

ICR TREATMENT STUDY ANALYSIS

Base Analysis and Data Review Comments

Treatment Study ID	1026
Study Protocol	GAC pilot-scale treatment study
Plant ICR Number	450
PWS Name	City of Durham
City, State, Zip	Durham, NC 27701

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

Major comments:

None.

General Comments:

1. As discussed in the Summary Report (page 12), during a two-week interval, the flow rate was maintained at 33 percent of the design flow rate. This period of low flow yielded a total throughput 4 percent below the theoretical throughput based on the design flow rate for the entire run time.

Outlier Data:

Five outliers removed.

Cell: A1

Comment: 1026-SAS.xls 2/15/00 23:14

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

Cell: C2

Comment: 1026-10-01 - Run 1 (BCAA) 2/15/00 22:58
Original value (CoefA0) = 0 New value = -0.1224
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: D2

Comment: 1026-10-01 - Run 1 (BCAA) 2/15/00 22:58
Original value (CoefAf) = 0 New value = 11.0199
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: E2

Comment: 1026-10-01 - Run 1 (BCAA) 2/15/00 22:58
Original value (CoefB) = 0 New value = 260.3347
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: F2

Comment: 1026-10-01 - Run 1 (BCAA) 2/15/00 22:58
Original value (CoefD) = 0 New value = 0.0149
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: J2

Comment: 1026-10-01 - Run 1 (BCAA) 2/15/00 22:58
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: C9

Comment: 1026-10-01 - Run 1 (DBCM) 2/15/00 22:52
Original value (CoefA0) = 0 New value = 1.182
Fewer than 6 points above MRL. Step function applied.

Cell: D9

Comment: 1026-10-01 - Run 1 (DBCM) 2/15/00 22:52
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: E9

Comment: 1026-10-01 - Run 1 (DBCM) 2/15/00 22:52
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: F9

Comment: 1026-10-01 - Run 1 (DBCM) 2/15/00 22:52
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: J9

Comment: 1026-10-01 - Run 1 (DBCM) 2/15/00 22:52
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: K9

Comment: 1026-10-01 - Run 1 (DBCM) 2/15/00 22:52
Original value (t0) = 0 New value = 148.7
Fewer than 6 points above MRL. Step function applied.

Cell: C15

Comment: 1026-10-01 - Run 1 (MBAA) 2/15/00 22:53
Original value (CoefA0) = 0 New value = 1.562
Fewer than 6 points above MRL. Step function applied.

Cell: D15

Comment: 1026-10-01 - Run 1 (MBAA) 2/15/00 22:53
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: E15

Comment: 1026-10-01 - Run 1 (MBAA) 2/15/00 22:53
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: F15

Comment: 1026-10-01 - Run 1 (MBAA) 2/15/00 22:53
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: J15

Comment: 1026-10-01 - Run 1 (MBAA) 2/15/00 22:53
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: K15

Comment: 1026-10-01 - Run 1 (MBAA) 2/15/00 22:53
Original value (t0) = 0 New value = 145.7
Fewer than 6 points above MRL. Step function applied.

Cell: C16

Comment: 1026-10-01 - Run 1 (MCAA) 2/15/00 23:00
Original value (CoefA0) = 0 New value = -0.2718
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: D16

Comment: 1026-10-01 - Run 1 (MCAA) 2/15/00 23:00
Original value (CoefAf) = 0 New value = 7.8744
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: E16

Comment: 1026-10-01 - Run 1 (MCAA) 2/15/00 23:00
Original value (CoefB) = 0 New value = 94.3787
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: F16

Comment: 1026-10-01 - Run 1 (MCAA) 2/15/00 23:00
Original value (CoefD) = 0 New value = 0.0164
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: J16

Comment: 1026-10-01 - Run 1 (MCAA) 2/15/00 23:00
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Logistic function (type 1) applied.

Cell: C23

Comment: 1026-10-01 - Run 1 (UV254) 2/15/00 22:59
Original value (CoefA0) = -0.0185 New value = 0.0014
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: D23

Comment: 1026-10-01 - Run 1 (UV254) 2/15/00 22:59
Original value (CoefAf) = 0.0419 New value = 0.0536
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: E23

Comment: 1026-10-01 - Run 1 (UV254) 2/15/00 22:59
Original value (CoefB) = 0.4054 New value = 20.0007
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: F23

Comment: 1026-10-01 - Run 1 (UV254) 2/15/00 22:59
Original value (CoefD) = 0 New value = 0.0101
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: J23

Comment: 1026-10-01 - Run 1 (UV254) 2/15/00 22:59
Original value (S) = 0 New value = 0
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: C90

Comment: 1026-20-01 - Run 2 (BCAA) 2/15/00 22:56
Original value (CoefA0) = 0 New value = 1.21
Fewer than 6 points above MRL. Step function applied.

Cell: D90

Comment: 1026-20-01 - Run 2 (BCAA) 2/15/00 22:56
Original value (CoefAf) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: E90

Comment: 1026-20-01 - Run 2 (BCAA) 2/15/00 22:56

Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: F90

Comment: 1026-20-01 - Run 2 (BCAA) 2/15/00 22:56
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: J90

Comment: 1026-20-01 - Run 2 (BCAA) 2/15/00 22:56
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: K90

Comment: 1026-20-01 - Run 2 (BCAA) 2/15/00 22:56
Original value (t0) = 0 New value = 244.76
Fewer than 6 points above MRL. Step function applied.

Cell: C97

Comment: 1026-20-01 - Run 2 (DBCM) 2/15/00 23:04
Original value (CoefA0) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: D97

Comment: 1026-20-01 - Run 2 (DBCM) 2/15/00 23:04
Original value (CoefAf) = 0 New value = 1.16
Fewer than 6 points above MRL. Step function applied.

Cell: E97

Comment: 1026-20-01 - Run 2 (DBCM) 2/15/00 23:04
Original value (CoefB) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: F97

Comment: 1026-20-01 - Run 2 (DBCM) 2/15/00 23:04
Original value (CoefD) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: J97

Comment: 1026-20-01 - Run 2 (DBCM) 2/15/00 23:04
Original value (S) = 0 New value = 0
Fewer than 6 points above MRL. Step function applied.

Cell: C103

Comment: 1026-20-01 - Run 2 (MBAA) 2/15/00 23:06
Original value (CoefA0) = 0 New value = 0.1875
Peak curve fit with S = 0. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: D103

Comment: 1026-20-01 - Run 2 (MBAA) 2/15/00 23:06
Original value (CoefAf) = 1.59 New value = 0.7474

Peak curve fit with $S = 0$. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: E103

Comment: 1026-20-01 - Run 2 (MBAA) 2/15/00 23:06

Original value (CoefB) = 50 New value = 18.2706

Peak curve fit with $S = 0$. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: F103

Comment: 1026-20-01 - Run 2 (MBAA) 2/15/00 23:06

Original value (CoefD) = 0.05 New value = 0.0226

Peak curve fit with $S = 0$. Refit to type 1 curve fit by iterative curve fit procedure.

Cell: J103

Comment: 1026-20-01 - Run 2 (MBAA) 2/15/00 23:06

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: C108

Comment: 1026-20-01 - Run 2 (TOC) 2/15/00 23:01

Original value (CoefA0) = 0 New value = 0.1526

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

Cell: D108

Comment: 1026-20-01 - Run 2 (TOC) 2/15/00 23:01

Original value (CoefAf) = 2.1973 New value = 15.533

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

Cell: E108

Comment: 1026-20-01 - Run 2 (TOC) 2/15/00 23:01

Original value (CoefB) = 1.9785 New value = 469.2922

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

Cell: F108

Comment: 1026-20-01 - Run 2 (TOC) 2/15/00 23:01

Original value (CoefD) = 0 New value = 0.016

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

Cell: J108

Comment: 1026-20-01 - Run 2 (TOC) 2/15/00 23:01

Original value (S) = 0 New value = 0

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

Cell: C110

Comment: 1026-20-01 - Run 2 (TSUVA) 2/15/00 23:02

Original value (CoefA0) = 99999 New value = -0.1345

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

Cell: D110

Comment: 1026-20-01 - Run 2 (TSUVA) 2/15/00 23:02

Original value (CoefAf) = 99999 New value = 1.2579

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

Cell: E110

Comment: 1026-20-01 - Run 2 (TSUVA) 2/15/00 23:02
Original value (CoefB) = 99999 New value = 20
Fewer than 6 points. Logistic function (type 1) applied.

Cell: F110

Comment: 1026-20-01 - Run 2 (TSUVA) 2/15/00 23:02
Original value (CoefD) = 99999 New value = 0.1
Fewer than 6 points. Logistic function (type 1) applied.

Cell: J110

Comment: 1026-20-01 - Run 2 (TSUVA) 2/15/00 23:02
Original value (S) = 0 New value = 0
Fewer than 6 points. Logistic function (type 1) applied.

Cell: C111

Comment: 1026-20-01 - Run 2 (UV254) 2/15/00 23:09
Original value (CoefA0) = -0.0165 New value = -0.0013
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: D111

Comment: 1026-20-01 - Run 2 (UV254) 2/15/00 23:09
Original value (CoefAf) = 0.0367 New value = 0.0452
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: E111

Comment: 1026-20-01 - Run 2 (UV254) 2/15/00 23:09
Original value (CoefB) = 0.5112 New value = 20.0004
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: F111

Comment: 1026-20-01 - Run 2 (UV254) 2/15/00 23:09
Original value (CoefD) = 0 New value = 0.01
Poor type -1 or 1 curve fit. Data was refit by iterative curve fit procedure.

Cell: J111

Comment: 1026-20-01 - Run 2 (UV254) 2/15/00 23:09
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#: NC 0332010 / 450
 ICR Contact: George Carter
 Phone No.: 919-560-4362
 Period: 4/28/98 - 1/26/99 (273 days)

Design Information

Design TOC: 2.3 mg/L
 Col Diameter: 76.2 mm

Full-Scale GAC Size: 12x40 US Std Mesh
 Full-Scale particle dia.: 1.053 mm
 Meas Dry Bed Density: 448.56 kg/m3

Water Quality Summary

Influent	Mean	SD	Count	Min/Max
TOC	2.6	0.5	22	1.4 - 3.7
pH	6.1	0.2	21	5.7 - 6.7
UV254	0.040	0.008	21	0.021 - 0.054
SUVA	NA	NA	0	0.0 - 0.0
Bromide	11.60	15.34	22	0.0 - 50.0
SDS-TOX	168	29	20	103 - 210
SDS-THM4	30	4	20	24 - 40
SDS-HAA6	48	20	20	13 - 85
Ammonia	0.00	0.00	6	0.00 - 0.00

Cumulative SDS Conditions

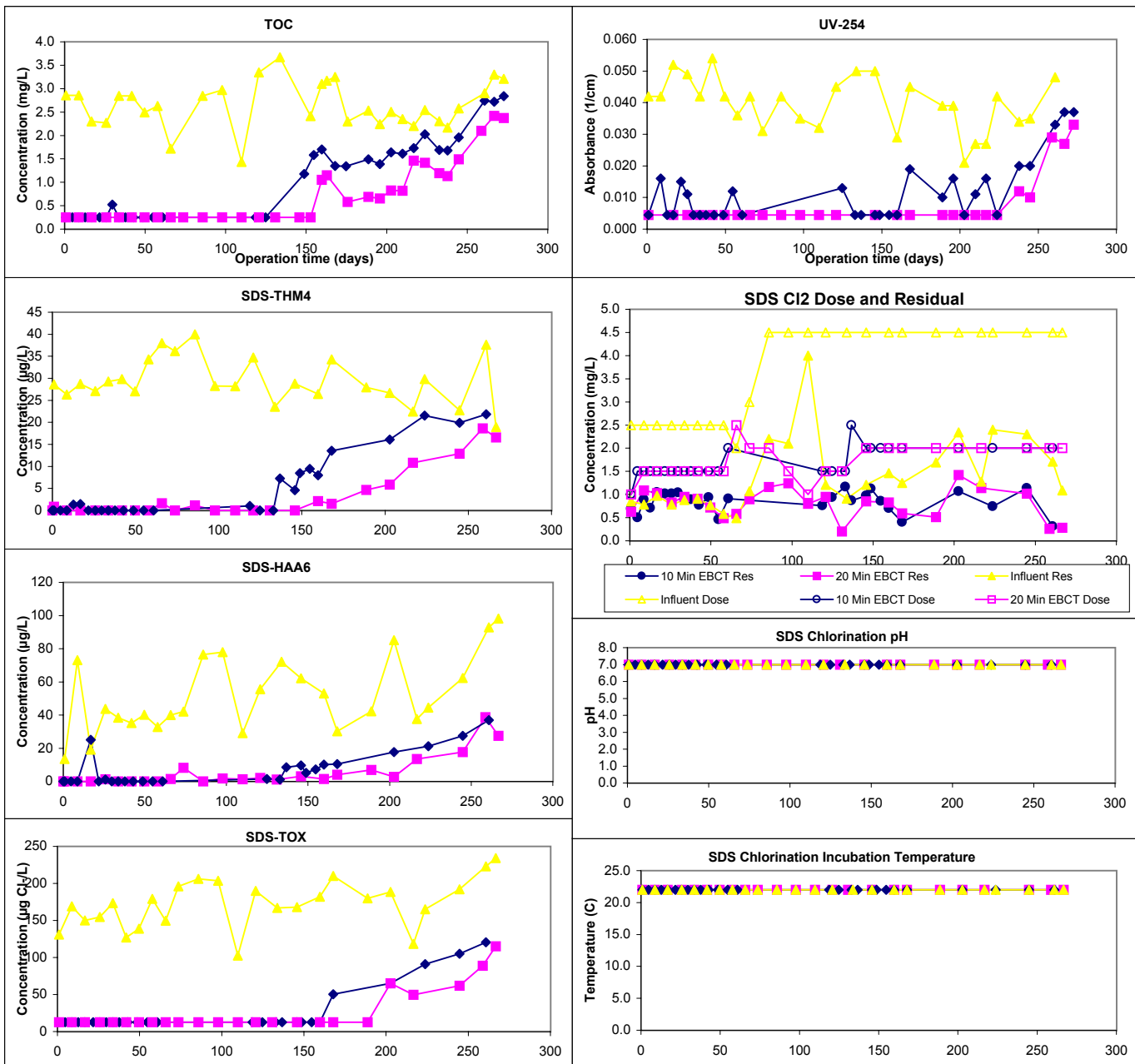
	Mean	SD	Count	Min/Max
Res (0)	1.02	0.57	76	0.20 - 4.00
Temp	22.0	0.0	76	22.0 - 22.0
pH	7.0	0.0	76	7.0 - 7.0
Time	23.9	0.9	76	18.5 - 24.0

Comments:

Effluent	10 Min EBCT	(189 days)	20 Min EBCT	(210 days)
Effluent pH	5.8	0.3	25	5.0 - 6.3
Effluent Temp	23.3	3.3	25	18.0 - 29.0
	5.9	0.4	21	5.1 - 6.3
	22.7	3.6	21	17.0 - 28.0

Chart
 Legend: 10 Min EBCT
 20 Min EBCT
 Influent

Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)

