BMRL	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.14	24.0
Avg-C4	Average	---	---	---	---	8.22	21.0	#DIV/0!	0.001	#VALUE!	1.50	0.90	0.60	21.0	8.14	24.0
RPD-C4	RPD	---	---	---	---	0.00	0.00	#####	0.00	#VALUE!	0.00	0.00	0.00	0.00	0.00	0.00
	Primary	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Duplicate	NA	NA	#VALUE!	#VALUE!	NA	NA	NA	NA	#VALUE!	NA	NA	#VALUE!	NA	NA	NA
	Average	---	---	---	---	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!
	RPD	---	---	---	---	#####	#VALUE!	#####	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

BMRL = Below Minimum Reporting Level; NA = Not Analyzed; NR = Not Reported

BMRL = Below Minimum Reporting Level

*: These six species make up HAA6, but the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

*: These six species make up HAA6, but

er Quality For The 20-Minute EBCT Run (continued)

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	BMRL	BMRL	1.00	1.00	2.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	1.30	1.50	1.70	1.20	5.70	BMRL	BMRL	BMRL	BMRL	BMRL	1.20	NA	NA	NA	0.00	1.20
BMRL	BMRL	1.00	1.20	1.00	3.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.50	1.00	3.50	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
NA	BMRL	1.00	1.20	1.00	3.20	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.60	1.00	3.60	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.30	1.00	3.30	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.60	1.20	3.80	BMRL	BMRL	BMRL	BMRL	1.00	BMRL	NA	NA	NA	1.00	1.00
BMRL	BMRL	1.00	1.00	1.00	3.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
BMRL	BMRL	1.00	1.00	1.00	3.00	BMRL	BMRL	BMRL	BMRL	BMRL	BMRL	NA	NA	NA	0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00
					0.00										0.00	0.00

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

SDS TOX µg Cl ⁻ /L	SDS CHCl3 µg/L	SDS BDCM µg/L	SDS DBCM µg/L	SDS CHBr3 µg/L	SDS THM4 µg/L	SDS MCAA* µg/L	SDS DCAA* µg/L	SDS TCAA* µg/L	SDS MBAA* µg/L	SDS DBAA* µg/L	SDS BCAA* µg/L	SDS TBAA µg/L	SDS CDBAA µg/L	SDS DCBAA µg/L	SDS HAA5 µg/L	SDS HAA6 µg/L
BMRL	1.30	1.50	1.70	1.20	5.70	BMRL	BMRL	BMRL	BMRL	BMRL	1.20	NA	NA	NA	0.00	1.20
BMRL	1.30	1.50	1.70	1.20	5.70	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
#DIV/0!	1.30	1.50	1.70	1.20	5.70	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.20	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.60
#VALUE!	0.00	0.00	0.00	0.00	0.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	200.00
BMRL	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
BMRL	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
NA	NA	NA	NA	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.00
#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!

el; NA = Not Analyzed; NR = Not Reported

t the other three HAA species, TBAA, CDBAA and DCBAA, should be reported if measured.

Field 4-9: GAC Cost Parameters

Cost Parameter	Parameter value
Capital Recovery Interest Rate (%)	8
Capital Recovery Period (years)	20
Overhead & Profit Factor (% of construction costs)	15
Special Sitework Factor (% of construction costs)	5
Construction Contingencies (% of construction costs)	10
Engineering Fee Factor (% of construction costs)	15
1998 ENR Construction Cost Index (CCI base year 1913)	4965 (May 92)
1998 Producers Price Index (PPI base year 1967 = 100)	326 (May 92)
Labor Rate + Fringe (\$/work-hour)	23
Labor Overhead Factor (% of labor)	35
Electric Rate (\$/kW-h)	0.05
Fuel Oil Rate (\$/gal)	0.95
Natural Gas Rate (\$/ft ³)	0.005
Current Process Water Rate (\$/1000 gal)	0.29
Modifications to Existing Plant (% of construction costs)	20

Appendix D: Treatment Study Summary Report Spreadsheet

Miscellaneous Information

9904a

PWSID	IL0555100
Plant ICR #	358

Full-Scale Plant Information

Item	Result
Primary Disinfectant	
Residual Disinfectant	Chloramines
Source Type	Lake
Source Name	Rend Lake

Laboratory Information

Item	ICR ID or Abbrev	Lab Name	Lab Type	Lab City	Lab State
Lab #1	IL003	Illinois EPA Champaign Inorganic State		Champaign	IL
Lab #2	IL004	Illinois EPA Springfield Organic State		Springfield	IL
Lab #3	IL014	Rend Lake Laboratory Utility		Benton	IL
Lab #4	IN004	Environmental Health Laborator Commercial		South Bend	IN

Batch Sampling Dates for Quarterly Bench-Scale Testing

Item	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Sample Collection Date	3/9/98	6/16/98	9/29/98	1/26/99

1998 Flow and Population Information

Source	Flow (mgd)	Population Served
Total Population Served		125,000
Surface Water	13	125,000
Ground Water	0	0
Purchased Finished Water	0	0
Total	13	

Full-Scale Water Quality Data**Full-Scale Influent Water Quality Data**

Item	Units	Average	Std Dev	Min	Max	Count
Temperature	C	17.7	8.4	5	28	18
pH	Unit	7.92	0.11	7.76	8.15	18
Turbidity	ntu	3.85	2.38	0.05	8.6	18
Alkalinity	mg/L as CaCO ₃	57	34	10	186	18
Total Hardness	mg/L as CaCO ₃	105	6	93	114	18
Calcium Hardness	mg/L as CaCO ₃	58	17	27	76	18
TOC	mg/L	5.6	1.3	4.8	10.4	18
UV ₂₅₄	1/cm	0.147	0.037	0.013	0.188	18
Bromide	µg/L	0.084	0.016	0.056	0.111	18
TSUVA*	L/(mg*m)	2.69	0.78	0.23	3.63	18

*TSUVA = [UV₂₅₄ (1/m)] / [TOC (mg/L)]. Summary information for TSUVA should only be calculated from TSUVA values with paired TOC and UV₂₅₄ measure

Full-Scale Finished Water Quality Data

Item	Units	Average	Std Dev	Min	Max	Count
Temperature	C	17.5	8.3	5	28	18
pH	unit	9.39	0.14	9.12	9.69	18
Turbidity	ntu	0.14	0.24	0.02	0.9	18
TOC	mg/L	4	1	3	7.6	18
UV ₂₅₄	1/cm	0.068	0.011	0.05	0.088	18
DS-THM4	µg/L	58.4	20	34.2	108.5	24
DS-HAA5	µg/L	22.7	7.1	13.8	37.5	24
DS-HAA6	µg/L	26.8	7.3	17.4	42.8	24

QA/QC Data - Sheet 1											Percentiles		
Analyte Identification	Units	Laboratory Identification	Start Service Date	End Service Date	Method	MRL		Count	Average	Std Dev	25th	50th	75th
pH	unit												
Temperature	C												
Alkalinity	mg/L as CaCO ₃												
Ammonia	mg NH ₃ -N/L	IL003	3/16/98	12/22/98	EPA 350.1	0.01							
Calcium Hardness	mg/L as CaCO ₃												
SDS-Cl ₂ Residual	mg/L												
Total Hardness	mg/L as CaCO ₃												
Turbidity	ntu												
Bromide	µg/L	IL003	12/22/98	12/22/98	EPA 300.0	20	RPE of Analytical Duplicates:	NA	NA	NA	NA	NA	NA
							% Recovery for Lab Fortified Matrix:	NA	NA	NA	NA	NA	NA
							% Recovery for PE Samples:	6	104.3	11.0	97.0	103.1	113.3
UV ₂₅₄	1/cm	IL003	3/9/98	3/31/99	SM 5910	0.002	RPE of Analytical Duplicates:	93	1.2	2.1	0.1	0.3	0.9
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:	6	91.5	7.8	86.8	91.9	96.4
TOC	mg/L	IL003	3/9/98	3/31/99	SM 5310 (0.7	RPE of Analytical Duplicates:	15	4.8	5.6	1.6	3.2	4.7
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:	6	102.5	9.4	99.0	102.7	108.3
SDS-TOX	µg Cl-/L	IL003	3/9/98	3/31/99	SM 5320 f	50	RPE of Analytical Duplicates:	16	13.5	20.1	2.3	4.9	8.6
							% Recovery for Lab Fortified Matrix:	6	93.0	34.5	74.3	85.7	93.0
							% Recovery for PE Samples:	8	90.0	15.4	80.4	84.5	100.8
SDS-CHCl ₃	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
SDS-BDCM	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
SDS-DBCM	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						

SDS-CHBr ₃	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
THM4	µg/L		% Recovery for PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
SDS-MCAA	µg/L		Avg % Recov for Indiv PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-TCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-MBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-BCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-TBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-CDBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DCBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
HAA5	µg/L		% Recovery for PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
HAA6	µg/L		Avg % Recov for Indiv PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
HAA9	µg/L			
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	

QA/QC Data - Sheet 2											Percentiles		
Analyte Identification	Units	Laboratory Identification	Start Service Date	End Service Date	Method	MRL	Count	Average	Std Dev		25th	50th	75th
pH	unit												
Temperature	C												
Alkalinity	mg/L as CaCO ₃												
Ammonia	mg NH ₃ -N/L												
Calcium Hardness	mg/L as CaCO ₃												
SDS-Cl ₂ Residual	mg/L												
Total Hardness	mg/L as CaCO ₃												
Turbidity	ntu												
Bromide	µg/L												
UV ₂₅₄	1/cm												
TOC	mg/L												
SDS-TOX	µg Cl-/L												
SDS-CHCl ₃	µg/L	IL004	3/9/98	3/31/98	EPA 502.2	1	RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:	20 23 5	4.0 106.3 106.3	4.6 17.1 7.9	0.6 98.0 100.6	2.0 101.0 110.9	6.5 107.5 111.2
SDS-BDCM	µg/L	IL004	3/9/98	3/31/98	EPA 502.2	1	RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:	20 23 5	5.6 96.8 105.4	8.3 9.2 8.6	0.0 92.0 102.0	2.7 97.0 106.0	7.1 100.5 112.7
SDS-DBCM	µg/L	IL004	3/9/98	3/31/98	EPA 502.2	1	RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix:	20 23	6.9 101.1	9.9 9.4	0.0 95.0	2.8 101.0	7.2 107.0

SDS-CHBr ₃	µg/L	IL004	3/9/98	3/31/98	EPA 502.2	1	% Recovery for PE Samples:	5	112.4	8.1	106.6	111.7	112.7
							RPE of Analytical Duplicates:	5	0.5	1.0	0.0	0.0	0.0
							% Recovery for Lab Fortified Matrix:	23	96.9	13.1	89.5	100.0	102.5
							% Recovery for PE Samples:	5	109.2	10.4	104.0	105.4	108.2
THM4	µg/L	IL004	3/9/98	3/31/98	EPA 502.2		Avg RPE of Indiv Anal Dupl:	20	4.4	5.4	0.2	2.2	9.1
							Avg % Recov for Indiv Lab Fort Matrix:	23	100.3	7.0	97.0	99.3	104.1
							Avg % Recov for Indiv PE Samples:	5	108.3	8.0	102.0	108.7	111.0
SDS-MCAA	µg/L	IL004	3/9/98	3/31/98	EPA 552.2	2	RPE of Analytical Duplicates:	1	6.5	NA	NA	NA	NA
							% Recovery for Lab Fortified Matrix:	38	118.4	29.8	103.0	109.5	124.0
							% Recovery for PE Samples:	4	96.7	8.8	95.4	100.1	101.5
SDS-DCAA	µg/L	IL004	3/9/98	3/31/98	EPA 552.2	1	RPE of Analytical Duplicates:	20	5.4	5.3	2.1	3.8	6.0
							% Recovery for Lab Fortified Matrix:	39	126.0	37.3	107.5	117.0	129.0
							% Recovery for PE Samples:	4	85.8	8.0	81.5	83.7	88.1
SDS-TCAA	µg/L	IL004	3/9/98	3/31/98	EPA 552.2	1	RPE of Analytical Duplicates:	20	9.8	11.8	1.9	6.2	14.5
							% Recovery for Lab Fortified Matrix:	39	133.5	46.8	107.5	115.0	136.5
							% Recovery for PE Samples:	4	93.9	11.6	88.6	96.0	101.2
SDS-MBAA	µg/L	IL004	3/9/98	3/31/98	EPA 552.2	1	RPE of Analytical Duplicates:	2	11.1	15.7	NA	NA	NA
							% Recovery for Lab Fortified Matrix:	39	113.0	21.7	100.0	105.0	117.0
							% Recovery for PE Samples:	4	82.3	12.4	72.1	81.3	91.5
SDS-DBAA	µg/L	IL004	3/9/98	3/31/98	EPA 552.2	1	RPE of Analytical Duplicates:	7	7.1	10.0	0.0	5.4	8.1
							% Recovery for Lab Fortified Matrix:	39	120.9	26.6	100.5	111.0	122.5
							% Recovery for PE Samples:	4	93.4	7.5	90.4	92.3	95.3
SDS-BCAA	µg/L	IL004	3/9/98	3/31/98	EPA 552.2	1	RPE of Analytical Duplicates:	20	5.5	5.7	1.7	4.3	7.6
							% Recovery for Lab Fortified Matrix:	39	121.0	41.1	104.5	114.0	120.5
							% Recovery for PE Samples:	4	87.0	4.5	84.2	86.6	89.4
SDS-TBAA	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
SDS-CDBAA	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
SDS-DCBAA	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
HAA5	µg/L	IL004	3/9/98	3/31/98	EPA 552.2		Avg RPE of Indiv Anal Dupl:	20	6.4	6.5	2.8	4.2	8.6
							Avg % Recov for Indiv Lab Fort Matrix:	38	122.7	26.5	105.0	112.1	133.0
							Avg % Recov for Indiv PE Samples:	4	90.4	5.2	87.5	89.4	92.3
HAA6	µg/L	IL004	3/9/98	3/31/98	EPA 552.2		Avg RPE of Indiv Anal Dupl:	20	6.2	6.3	2.5	4.0	8.9
							Avg % Recov for Indiv Lab Fort Matrix:	38	122.6	26.3	105.5	113.3	131.5
								4	89.9	4.8	87.0	89.3	92.2
HAA9	µg/L						Avg RPE of Indiv Anal Dupl:						
							Avg % Recov for Indiv Lab Fort Matrix:						

QA/QC Data - Sheet 3											Percentiles		
Analyte Identification	Units	Laboratory Identification	Start Service Date	End Service Date	Method	MRL	Count	Average	Std Dev		25th	50th	75th
pH	unit	IL014	3/9/98	3/31/99	SM 4500-H+ B								
Temperature	C	IL014	3/9/98	3/31/99	SM 2550 B								
Alkalinity	mg/L as CaCO ₃	IL014	3/9/98	3/31/99	SM 2320 B	NA							
Ammonia	mg NH ₃ -N/L												
Calcium Hardness	mg/L as CaCO ₃	IL014	3/9/98	3/31/99	SM 3500-Ca D	NA							
SDS-Cl ₂ Residual	mg/L	IL014	3/9/98	3/31/99	SM 4500-Cl F	NA							
Total Hardness	mg/L as CaCO ₃	IL014	3/9/98	3/31/99	SM 2340 B	NA							
Turbidity	ntu	IL014	3/9/98	3/31/99	SM 2130 B	NA							
Bromide	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
UV ₂₅₄	1/cm									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
TOC	mg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-TOX	µg Cl-/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-CHCl ₃	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-BDCM	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-DBCM	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			

SDS-CHBr ₃	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
THM4	µg/L		Avg RPE of Indiv Anal Dupl:
			Avg % Recov for Indiv Lab Fort Matrix:
			Avg % Recov for Indiv PE Samples:
SDS-MCAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-DCAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-TCAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-MBAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-DBAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-BCAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-TBAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-CDBAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
SDS-DCBAA	µg/L		RPE of Analytical Duplicates:
			% Recovery for Lab Fortified Matrix:
			% Recovery for PE Samples:
HAA5	µg/L		Avg RPE of Indiv Anal Dupl:
			Avg % Recov for Indiv Lab Fort Matrix:
			Avg % Recov for Indiv PE Samples:
HAA6	µg/L		Avg RPE of Indiv Anal Dupl:
			Avg % Recov for Indiv Lab Fort Matrix:
HAA9	µg/L		Avg RPE of Indiv Anal Dupl:
			Avg % Recov for Indiv Lab Fort Matrix:

QA/QC Data - Sheet 4											Percentiles		
Analyte Identification	Units	Laboratory Identification	Start Service Date	End Service Date	Method	MRL		Count	Average	Std Dev	25th	50th	75th
pH	unit												
Temperature	C												
Alkalinity	mg/L as CaCO ₃												
Ammonia	mg NH ₃ -N/L												
Calcium Hardness	mg/L as CaCO ₃												
SDS-Cl ₂ Residual	mg/L												
Total Hardness	mg/L as CaCO ₃												
Turbidity	ntu												
Bromide	µg/L	IN004	8/12/98	8/12/98	EPA 300	20	RPE of Analytical Duplicates:	NA	NA	NA	NA	NA	NA
							% Recovery for Lab Fortified Matrix:	NA	NA	NA	NA	NA	NA
							% Recovery for PE Samples:	NA	NA	NA	NA	NA	NA
UV ₂₅₄	1/cm						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
TOC	mg/L	IN004	5/20/98	9/29/98	SM 5310 (0.7	RPE of Analytical Duplicates:	NA	NA	NA	NA	NA	NA
							% Recovery for Lab Fortified Matrix:	NA	NA	NA	NA	NA	NA
							% Recovery for PE Samples:	NA	NA	NA	NA	NA	NA
SDS-TOX	µg Cl-/L	IN004	4/8/98	6/16/98	SM 5320 f	50	RPE of Analytical Duplicates:	1	8.3	NA	NA	NA	NA
							% Recovery for Lab Fortified Matrix:	NA	NA	NA	NA	NA	NA
							% Recovery for PE Samples:	NA	NA	NA	NA	NA	NA
SDS-CHCl ₃	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
SDS-BDCM	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						
							% Recovery for PE Samples:						
SDS-DBCM	µg/L						RPE of Analytical Duplicates:						
							% Recovery for Lab Fortified Matrix:						

SDS-CHBr ₃	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
THM4	µg/L		% Recovery for PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
SDS-MCAA	µg/L		Avg % Recov for Indiv PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-TCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-MBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-BCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-TBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-CDBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DCBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
HAA5	µg/L		% Recovery for PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
HAA6	µg/L		Avg % Recov for Indiv PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
HAA9	µg/L			
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	

QA/QC Data - Sheet 4											Percentiles		
Analyte Identification	Units	Laboratory Identification	Start Service Date	End Service Date	Method	MRL	Count	Average	Std Dev		25th	50th	75th
pH	unit												
Temperature	C												
Alkalinity	mg/L as CaCO ₃												
Ammonia	mg NH ₃ -N/L												
Calcium Hardness	mg/L as CaCO ₃												
SDS-Cl ₂ Residual	mg/L												
Total Hardness	mg/L as CaCO ₃												
Turbidity	ntu												
Bromide	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
UV ₂₅₄	1/cm									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
TOC	mg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-TOX	µg Cl-/L	IN004	7/7/98	12/16/98	SM 5320 f	25				RPE of Analytical Duplicates: NA % Recovery for Lab Fortified Matrix: NA % Recovery for PE Samples: NA	NA	NA	NA
SDS-CHCl ₃	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-BDCM	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix: % Recovery for PE Samples:			
SDS-DBCM	µg/L									RPE of Analytical Duplicates: % Recovery for Lab Fortified Matrix:			

SDS-CHBr ₃	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
THM4	µg/L		% Recovery for PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
SDS-MCAA	µg/L		Avg % Recov for Indiv PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-TCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-MBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-BCAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-TBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-CDBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
SDS-DCBAA	µg/L		% Recovery for PE Samples:	
			RPE of Analytical Duplicates:	
			% Recovery for Lab Fortified Matrix:	
HAA5	µg/L		% Recovery for PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
HAA6	µg/L		Avg % Recov for Indiv PE Samples:	
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	
HAA9	µg/L			
			Avg RPE of Indiv Anal Dupl:	
			Avg % Recov for Indiv Lab Fort Matrix:	