ICR TREATMENT STUDY ANALYSIS

Base Analysis and Data Review Comments

Treatment Study ID 1071

Study Protocol GAC bench-scale treatment study

Plant ICR Number 358

PWS Name Rend Lake Intercity Water System

City, State, Zip Benton, IL 62812

General comments:

1. This bench-scale study examined DBP precursor removal by F-400, a bituminous coal-based GAC, over four quarterly sessions at 10 and 20 minute EBCTs.

2. As indicated in the Summary Report, the RSSCTs were operated intermittently. They were operated for 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 had on the experimental results. However, TOC breakthrough did not occur above the MRL for three of the four runs, which is highly unusual given the average influent TOC concentration ranging between 3.6 and 5.0 mg/L. The intermittent operation of the RSSCTs may have resulted in run times prior to breakthrough that were much longer than expected based under constant RSSCT operation. **Therefore, the breakthrough data generated during this study will not be carried forward for data analysis.**

Rend Lake Intercity Water System | **Bench-Scale RSSCT Treatment Study Summary** | **Quarter:** 1

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	**Full-Scale GAC Size:**	12x40 Bituminous
Col Diameter:	11.0 mm	**Bench-Scale GAC Size:**	100x200
Min Reynolds#:	0.50	**Scaling Factor:**	9.36
Full-Scale Temp:	21.0 C	**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
TOC	3.7	0.2	3	3.5 - 3.9	3.7	0.2	3	3.5 - 3.9
pH	10.1	0.1	3	10.0 - 10.2	10.1	0.1	3	10.0 - 10.2
UV254	0.059	0.003	3	0.056 - 0.062	0.059	0.003	3	0.056 - 0.062
SUVA	1.60	0.02	3	1.58 - 1.62	1.60	0.02	3	1.58 - 1.62
Bromide	NA	0	0	0 - 0	NA	0	0	0 - 0
SDS-TOX	155	97	3	56 - 250	155	97	3	56 - 250
SDS-THM4	23	29	3	2 - 56	23	29	3	2 - 56
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)
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

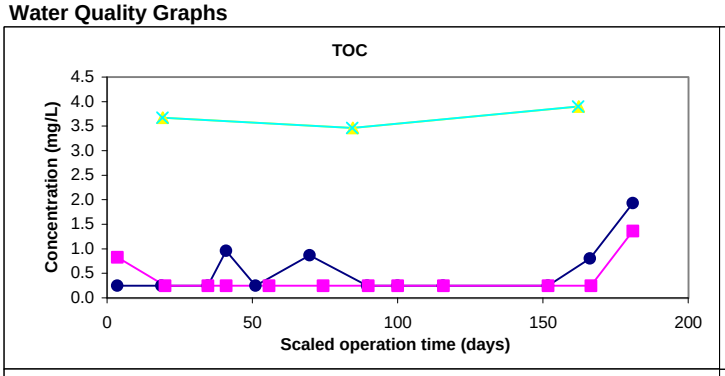
Cumulative SDS Conditions

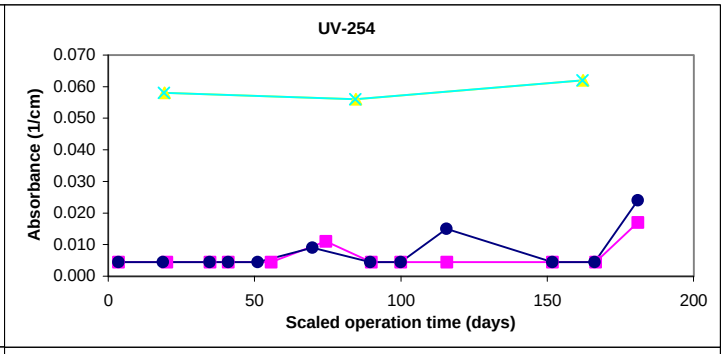
	Mean	SD	Count	Min/Max
Res (0)	0.68	0.23	30	0.30 - 1.00
Temp	14.3	5.0	30	8.0 - 23.0
pH	8.6	0.6	30	7.9 - 10.0
Time	24.0	0.0	30	24.0 - 24.0

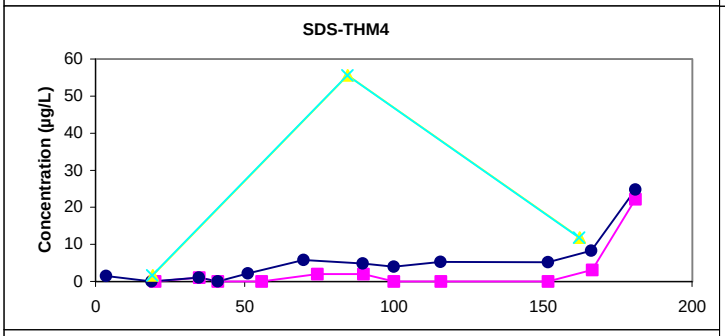
Comments:

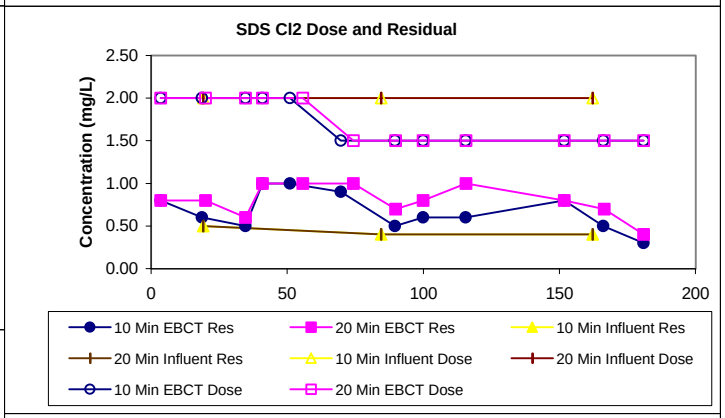
Chart Legend: 10 Min EBCT; 20 Min EBCT; 10 Min Influent; 20 Min Influent

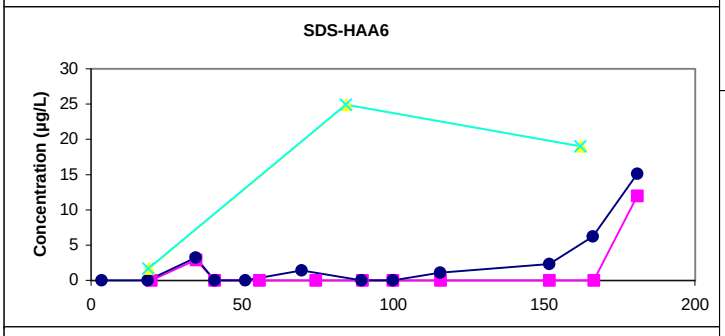
Water Quality Graphs

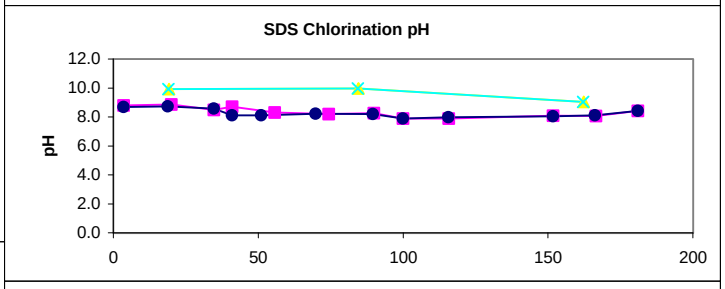


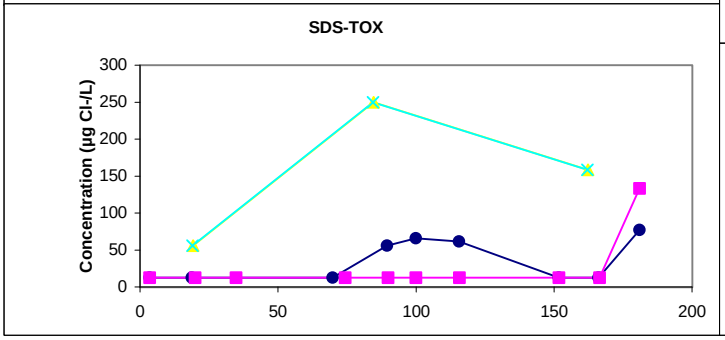


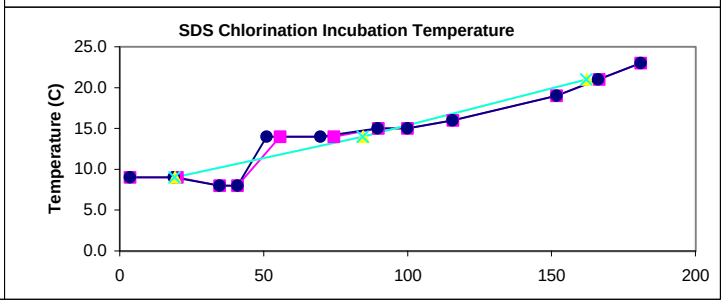




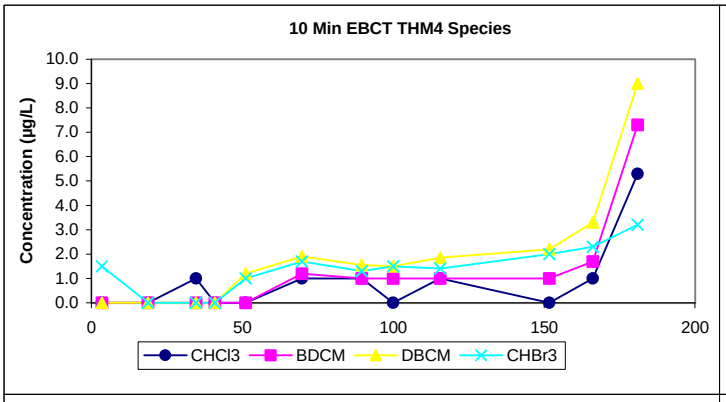


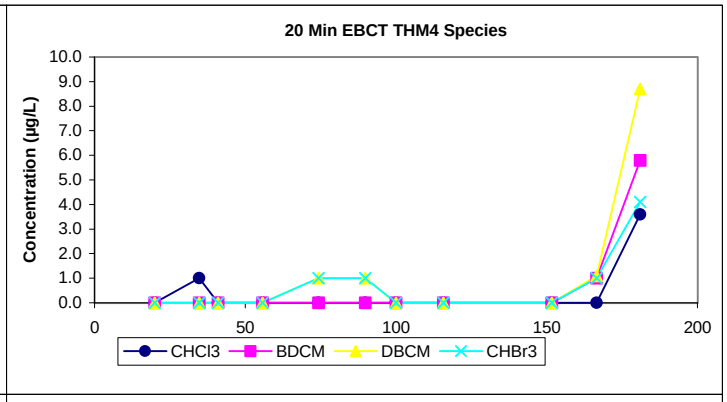


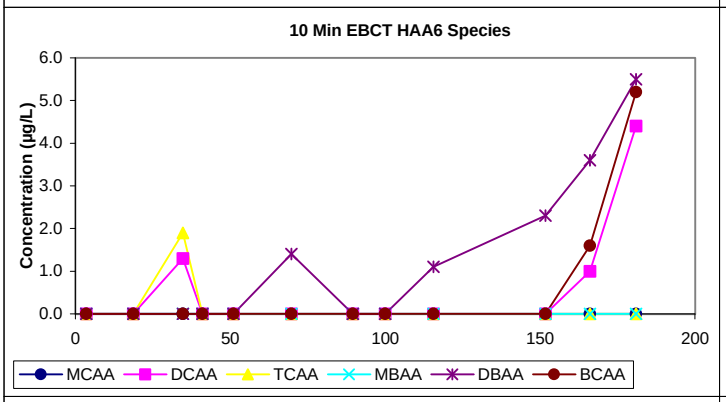


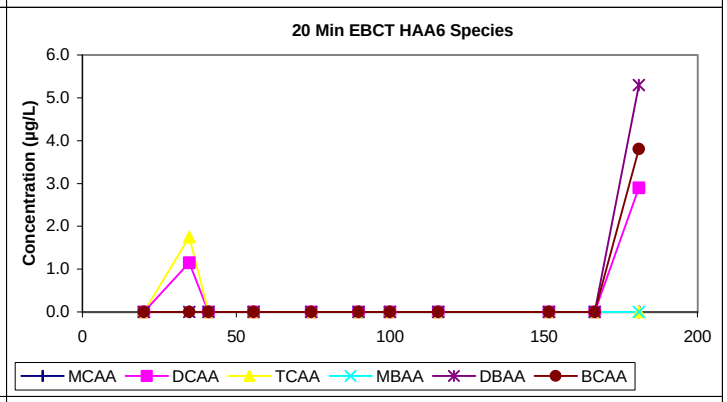


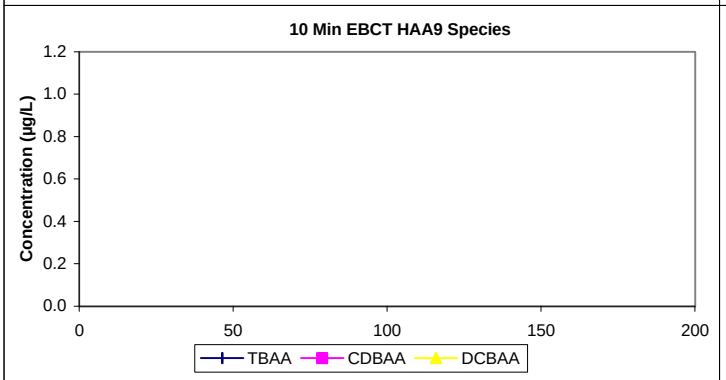
Water Quality Graphs (Continued)

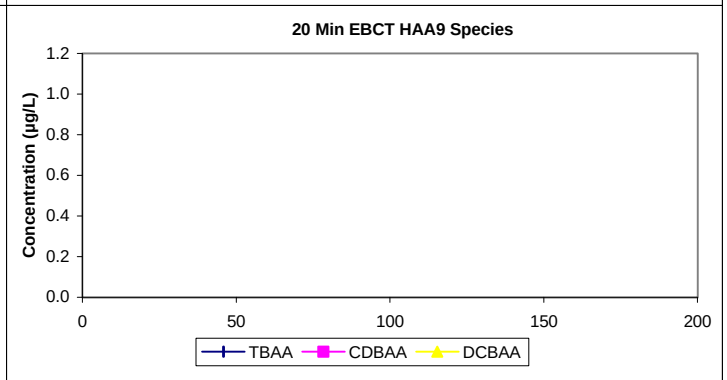


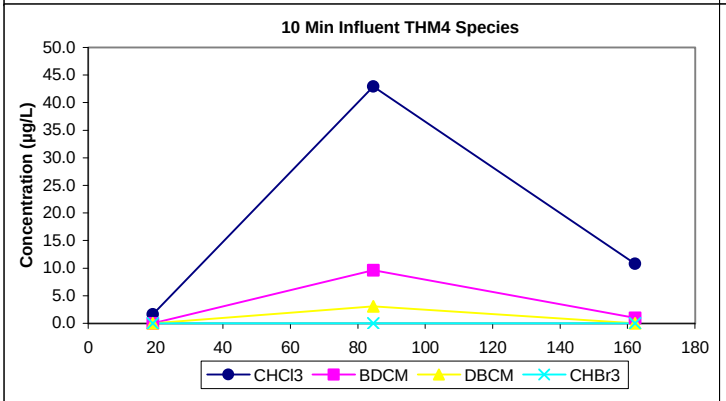


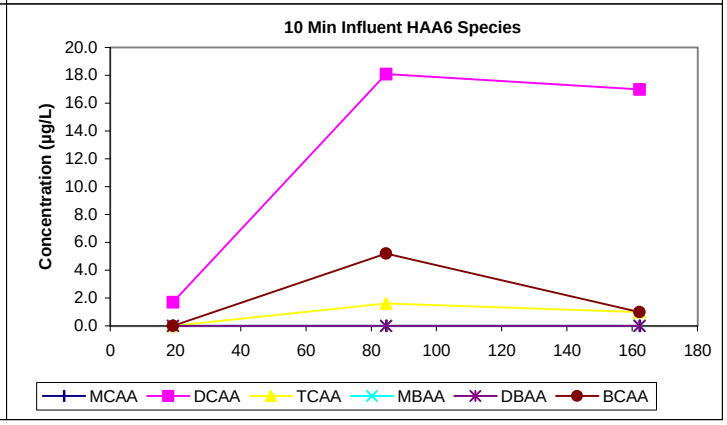












Rend Lake Intercity Water System | **Bench-Scale RSSCT Treatment Study Summary** | **Quarter:** 2

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	**Full-Scale GAC Size:**	12x40 Bituminous
Col Diameter:	11.0 mm	**Bench-Scale GAC Size:**	100x200
Min Reynolds#:	0.50	**Scaling Factor:**	9.36
Full-Scale Temp:	21.0 C	**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
TOC	3.6	0.3	3	3.3 - 3.9	3.6	0.3	3	3.3 - 3.9
pH	9.9	0.1	3	9.8 - 10.0	9.9	0.1	3	9.8 - 10.0
UV254	0.060	0.000	2	0.060 - 0.060	0.060	0.000	2	0.060 - 0.060
SUVA	1.59	0.06	2	1.56 - 1.62	1.59	0.06	2	1.56 - 1.62
Bromide	58	0	1	58 - 58	10	0	1	10 - 10
SDS-TOX	139	3	2	137 - 140	139	3	2	137 - 140
SDS-THM4	33	28	3	10 - 65	33	28	3	10 - 65
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)
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

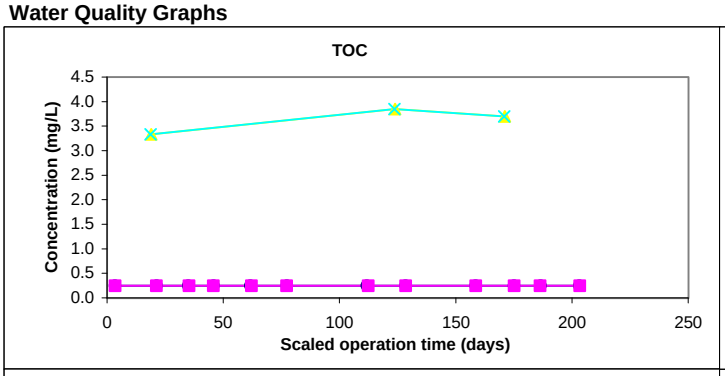
Cumulative SDS Conditions

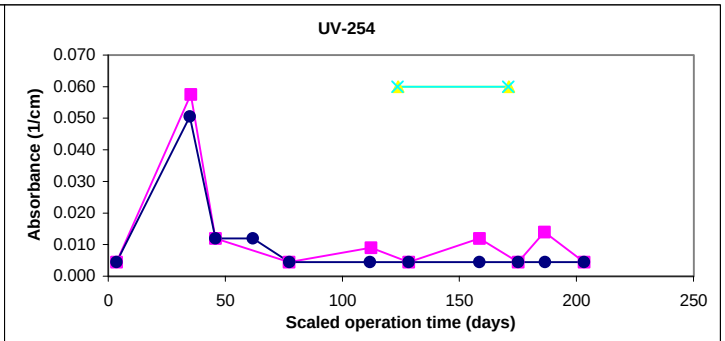
	Mean	SD	Count	Min/Max
Res (0)	0.66	0.29	30	0.20 - 1.00
Temp	26.3	1.2	30	24.0 - 28.0
pH	8.4	0.4	30	8.0 - 9.4
Time	24.0	0.0	30	24.0 - 24.0

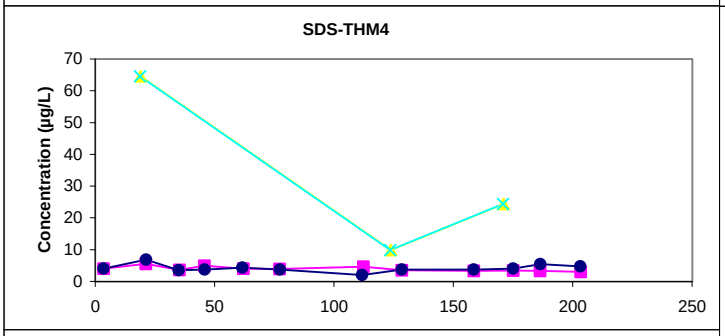
Comments:

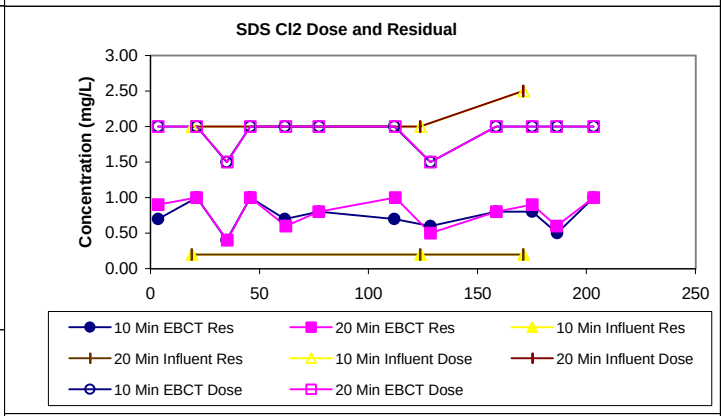
Chart Legend: 10 Min EBCT; 20 Min EBCT; 10 Min Influent; 20 Min Influent

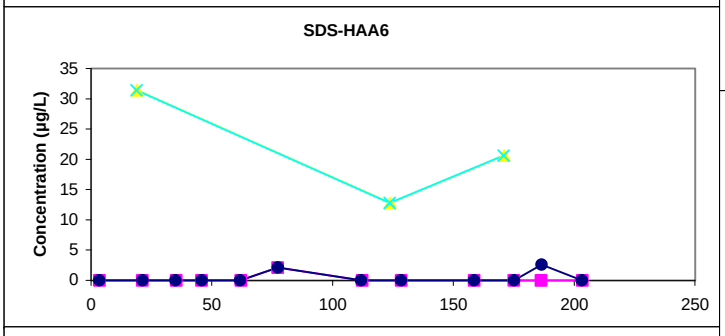
Water Quality Graphs

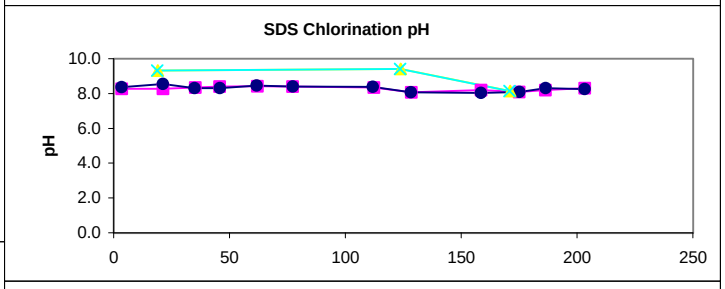


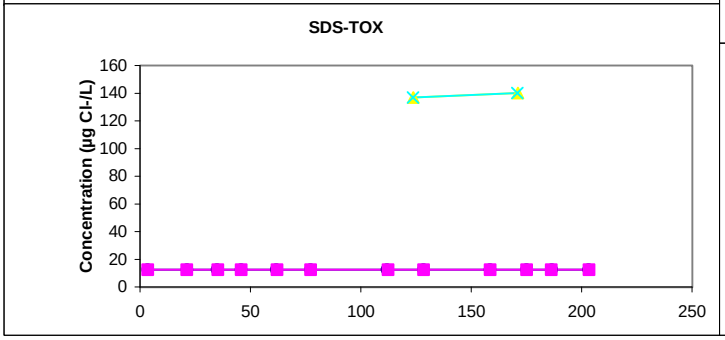


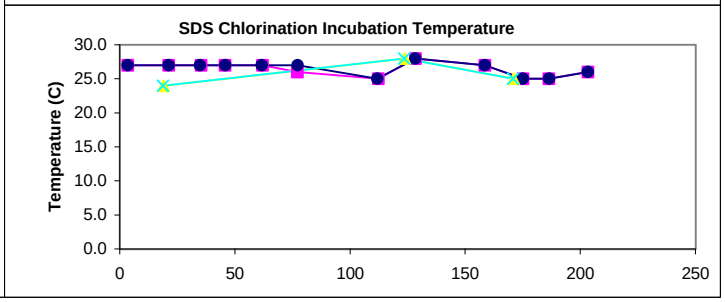




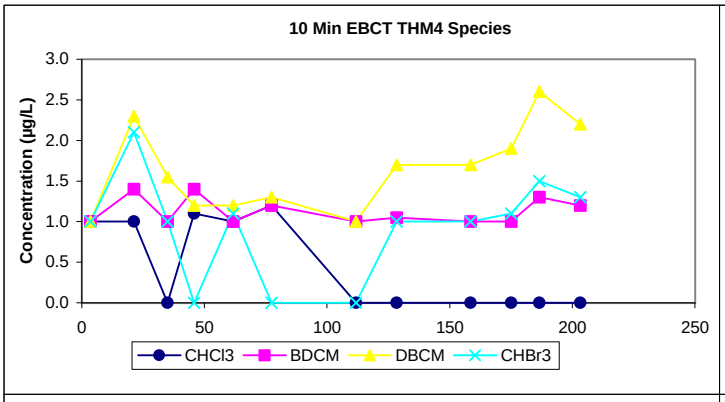


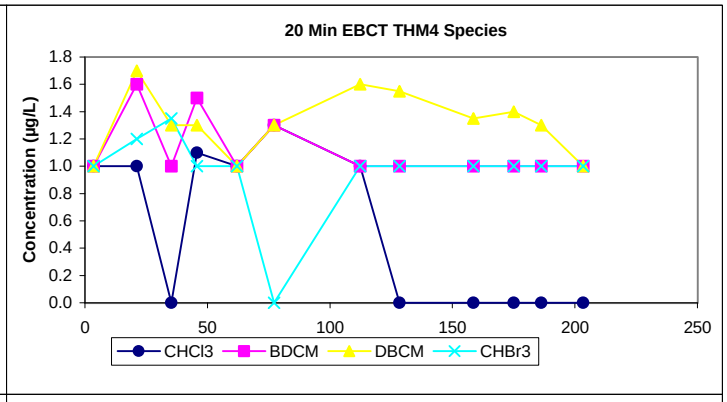


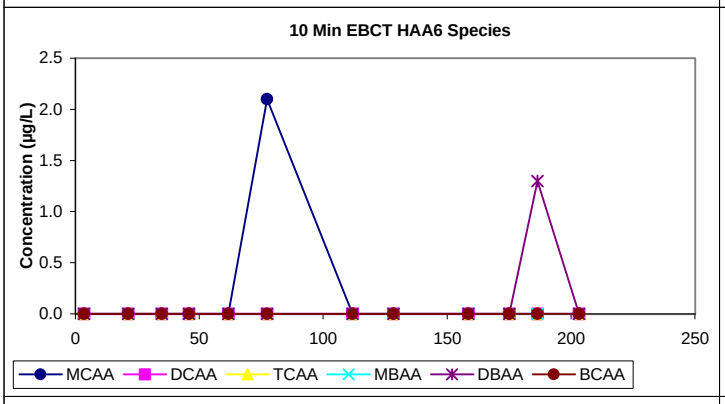


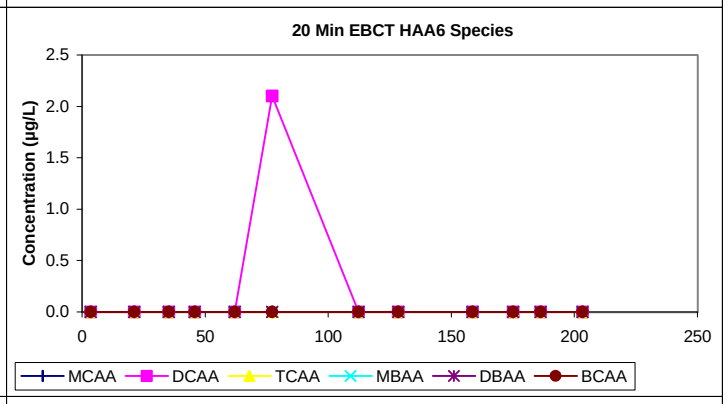


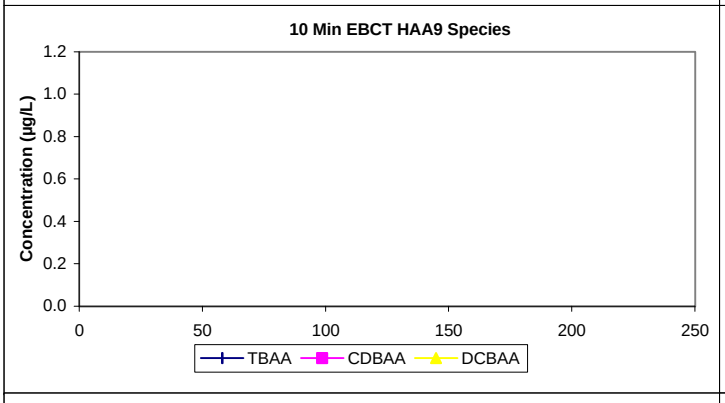
Water Quality Graphs (Continued)

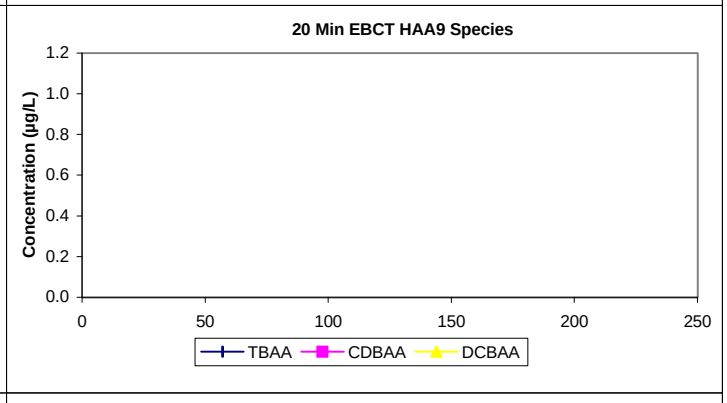


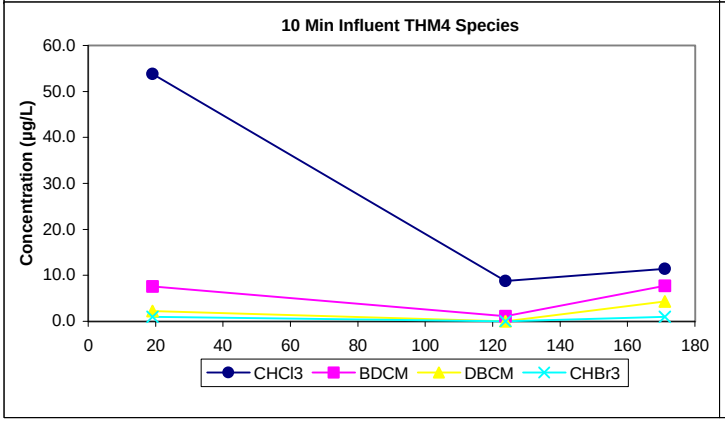


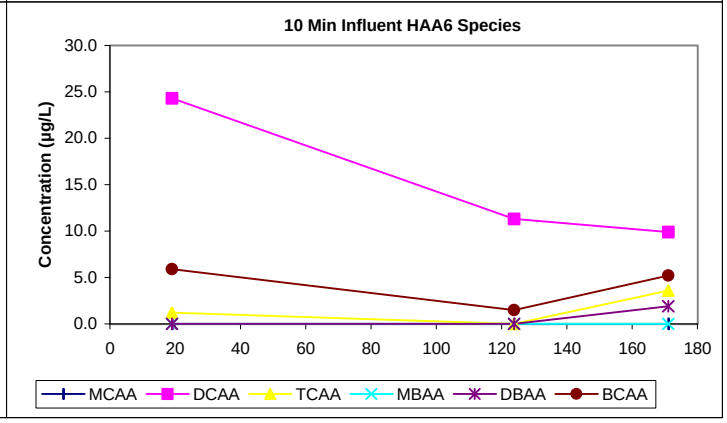












Rend Lake Intercity Water System | **Bench-Scale RSSCT Treatment Study Summary** | **Quarter:** 3

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	**Full-Scale GAC Size:**	12x40 Bituminous
Col Diameter:	11.0 mm	**Bench-Scale GAC Size:**	100x200
Min Reynolds#:	0.50	**Scaling Factor:**	9.36
Full-Scale Temp:	21.0 C	**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
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
UV254	0.080	0.007	3	0.072 - 0.085	0.080	0.007	3	0.072 - 0.085
SUVA	1.83	0.20	3	1.61 - 2.00	1.83	0.20	3	1.61 - 2.00
Bromide	NA	0	0	0 - 0	NA	0	0	0 - 0
SDS-TOX	163	**39**	3	139 - 208	163	**39**	3	139 - 208
SDS-THM4	40	6	3	34 - 46	40	6	3	34 - 46
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

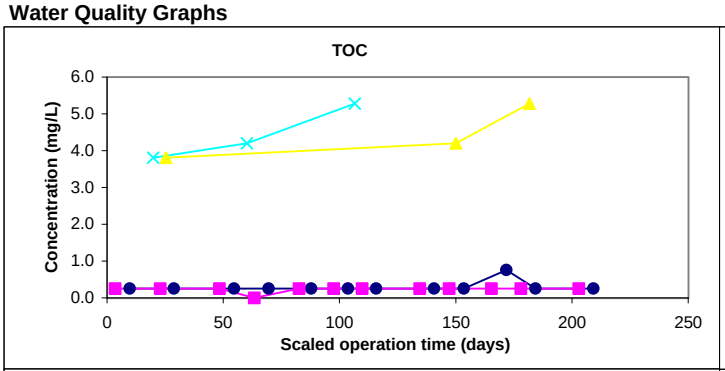
Cumulative SDS Conditions

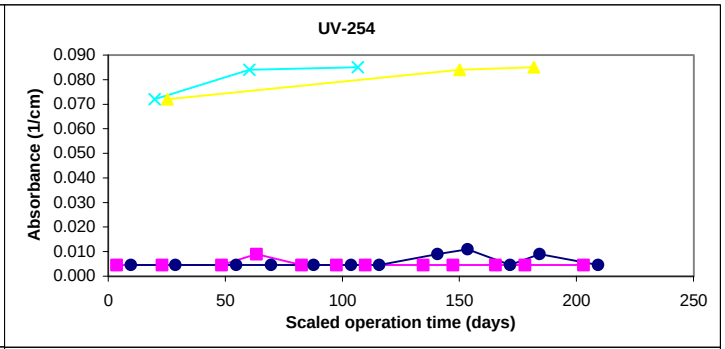
	Mean	SD	Count	Min/Max
Res (0)	0.74	0.31	30	0.20 - 1.20
Temp	22.4	1.4	30	19.0 - 26.0
pH	8.6	0.4	30	8.2 - 9.6
Time	24.0	0.0	30	24.0 - 24.0

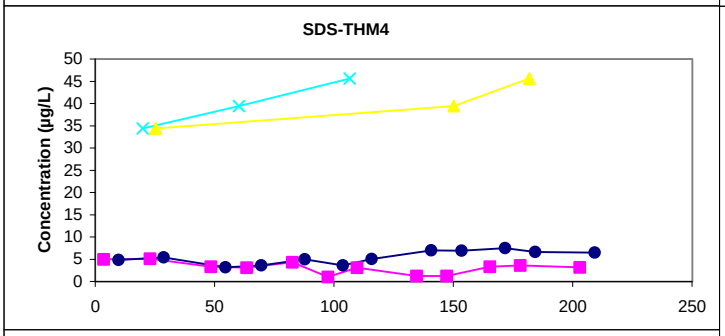
Comments:

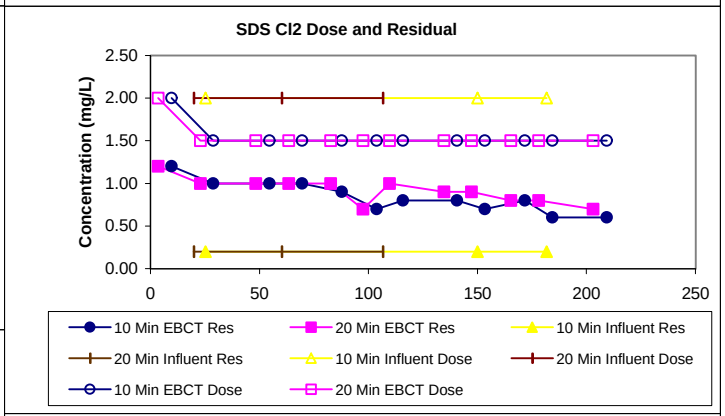
Chart Legend: 10 Min EBCT; 20 Min EBCT; 10 Min Influent; 20 Min Influent

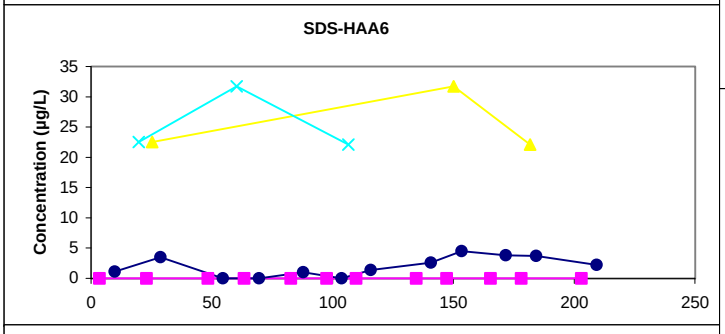
Water Quality Graphs

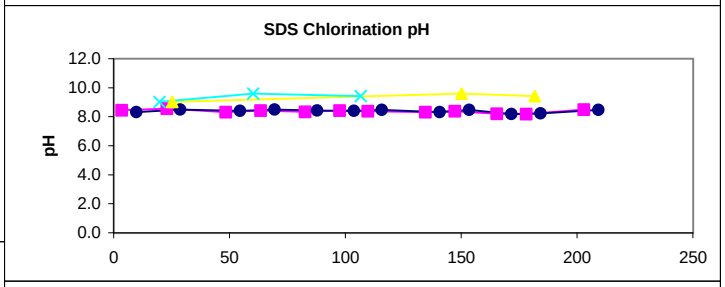


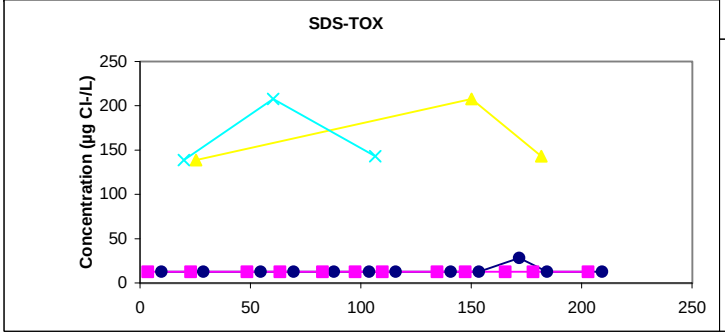


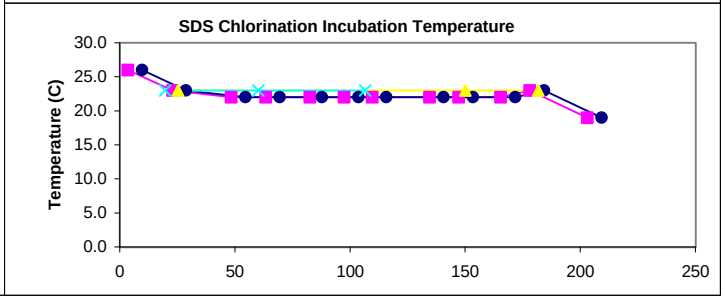




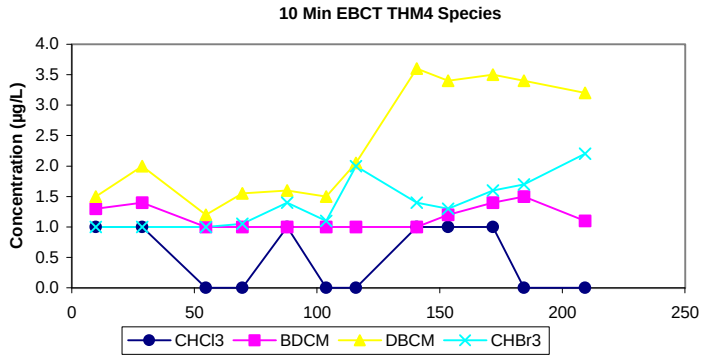


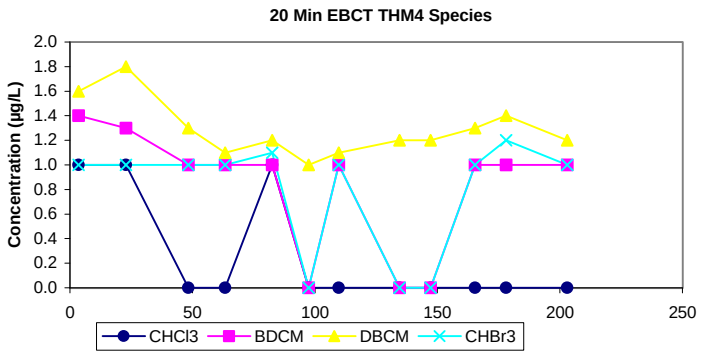


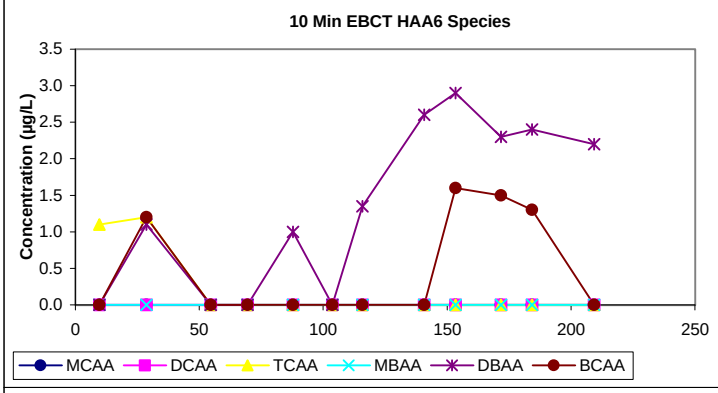


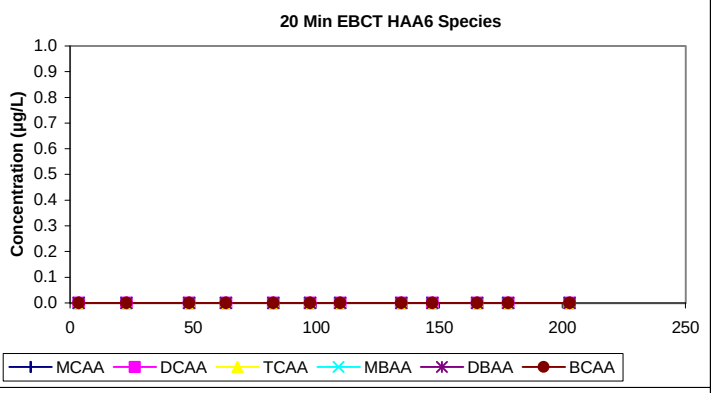


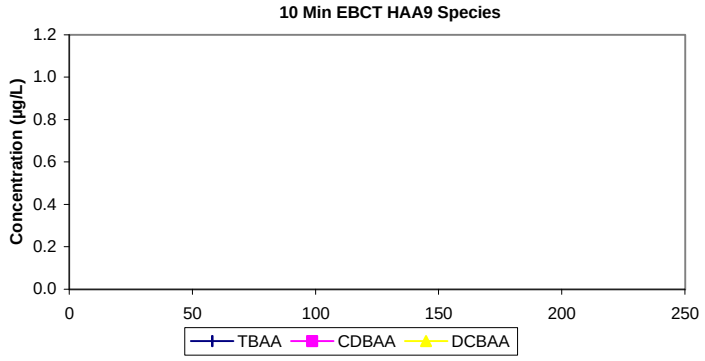
Water Quality Graphs (Continued)

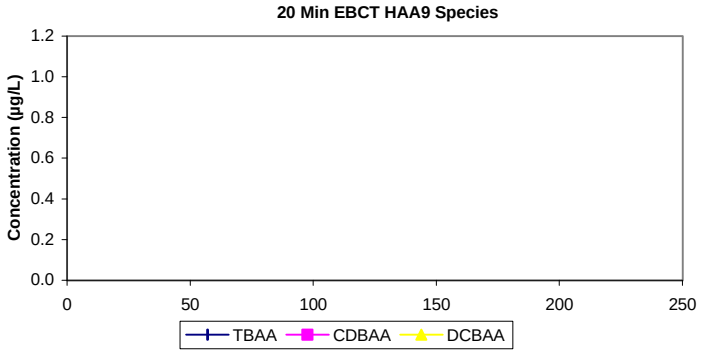


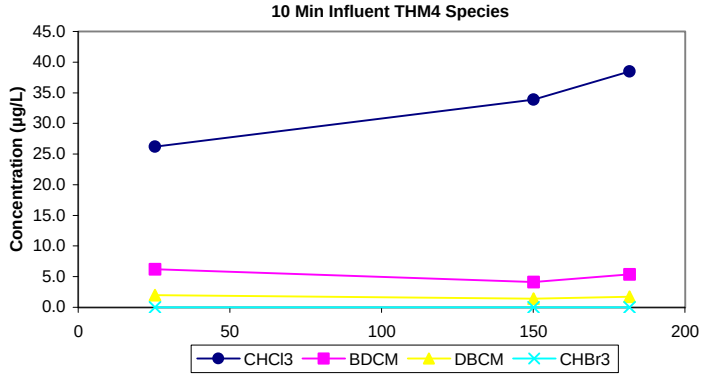


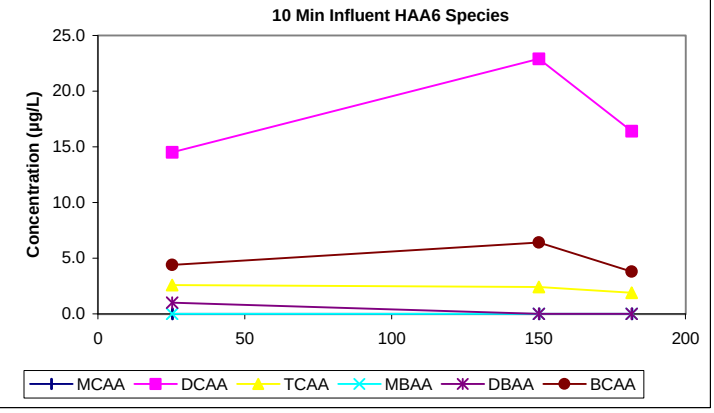












Rend Lake Intercity Water System | **Bench-Scale RSSCT Treatment Study Summary** | **Quarter:** 4

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
TOC	5.0	0.0	1	5.0 - 5.0	4.9	0.0	1	4.9 - 4.9
pH	9.4	0.4	3	9.0 - 9.7	9.4	0.4	3	9.0 - 9.7
UV254	0.091	0.000	1	0.091 - 0.091	0.090	0.000	1	0.090 - 0.090
SUVA	1.83	0.00	1	1.83 - 1.83	1.84	0.00	1	1.84 - 1.84
Bromide	NA	0	0	0 - 0	NA	0	0	0 - 0
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
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

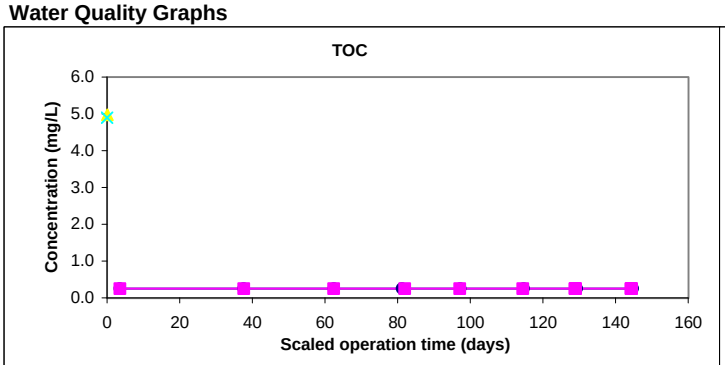
Cumulative SDS Conditions

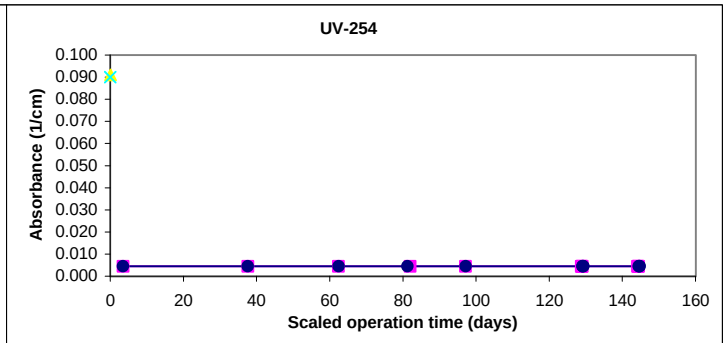
	Mean	SD	Count	Min/Max
Res (0)	0.69	0.32	30	0.10 - 1.20
Temp	22.2	1.9	30	20.0 - 27.0
pH	8.4	0.2	30	8.1 - 8.9
Time	24.0	0.0	30	24.0 - 24.0

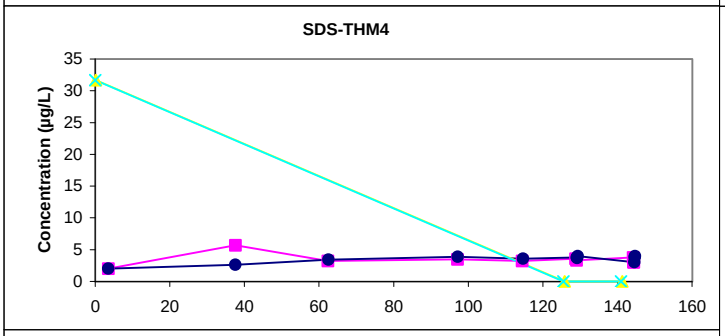
Comments:

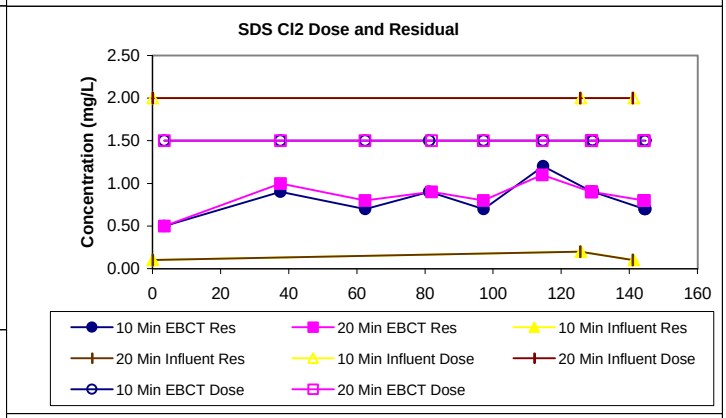
Chart Legend: 10 Min EBCT; 20 Min EBCT; 10 Min Influent; 20 Min Influent

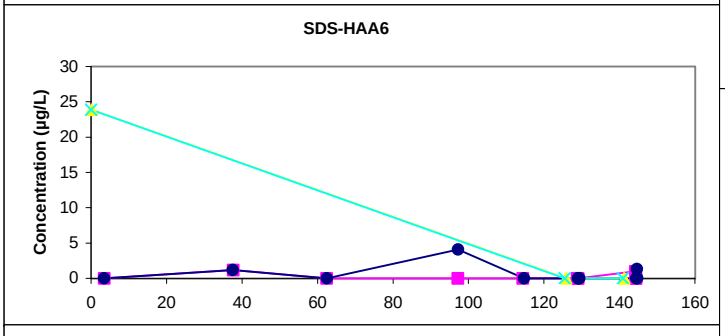
Water Quality Graphs

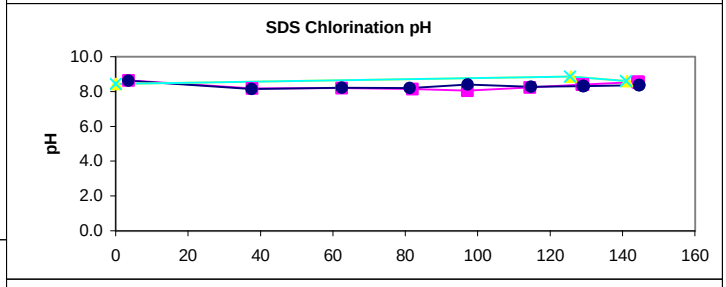


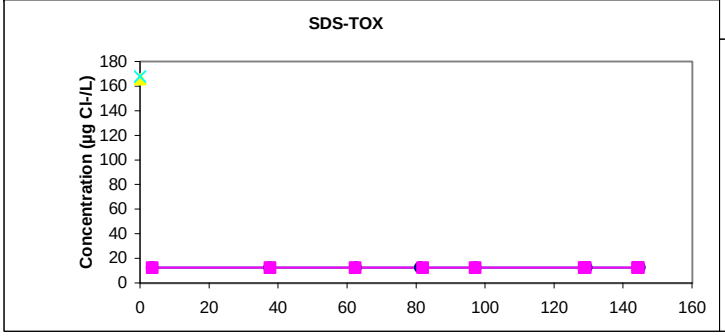


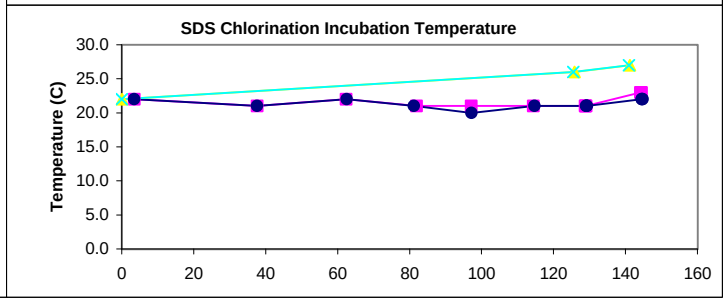












Water Quality Graphs (Continued)