

ICR TREATMENT STUDY ANALYSIS

Base Analysis and Data Review Comments

Treatment Study ID	1082
Study Protocol	GAC RSSCT treatment study
Plant ICR Number	425
PWS Name	City of Minneapolis Water Works
City, State, Zip	Minneapolis, MN 55421

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

Major comments:

1. Treatment study influent was collected after softening and recarbonation, but prior to ferric chloride coagulation. Ferric chloride coagulation was not simulated through bench-scale experiments. It is not clear why the ferric chloride coagulation step was not simulated, and whether this step contributes significantly to full-scale DBP precursor removal. The GAC influent pH was adjusted to 8.5 during all quarters of testing, representing the full-scale finished water pH.

General Comments:

1. During the second quarter of testing, the SDS chlorination temperature of 16°C (target temperature) was decreased to 12°C for the last three 10 minute EBCT samples, the last five 20 minute EBCT samples, and the last two influent samples. Influent DBP levels did not seem to be significantly affected by the temperature change.

Outlier Data:

4 outliers removed, 2 of which were HAA9.

Cell: A1

Comment: 1082-SAS.xls 2/6/00 20:08

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

1082-SAS.xls 2/7/00 13:36

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

Cell: C9

Comment: 1082-10-01 - Run 1 (DBCM) 2/6/00 19:03

Original value (CoefA0) = -0.3109 New value = 0.3638

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

Cell: D9

Comment: 1082-10-01 - Run 1 (DBCM) 2/6/00 19:03

Original value (CoefAf) = 2.6427 New value = 4.4774

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

Cell: E9

Comment: 1082-10-01 - Run 1 (DBCM) 2/6/00 19:03

Original value (CoefB) = 0.3107 New value = 20.0149

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

Cell: F9

Comment: 1082-10-01 - Run 1 (DBCM) 2/6/00 19:03

Original value (CoefD) = 0.2523 New value = 0.7724

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

Cell: J9

Comment: 1082-10-01 - Run 1 (DBCM) 2/6/00 19:03

Original value (S) = -0.0106 New value = -0.0591

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

Cell: C16

Comment: 1082-10-01 - Run 1 (MCAA) 2/6/00 18:40

Original value (CoefA0) = 0 New value = 2.8625

Fewer than 6 points above MRL. Step function applied.

Cell: D16

Comment: 1082-10-01 - Run 1 (MCAA) 2/6/00 18:40

Original value (CoefAf) = 0 New value = 0

Fewer than 6 points above MRL. Step function applied.

Cell: E16

Comment: 1082-10-01 - Run 1 (MCAA) 2/6/00 18:40

Original value (CoefB) = 0 New value = 0

Fewer than 6 points above MRL. Step function applied.

Cell: F16

Comment: 1082-10-01 - Run 1 (MCAA) 2/6/00 18:40
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: J16

Comment: 1082-10-01 - Run 1 (MCAA) 2/6/00 18:40
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: K16

Comment: 1082-10-01 - Run 1 (MCAA) 2/6/00 18:40
Original value (t0) = 0 New value = 34.8125
Fewer than 6 points above MRL. Step function applied.

Cell: C27

Comment: 1082-10-02 - Run 3 (CHBr3) 2/6/00 19:08
Original value (CoefA0) = 0 New value = -0.1719
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: D27

Comment: 1082-10-02 - Run 3 (CHBr3) 2/6/00 19:08
Original value (CoefAf) = 0 New value = 1.8043
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: E27

Comment: 1082-10-02 - Run 3 (CHBr3) 2/6/00 19:08
Original value (CoefB) = 0 New value = 20.0127
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: F27

Comment: 1082-10-02 - Run 3 (CHBr3) 2/6/00 19:08
Original value (CoefD) = 0 New value = 0.6276
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: J27

Comment: 1082-10-02 - Run 3 (CHBr3) 2/6/00 19:08
Original value (S) = 0 New value = -0.072
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: C30

Comment: 1082-10-02 - Run 3 (DBAA) 2/6/00 19:10
Original value (CoefA0) = 0.0242 New value = -0.1549
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D30

Comment: 1082-10-02 - Run 3 (DBAA) 2/6/00 19:10
Original value (CoefAf) = 1.562 New value = 2.0625
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E30

Comment: 1082-10-02 - Run 3 (DBAA) 2/6/00 19:10
Original value (CoefB) = 10.9606 New value = 74.0876
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F30

Comment: 1082-10-02 - Run 3 (DBAA) 2/6/00 19:10
Original value (CoefD) = 0.138 New value = 0.385
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J30

Comment: 1082-10-02 - Run 3 (DBAA) 2/6/00 19:10
Original value (S) = -0.0094 New value = -0.0184
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C31

Comment: 1082-10-02 - Run 3 (DBCM) 2/6/00 19:07
Original value (CoefA0) = 0 New value = 0.0281
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D31

Comment: 1082-10-02 - Run 3 (DBCM) 2/6/00 19:07
Original value (CoefAf) = 5.8 New value = 5.8815
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E31

Comment: 1082-10-02 - Run 3 (DBCM) 2/6/00 19:07
Original value (CoefB) = 10 New value = 103.1159
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F31

Comment: 1082-10-02 - Run 3 (DBCM) 2/6/00 19:07
Original value (CoefD) = 0.15 New value = 0.4798
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J31

Comment: 1082-10-02 - Run 3 (DBCM) 2/6/00 19:07
Original value (S) = 0 New value = -0.019
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C52

Comment: 1082-10-03 - Run 5 (DBAA) 2/7/00 13:34
Original value (CoefA0) = 0 New value = 1.2
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: D52

Comment: 1082-10-03 - Run 5 (DBAA) 2/7/00 13:34
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: E52

Comment: 1082-10-03 - Run 5 (DBAA) 2/7/00 13:34
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: F52

Comment: 1082-10-03 - Run 5 (DBAA) 2/7/00 13:34
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: J52

Comment: 1082-10-03 - Run 5 (DBAA) 2/7/00 13:34
Original value (S) = 0 New value = -0.0405
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: C53

Comment: 1082-10-03 - Run 5 (DBCM) 2/6/00 19:14
Original value (CoefA0) = -0.0097 New value = -0.2359
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D53

Comment: 1082-10-03 - Run 5 (DBCM) 2/6/00 19:14
Original value (CoefAf) = 4.487 New value = 4.9432
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E53

Comment: 1082-10-03 - Run 5 (DBCM) 2/6/00 19:14
Original value (CoefB) = 9.7941 New value = 32.417
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F53

Comment: 1082-10-03 - Run 5 (DBCM) 2/6/00 19:14
Original value (CoefD) = 0.1552 New value = 0.4042
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J53

Comment: 1082-10-03 - Run 5 (DBCM) 2/6/00 19:14
Original value (S) = -0.0047 New value = -0.0229
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C69

Comment: 1082-10-04 - Run 7 (BDCM) 2/6/00 19:21
Original value (CoefA0) = 1.9679 New value = -0.6701
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D69

Comment: 1082-10-04 - Run 7 (BDCM) 2/6/00 19:21
Original value (CoefAf) = 6.5342 New value = 9.7314
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E69

Comment: 1082-10-04 - Run 7 (BDCM) 2/6/00 19:21

Original value (CoefB) = 7208.4413 New value = 24.1303
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F69

Comment: 1082-10-04 - Run 7 (BDCM) 2/6/00 19:21
Original value (CoefD) = 1.1923 New value = 0.4639
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J69

Comment: 1082-10-04 - Run 7 (BDCM) 2/6/00 19:21
Original value (S) = -0.0358 New value = -0.0374
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C75

Comment: 1082-10-04 - Run 7 (DBCM) 2/6/00 19:19
Original value (CoefA0) = 0 New value = 3.9
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: D75

Comment: 1082-10-04 - Run 7 (DBCM) 2/6/00 19:19
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: E75

Comment: 1082-10-04 - Run 7 (DBCM) 2/6/00 19:19
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: F75

Comment: 1082-10-04 - Run 7 (DBCM) 2/6/00 19:19
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: J75

Comment: 1082-10-04 - Run 7 (DBCM) 2/6/00 19:19
Original value (S) = 0 New value = -0.101
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: C77

Comment: 1082-10-04 - Run 7 (DCBAA) 2/6/00 19:22
Original value (CoefA0) = -1.55 New value = -0.1972
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: D77

Comment: 1082-10-04 - Run 7 (DCBAA) 2/6/00 19:22
Original value (CoefAf) = 3.6281 New value = 2.2638
Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: E77

Comment: 1082-10-04 - Run 7 (DCBAA) 2/6/00 19:22
Original value (CoefB) = 1.8323 New value = 18.6896

Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: F77

Comment: 1082-10-04 - Run 7 (DCBAA) 2/6/00 19:22

Original value (CoefD) = 0.2529 New value = 0.4486

Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: J77

Comment: 1082-10-04 - Run 7 (DCBAA) 2/6/00 19:22

Original value (S) = 0 New value = 0

Poor peak curve fit. Data was refit to type 1 curve fit by iterative curve fit procedure.

Cell: C97

Comment: 1082-20-01 - Run 2 (DBCM) 2/6/00 19:04

Original value (CoefA0) = 0.696 New value = 0.2054

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

Cell: D97

Comment: 1082-20-01 - Run 2 (DBCM) 2/6/00 19:04

Original value (CoefAf) = 6.975 New value = 11.4517

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

Cell: E97

Comment: 1082-20-01 - Run 2 (DBCM) 2/6/00 19:04

Original value (CoefB) = 29.7127 New value = 21.6049

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

Cell: F97

Comment: 1082-20-01 - Run 2 (DBCM) 2/6/00 19:04

Original value (CoefD) = 0.1332 New value = 0.1117

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

Cell: J97

Comment: 1082-20-01 - Run 2 (DBCM) 2/6/00 19:04

Original value (S) = -0.0181 New value = -0.0209

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

Cell: C104

Comment: 1082-20-01 - Run 2 (MCAA) 2/6/00 19:05

Original value (CoefA0) = 0 New value = -0.8054

Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: D104

Comment: 1082-20-01 - Run 2 (MCAA) 2/6/00 19:05

Original value (CoefAf) = 0 New value = 12.089

Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: E104

Comment: 1082-20-01 - Run 2 (MCAA) 2/6/00 19:05

Original value (CoefB) = 0 New value = 27.075

Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: F104

Comment: 1082-20-01 - Run 2 (MCAA) 2/6/00 19:05
Original value (CoefD) = 0 New value = 0.0185
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: J104

Comment: 1082-20-01 - Run 2 (MCAA) 2/6/00 19:05
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: C114

Comment: 1082-20-02 - Run 4 (CDBAA) 2/6/00 19:13
Original value (CoefA0) = 0 New value = 2.033
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: D114

Comment: 1082-20-02 - Run 4 (CDBAA) 2/6/00 19:13
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: E114

Comment: 1082-20-02 - Run 4 (CDBAA) 2/6/00 19:13
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: F114

Comment: 1082-20-02 - Run 4 (CDBAA) 2/6/00 19:13
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: J114

Comment: 1082-20-02 - Run 4 (CDBAA) 2/6/00 19:13
Original value (S) = 0 New value = -0.0533
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: C115

Comment: 1082-20-02 - Run 4 (CHBr3) 2/6/00 19:11
Original value (CoefA0) = 0 New value = 1.7
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: D115

Comment: 1082-20-02 - Run 4 (CHBr3) 2/6/00 19:11
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: E115

Comment: 1082-20-02 - Run 4 (CHBr3) 2/6/00 19:11
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: F115

Comment: 1082-20-02 - Run 4 (CHBr3) 2/6/00 19:11
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: J115

Comment: 1082-20-02 - Run 4 (CHBr3) 2/6/00 19:11
Original value (S) = 0 New value = -0.0264
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: C136

Comment: 1082-20-03 - Run 6 (CDBAA) 2/6/00 19:17
Original value (CoefA0) = 0 New value = 2.6
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: D136

Comment: 1082-20-03 - Run 6 (CDBAA) 2/6/00 19:17
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: E136

Comment: 1082-20-03 - Run 6 (CDBAA) 2/6/00 19:17
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: F136

Comment: 1082-20-03 - Run 6 (CDBAA) 2/6/00 19:17
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: J136

Comment: 1082-20-03 - Run 6 (CDBAA) 2/6/00 19:17
Original value (S) = 0 New value = -0.1061
Fewer than 6 points above MRL. Peak curve/step function combination applied.

Cell: C140

Comment: 1082-20-03 - Run 6 (DBAA) 2/6/00 19:16
Original value (CoefA0) = 0.0125 New value = -0.0802
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: D140

Comment: 1082-20-03 - Run 6 (DBAA) 2/6/00 19:16
Original value (CoefAf) = 0.8261 New value = 1.2816
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: E140

Comment: 1082-20-03 - Run 6 (DBAA) 2/6/00 19:16
Original value (CoefB) = 10.4522 New value = 968.4705
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: F140

Comment: 1082-20-03 - Run 6 (DBAA) 2/6/00 19:16

Original value (CoefD) = 0.0977 New value = 0.3636
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: J140

Comment: 1082-20-03 - Run 6 (DBAA) 2/6/00 19:16
Original value (S) = -0.0072 New value = -0.0074
Poor peak curve fit. Data was refit by iterative curve fit procedure.

Cell: C163

Comment: 1082-20-04 - Run 8 (DBCM) 2/6/00 19:25
Original value (CoefA0) = 0 New value = -0.8303
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: D163

Comment: 1082-20-04 - Run 8 (DBCM) 2/6/00 19:25
Original value (CoefAf) = 0 New value = 13.2719
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: E163

Comment: 1082-20-04 - Run 8 (DBCM) 2/6/00 19:25
Original value (CoefB) = 0 New value = 21.6333
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: F163

Comment: 1082-20-04 - Run 8 (DBCM) 2/6/00 19:25
Original value (CoefD) = 0 New value = 0.0905
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

Cell: J163

Comment: 1082-20-04 - Run 8 (DBCM) 2/6/00 19:25
Original value (S) = 0 New value = -0.1384
Fewer than 6 points above MRL. Data was fit to peak curve by iterative curve fit procedure.

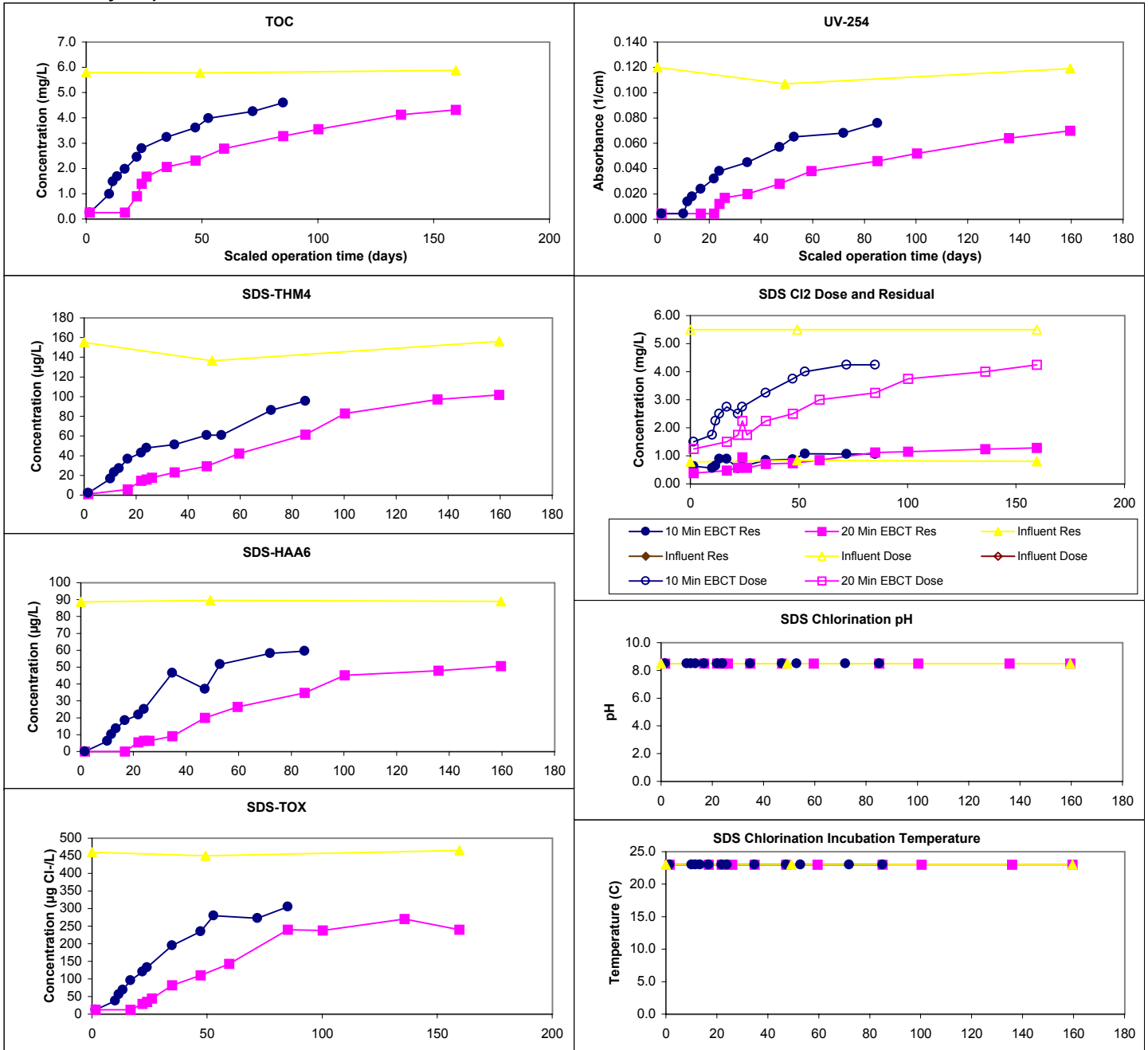
Design Information

ID / ICR#: MN 1270024 / 425	Design TOC: 6.0 mg/L	Full-Scale GAC Size: 8x40 Bituminous coal
ICR Contact: Mr. Larry Cole	Col Diameter: 11.0 mm	Bench-Scale GAC Size: 100x200
Phone No.: (612) 661-4923	Min Reynolds#: 0.50	Scaling Factor: 12.38
Period: 8/8/98 - 8/21/98 (13 B-S days)	Full-Scale Temp: 24.4 C	Meas Dry Bed Density: 0.54 g/cm3

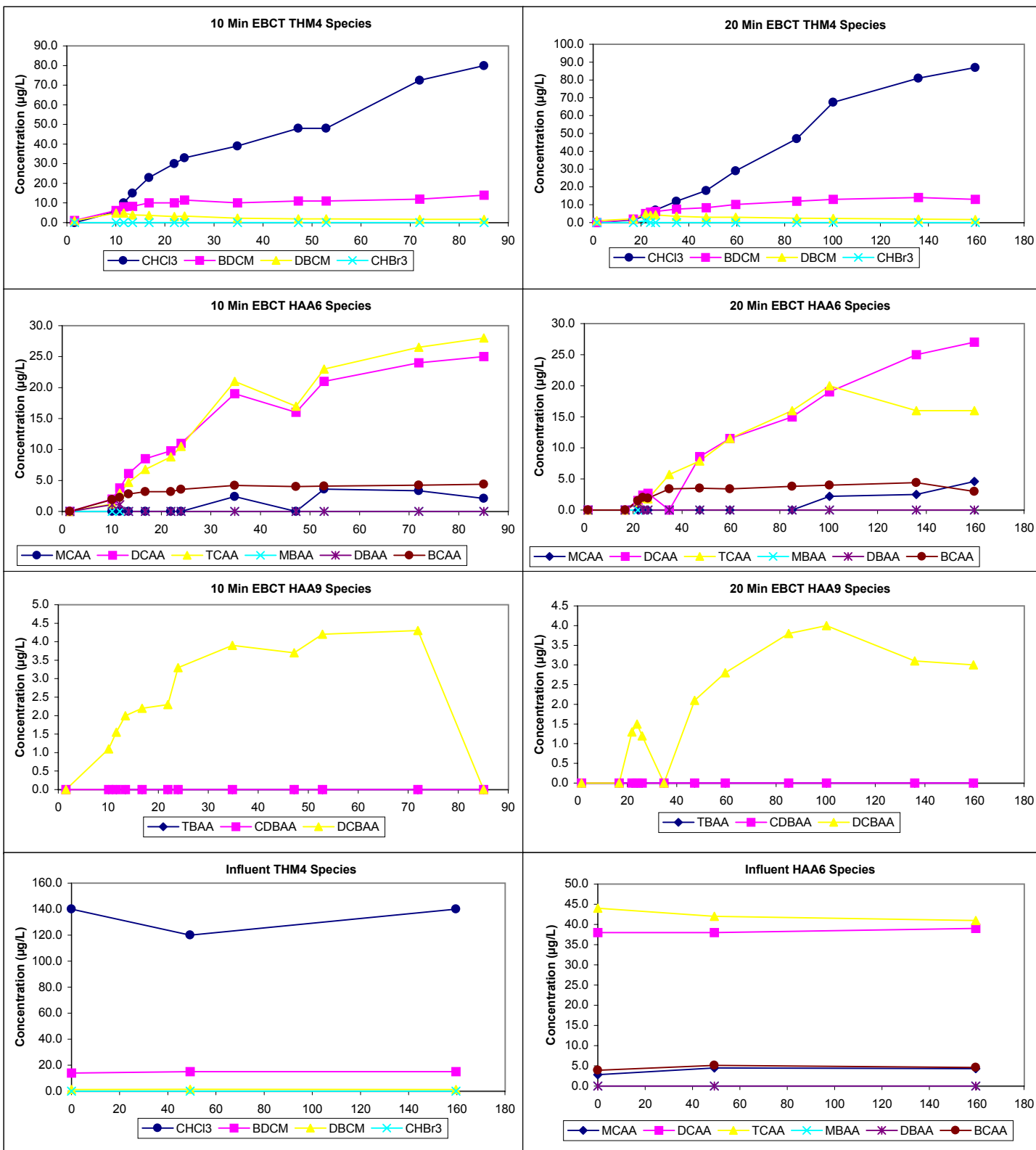
Cumulative SDS Conditions

Influent	Influent				Influent				Res (0)	Mean	SD	Count	Min/Max
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max					
TOC	5.8	0.1	3	5.8 - 5.9									
pH	8.3	0.2	3	8.2 - 8.5					Temp	23.0	0.0	27	23.0 - 23.0
UV254	0.115	0.007	3	0.107 - 0.120					pH	8.5	0.0	27	8.5 - 8.5
SUVA	1.98	0.11	3	1.85 - 2.07					Time	18.0	0.0	27	18.0 - 18.0
Bromide	25	6	2	22 - 28					Comments:				
SDS-TOX	458	8	3	450 - 465									
SDS-THM4	149	11	3	137 - 156					<div><div><div>●</div>10 Min EBCT</div><div><div>■</div>20 Min EBCT</div><div><div>▲</div>Influent</div><div><div>✕</div>Influent</div></div>				
SDS-HAA6	89	0	3	89 - 90									
Effluent	10 Min EBCT (7 B-S days)				20 Min EBCT (13 B-S days)				Chart Legend:				
Effluent pH	8.0	0.1	12	7.8 - 8.2	8.1	0.2	12	7.8 - 8.7					
Effluent Temp	23.7	0.6	12	23.0 - 25.0	23.5	0.6	12	22.6 - 24.5					

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information





ID / ICR#: MN 1270024 / 425
 ICR Contact: Mr. Larry Cole
 Phone No.: (612) 661-4923
 Period: 10/15/98 - 10/30/98 (14 B-S days)

Design Information

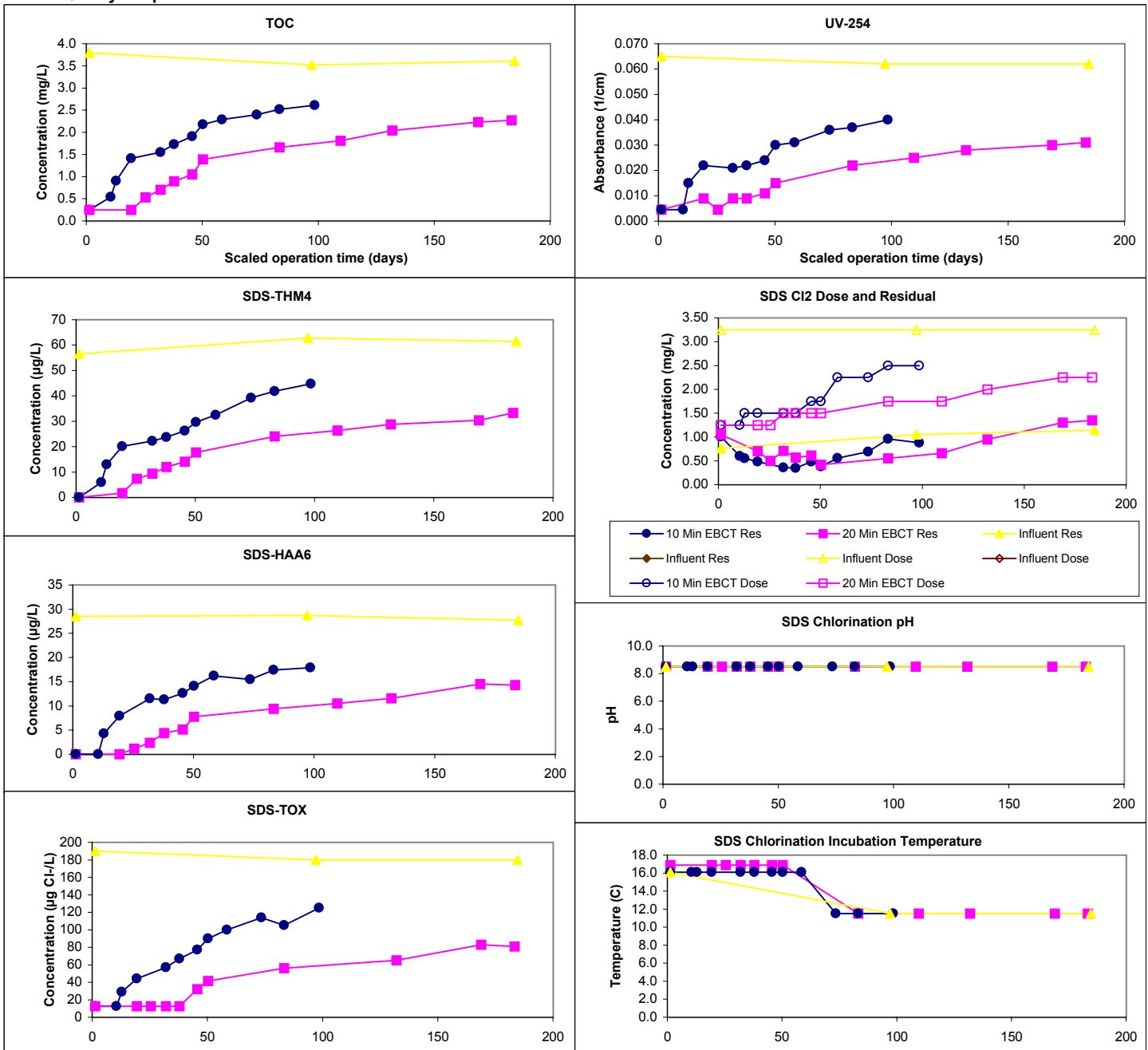
Design TOC: 3.5 mg/L
 Col Diameter: 11.0 mm
 Min Reynolds#: 0.38
 Full-Scale Temp: 13.0 C

Full-Scale GAC Size: 8x40 Bituminous coal
 Bench-Scale GAC Size: 100x200
 Scaling Factor: 12.38
 Meas Dry Bed Density: 0.54 g/cm3

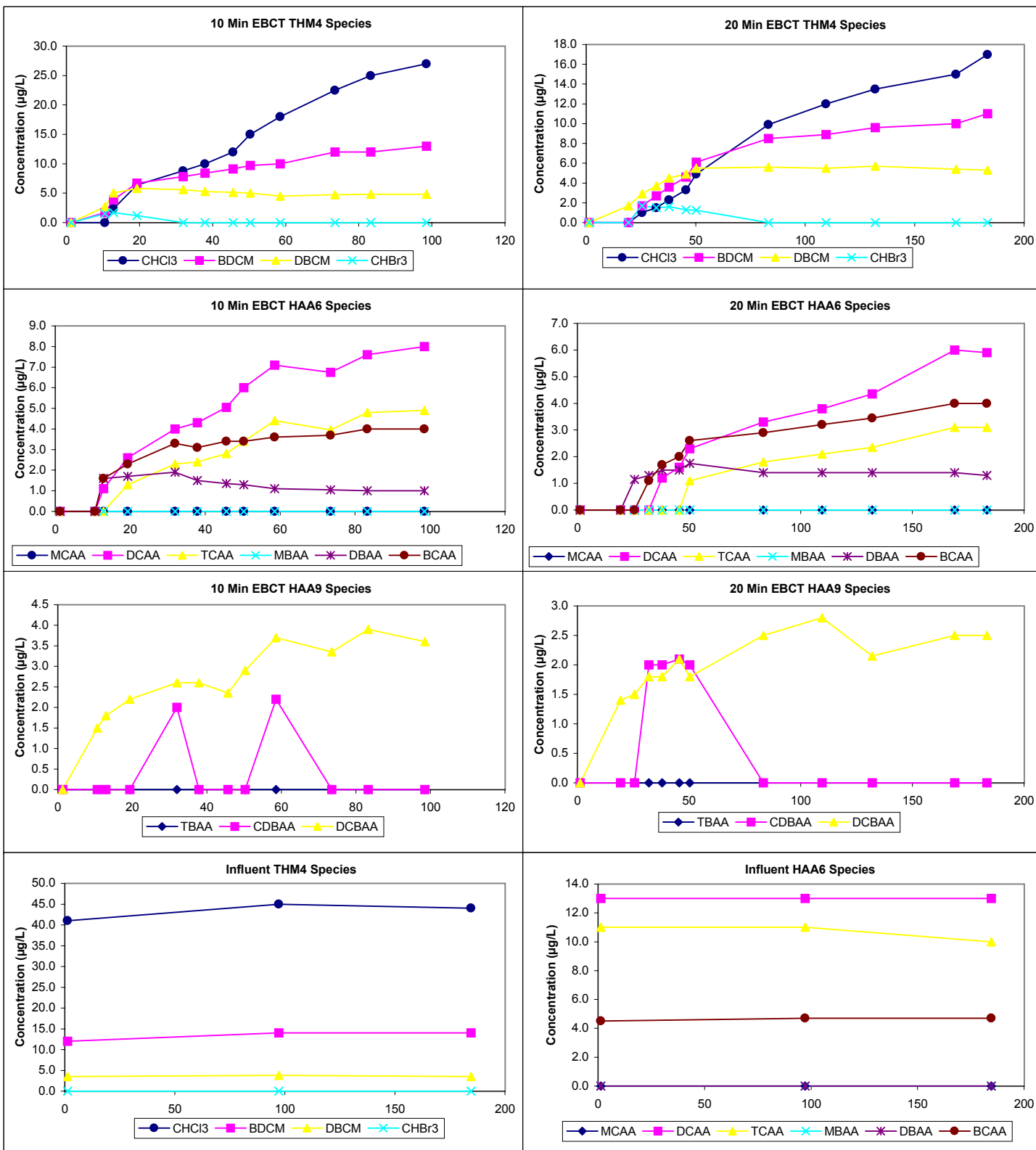
Water Quality Summary

Influent	Influent				Influent								
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max		Mean	SD	Count	Min/Max
TOC	3.6	0.1	3	3.5 - 3.8					Res (0)	0.73	0.29	27	0.35 - 1.35
pH	8.4	0.4	3	8.0 - 8.7					Temp	14.6	2.4	27	11.5 - 16.9
UV254	0.063	0.002	3	0.062 - 0.065					pH	8.5	0.0	27	8.5 - 8.5
SUVA	1.73	0.03	3	1.72 - 1.76					Time	18.0	0.0	27	18.0 - 18.0
Bromide	38	0	2	38 - 38					Comments:				
SDS-TOX	183	6	3	180 - 190									
SDS-THM4	60	3	3	57 - 63									
SDS-HAA6	28	1	3	28 - 29									
Effluent	10 Min EBCT (8 B-S days)				20 Min EBCT (15 B-S days)				Chart Legend:				
Effluent pH	8.2	0.1	9	8.0 - 8.3	8.2	0.2	10	7.9 - 8.5		 10 Min EBCT			
Effluent Temp	22.3	0.8	9	21.2 - 24.2	22.7	0.9	10	21.4 - 24.2		 20 Min EBCT			
									 Influent				
									 Influent				

Water Quality Graphs



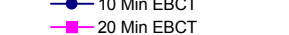
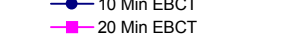
Water Quality Graphs (Continued)



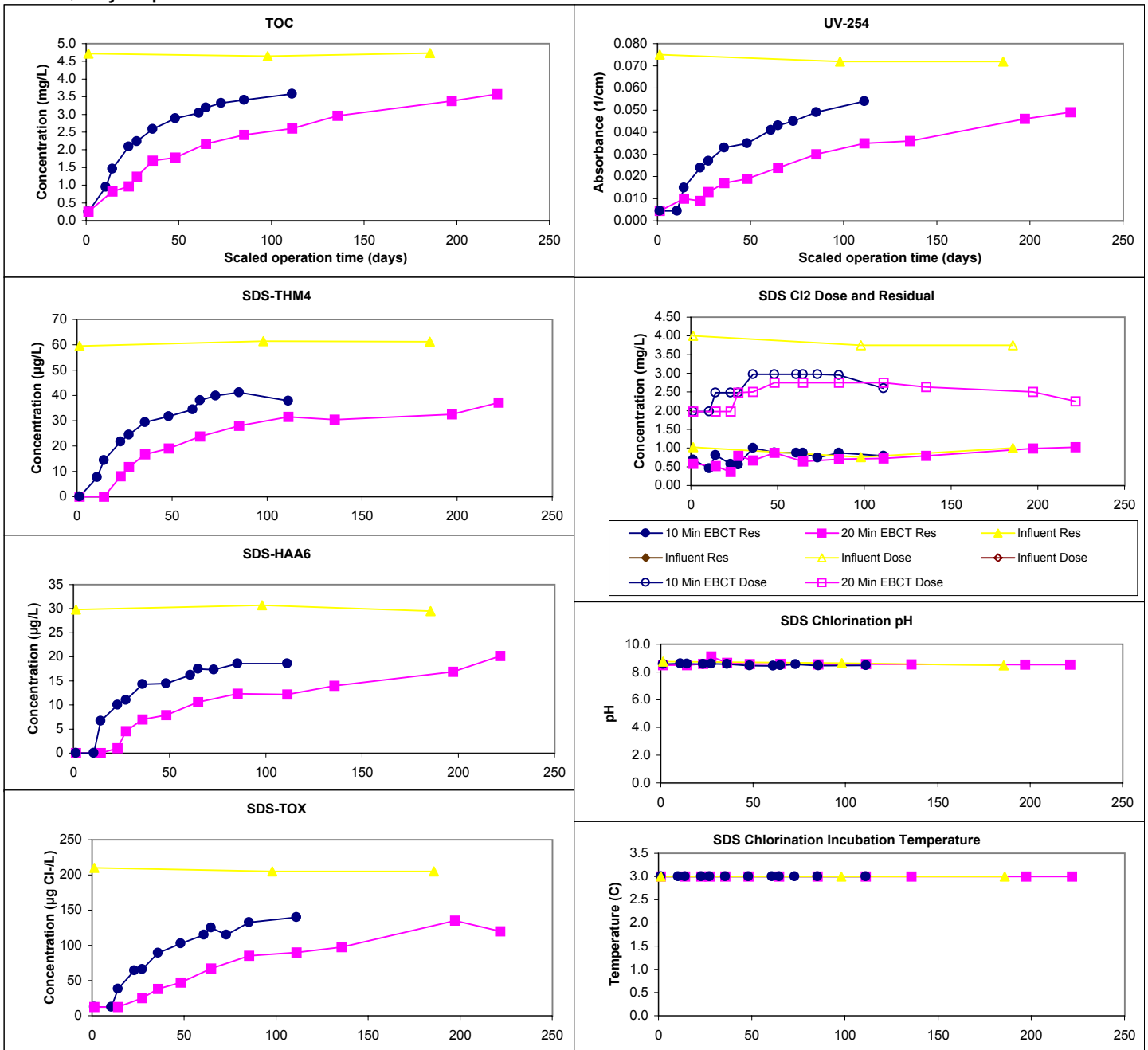
Design Information

ID / ICR#: MN 1270024 / 425	Design TOC: 4.7 mg/L	Full-Scale GAC Size: 8x40 Bituminous coal
ICR Contact: Mr. Larry Cole	Col Diameter: 11.0 mm	Bench-Scale GAC Size: 100x200
Phone No.: (612) 661-4923	Min Reynolds#: 0.27	Scaling Factor: 12.38
Period: 1/21/99 - 2/8/99 (18 B-S days)	Full-Scale Temp: 0.2 C	Meas Dry Bed Density: 0.54 g/cm3

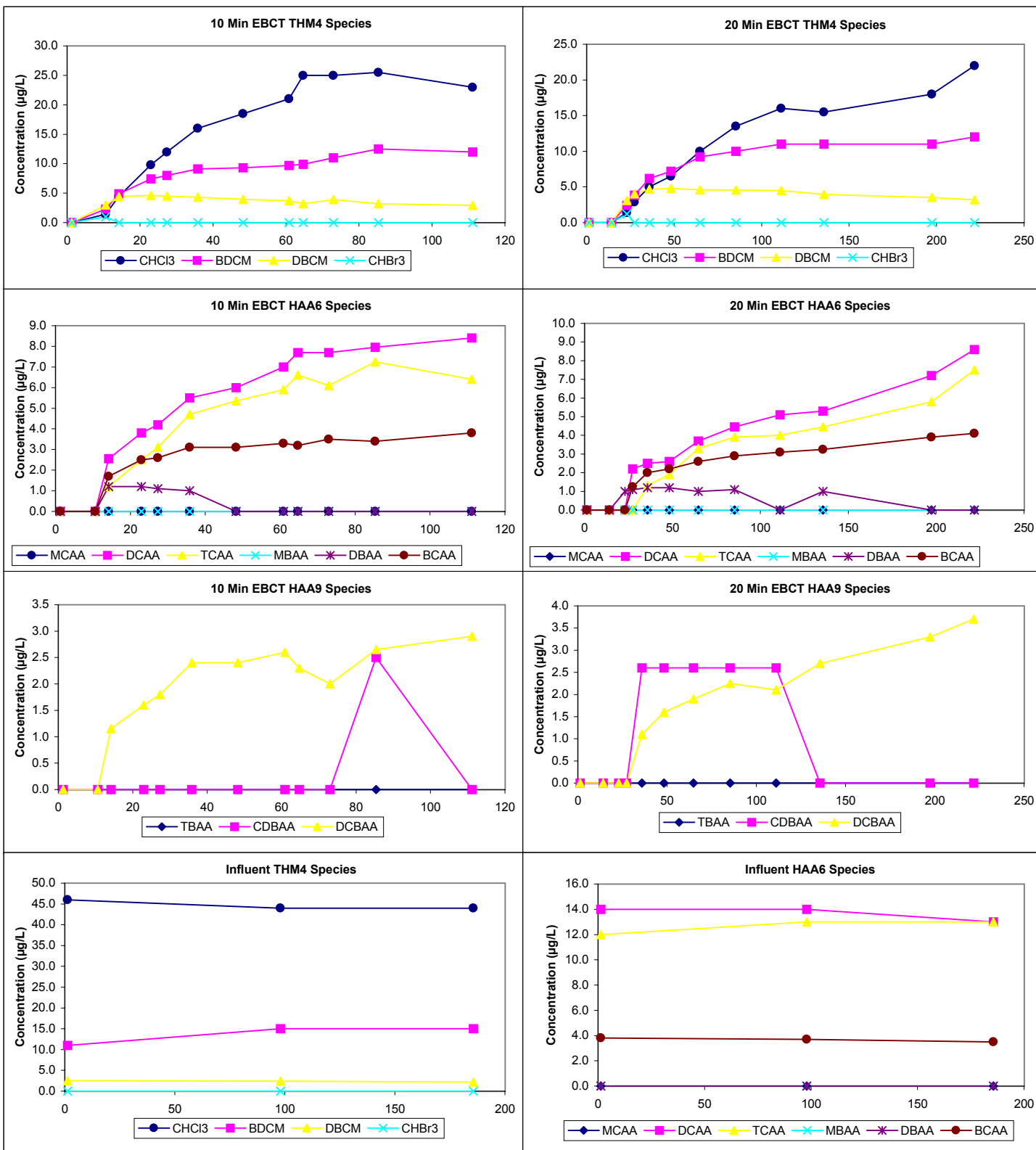
Cumulative SDS Conditions

Influent	Influent				Influent				Res (0)	Mean	SD	Count	Min/Max
	Mean	SD/RD	Count	Min/Max	Mean	SD/RD	Count	Min/Max					
TOC	4.7	0.0	3	4.7 - 4.7									
pH	8.7	0.2	3	8.5 - 8.9					Temp	3.0	0.0	27	3.0 - 3.0
UV254	0.073	0.002	3	0.072 - 0.075					pH	8.6	0.1	27	8.4 - 9.1
SUVA	1.55	0.03	3	1.52 - 1.59					Time	18.0	0.0	27	18.0 - 18.0
Bromide	22	0	2	22 - 22					Comments: 				
SDS-TOX	207	3	3	205 - 210									
SDS-THM4	61	1	3	60 - 61									
SDS-HAA6	30	1	3	30 - 31									
Effluent	10 Min EBCT (9 B-S days)				20 Min EBCT (18 B-S days)				Chart Legend: 				
Effluent pH	8.4	0.3	12	7.8 - 8.9	8.4	0.3	12	8.0 - 8.9					
Effluent Temp	20.7	0.8	11	19.4 - 22.3	20.9	0.8	12	20.0 - 22.3					

Water Quality Graphs



Water Quality Graphs (Continued)



ICR Information

ID / ICR#: MN 1270024 / 425
 ICR Contact: Mr. Larry Cole
 Phone No.: (612) 661-4923
 Period: 4/23/99 - 5/7/99 (13 B-S days)

Design Information

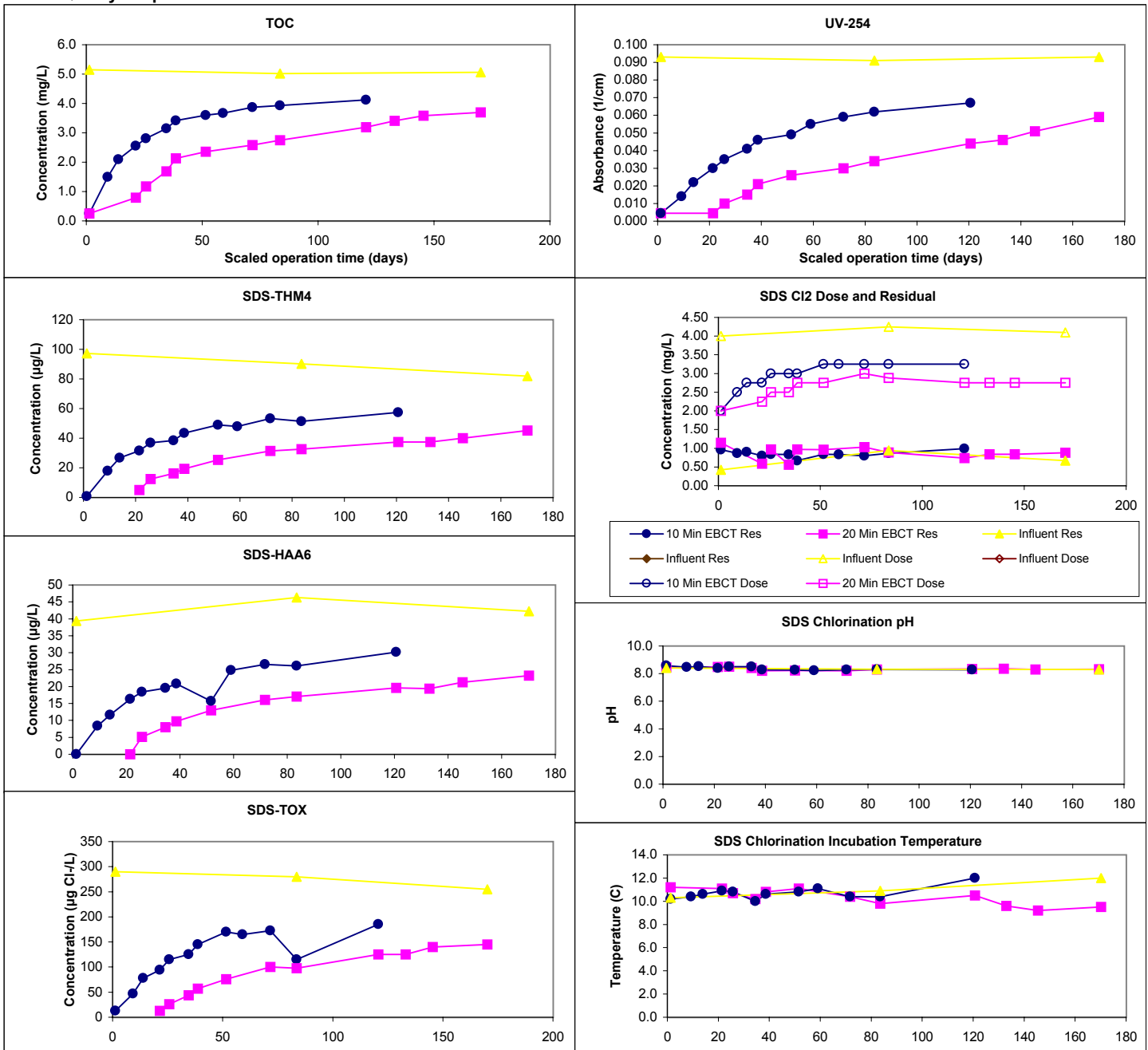
Design TOC: 6.0 mg/L
 Col Diameter: 11.0 mm
 Min Reynolds#: 0.33
 Full-Scale Temp: 7.9 C

Full-Scale GAC Size: 8x40 Bituminous coal
 Bench-Scale GAC Size: 100x200
 Scaling Factor: 12.38
 Meas Dry Bed Density: 0.54 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	5.1	0.1	3	5.0 - 5.2									
pH	8.5	0.2	3	8.3 - 8.6									
UV254	0.092	0.001	3	0.091 - 0.093									
SUVA	1.82	0.02	3	1.81 - 1.84									
Bromide	10	0	2	10 - 10									
SDS-TOX	275	18	3	255 - 290									
SDS-THM4	90	8	3	82 - 97									
SDS-HAA6	43	3	3	39 - 46									
Effluent	10 Min EBCT (10 B-S days)				20 Min EBCT (14 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	7.9	0.2	12	7.7 - 8.2	7.8	0.2	12	7.6 - 8.1					
Effluent Temp	22.1	0.6	12	21.2 - 22.8	22.0	0.8	12	20.6 - 23.5					

Water Quality Graphs



Water Quality Graphs (Continued)

