

ICR TREATMENT STUDY ANALYSIS

Base Analysis and Data Review Comments

Treatment Study ID	1040
Study Protocol	GAC RSSCT treatment study
Plant ICR Number	383
PWS Name	City of Topeka
City, State, Zip	Topeka, KS 66606

These are general comments that do not need to be responded to directly.

Major comments:

1. Very rapid breakthrough of SDS-DCAA occurred in quarters 1, 2 and 4 (in the 3rd quarter, SDS-DCAA breakthrough followed the breakthrough pattern of other DBPs). This rapid breakthrough of SDS-DCAA can be indicative of preformed DCAA. Recarbonation feeds, which contained plant chlorinated finished water were not utilized during the first sampling session. However, the recarbonation feeds were left on during the 2nd, 3rd, and 4th quarters of testing. Also, breakthrough of SDS-DCAA exhibited a “peak” curve during the 2nd quarter – 20- minute EBCT and a “peak-valley-peak” curve during the 4th quarter – 20-minute EBCT.

Response: The presence of the recarbonation feeds during the 2nd, 3rd, and 4th quarters may explain the SDS-DCAA breakthrough during the 2nd and 4th quarter. Although it is not known why, the breakthrough of SDS-DCAA during the 3rd quarter indicates that there was likely no preformed DCAA in the GAC influent. During the 1st quarter, when the recarbonation feeds were off, the rapid breakthrough of SDS-DCAA remains unexplained. Note that the plant does not return filter washwater to the head of the plant, so this is not a potential source of preformed DBPs.

General Comments:

1. The MRL for UV-254 is reported at 0.009 1/cm, but values as low as 0.001 1/cm are reported in the Data Collection Spreadsheets. The MRL for TOC is reported as 0.5 mg/L, but values as low as 0.25 are reported in Data Collection Spreadsheets. The MRL for TOX is reported as 25 ug/L, but values as low as 13 ug/L are reported in Data Collection Spreadsheets. It is acceptable to use these measured values below the MRL, but comments should be included

that indicate these values are BMRL. Alternatively, the MRL could be revised if it was determined according to acceptable procedures.

Response: Values below the MRL in the Data Collection Spreadsheets are estimates. A comment indicating this has been added to the Data Collection Spreadsheets.

2. High variability in the third effluent HAA duplicate from the 20-minute EBCT was observed during the third session (September). This issue is discussed in the Summary Report, but no explanation for this variability could be identified.

Outlier Data:

No outliers were removed.

Cell: A1

Comment: 1040_SAS.xls 2/1/00 09:24

All curve fits reviewed and approved. See below for log of refit datasets.

1040_SAS.xls 2/2/00 16:32

Curve fit review updated and approved. See below for log of refit datasets.

Cell: C26

Comment: 1040-10-02 - Run 3 (CDBAA) 2/2/00 16:27

Original value (CoefA0) = 0 New value = 2.421

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: D26

Comment: 1040-10-02 - Run 3 (CDBAA) 2/2/00 16:27

Original value (CoefAf) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: E26

Comment: 1040-10-02 - Run 3 (CDBAA) 2/2/00 16:27

Original value (CoefB) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: F26

Comment: 1040-10-02 - Run 3 (CDBAA) 2/2/00 16:27

Original value (CoefD) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: J26

Comment: 1040-10-02 - Run 3 (CDBAA) 2/2/00 16:27

Original value (S) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: K26

Comment: 1040-10-02 - Run 3 (CDBAA) 2/2/00 16:27

Original value (t0) = 0 New value = 53.1955

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: C62

Comment: 1040-10-03 - Run 5 (TCAA) 1/31/00 16:16

Original value (CoefA0) = -0.8306 New value = -0.4514

Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: D62

Comment: 1040-10-03 - Run 5 (TCAA) 1/31/00 16:16

Original value (CoefAf) = 2.4239 New value = 7.683

Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: E62

Comment: 1040-10-03 - Run 5 (TCAA) 1/31/00 16:16
Original value (CoefB) = 2.2299 New value = 25.4758
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: F62

Comment: 1040-10-03 - Run 5 (TCAA) 1/31/00 16:16
Original value (CoefD) = 0.0837 New value = 0.0251
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: J62

Comment: 1040-10-03 - Run 5 (TCAA) 1/31/00 16:16
Original value (S) = 0 New value = 0
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: C74

Comment: 1040-10-04 - Run 7 (DBAA) 1/31/00 16:33
Original value (CoefA0) = 0 New value = -3.0063
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D74

Comment: 1040-10-04 - Run 7 (DBAA) 1/31/00 16:33
Original value (CoefAf) = 5.881 New value = 11.5269
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E74

Comment: 1040-10-04 - Run 7 (DBAA) 1/31/00 16:33
Original value (CoefB) = 20 New value = 3.1614
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F74

Comment: 1040-10-04 - Run 7 (DBAA) 1/31/00 16:33
Original value (CoefD) = 0.13 New value = 0.0528
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J74

Comment: 1040-10-04 - Run 7 (DBAA) 1/31/00 16:33
Original value (S) = 0 New value = -0.0166
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C92

Comment: 1040-20-01 - Run 2 (CDBAA) 2/2/00 16:26
Original value (CoefA0) = 0 New value = 2.2014
Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: D92

Comment: 1040-20-01 - Run 2 (CDBAA) 2/2/00 16:26
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: E92

Comment: 1040-20-01 - Run 2 (CDBAA) 2/2/00 16:26

Original value (CoefB) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: F92

Comment: 1040-20-01 - Run 2 (CDBAA) 2/2/00 16:26

Original value (CoefD) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: J92

Comment: 1040-20-01 - Run 2 (CDBAA) 2/2/00 16:26

Original value (S) = 0 New value = 0

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: K92

Comment: 1040-20-01 - Run 2 (CDBAA) 2/2/00 16:26

Original value (t0) = 0 New value = 95.9685

Fewer than 6 points above MRL, average above 1/2 MRL. Step function applied.

Cell: C114

Comment: 1040-20-02 - Run 4 (CDBAA) 2/2/00 16:27

Original value (CoefA0) = 0 New value = 2.3938

Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D114

Comment: 1040-20-02 - Run 4 (CDBAA) 2/2/00 16:27

Original value (CoefAf) = 0 New value = 0

Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E114

Comment: 1040-20-02 - Run 4 (CDBAA) 2/2/00 16:27

Original value (CoefB) = 0 New value = 0

Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F114

Comment: 1040-20-02 - Run 4 (CDBAA) 2/2/00 16:27

Original value (CoefD) = 0 New value = 0

Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J114

Comment: 1040-20-02 - Run 4 (CDBAA) 2/2/00 16:27

Original value (S) = 0 New value = 0

Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: K114

Comment: 1040-20-02 - Run 4 (CDBAA) 2/2/00 16:27

Original value (t0) = 0 New value = 143.0187

Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C120

Comment: 1040-20-02 - Run 4 (DCAA) 1/31/00 16:15
Original value (CoefA0) = -0.0532 New value = -4.4481
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: D120

Comment: 1040-20-02 - Run 4 (DCAA) 1/31/00 16:15
Original value (CoefAf) = 8.0075 New value = 9.4917
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: E120

Comment: 1040-20-02 - Run 4 (DCAA) 1/31/00 16:15
Original value (CoefB) = 50 New value = 21.7177
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: F120

Comment: 1040-20-02 - Run 4 (DCAA) 1/31/00 16:15
Original value (CoefD) = 0.115 New value = 1.2299
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: J120

Comment: 1040-20-02 - Run 4 (DCAA) 1/31/00 16:15
Original value (S) = -0.0137 New value = 0
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: C140

Comment: 1040-20-03 - Run 6 (DBAA) 1/31/00 16:29
Original value (CoefA0) = -0.6388 New value = -0.8996
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D140

Comment: 1040-20-03 - Run 6 (DBAA) 1/31/00 16:29
Original value (CoefAf) = 16.1452 New value = 30.812
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E140

Comment: 1040-20-03 - Run 6 (DBAA) 1/31/00 16:29
Original value (CoefB) = 14.35 New value = 14.1057
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F140

Comment: 1040-20-03 - Run 6 (DBAA) 1/31/00 16:29
Original value (CoefD) = 0.0341 New value = 0.0183
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J140

Comment: 1040-20-03 - Run 6 (DBAA) 1/31/00 16:29
Original value (S) = -0.0044 New value = -0.0459
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C144

Comment: 1040-20-03 - Run 6 (HAA5) 1/31/00 16:23

Original value (CoefA0) = -0.3112 New value = 1.1096
Peak curve fit with S = 0. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: D144

Comment: 1040-20-03 - Run 6 (HAA5) 1/31/00 16:23
Original value (CoefAf) = 30.4463 New value = 17.4216
Peak curve fit with S = 0. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: E144

Comment: 1040-20-03 - Run 6 (HAA5) 1/31/00 16:23
Original value (CoefB) = 24.5276 New value = 84.7796
Peak curve fit with S = 0. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: F144

Comment: 1040-20-03 - Run 6 (HAA5) 1/31/00 16:23
Original value (CoefD) = 0.0263 New value = 0.0488
Peak curve fit with S = 0. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: J144

Comment: 1040-20-03 - Run 6 (HAA5) 1/31/00 16:23
Original value (S) = 0 New value = 0
Peak curve fit with S = 0. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: C150

Comment: 1040-20-03 - Run 6 (TCAA) 1/31/00 16:26
Original value (CoefA0) = -0.78 New value = -0.1281
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: D150

Comment: 1040-20-03 - Run 6 (TCAA) 1/31/00 16:26
Original value (CoefAf) = 2.32 New value = 2.2423
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: E150

Comment: 1040-20-03 - Run 6 (TCAA) 1/31/00 16:26
Original value (CoefB) = 3.56 New value = 675.5217
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: F150

Comment: 1040-20-03 - Run 6 (TCAA) 1/31/00 16:26
Original value (CoefD) = 0.04 New value = 0.0621
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: J150

Comment: 1040-20-03 - Run 6 (TCAA) 1/31/00 16:26
Original value (S) = 0 New value = 0
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

ICR Information

ID / ICR#: KS2017701 / 383
 ICR Contact: Bruce Northup
 Phone No.: (785) 368-3882
 Period: 2/12/98 - 3/3/98 (18 B-S days)

Design Information

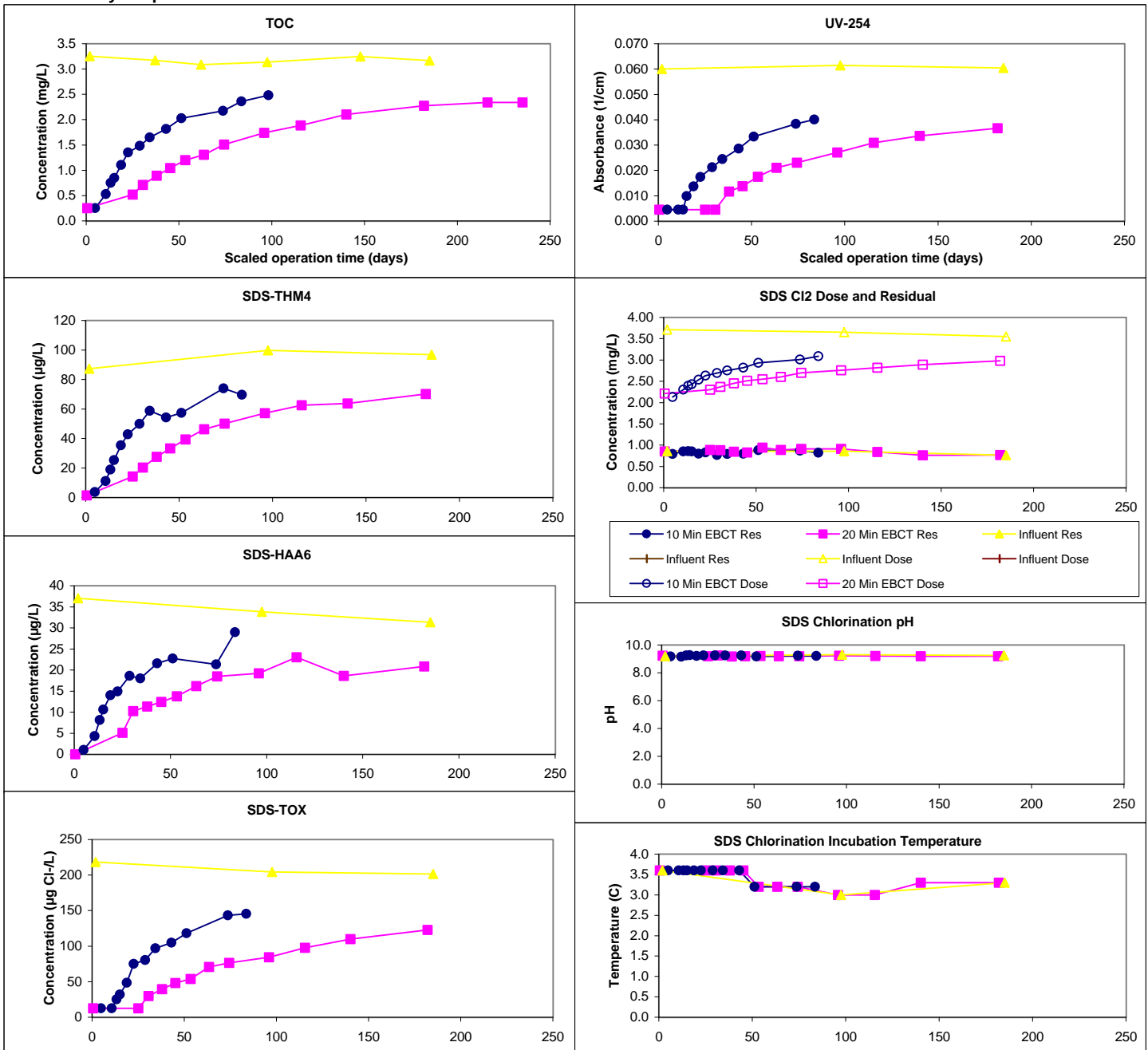
Design TOC: 2.8 mg/L
 Col Diameter: 8.0 mm
 Min Reynolds#: 0.31
 Full-Scale Temp: 4.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 140x230
 Scaling Factor: 12.57
 Meas Dry Bed Density: 0.52 g/cm3

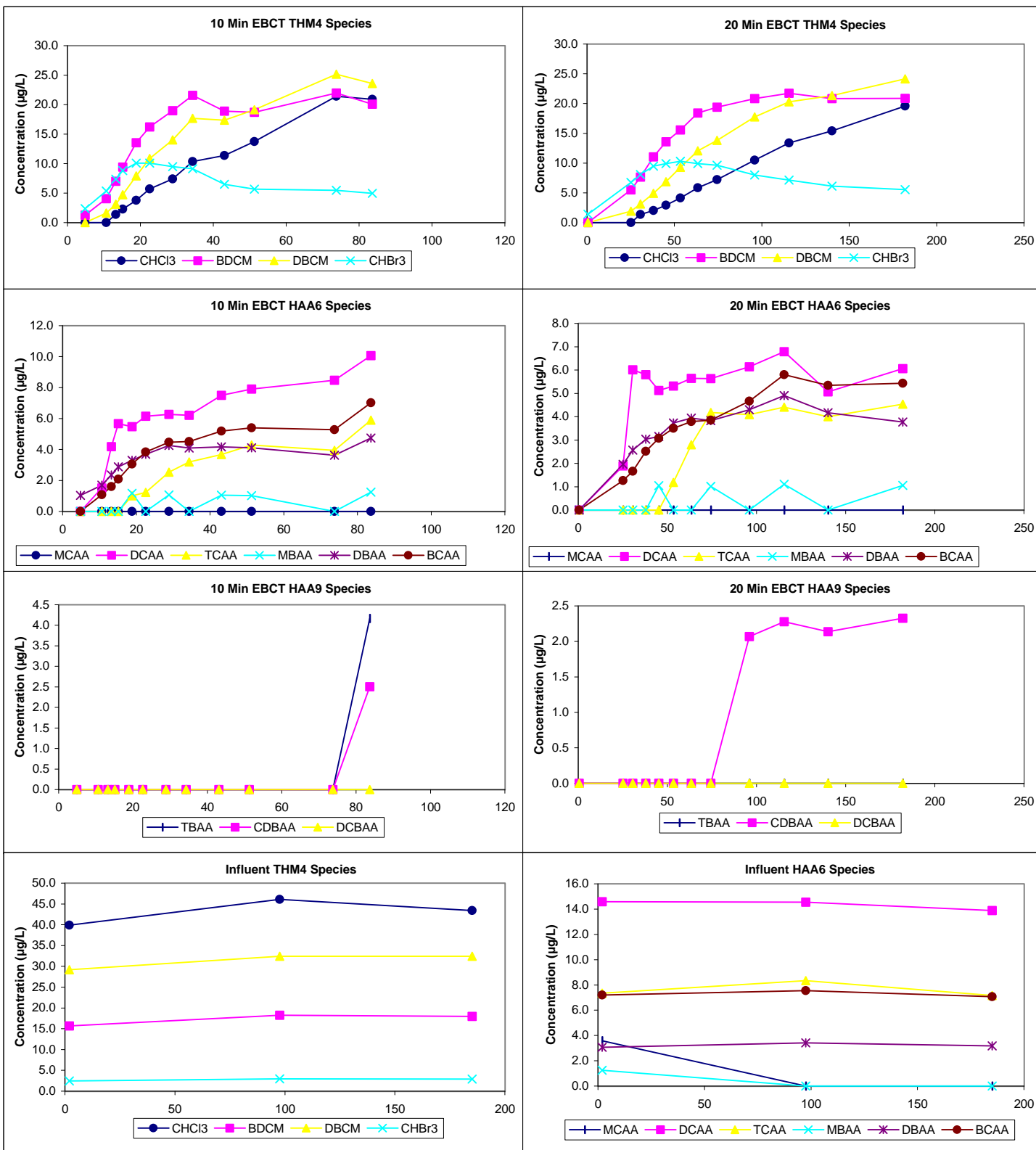
Water Quality Summary

Influent	Influent				Influent				<div><div>Res (0)</div><div>Temp</div><div>pH</div><div>Time</div></div> <div><div>Mean</div><div>SD</div><div>Count</div><div>Min/Max</div></div>				
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max					
	3.2	0.1	6	3.1 - 3.3									
	9.2	0.0	6	9.2 - 9.2									
	0.061	0.001	3	0.060 - 0.061									
	SUVA	1.90	0.06	3	1.84 - 1.96								
	Bromide	84	5	2	81 - 86								
	SDS-TOX	208	9	3	202 - 218								
	SDS-THM4	95	6	3	87 - 100								
	SDS-HAA6	34	3	3	31 - 37								
Effluent	10 Min EBCT (7 B-S days)				20 Min EBCT (19 B-S days)				Chart Legend:				
Effluent pH	8.6	0.6	13	7.3 - 9.2	8.8	0.4	14	7.8 - 9.3	<div><div></div><div>10 Min EBCT</div></div>	<div><div></div><div>20 Min EBCT</div></div> <div><div></div><div>Influent</div></div> <div><div></div><div>Influent</div></div>			
Effluent Temp	21.3	0.7	13	20.3 - 23.0	21.6	0.8	14	20.1 - 23.2					

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: KS2017701 / 383
 ICR Contact: Bruce Northup
 Phone No.: (785) 368-3882
 Period: 6/1/98 - 6/21/98 (19 B-S days)

Design Information

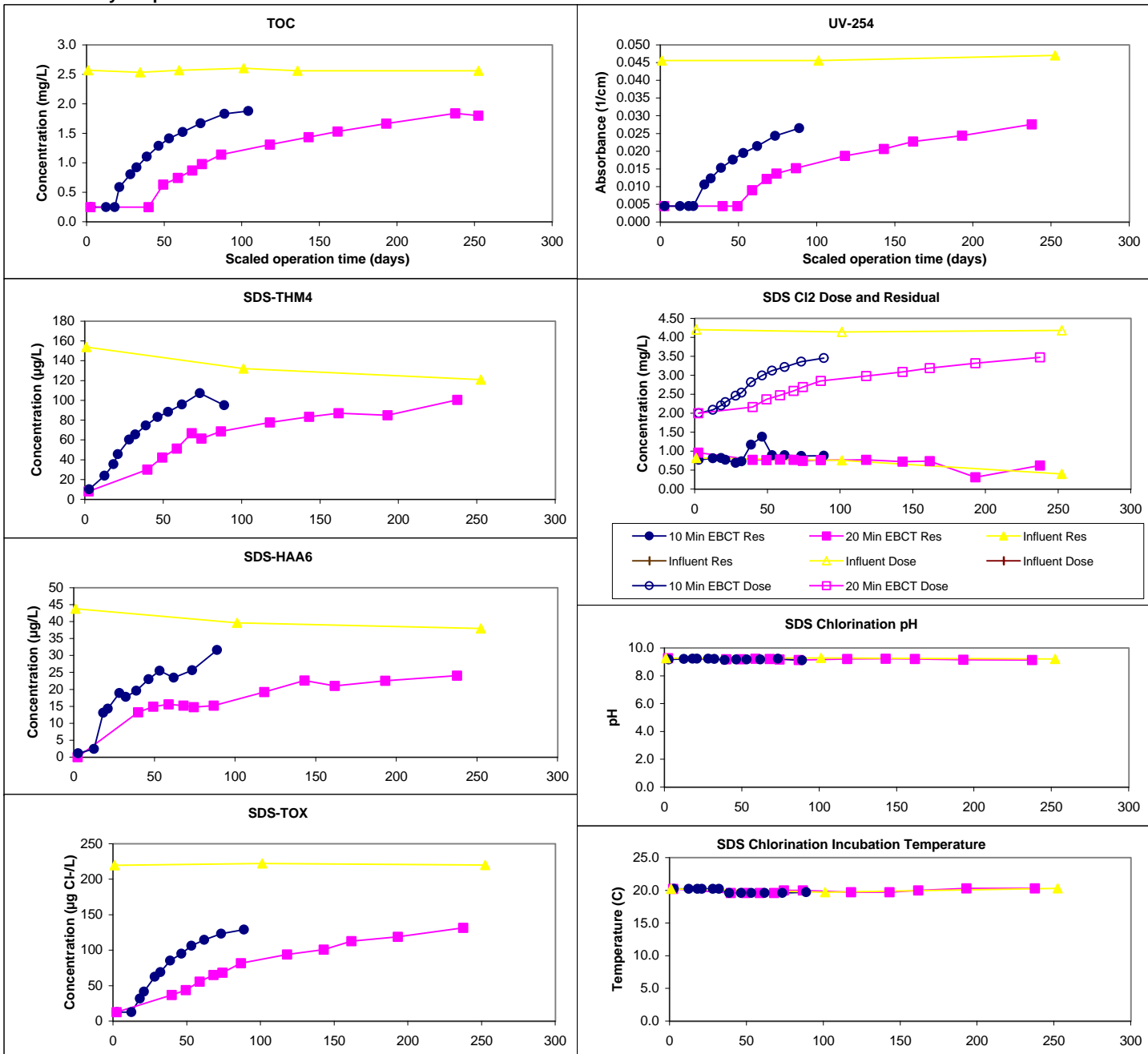
Design TOC: 2.4 mg/L
 Col Diameter: 8.0 mm
 Min Reynolds#: 0.50
 Full-Scale Temp: 20.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 140x230
 Scaling Factor: 12.57
 Meas Dry Bed Density: 0.52 g/cm3

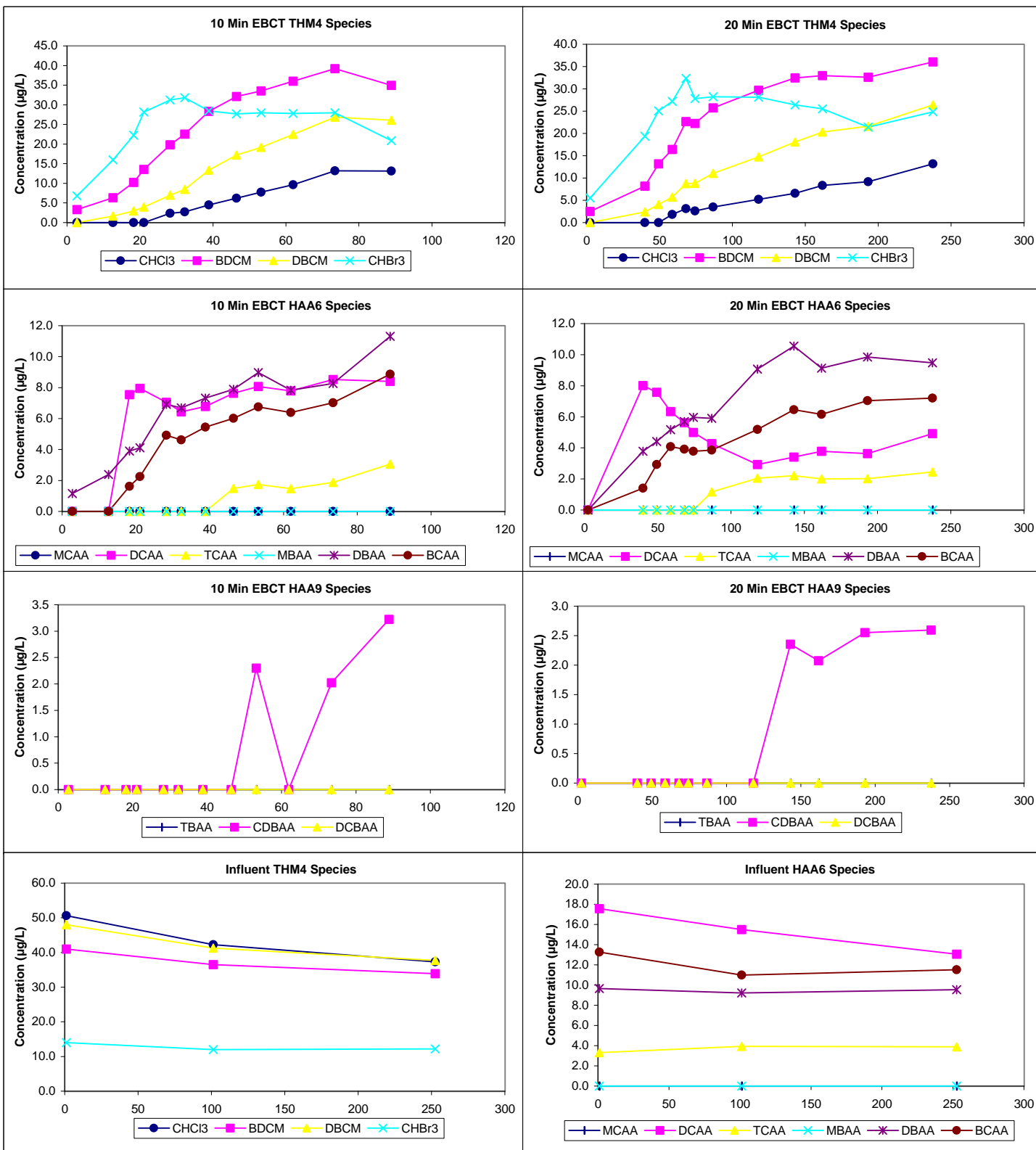
Water Quality Summary

Influent	Influent				Influent	Influent				Res (0)	Mean	SD	Count	Min/Max
	Mean	SD/RD	Count	Min/Max		Mean	SD/RD	Count	Min/Max					
TOC	2.6	0.0	6	2.5 - 2.6										
pH	9.0	0.0	3	9.0 - 9.0										
UV254	0.046	0.001	3	0.046 - 0.047										
SUVA	1.79	0.05	3	1.75 - 1.84										
Bromide	110	0	2	110 - 110										
SDS-TOX	221	1	3	220 - 222										
SDS-THM4	136	17	3	121 - 154										
SDS-HAA6	40	3	3	38 - 44										
Effluent	10 Min EBCT (8 B-S days)				20 Min EBCT (20 B-S days)				Chart Legend:	<div><div><div></div><div>10 Min EBCT</div></div><div><div></div><div>20 Min EBCT</div></div><div><div></div><div>Influent</div></div><div><div></div><div>Influent</div></div></div>				
Effluent pH	8.6	0.1	13	8.4 - 8.8	8.7	0.1	13	8.5 - 8.8						
Effluent Temp	22.5	0.9	13	21.5 - 24.4	22.6	1.0	13	20.4 - 24.1						

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: KS2017701 / 383
 ICR Contact: Bruce Northup
 Phone No.: (785) 368-3882
 Period: 9/8/98 - 9/28/98 (19 B-S days)

Design Information

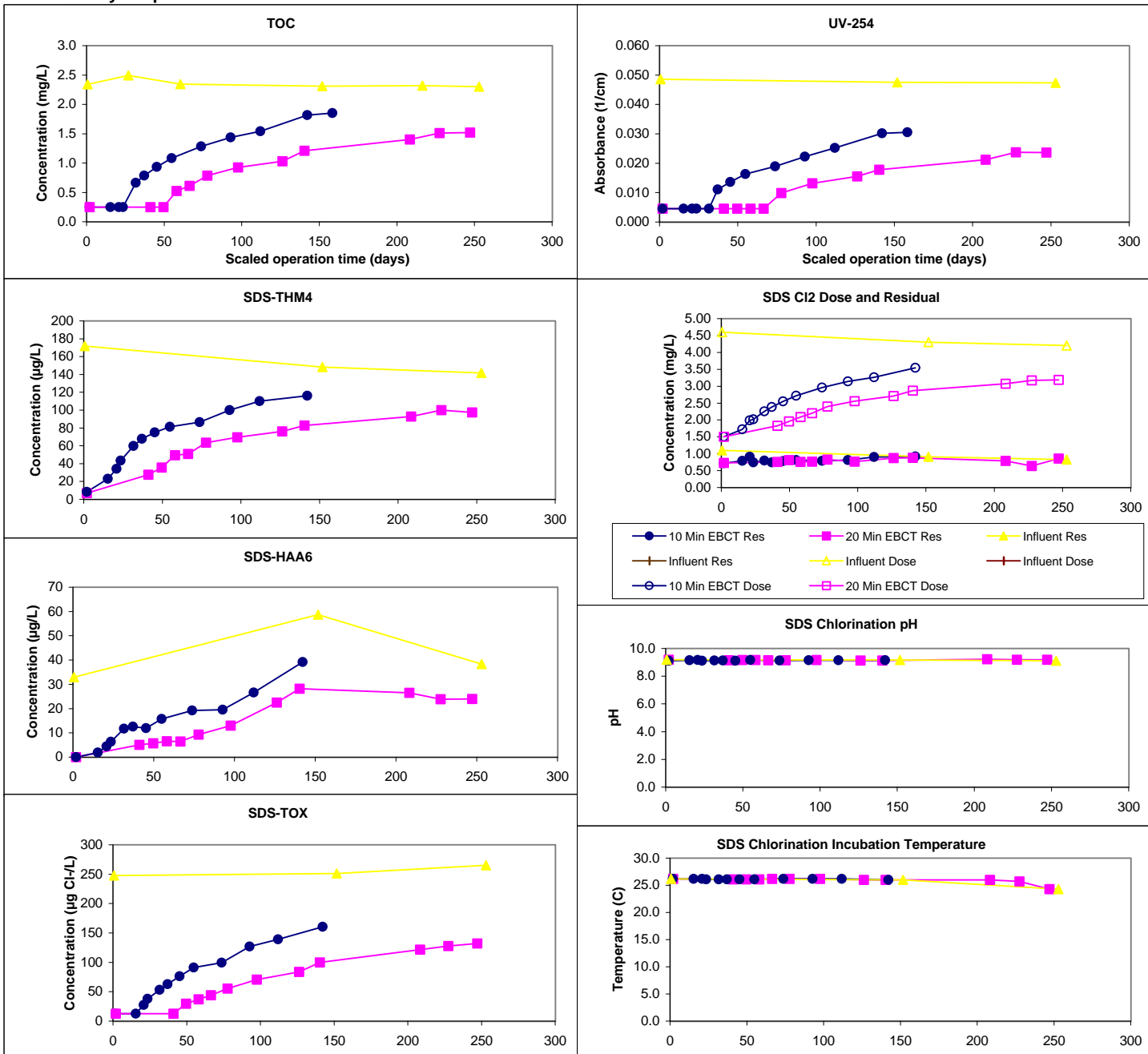
Design TOC: 2.5 mg/L
 Col Diameter: 10.0 mm
 Min Reynolds#: 0.50
 Full-Scale Temp: 28.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 140x230
 Scaling Factor: 12.57
 Meas Dry Bed Density: 0.45 g/cm3

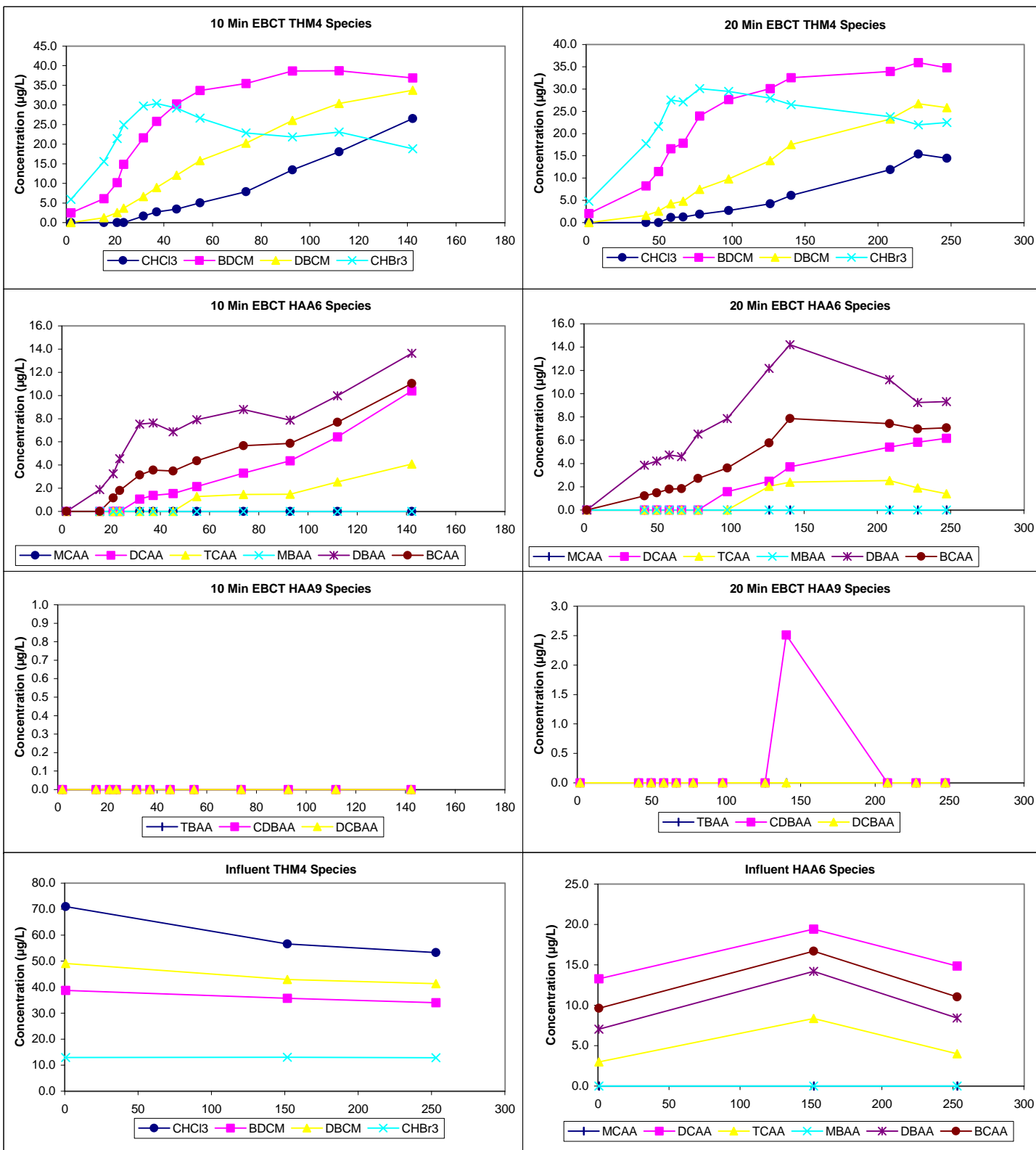
Water Quality Summary

Influent	Influent				Influent				Res (0)	Mean	SD	Count	Min/Max
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max					
TOC	2.4	0.1	6	2.3 - 2.5									
pH	9.0	0.1	5	8.9 - 9.1					Temp	26.0	0.5	27	24.3 - 26.2
UV254	0.048	0.001	3	0.047 - 0.049					pH	9.2	0.0	27	9.1 - 9.2
SUVA	2.06	0.01	3	2.06 - 2.07					Time	48.0	0.2	27	47.7 - 48.3
Bromide	150	20	2	140 - 160					Comments:				
SDS-TOX	255	9	3	248 - 265									
SDS-THM4	154	16	3	142 - 172									
SDS-HAA6	43	14	3	33 - 59									
Effluent	10 Min EBCT (13 B-S days)				20 Min EBCT (20 B-S days)				Chart Legend:	<div><div><div></div><div>10 Min EBCT</div></div><div><div></div><div>20 Min EBCT</div></div><div><div></div><div>Influent</div></div><div><div></div><div>Influent</div></div></div>			
Effluent pH	8.6	0.2	13	8.4 - 8.9	8.6	0.2	12	8.3 - 9.1					
Effluent Temp	21.4	0.4	13	21.0 - 22.4	22.0	0.7	12	21.2 - 23.0					

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: KS2017701 / 383
 ICR Contact: Bruce Northup
 Phone No.: (785) 368-3882
 Period: 11/19/98 - 12/11/98 (21 B-S days)

Design Information

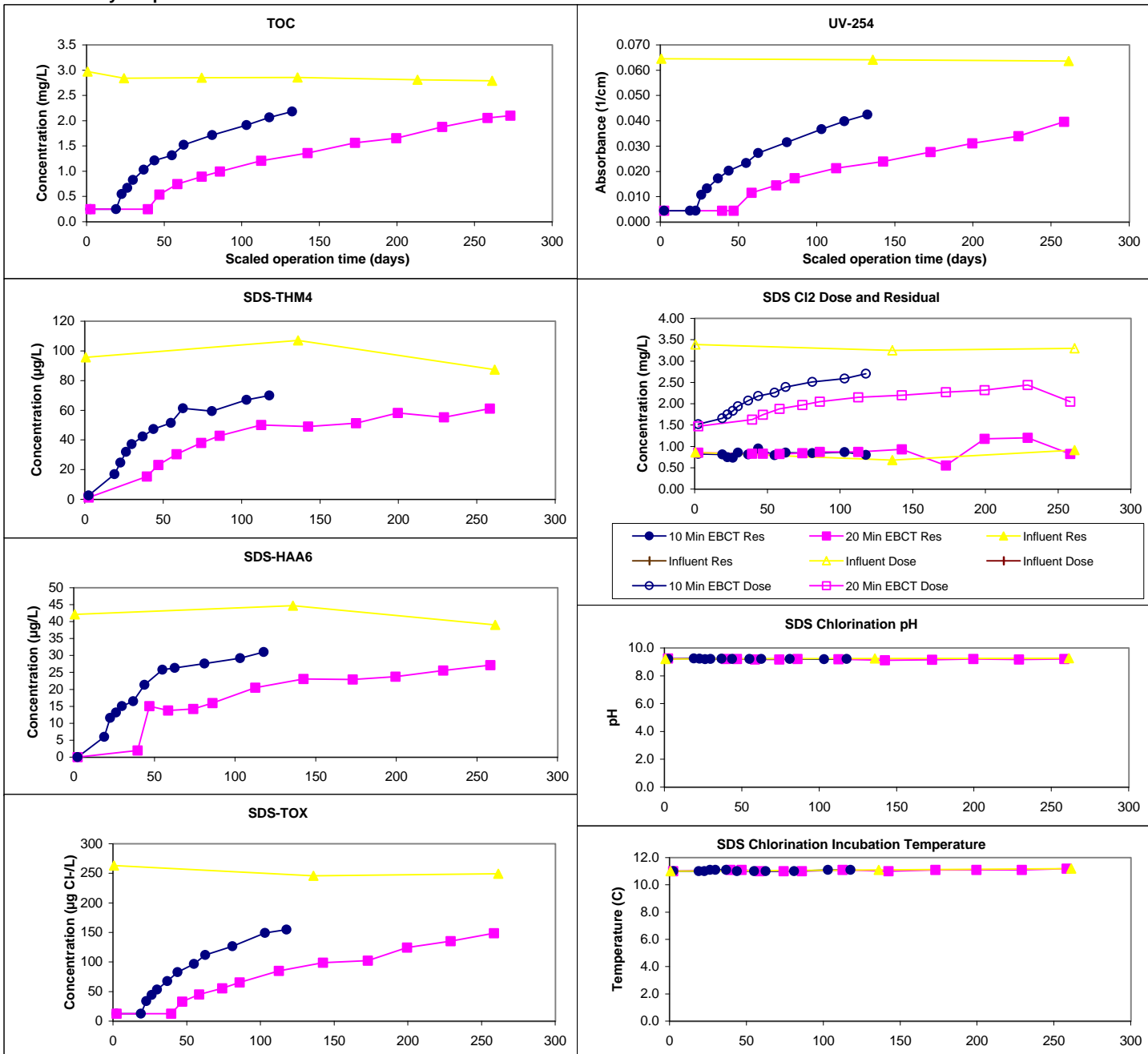
Design TOC: 3.2 mg/L
 Col Diameter: 8.0 mm
 Min Reynolds#: 0.40
 Full-Scale Temp: 11.0 C

Full-Scale GAC Size: 12x40 Bituminous
 Bench-Scale GAC Size: 140x230
 Scaling Factor: 12.57
 Meas Dry Bed Density: 0.46 g/cm3

Water Quality Summary

Influent	Influent				Influent				Res (0)	Mean	SD	Count	Min/Max
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max					
TOC	2.9	0.1	6	2.8 - 3.0						0.85	0.13	27	0.55 - 1.20
pH	9.0	0.0	6	9.0 - 9.1						11.1	0.1	27	11.0 - 11.2
UV254	0.064	0.000	3	0.064 - 0.065						9.2	0.0	27	9.1 - 9.3
SUVA	2.23	0.06	3	2.17 - 2.28						48.1	0.2	27	47.5 - 48.6
Bromide	80	3	2	78 - 81						Comments:			
SDS-TOX	253	9	3	246 - 263									
SDS-THM4	97	10	3	87 - 107						Chart Legend:			
SDS-HAA6	42	3	3	39 - 45									
Effluent	10 Min EBCT (11 B-S days)				20 Min EBCT (22 B-S days)				Chart Legend:	<div><div><div></div><div>10 Min EBCT</div></div><div><div></div><div>20 Min EBCT</div></div><div><div></div><div>Influent</div></div><div><div></div><div>Influent</div></div></div>			
Effluent pH	8.8	0.1	13	8.7 - 8.9	8.7	0.1	13	8.6 - 9.1					
Effluent Temp	21.7	0.7	13	21.0 - 23.9	22.2	0.5	13	21.4 - 23.2					

Water Quality Graphs



Water Quality Graphs (Continued)

