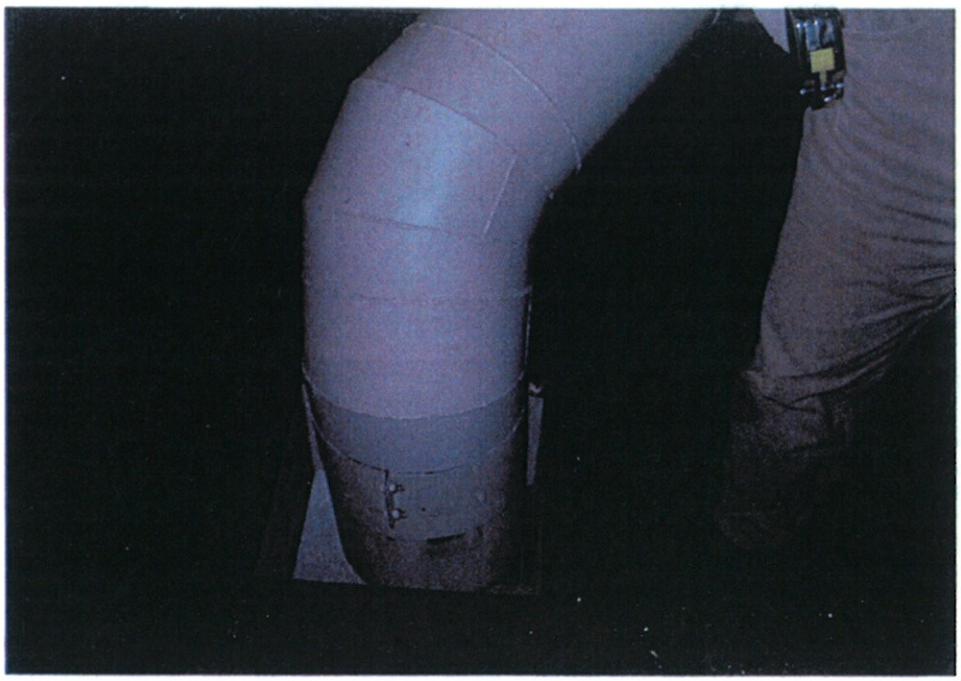
Appendix C – Photographs of Odor Sources Sampled

#2 - Grit hopper

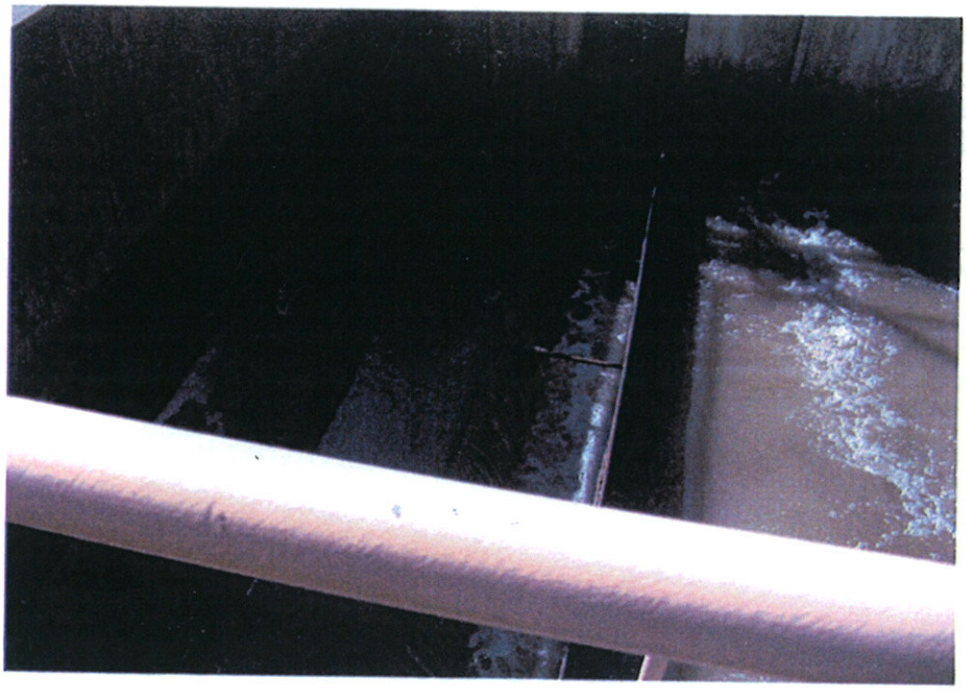
#3 - Headworks odor control exhaust

#3 - Headworks roof exhaust vent

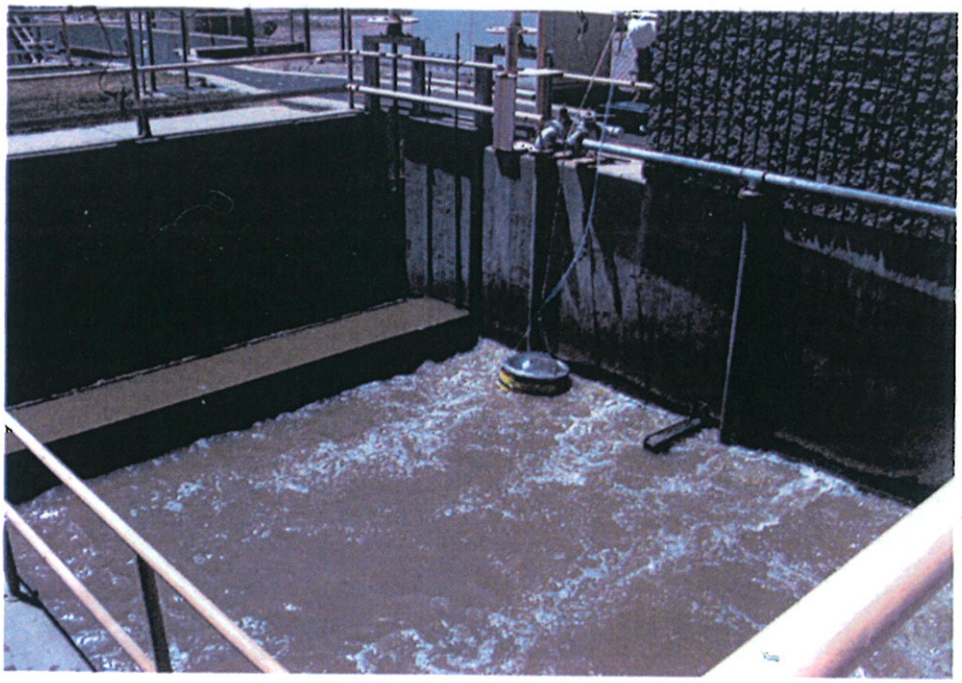


#4 - Headworks odor vent to first floor

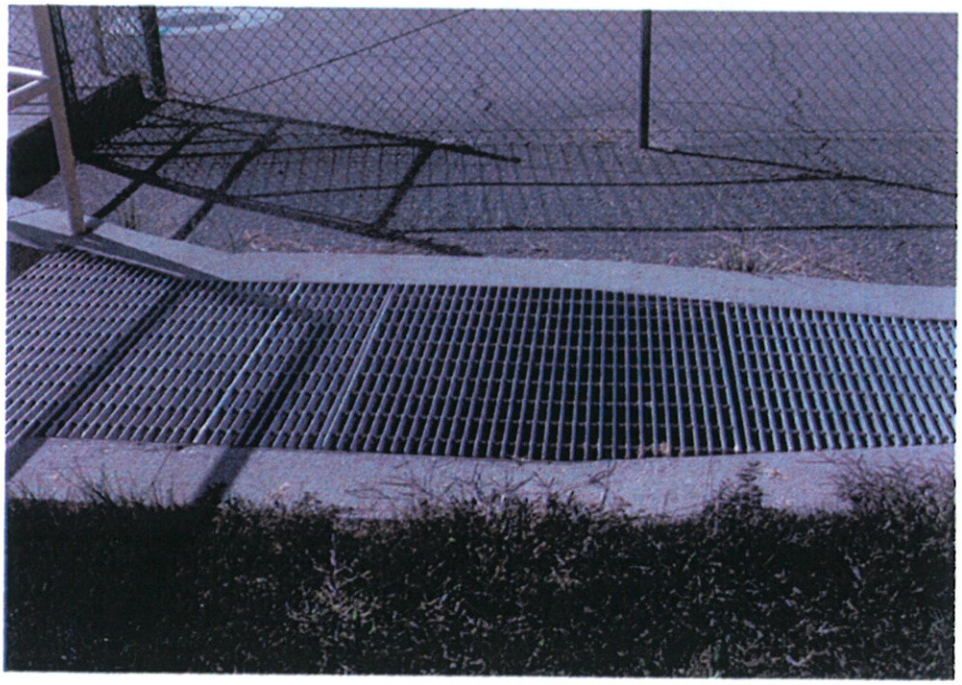
#6 - Headworks effluent junction box



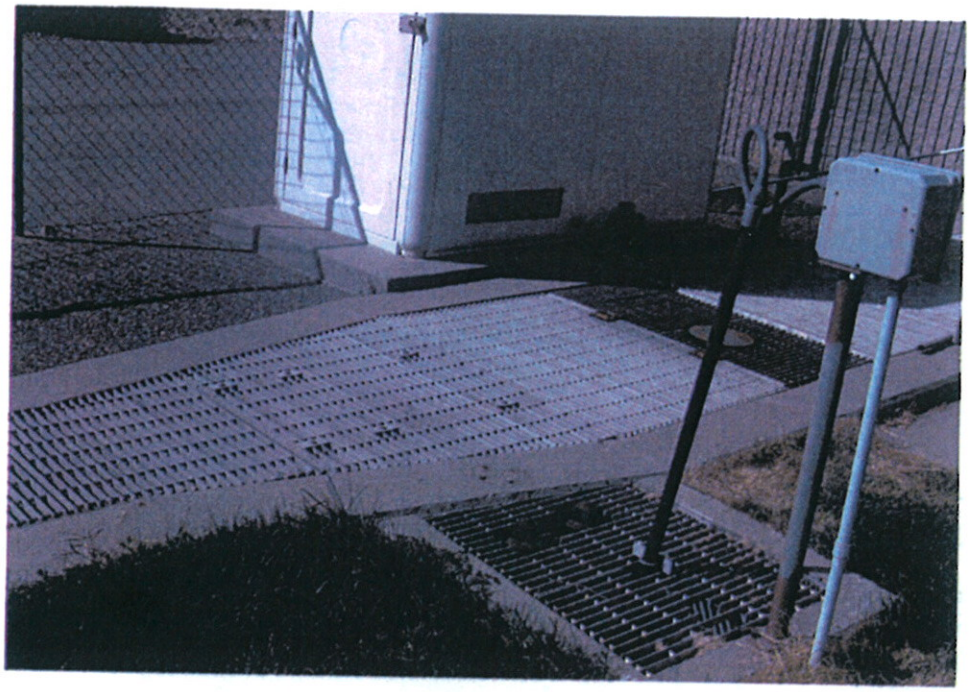
#7 - Aerated grit chamber



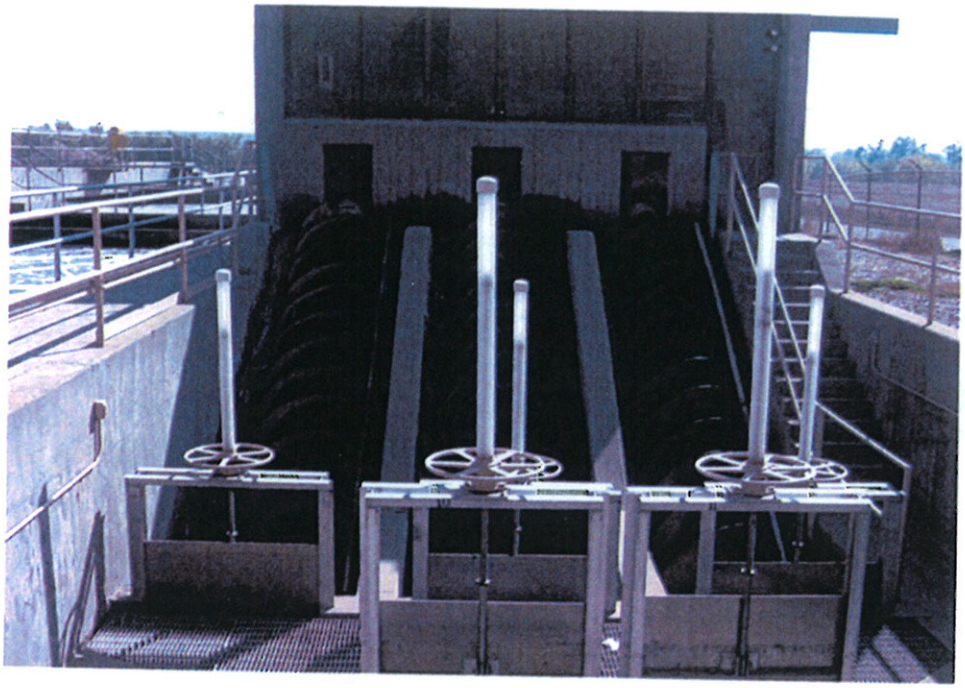
#7 - Aerated grit chamber



#8 - Aerated grit effluent channel (sample location)

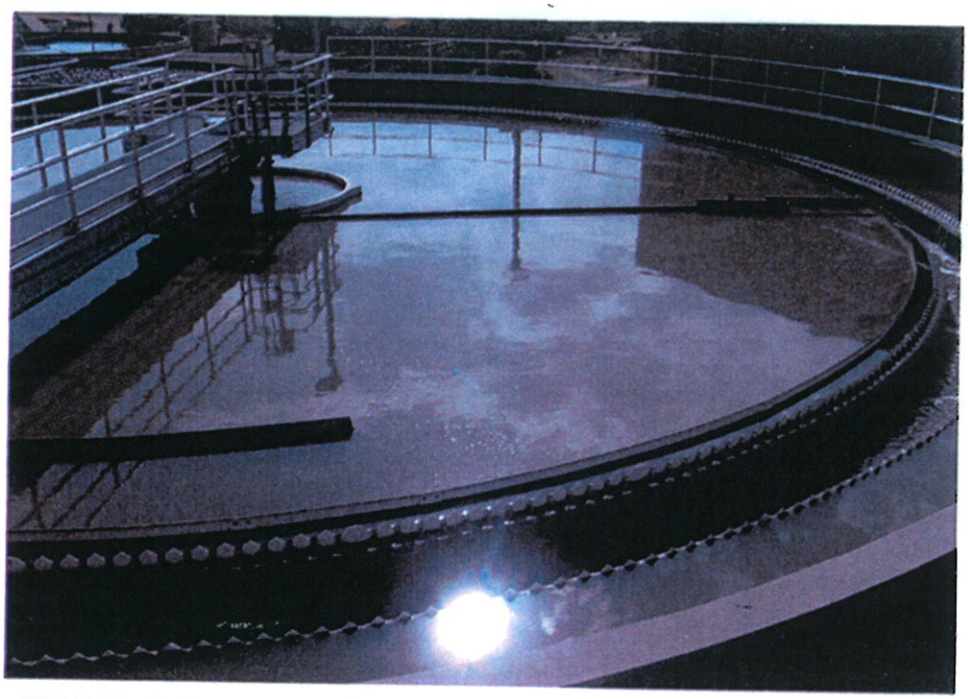


#8 - Aerated grit effluent channel (front)



 # 9&10 - Screw pumps

#12&14 - Primary clarifier (center)

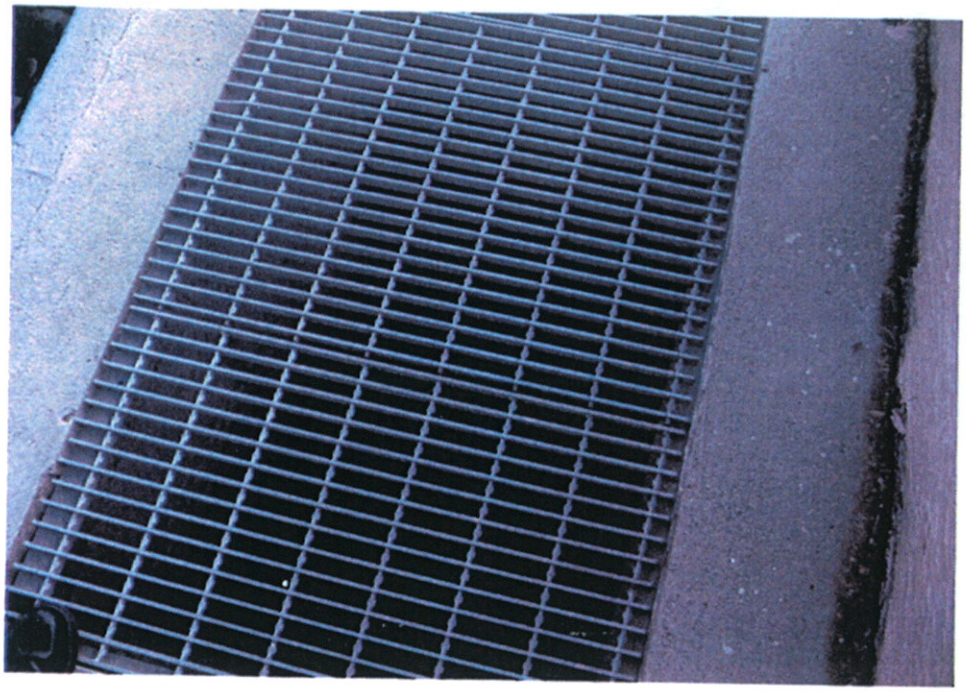


#13&15 - Primary clarifier (effluent weir)

#16 - Primary effluent wetwell

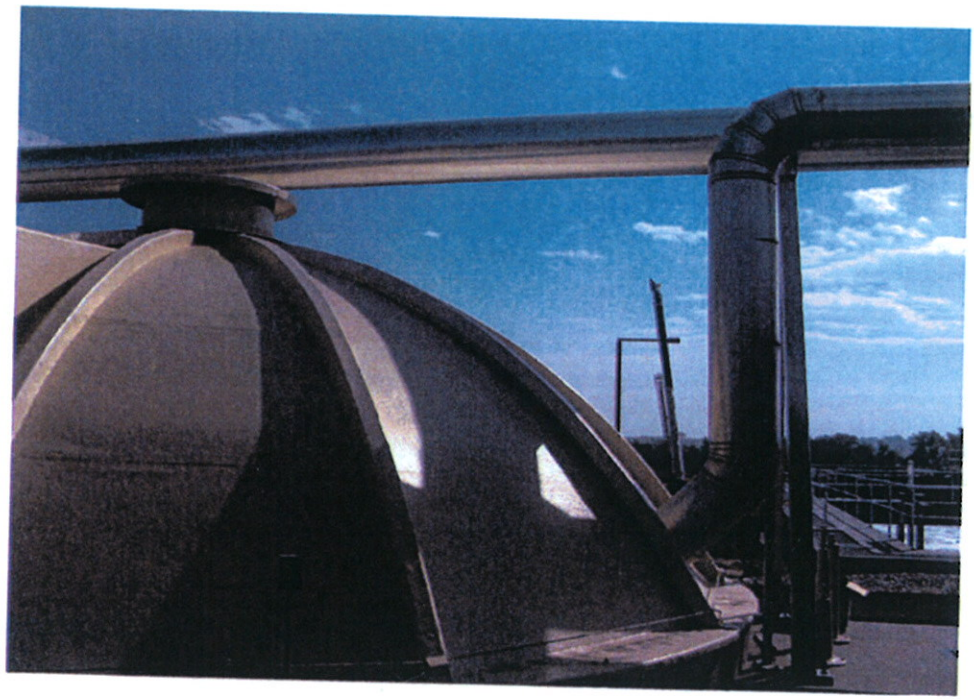
#17&18 - Trickling filter

#17&18 - Trickling filter

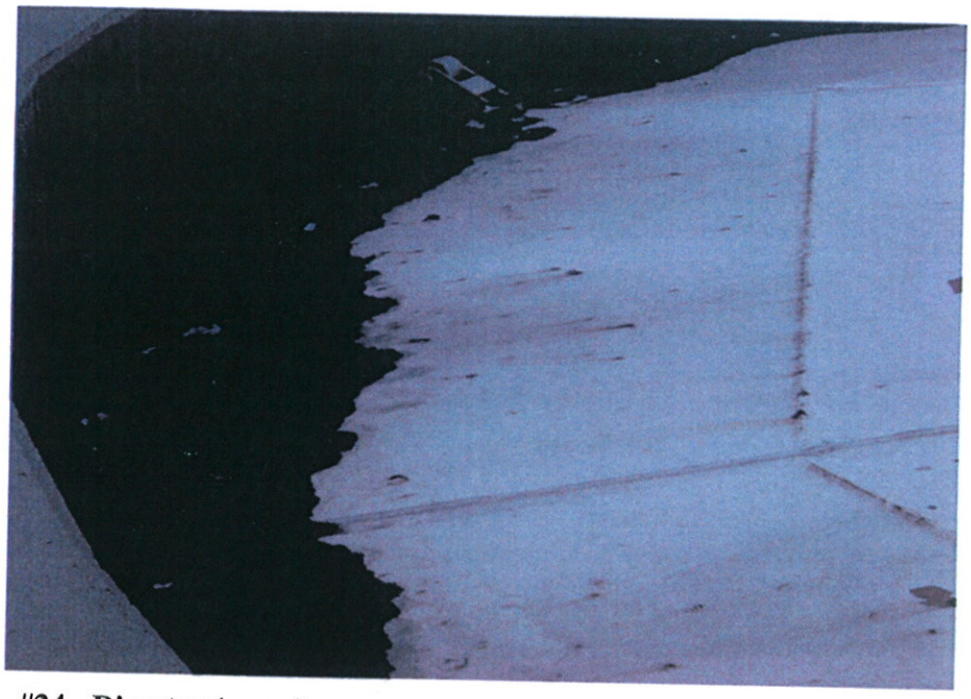


#19 - Trickling filter effluent channel

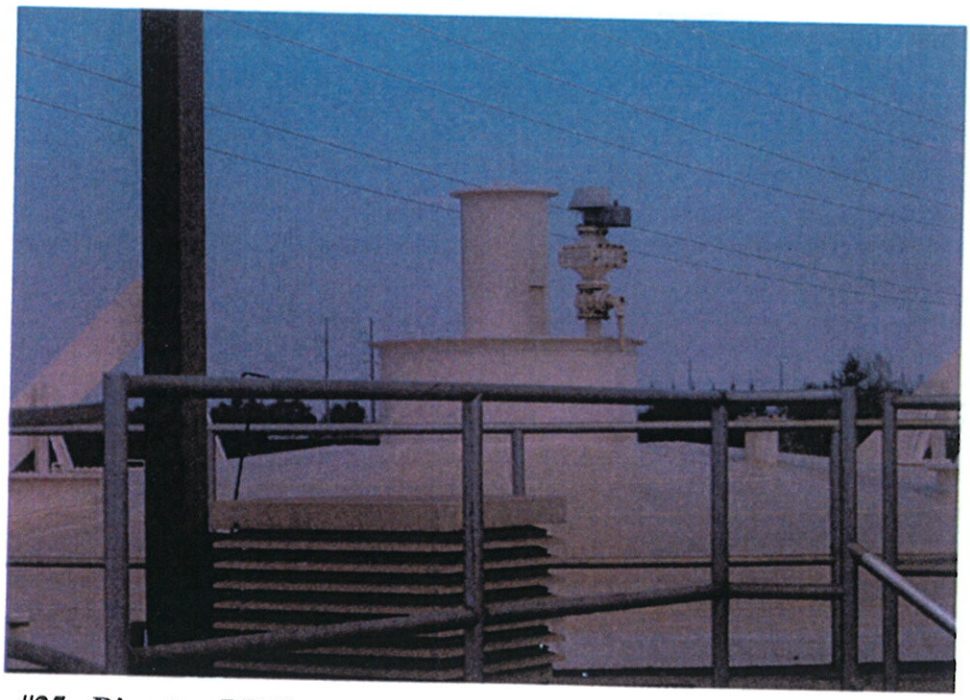
 # 23 - DAFT (sample at open port)



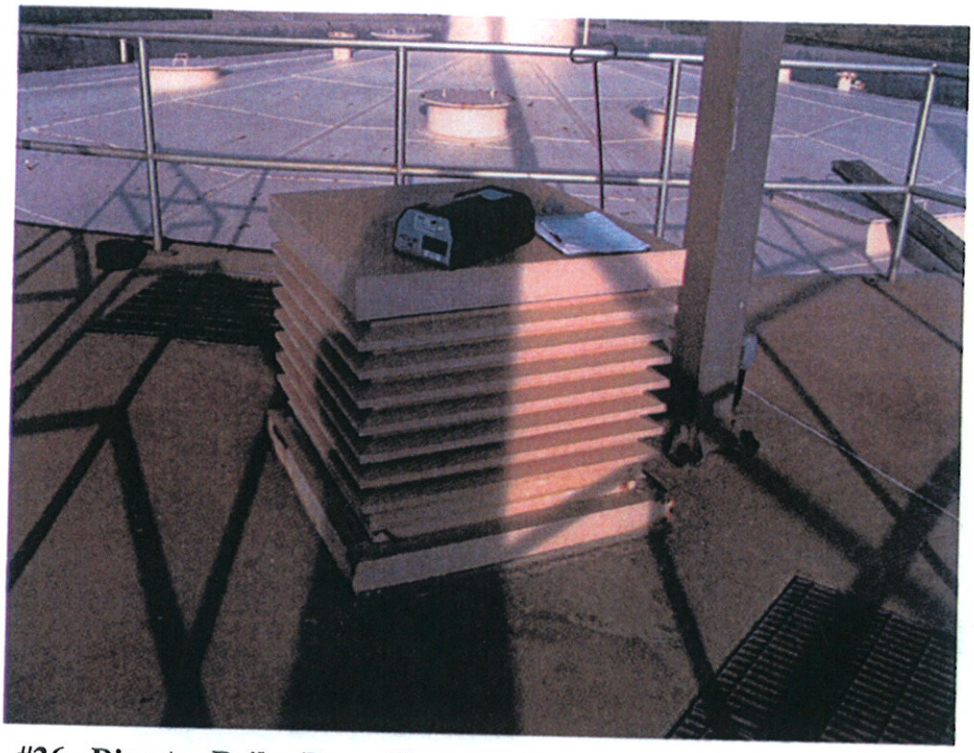
 # 23 - DAFT



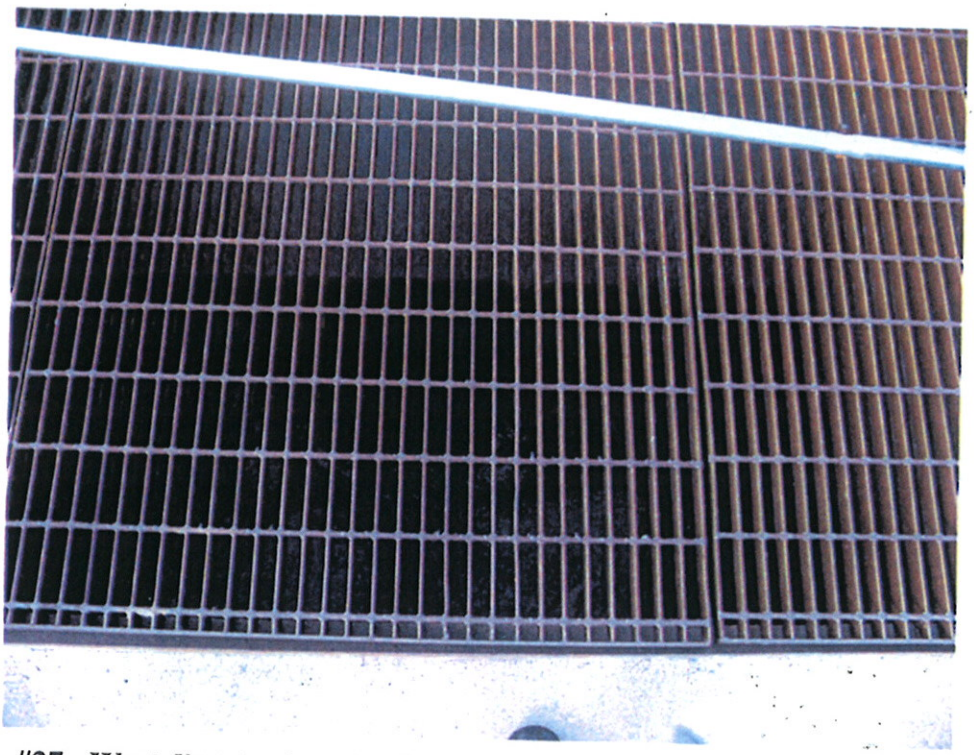
#24 - Digester (cover)



#25 - Digester (PRV)



#26 - Digester Boiler Room Vent (intake vent is pictured)

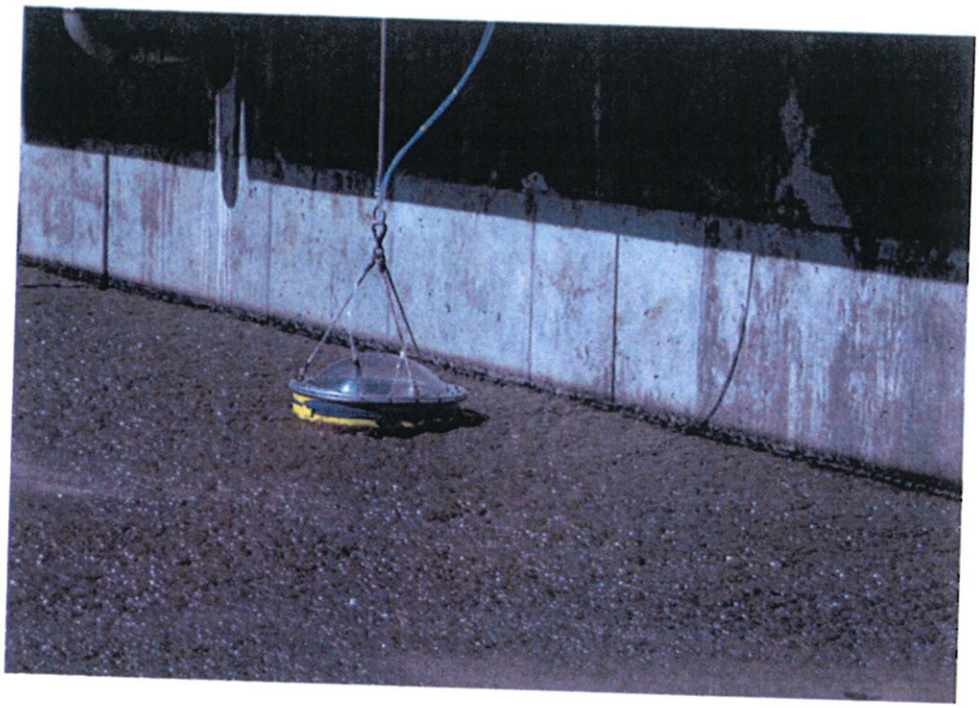


#27 - West digester junction box

#29 - Biosolids truck loading

#29 - Biosolids truck loading (close-up)

#32 - New Aeration Basin



#32 - New Aeration Basin

Appendix D – Summary of Jerome Meter Sampling Results

Summary of Loveland WWTP Sampling Results

	Sample Event	1	2	3	4	5	6	7	8	9
	Date	10/02/2003	10/02/2003	10/03/2003	10/07/2003	10/07/2003	10/07/2003	10/08/2003	10/08/2003	10/08/2003
	Time	*8 to 10 am*	*2 to 3 pm*	*12 to 1 pm*	*9 to 10 am*	*2 to 3 pm*	*4 to 5 pm*	*9:30 to 10 am*	*1 to 2 pm*	*5 to 6 pm*
Sampling Location	Location Description	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)
1	Influent collection well	0.40	0.08	0.35	0.01	0.32	1.06	0.28	0.23	2.50
2	Grit hopper	0.70	2.00	2.60	1.70	3.00	2.40	2.60	2.00	3.00
3	Headworks odor control exhaust	0.59	2.60	1.80	1.20	2.70	2.20	1.70	1.70	2.30
4	Headworks vent to 1st floor	0.94	3.00	2.60	2.20	3.40	3.20	2.40	2.00	3.30
5	Grit truck loading - at open door	-	-	-	-	-	-	-	-	-
6	Headworks effluent junction box	0.75	-	11.00	3.90	11.00	12.50	8.90	2.70	13.00
7	Aerated grit chamber	1.90	17.00	21.00	1.30	1.30	0.73	5.70	3.40	1.40
8	Aerated grit effluent channel	0.07	1.40	1.70	2.30	0.25	0.32	0.24	0.30	1.40
9	Screw pumps (bottom)	0.43	0.22	0.31	1.03	0.47	1.50	1.50	0.93	1.40
10	Screw pumps (top)	0.12	2.20	1.18	3.50	0.27	0.97	2.80	2.50	1.70
11	Primary splitter box	0.56	13.00	3.40	3.80	0.69	0.66	0.62	0.57	2.70
12	Primary clarifier W (center)	0.07	0.03	0.01	0.14	0.16	0.13	0.05	0.17	0.04
13	Primary clarifier W (effluent weir)	0.30	0.55	0.37	0.13	1.30	0.15	0.26	0.28	1.10
14	Primary clarifier E (center)	-	0.18	0.14	0.15	0.11	0.02	0.19	0.02	0.10
15	Primary clarifier E (effluent weir)	-	0.31	0.21	0.14	0.24	0.12	0.03	0.28	0.19
16	Primary effluent wetwell	1.60	2.60	1.50	0.20	2.20	3.70	0.19	1.10	10.20
17	Trickling filter E	0.44	0.50	0.38	0.03	0.77	0.35	0.14	1.20	0.27
18	Trickling filter W	0.31	0.77	0.70	0.02	0.94	0.25	0.11	0.62	1.20
19	Trickling filter effluent channel E	2.10	0.19	0.31	0.04	3.70	0.68	0.25	1.20	0.78
20	Aeration basin N	0.01	0.20	0.02	0.01	0.01	0.02	0.04	0.12	0.09
21	Aeration basin effluent channel	0.45	0.02	0.00	0.06	0.02	0.04	0.04	0.04	0.16
22	Final clarifier	0.01	0.00	0.01	0.01	0.01	0.00	0.02	0.06	0.00
23	DAF thickener	8.80	1.60	1.50	6.50	2.00	1.10	3.00	1.80	4.70
24	Anaerobic Digester (cover)	0.45	0.11	0.15	1.90	1.90	1.10	1.80	0.85	0.71
25	Anaerobic Digester (PRV)	-	-	2.20	0.00	0.01	0.01	0.01	0.00	0.00
26	Vent from boiler box	0.66	0.50	0.25	0.01	0.14	0.13	0.11	0.12	0.14
27	E digester junction box	0.43	0.15	0.01	10.00	0.01	0.01	0.03	0.01	31.00
28	W digester junction box	19.00	12.00	17.00	14.00	17.00	24.00	12.00	30.00	0.01
29	Biosolids truck loading - at hatch	>50	-	-	23.00	-	-	-	-	-
30	Ambient air during truck loading - 10' away	18.00	-	-	0.03	-	-	-	-	-
31	RAS well	-	-	0.04	0.01	0.02	0.01	0.12	0.11	0.11

*H2S concentrations measured with a Jerome 631-X
Hydrogen Sulfide Analyzer

Appendix D
Summary of Loveland WWTP Sampling Results

	Sample Event	10	11	12	13	14	15	16	17	18
	Date	10/11/2003	10/11/2003	10/11/2003	10/13/2003	10/13/2003	10/13/2003	10/15/2003	10/15/2003	10/15/2003
	Time	*9 - 10 am*	*2 to 3 pm*	*5 to 6 pm*	*7 to 8 am*	*12 to 1 pm*	*3 to 4 pm*	*9 to 10 am*	*2 to 3 pm*	*4 to 5 pm*
Sampling Location	Location Description	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)
1	Influent collection well	0.01	0.70	1.17	0.01	0.51	0.04	0.20	0.76	2.00
2	Grit hopper	2.00	4.20	4.60	0.86	3.10	2.30	1.70	1.04	1.60
3	Headworks odor control exhaust	1.10	3.20	3.70	0.56	3.00	1.50	2.30	1.13	1.40
4	Headworks vent to 1st floor	1.26	5.00	5.10	0.63	4.30	2.90	7.10	1.14	3.00
5	Grit truck loading - at open door	-	-	-	-	-	-	-	-	-
6	Headworks effluent junction box	2.30	13.00	18.00	0.65	4.60	13.00	9.10	2.60	6.90
7	Aerated grit chamber	1.40	12.00	1.40	0.23	20.00	0.45	0.68	2.00	1.43
8	Aerated grit effluent channel	0.06	0.40	0.31	0.00	1.60	0.28	0.07	1.90	2.10
9	Screw pumps (bottom)	1.00	2.50	1.80	0.14	1.50	2.20	0.71	2.90	2.20
10	Screw pumps (top)	0.60	3.80	2.90	0.32	4.30	4.00	7.90	2.20	1.70
11	Primary splitter box	0.25	1.60	4.00	0.56	0.89	0.38	1.10	1.10	3.20
12	Primary clarifier W (center)	0.02	0.13	0.14	0.16	0.01	0.14	0.01	0.04	0.21
13	Primary clarifier W (effluent weir)	0.22	0.41	0.40	0.30	0.54	0.34	0.02	0.16	0.54
14	Primary clarifier E (center)	0.06	0.15	0.30	0.11	0.02	0.03	0.07	0.04	0.02
15	Primary clarifier E (effluent weir)	0.02	0.41	0.54	0.46	0.23	0.15	0.08	0.04	0.17
16	Primary effluent wetwell	0.71	1.14	4.00	1.22	0.25	0.22	0.14	3.90	7.70
17	Trickling filter E	0.63	0.44	0.53	1.40	2.10	0.68	0.44	0.38	0.73
18	Trickling filter W	0.36	0.39	1.70	0.36	1.10	0.72	0.77	0.60	1.31
19	Trickling filter effluent channel E	1.50	0.20	0.33	5.00	3.90	2.00	1.50	0.54	1.20
20	Aeration basin N	0.01	0.13	0.01	0.02	0.01	0.09	0.15	0.03	0.12
21	Aeration basin effluent channel	0.03	0.01	0.01	0.21	0.05	0.06	0.01	0.27	0.28
22	Final clarifier	0.01	0.00	0.00	0.01	0.04	0.01	0.00	0.00	0.00
23	DAF thickener	2.00	0.86	1.10	1.45	3.90	1.80	0.79	2.50	4.20
24	Anaerobic Digester (cover)	0.59	2.50	12.00	19.00	0.04	0.13	3.40	14.00	22.00
25	Anaerobic Digester (PRV)	0.01	0.02	0.02	0.06	0.04	0.06	0.03	0.02	0.01
26	Vent from boiler box	0.26	0.21	0.15	0.18	0.14	0.11	0.14	14.00	0.16
27	E digester junction box	0.12	0.02	0.01	0.05	0.03	0.04	0.16	0.01	0.01
28	W digester junction box	5.50	11.20	17.00	31.00	1.60	0.41	3.50	0.14	3.70
29	Biosolids truck loading - at hatch	-	-	-	HL	HL	-	>50.0	-	-
30	Ambient air during truck loading - 10' away	-	-	-	-	0.02	-	0.00	-	-
31	RAS well	0.14	0.01	0.00	0.02	0.02	0.00	0.02	0.01	0.00

*H2S concentrations measured with a Jerome 631-X Hydrogen Sulfide Analyzer

App ix B

Summary of Loveland WWTP Sampling Results

	Sample Event	19	20	21	22	23	24	25	26	27
	Date	10/17/2003	10/17/2003	10/17/2003	10/20/2003	10/20/2003	10/20/2003	10/22/2003	10/22/2003	10/22/2003
	Time	*9 to 10 am*	*11 to 12 am*	*3 to 4 pm*	*9 to 10 am*	*1 to 2 pm*	*6 to 7 pm*	*6 to 7 am*	*3 to 4 pm*	*4 to 5 pm*
Sampling Location	Location Description	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)
1	Influent collection well	0.43	1.16	1.50	0.39	1.60	6.10	0.16	6.00	3.00
2	Grit hopper	1.70	4.40	4.60	1.90	1.80	4.70	0.61	1.20	1.80
3	Headworks odor control exhaust	-1.50	4.50	3.80	1.30	1.30	3.30	0.50	1.10	1.80
4	Headworks vent to 1st floor	2.30	6.20	5.00	1.90	1.80	4.40	0.57	1.50	2.30
5	Grit truck loading - at open door	-	-	-	-	-	-	-	-	-
6	Headworks effluent junction box	4.10	14.90	5.90	1.70	5.20	12.00	0.99	2.20	2.50
7	Aerated grit chamber	0.70	1.40	4.40	0.52	0.70	1.90	0.02	12.00	17.00
8	Aerated grit effluent channel	0.49	6.50	0.24	0.23	0.73	0.11	0.16	0.32	0.82
9	Screw pumps (bottom)	1.16	2.30	1.40	0.38	1.20	1.90	0.25	1.20	8.10
10	Screw pumps (top)	2.10	9.20	3.30	0.50	4.90	3.90	0.17	1.80	9.30
11	Primary splitter box	0.64	4.30	3.70	1.30	2.50	14.90	1.41	2.80	1.60
12	Primary clarifier W (center)	0.16	0.17	0.20	0.01	0.11	0.41	0.06	0.18	0.60
13	Primary clarifier W (effluent weir)	0.16	0.26	2.20	0.16	0.54	2.20	0.37	0.27	0.41
14	Primary clarifier E (center)	0.01	0.01	0.12	0.11	0.12	0.65	0.12	0.11	0.30
15	Primary clarifier E (effluent weir)	0.08	0.47	1.21	0.23	0.38	1.20	0.11	0.35	0.93
16	Primary effluent wetwell	0.19	1.33	0.76	0.38	2.90	2.90	1.20	16.00	31.00
17	Trickling filter E	0.25	0.80	1.90	0.38	0.86	2.00	0.48	1.50	3.00
18	Trickling filter W	0.31	1.29	2.50	0.44	0.69	2.50	0.33	2.00	1.70
19	Trickling filter effluent channel E	2.20	0.48	2.80	7.20	0.26	28.00	0.14	1.28	18.00
20	Aeration basin N	0.08	0.01	0.02	0.01	0.01	0.58	0.15	0.01	0.10
21	Aeration basin effluent channel	0.03	0.12	0.01	0.04	0.01	0.29	0.23	0.03	0.17
22	Final clarifier	0.25	0.01	0.01	0.01	0.01	0.03	0.05	0.02	0.03
23	DAF thickener	4.80	2.80	3.60	3.80	0.61	1.80	1.60	2.60	0.88
24	Anaerobic Digester (cover)	21.00	21.00	3.10	0.63	1.50	0.85	5.20	1.20	4.20
25	Anaerobic Digester (PRV)	0.04	0.01	0.19	0.47	0.11	0.32	0.13	0.01	0.02
26	Vent from boiler box	0.15	0.14	0.23	5.30	0.25	0.56	0.28	0.19	17.00
27	E digester junction box	0.21	0.15	0.08	0.14	0.02	0.16	0.13	0.03	0.02
28	W digester junction box	0.64	1.20	2.80	0.29	13.30	12.00	10.40	2.80	0.12
29	Biosolids truck loading - at hatch	>50.0	-	-	>50.0	-	-	>50.0	-	-
30	Ambient air during truck loading - 10' away	0.01	-	-	0.00	-	-	0.01	-	-
31	RAS well	0.12	0.01	0.24	0.01	0.01	0.12	0.33	0.01	0.02

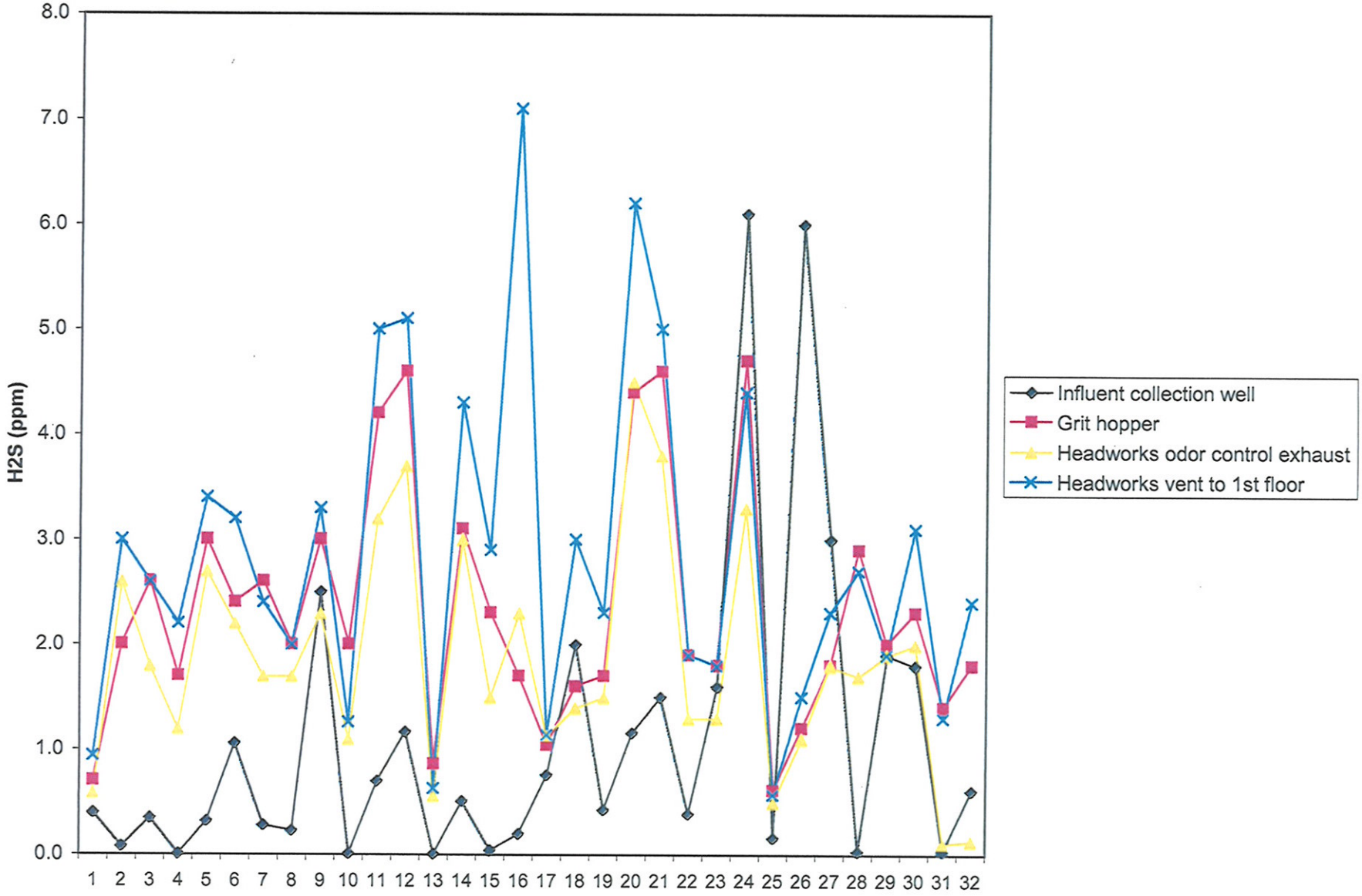
*H2S concentrations measured with a Jerome 631-X Hydrogen Sulfide Analyzer

Appendix D
Summary of Loveland WWTP Sampling Results

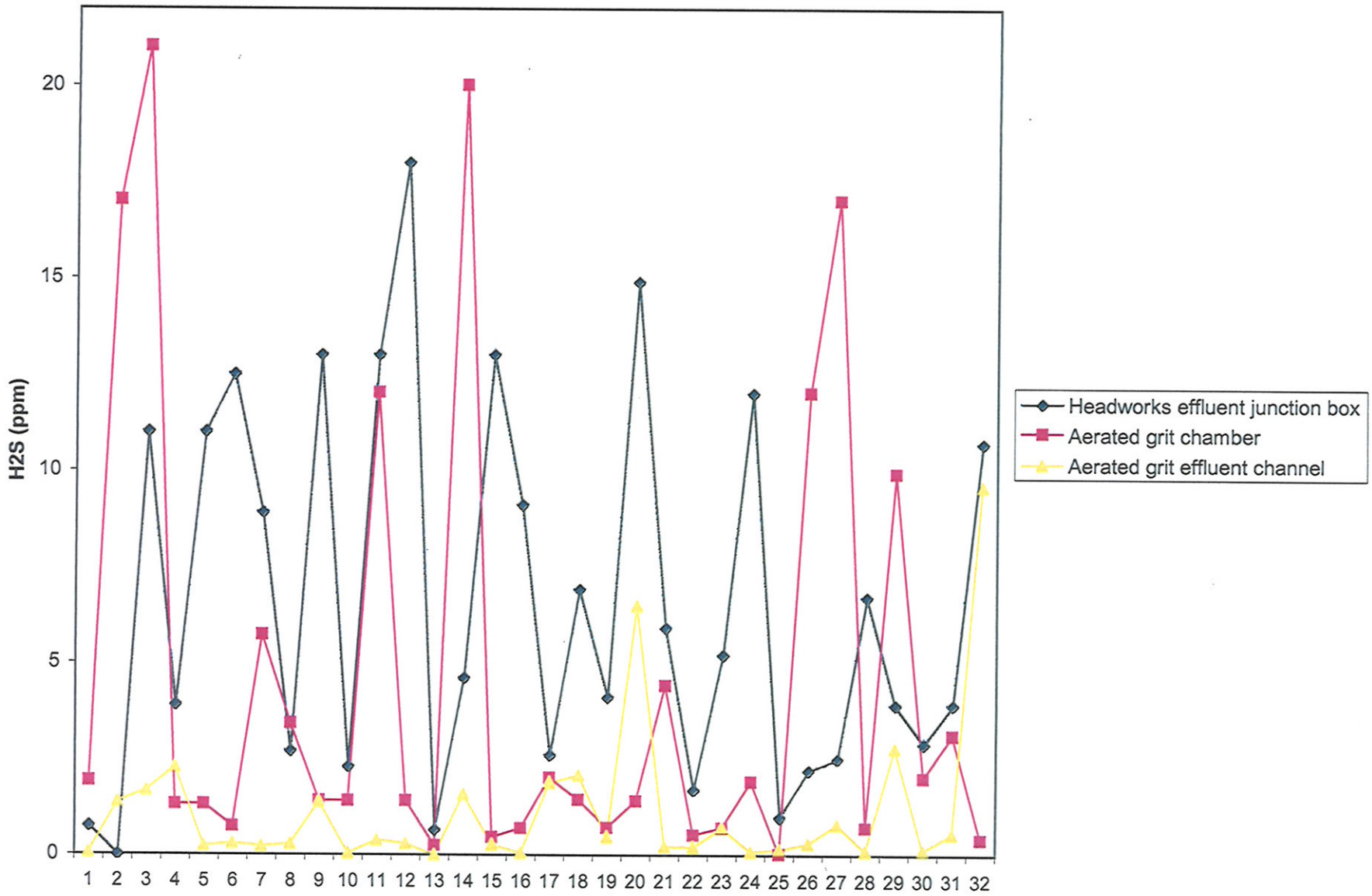
	Sample Event	28	29	30	31	32			
	Date	10/23/2003	10/23/2003	10/23/2003	06/02/2004	06/02/2004			
	Time	*9 to 10 am*	*1 to 2 pm*	*3 to 4 pm*	*10 to 11 am*	*3 to 4 pm*			
Sampling Location	Location Description	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	Average	Min	Max
1	Influent collection well	0.03	1.90	1.80	0.03	0.61	1.10	0.01	6.10
2	Grit hopper	2.90	2.00	2.30	1.40	1.80	2.33	0.61	4.70
3	Headworks odor control exhaust	1.70	1.90	2.00	0.11	0.13	1.98	0.11	4.50
4	Headworks vent to 1st floor	2.70	1.90	3.10	1.30	2.40	2.84	0.57	7.10
5	Grit truck loading - at open door	-	-	-	-	-	-	-	-
6	Headworks effluent junction box	6.70	3.90	2.90	3.90	10.70	6.82	0.65	18.00
7	Aerated grit chamber	0.70	9.90	2.00	3.10	0.40	4.63	0.02	21.00
8	Aerated grit effluent channel	0.12	2.80	0.14	0.57	9.60	1.17	0.00	9.60
9	Screw pumps (bottom)	1.10	0.91	1.20	1.30	0.32	1.42	0.14	8.10
10	Screw pumps (top)	1.50	3.30	2.50	4.90	1.70	2.88	0.12	9.30
11	Primary splitter box	1.40	1.60	2.00	2.30	5.90	2.67	0.25	14.90
12	Primary clarifier W (center)	0.11	0.18	0.17	0.23	0.12	0.14	0.01	0.60
13	Primary clarifier W (effluent weir)	0.36	0.21	1.24	1.10	0.31	0.54	0.02	2.20
14	Primary clarifier E (center)	0.06	0.08	0.12	0.07	0.06	0.12	0.01	0.65
15	Primary clarifier E (effluent weir)	0.11	0.33	0.40	1.33	0.58	0.37	0.02	1.33
16	Primary effluent wetwell	0.40	2.50	5.20	1.50	1.50	3.45	0.14	31.00
17	Trickling filter E	0.47	0.39	0.60	0.91	0.68	0.80	0.03	3.00
18	Trickling filter W	0.30	0.61	1.60	1.41	1.30	0.91	0.02	2.50
19	Trickling filter effluent channel E	0.34	0.51	0.83	0.86	0.44	2.77	0.04	28.00
20	Aeration basin N	0.11	0.03	0.06	0.05	0.01	0.07	0.01	0.58
21	Aeration basin effluent channel	0.08	0.02	0.14	0.05	0.13	0.10	0.00	0.45
22	Final clarifier	0.02	0.02	0.01	0.016	0.007	0.02	0.00	0.25
23	DAF thickener	1.50	0.69	1.60	19.00	1.23	3.00	0.61	19.00
24	Anaerobic Digester (cover)	1.32	1.20	0.44	0.50	0.51	4.54	0.04	22.00
25	Anaerobic Digester (PRV)	0.17	0.01	0.01	31.00	1.90	1.23	0.00	31.00
26	Vent from boiler box	0.19	0.01	0.11	0.01	0.15	1.31	0.01	17.00
27	E digester junction box	0.14	0.01	0.04	0.28	-	1.40	0.01	31.00
28	W digester junction box	20.00	2.00	4.30	12.50	3.50	9.53	0.01	31.00
29	Biosolids truck loading - at hatch	-	-	-	-	-	23.00	23.00	>50.0
30	Ambient air during truck loading - 10' away	-	-	-	0.40	-	2.31	0.00	18.00
31	RAS well	0.02	0.01	0.01	0.02	0.02	0.05	0.00	0.33

*H2S concentrations measured with a Jerome 631-X Hydrogen Sulfide Analyzer

Summary of Loveland WWTP Sampling Results



Summary of Loveland WWTP Sampling Results



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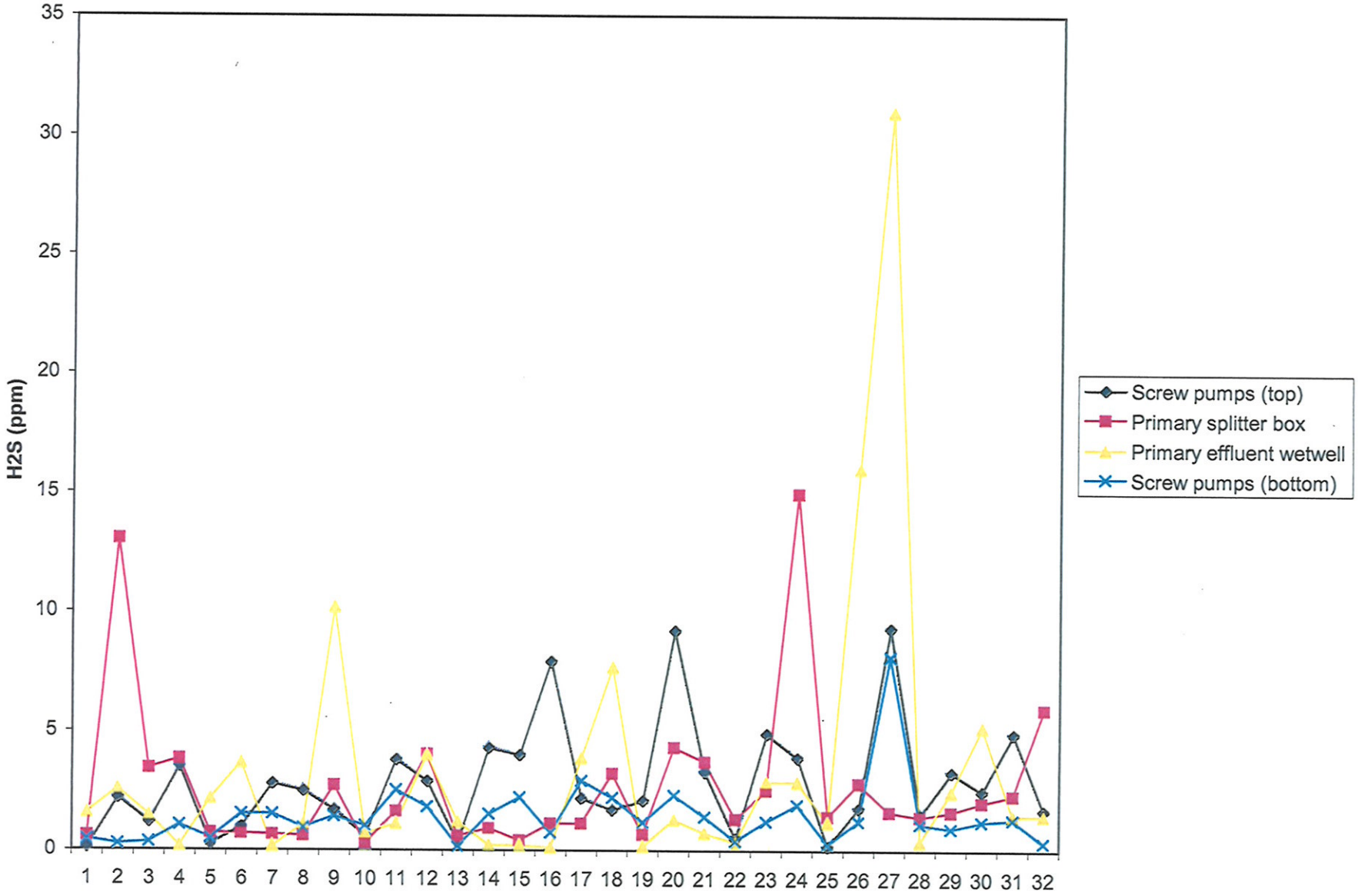

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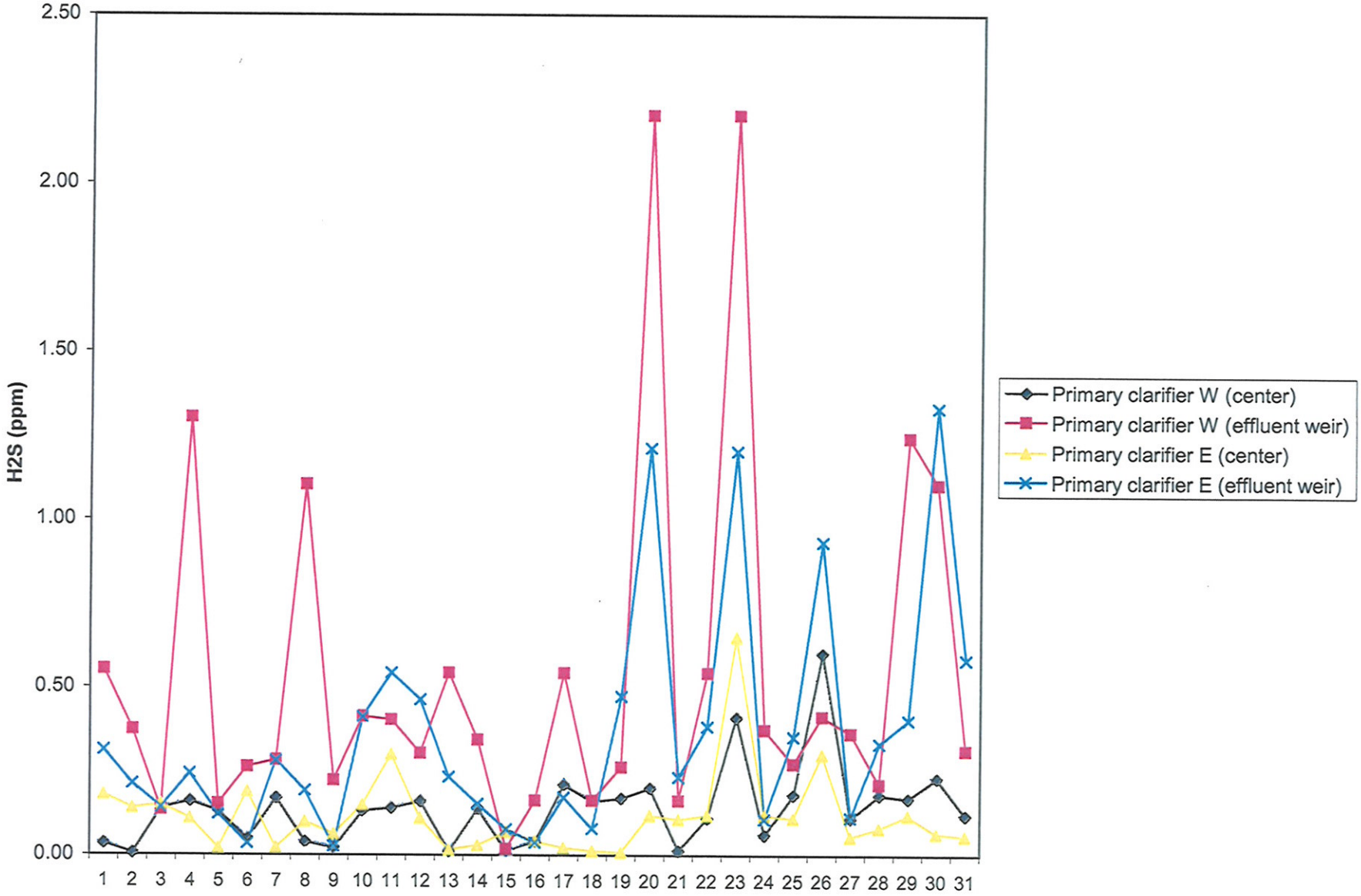

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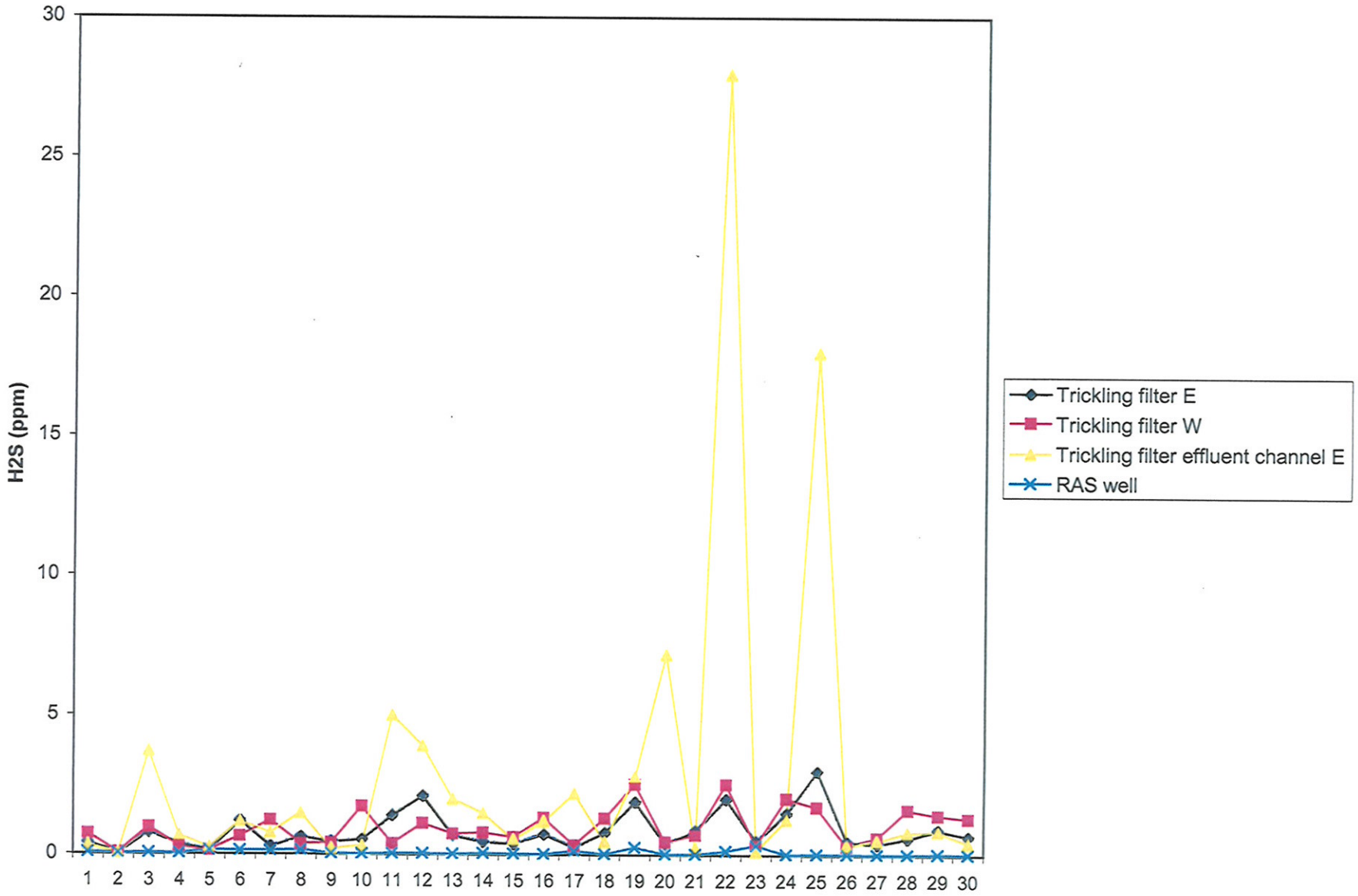

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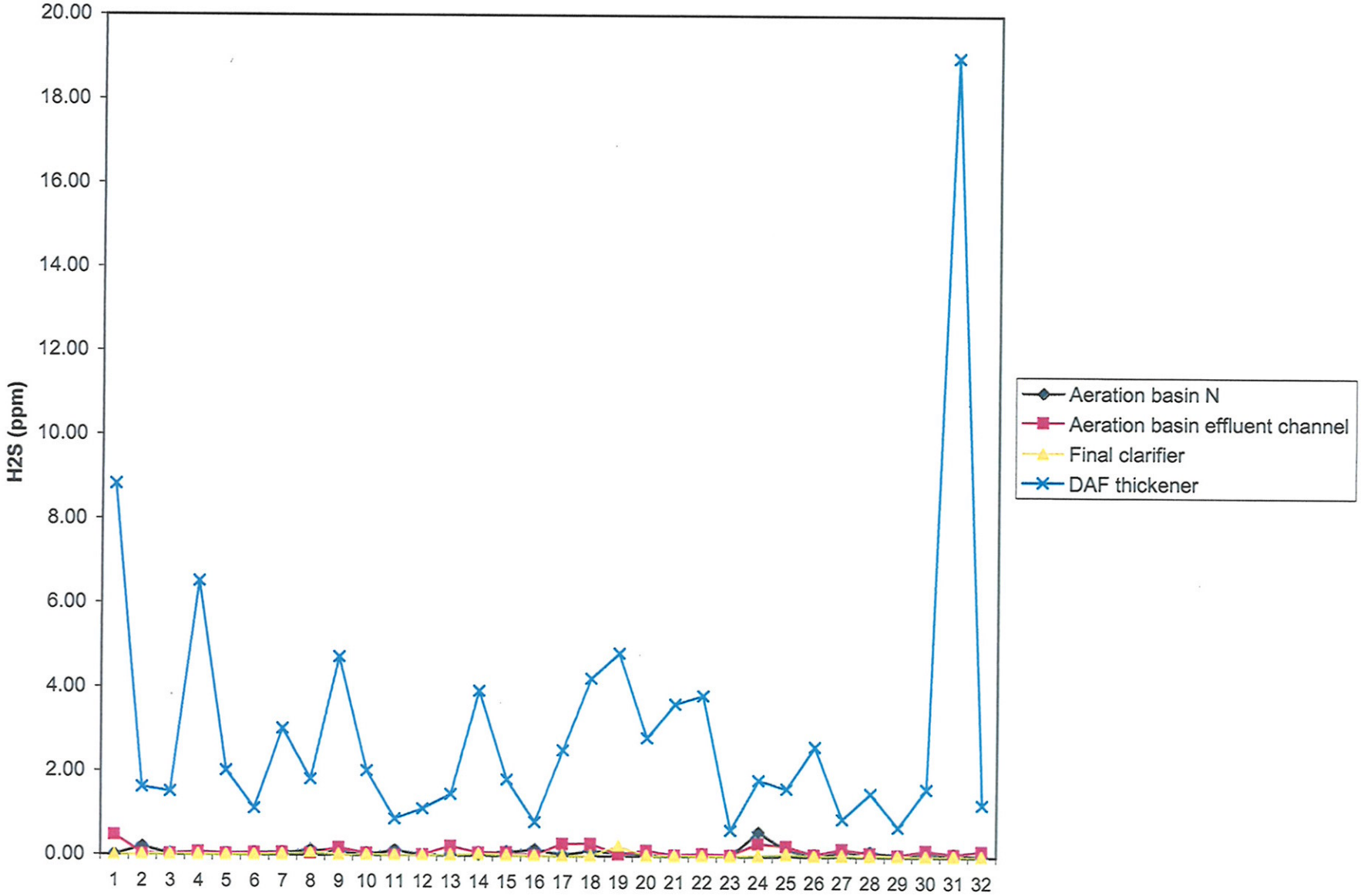
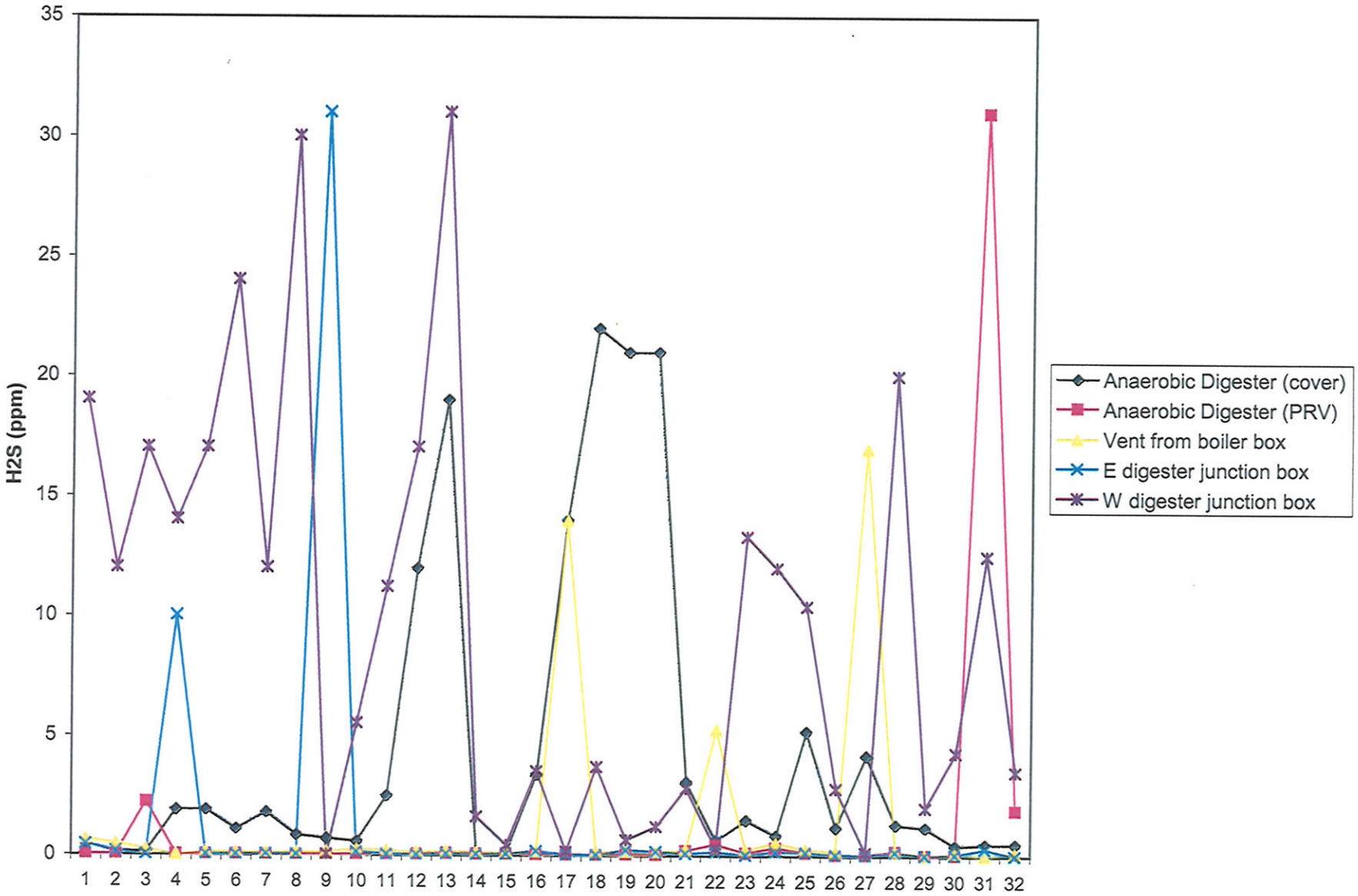


Summary of Loveland WWTP Sampling Results



Appendix E – Flux Chamber Sampling Report

City of Loveland, CO
Wastewater Treatment Plant

Wastewater Treatment Plant Odor Emissions Testing

Final Report

Revision 3

December 2004

Prepared by

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Appendices

Background

The City of Loveland, CO operates a wastewater treatment plant Southeast of the city in an area undergoing transition from rural to subdivision land use. On June 2, 2004 the odor emissions from this facility were tested using the USEPA developed Surface Isolation Emission Flux chamber. This report provides a summary of those results along with complete data set documentation.

Objectives

The objectives of this test program are to quantify odor emissions, hydrogen sulfide (H_2S), organic reduced sulfur (ORS), and ammonia (NH_3) from the WWTP processes.

Summary of Results

A summary of the results is presented in Table 1. The facility had much higher than average hydrogen sulfide emissions compared to other facilities of its size and latitude. Even with these high hydrogen sulfide emissions, hydrogen sulfide only represented about 30% of the total odorous emissions. It is not known at this time what the remainder of the odorous emissions are, but the organic reduced sulfur analyte target compounds could only account for an additional 25%. Ammonia was inconsequential except for the digested sludge.

Figure 1 shows the comparison of total odor emissions (in H_2S equivalents) to the H_2S emission alone. This data indicates that there are significant sources of odor that were not speciated in the odor study. The major sources for this odor were the aeration basins. In our project experience, the only time this level of non-H_2S odor occurred in an aeration basin is when there was a large methyl mercaptan concentration going into the aeration basin. The potential odor causing compound in the aeration basin would be an amine compound.

Recommendations

The high measured odor level of the aeration basins is definitely a concern. It is not recommended that decisions of major consequence be made about the aeration basins until the high level is confirmed in an addition sampling event. The high level of odor could be due to an unique operating situation that is not typical of normal plant performance.

Table 1
City of Loveland WWTP Odor Emissions Estimate

Field and Laboratory Data Summary

Process	Field H2S (ppmv)	NH3 (ppmv)	Laboratory Odor (D/T)	H2S (ppmv)	CS (ppmv)	MM (ppmv)	DMS (ppmv)	CDS (ppmv)	DMDS (ppmv)
Headworks Scrubber in	1.0								
Headworks Scrubber out	0.003	0.05	90	0.001	0.017	0.001	0.001	0.0018	0.001
Aerated Grit Chamber	60	0.2	4,000	26.1	0.001	0.339	0.001	0.001	0.001
Primary Clarifier	4.1	0.1	2,400	0.75	0.001	0.011	0.001	0.001	0.001
Primary Clarifier Weir	28	0.05	4,400	9.61	0.001	0.153	0.001	0.001	0.001
Trickling Filter	18	0.2	2,700	7.07	0.001	0.579	0.001	0.001	0.001
New Aeration Basin	0.019	0.05	1,500	0.001	0.001	0.001	0.003	0.001	0.027
Old Aeration Basin	0.014	0.05	370	0.001	0.001	0.001	0.0015	0.001	0.006
DAF	26	0.2	4,400	9.65	0.001	0.415	0.001	0.001	0.001
Digester Overflow Well	12	0.8	2,900	3.09	0.001	0.001	0.001	0.001	0.001
Sludge Surface	2	85	3,100	0.002	0.001	0.001	0.001	0.001	0.001
						104	1.4		0.13

Process Emissions Calculation (H2S equivalents)

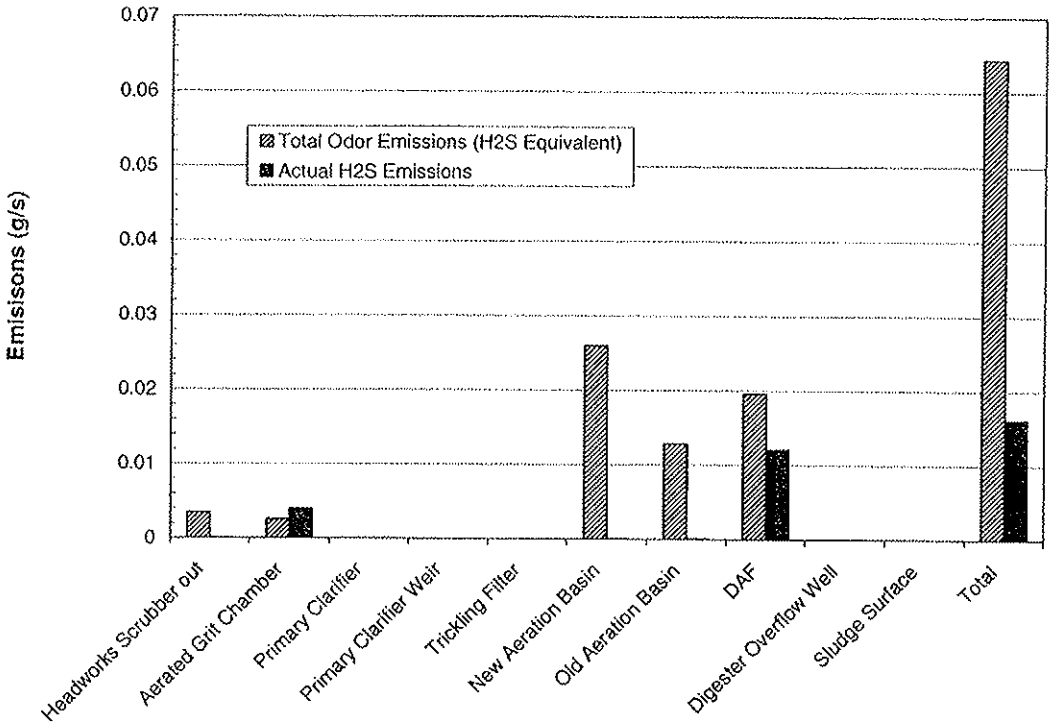
Process	Number	Length/Dia (ft)	Width (ft)	Area (ft2)	Air Flow (cfm)	Source Strength (ppmHSEQ)	(mg/m3)	Flux Flow (m3/m)	Flux (mg/m/m2)	Emissions (g/s)
Headworks Scrubber out	1				6,000	0.87	1.21			0.0034
Aerated Grit Chamber	1	15	8	120	100	38.46	53.85	0.054	22.37	0.0025
Primary Clarifier	2	78		9,557		23.08	32.31	0.005	1.24	0.0000
Primary Clarifier Weir	2	2	210	840		42.31	59.23	0.005	2.28	0.0000
Trickling Filter	2	98		15,086		25.96	36.35	0.005	1.40	0.0000
New Aeration Basin	2	60	60	7,200	2,733	14.42	20.19	0.031	4.82	0.0260
Old Aeration Basin	4	60	60	11,310	5,467	3.56	4.98	0.031	1.19	0.0128
DAF	1				700	42.31	59.23			0.0196
Digester Overflow Well	1	5	5	25		27.88	39.04	0.005	1.50	0.0000
Sludge Surface	1	40	8	320		29.81	41.73	0.005	1.61	0.0000
									Total	0.0644

Process Emissions Calculation (H2S)

Process	Number	Length/Dia (ft)	Width (ft)	Area (ft2)	Air Flow (cfm)	Source Strength (ppm)	(mg/m3)	Flux Flow (m3/m)	Flux (mg/m/m2)	Emissions (g/s)
Headworks Scrubber out	1				6,000	0.003	0.00			0.0000
Aerated Grit Chamber	1	15	8	120	100	60.00	84.00	0.054	34.89	0.0040
Primary Clarifier	2	78		9,557		4.10	5.74	0.005	0.22	0.0000
Primary Clarifier Weir	2	2	210	840		28.00	39.20	0.005	1.51	0.0000
Trickling Filter	2	98		15,086		18.00	25.20	0.005	0.97	0.0000
New Aeration Basin	2	60	60	7,200	2,733	0.02	0.03	0.031	0.01	0.0000
Old Aeration Basin	4	60	60	11,310	5,467	0.01	0.02	0.031	0.00	0.0001
DAF	1				700	26.00	36.40			0.0120
Digester Overflow Well	1	5	5	25		12.00	16.80	0.005	0.65	0.0000
Sludge Surface	1	40	8	320		2.00	2.80	0.005	0.11	0.0000
									Total	0.0161

Notes:
1. Light gray values are shown when the compound was not detected. The value shown is the method detection limit.

Figure 1. – Total Facility Calculated Mass Emissions in Total Odor and Hydrogen Sulfide Alone.

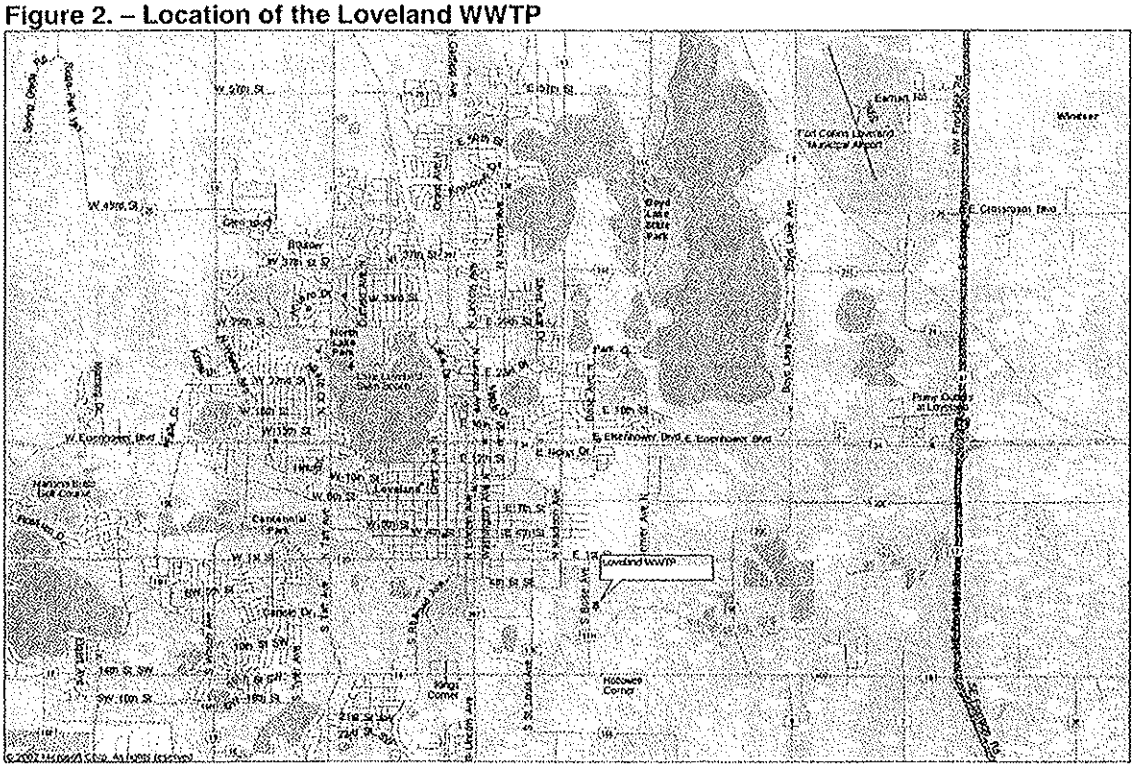


Summary of Sampling Event

Site Location

The sampling will took place at the Loveland Wastewater Treatment Plant. Figure 2 shows the location of the plant.

Figure 2. – Location of the Loveland WWTP



Sampling Locations

Headworks Scrubber

The facility has an activated carbon scrubber in the headworks. It performs very well in hydrogen sulfide removal (97.3%) but still has a fairly high measured residual odor level in the exhaust. It has larger total odor emissions than the digester overflow and sludge truck combined.

Aerated Grit Chamber

This is a small process that has a very high hydrogen sulfide level. It was the sixth largest measured odor source, between the levels of the primary clarifier surface and the primary clarifier weirs.

Primary Clarifier

The facility has two primary clarifiers. The surface had significantly more emissions than the weirs. Therefore, if this process is to be covered, the whole process needs to be covered, not just the weirs.

Trickling Filter

This process is to be discontinued. This process had the second largest odor emissions. The aeration basins had larger emissions

Aeration Basins

These were by far the largest sources. The odor from this source was not uniquely noticeable around the plant site. This high value could be either a process irregularity or a sampling problem (or just plain high emissions). Because of the unusual nature of the measured emissions (no non-H_2S compounds found in significant concentrations) it is not recommended that major decisions be made about this process without resampling.

DAF

This had significant emissions and is relatively easy to control. It was the third largest odor source behind the aeration basins and trickling filters.

Digester Overflow

This is a high concentration, but small source. It has close proximity to the fenceline though and may have concentration fluctuations. This is a good candidate for control.

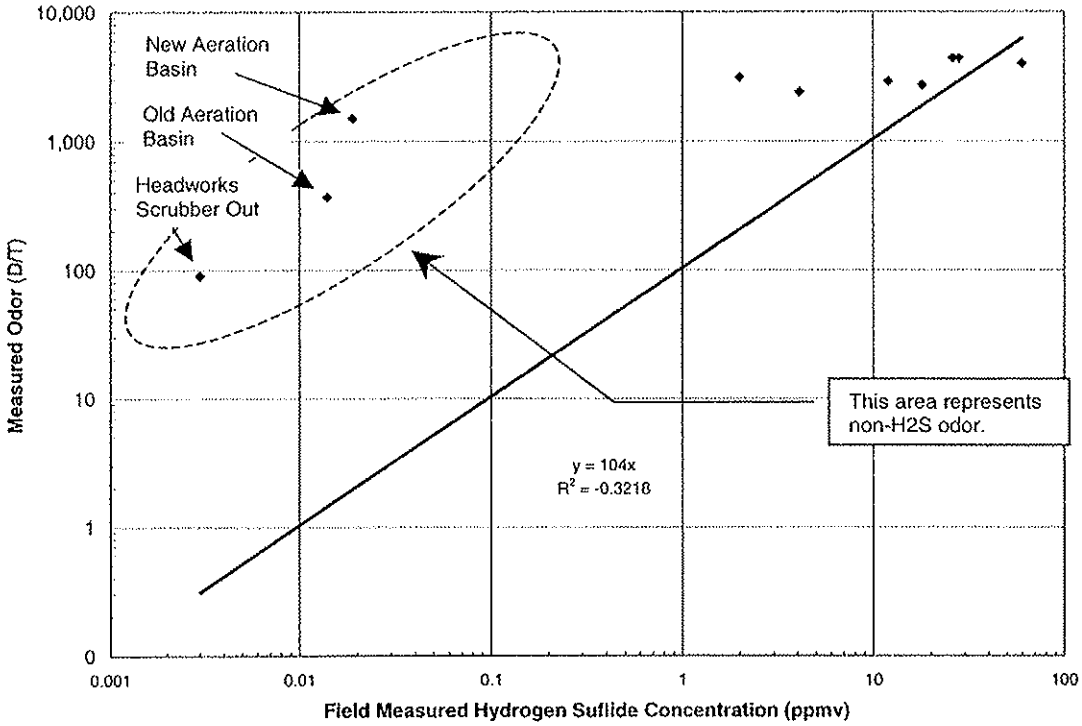
Sludge Truck

This is relatively small source, but it is mobile. May have off-site consequences while on the road.

Data Analysis

The field hydrogen sulfide values were compared to the measured odor levels to devise a conversion factor from total odor to hydrogen sulfide equivalents of total odor. Figure 3 shows a plot of the measured hydrogen sulfide compared to the measured odor. This figure indicates that a large fraction of the odor is not H_2S and that a value of 1 D/T is equivalent to about 0.010 ppmv of hydrogen sulfide.

Figure 3. – Measured Hydrogen Sulfide Concentrations Compared to Measured Odor Concentrations.



Analytical Protocols

This section describes the analytical protocols that will be used to analyze the field samples. Copies of all protocols used are available upon request.

ASTM Method E 679 for Odor

Odor samples will be analyzed using an olfactory panel and butanol calibration. Gas samples are collected in purged tedlar bags using a decompression device where gas is collected by filling a bag without passing the sample through a pump. Tedlar bag samples are collected, stored in light-shielded cardboard containers, and shipped to the lab via overnight express mail for analysis within 24-hours.

The odor samples are diluted to below olfactory detection limits and then introduced to a gas delivery system. A panel of eight members trained in odor response serves as the odor "detector". Panel members are asked to smell air samples delivered to one of three nose cones (the other nose cones have clean air), one of which has the diluted sample. The concentrations of sample are increased until one-half of the odor panel members can detect the odor. The odor measurement is concluded when detection by four of the eight panel members is recorded. The odor concentration is expressed as the number of dilutions that were required for one-half of the panel members to record detection: dilution-to-threshold (D/T) level. Typical method quality control includes field blank samples and duplicate analysis. Odor concentrations can be used to evaluate odor strengths, ambient odor, or in modeling exercises to estimate a downwind odor strength.

Hydrogen sulfide equivalents (1 D/T is equivalent to 1.4 ppbv H_2S) are often used for modeling purposes.

EPA Method 16 for Reduced Sulfur Species

Hydrogen sulfide and total reduced sulfur (TRS) compounds will be analyzed from tedlar bag samples using GC/sulfur flame photo-metric detector (GC/FPD). Gas sample are collected in purged tedlar bags using a decompression device so that the sample bag can be filled without passing the sample through a pump. Samples are stored in light-shielded cardboard containers and shipped to the laboratory via overnight express mail. The analysis must be complete within 48 hours and the hold time specified is less than 24 hours. (Note- the target analysis time will be 24 hours.)

ASTM D 4490 for Ammonia

Gas-Tech colorimetric tubes will be used for the ammonia analysis.

Real Time Hydrogen Sulfide Analysis by Gold Film Analyzer

Hydrogen sulfide will be analyzed using a Jerome 631-X handheld analyzer. This instrument is factory calibrated and has a working range of 1 to 50,000 ppbv. It will detect other reduced sulfur compounds at about 10% of the sensitivity to hydrogen sulfide.

Attachments

Attachment 1 – Data Technical Memorandum
Attachment 2 – Laboratory Data
Attachment 3 – Field Notes
Attachment 4 – Chain of Custody Form

CE Schmidt, Ph.D.
Environmental Consultant

TECHNICAL MEMORANDUM

ODOR EMISSIONS INVENTORY TESTING:

Results of the Surface Flux Chamber Testing
At the Loveland Wastewater Treatment Plant
Located in Loveland, Colorado

Draft

Prepared For:

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Environmental Management Consulting
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Enumclaw, WA 98022

Prepared By:

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19200 Live Oak Road
Red Bluff, California 96080

June 2004

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CE Schmidt, Ph.D.
Environmental Consultant

Attachments

A- Emissions Measurement Data Sheets
B- Chain of Custody
C- Lab Reports

References

EXECUTIVE SUMMARY

Field measurements were conducted at the Loveland Wastewater Treatment Plant located in Loveland, Colorado on June 2, 2004. The testing was conducted to measure the odor emissions from key unit treatment processes as part of a facility-wide odor and odorous compound emission inventory. Testing was conducted in conjunction with facility assessment and engineering with CH2MHill. CE Schmidt conducted the testing with Mr. Tom Card and with the assistance and support of CH2MHill. CH2MHill and Mr. Tom Card with Environmental Management Consulting intends to use this information in support of a facility emissions control strategy effort.

Source assessment was conducted using the USEPA surface emission isolation flux chamber on area sources, including: primary treatment weir channel, primary treatment quiescent tank zone, trickling filter, new aeration basin, old aeration basin, aerated grit chamber, sludge, and the digester tank wet well. The DAF headspace (covered process) and the headworks scrubber

exhaust were also tested as point sources of odorous air emissions

Ammonia flux was measured by colorimetric tube detection in the field and total sulfides measured as H2S by real time analyzer (Jerome 631X). Tedlar bags were collected for both olfactory odor (ASTM Method D679 Olfactory analysis), and reduced sulfur compounds. Odor was determined by ASTM Method D679, and reduced sulfur compounds were analyzed by ASTM Method 5504. Support information at key locations was also collected in the field for temperature, dissolved liquid phase sulfides, pH, and dissolved oxygen.

A detailed-screening field program was conducted and flux measurements were made using the United States Environmental Protection Agency (US EPA) recommended surface flux chamber. The surface flux chamber testing was conducted on a total of eight different surfaces on each of seven unit processes as identified above. Volumetric flow rate was measured at aerated surfaces, and quality control testing included blank and replicate tests.

Field testing identified high levels of olfactory odor at many significant sources, and the primary odorants responsible for the olfactory odor. High odor flux was observed at most locations tested with the highest odor flux observed from the aerated zone of the aerated grit chamber. The new aeration basin showed high odor, along with the primary treatment weir and the sludge material. The lowest odor flux was observed at the old aeration basin. Amines were not significant odorants for the liquid sources but were found high in sludge and the digester wet well. Aerated grit chamber emissions, primary treatment, and trickling filter were dominated by hydrogen sulfide with some methyl mercaptan, and the aeration basins showed dimethyl sulfide, carbon disulfide, and dimethyl disulfide.

CE Schmidt, Ph.D.
Environmental Consultant

I. INTRODUCTION

This technical memorandum describes the field testing that was conducted in order to assess the odor and odorous compound emissions from selected unit treatment processes at the Loveland wastewater treatment plant. Area source flux data were collected with the intention of using the flux data as input to an engineering odor emissions assessment from the facility. Testing was conducted by Dr. C.E. Schmidt and Mr. Tom Card on June 2, 2004. Site preparation included reviewing site operational information and identifying representative surface areas and vents for testing.

The objective of the study was to provide site characterization data representative of fugitive air emissions of study compounds (odor and odorous compound emissions) from unit treatment processes. Surface flux data can be used, along with information about the engineering process to assess the air emissions from the tested unit treatment processes and to estimate odor emissions.

This memorandum includes a discussion of the testing methodology, quality control procedures, results, discussion of the results, and summary statements.

II. TEST METHODOLOGY

Testing for surface flux was conducted using the USEPA recommended Surface Isolation Flux Chamber (USEPA. Radian Corporation, February 1986). Flux chamber sampling was performed on piles of green waste materials and green waste mulch/compost as found on these sites the day of testing.

The operation of the surface flux chamber is given below:

1) Flux chamber, sweep air, sample collection equipment, and field documents were located on-site.

2) The site information, location information, equipment information, date, and proposed time of testing were documented on the Emissions Measurement Field Data Sheet.

3) The exact test location was selected and placed about 1/4" into the rock and wood chip matrix sealing the chamber for surface testing. .

4) The sweep air flow rate was initiated and the rotometer, which controls the flow rate, was set at 5.0 liters per minute. A constant sweep air flow rate was maintained throughout the measurement for each sampling location.

5) Flux chamber data were recorded every residence interval (6 minutes) for five intervals, or 30 minutes.

6) At steady-state (assumed to be greater than 5 residence intervals), the sample collection was performed by interfacing the sample container (tedlar bag or impinger) to the purged, sample line and filling the container with sample gas or collecting the impinger sample.

7) After sample collection (tedlar bag, colorimetric tube, real time instrument), all field data were documented on the data sheet.

8) After sampling, the flux measurement was discontinued by shutting off the sweep air, removing the chamber, and securing the equipment. The chamber was cleaned by dry wipe with a clean paper towel and the sample lines were purged with UHP air.

9) Sampling locations were recorded on the field data sheet. The equipment was then relocated to the next test location and steps 1) through 8) were repeated.

III. QUALITY CONTROL

Control procedures that were used to assure that data of sufficient quality resulted from the flux chamber study are listed and described below. The application and frequency of these procedures were developed to meet the program data quality objectives as described in the project source test protocol or quality assurance project plan (Card, T. and Schmidt, C.E., April, 2003).

Field Documentation -- A field notebook containing data forms, including sample chain-of-custody (COC) forms, was maintained for the testing program. Attachment A contains the Emission Measurement Data Sheets.

Chain-of-Custody -- COC forms were not used for field data collection. Field data were recorded on the Chain-of-Custody forms provided in Attachment B.

Real Time Jerome 631X QC

The Jerome 631X field QC consisted of pre and post-use instrument blank and regeneration instrument preparation, and electronic zero calibration. All Jerome 631X data were collect in triplicate

Odor Analysis by ASTM D679

Trip Blank—One trip blank was conducted by filling a tedlar bag with pure air. The trip blank showed detect for odor at the 40 D/T level. Blank level correction of field data can be conducted using this level if desired. The reported data have not been corrected.

Field Replicate Sample – One replicate field sample pair (OD-108/OD-109) was collected and analyzed. For the sample/replicate pair, the RPD was within the QC criteria of 50 RPD: RPD 0.0. These data indicate acceptable method performance.

Reduced Sulfur Compound Analysis by ASTM D5504-01

Laboratory Method Blank – One method blank sample was conducted and none of the 20 listed reduced sulfur compounds were detected above method detection limits (1.4 ug/m3 to 5.2 mg/m3). These data indicate acceptable method performance.

Duplicate Laboratory Analysis -- One QC sample was analyzed in duplicate and it contained two compounds, both of which were analyzed having a RPD response within criteria: RPD 0.0 and 1.0. These data indicate acceptable method performance.

QC Spike Recovery – One QC sample was performed and it contained two compounds, both of which were recovered in the sample and replicate sample within QC limits of ±50%; 65% to 72%.

These data indicate acceptable method performance.

Field Replicate Sample – One replicate field sample pair (EAS-108/-109) was collected and analyzed. For the two sample/replicate compound pairs detected, both were within the QC criteria of 50 RPD: RPD 1.1 and 10. These data indicate acceptable method performance.

IV. RESULTS AND DISCUSSIONS

A summary of the field sample collection for the unit process odor emission assessment is shown in Table 1. All field data for the surface flux chamber testing for ammonia, hydrogen sulfide, aeration flow rate, dissolved oxygen, liquid phase sulfides, and pH are presented in Table 1, and flux for real time species as well as odor are shown in Table 2 in concentration units (ppmv) and flux (mg/m2,min-1. Odor is given in concentration (D/T) and flux ((D/T)/m2,min-1). Reduced sulfur compound data are shown in Table 3 with flux data shown in mg/m2,min-1 (advective flow included in the calculation) and stack data shown in concentration units (ug/m3).

Surface flux data for a surface area source are calculated using measured target compound concentrations and flux chamber operating parameter data (sweep air flow rate of 5.0 liters per minute plus advective flow [L/min], surface area of 0.13 square meters [m^2]). The site emissions can be calculated by multiplying the flux by the surface area of the source. The flux is calculated from the sweep air flow rate Q (cubic meters per minute [m^3/min]), the species concentration Yi (micrograms per cubic meter [mg/m^3)], and exposure to the chamber surface area A (square meters [m^2]), as follows:

$$Fi = (Q)\,(Yi) / (A)$$

Emission rate of from a given surface representing a unit treatment process can be calculated by multiplying unit flux data per compound by surface area and reported as a function of process operation.

V. SUMMARY

Area source testing was conducted for the purpose of obtaining data of sufficient quality to assess the odor and odorous compound emissions from selected unit treatment processes at the wastewater treatment plant. The following is a summary of activities and results associated with this objective:

- Surface flux measurements of study compounds were measured at eight unique locations on seven unit treatment processes using the USEPA recommended surface flux chamber technology. This technology quantitatively measures flux at the test surface due to the presence of fugitive volatile compounds.

- Field quality control data indicate acceptable data quality for all methods. Data qualification or baseline adjustment can be performed on the olfactory odor data using the blank odor data if need be.

- The flux data can be used to estimate hydrogen sulfide, other reduced sulfur compounds, odor, and ammonia emissions from the tested unit treatment processes.

Table .. Summary Field Sample Collection Information and Real Time Data.

DATE	TIME	LOCATION	ODOR ID	SULFUR ID	LIQ TEMP	H2S ppmv	NH3 ppmv	FLOW lpm	DO Inlet	DO Outlet
6/2/2004	717	Primary- weir	OD-101	EAS-101	62	28	<0.05	N/A	1.1 ppm @ 15.9	1.4 @ 16.1
6/2/2004	750	DAF Headspace	OD-102	EAS-102	N/A	26	0.2	N/A	N/A	N/A
6/2/2004	815	Primary- Quies	OD-103	EAS-103	62	4.1	0.1	N/A	N/A	N/A
6/2/2004	916	Trick Filter	OD-104	EAS-104	N/A	18	0.2	N/A	N/A	N/A
6/2/2004	945	New Aeration	OD-105	EAS-105	63	0.019	<0.05	26	2.4 Direct Read	N/A
6/2/2004	1051	Old Aeration	OD-106	EAS-106	64	0.014	<0.05	26	6.0	N/A
6/2/2004	1151	HW Scrubber	OD-107	EAS-107	N/A	0.003	<0.05	1.7" delta P	N/A	N/A
6/2/2004	1216	Aer Grit Chamber	OD-108	EAS-108	61	60	0.2	49	N/A	N/A
6/2/2004	1216	Replicate Sample	OD-109	EAS-109	61	60	0.2	49	N/A	N/A
6/2/2004	1255	Sludge in Tub	OD-110	EAS-110	94	2.0	85	N/A	N/A	N/A
6/2/2004	1345	Digest O.F. Well	OD-111	EAS-111	N/A	12	0.8	N/A	N/A	N/A
6/2/2004	1443	Media Blank	OD-112	EAS-112	N/A	N/A	N/A	N/A	N/A	N/A

LIQ H2S	pH	COMMENT
N/A	N/A	2' Wide channel
N/A	N/A	Sample at front door
3 mg/l	7.04	Center of Quiescent
1 mg/l @ 16.1	7.04	Location 12' in
N/A	N/A	Non-homogeneous aeration
N/A	N/A	Non-homogeneous aeration
N/A	N/A	H2S inlet 0.98 ppmv
2 mg/l @ 18.1	N/A	Limited aerated surf area
2 mg/l @ 18.1	N/A	Replicate Field Sample
N/A	N/A	Represents sludge in trucks
N/A	N/A	Grate sample- ventilated
N/A	N/A	UHP air in media

Table . Summary of Real Time Flux Data (mg/m2,min-1) and Odor Flux Data ((D/T)/m2,min-1).

LOCATION	ODOR ID	SULFUR ID	FLOW lpm	TOTAL FLOW	H2S ppmv	H2S Flux	ODOR	ODOR Flux	NH3 ppmv
			(lpm)	(m3/min)	ppmv	mg/m2,min-1	(D/T)	(D/T)/m2,min-1	ppmv
Primary- weir	OD-101	EAS-101	N/A	0.005	28	1.5	4400	169	0.05
DAF Headspace	OD-102	EAS-102	N/A	N/A	26	N/A	4,400	N/A	0.2
Primary- Quies	OD-103	EAS-103	N/A	0.005	4.1	0.21	2400	92	0.1
Trick Filter	OD-104	EAS-104	N/A	0.005	18	0.94	2700	104	0.2
New Aeration	OD-105	EAS-105	26	0.031	0.019	0.0062	1500	358	0.05
Old Aeration	OD-106	EAS-106	26	0.031	0.014	0.0045	370	88	0.05
HW Scrubber	OD-107	EAS-107	1.7" delta P	N/A	0.003	N/A	90.0	N/A	0.05
Aer Grit Chamber	OD-108	EAS-108	49	0.054	60	34	4000	1662	0.2
Replicate Sample	OD-109	EAS-109	49	0.054	60	34	4000	1662	0.2
Sludge in Tub	OD-110	EAS-110	N/A	0.005	2.0	0.10	3100	119	85
Digest O.F. Well	OD-111	EAS-111	N/A	0.005	12	0.63	2900	112	0.8
Media Blank	OD-112	EAS-112	N/A	0.005	N/A	N/A	40	1.5	N/A

H2S Flux = (ppmv)(34/25)(m3/min)/(0.13 m2) = mg/m2,min-1
Odor Flux = (D/T)(m3/min)/(0.13 m2) = (D/T)/m2,min-1
NH3 Flux = (ppmv)(18/25)(m3/min)/(0.13 m2) = mg/m2,min-1
Note- NH3 recorded as <0.05 ppmv were calculated as 0.05 ppmv or as MDL

NH3 Flux	COMMENT
mg/m2,min-1	
0.0014	2' Wide channel
N/A	Sample at front door
0.0028	Center of Quiescent
0.0055	Location 12' in
0.0086	Non-homogeneous aeration
0.0086	Non-homogeneous aeration
N/A	H2S inlet 0.98 ppmv
0.060	Limited aerated surf area
0.060	Replicate Field Sample
2.4	Represents sludge in trucks
0.022	Grate sample- ventilated
N/A	UHP air in media

Table 3. Summary of All Sample Concentration Results for Reduced Sulfur Compounds (mg/m3) and Flux Data for Area Sources (mg/m2,min-1).

COMPOUNDS	EAS-112	EAS-112	EAS-101	EAS-101	EAS-102	EAS-103	EAS-103	EAS-104	EAS-104
(location)	M Blank	M Blank	Prim Weir	Prim Weir	DAF Head	Prim Quies	Prim Quies	Trick Filter	Trick Filter
(units)	mg/m3	mg/m2,min-1	mg/m3	mg/m2,min-1	mg/m3	mg/m3	mg/m2,min-1	mg/m3	mg/m2,min-1
Hydrogen Sulfide	0.015	0.00058	**14**	**0.54**	**14**	**1.1**	**0.042**	**10**	**0.39**
Carbonyl Sulfide	ND		ND	ND	ND	ND	ND	ND	ND
Methyl Mercaptan	ND		**0.31**	**0.012**	**0.84**	**0.022**	**0.00085**	**1.2**	**0.046**
Ethyl Mercaptan	ND		ND	ND	ND	ND	ND	ND	ND
Dimethyl Sulfide	ND		ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND		ND	ND	ND	ND	ND	ND	ND
I-Propyl Mercaptan	ND		ND	ND	ND	ND	ND	ND	ND
Ethyl Methy Sulfide	ND		ND	ND	ND	ND	ND	ND	ND
n-Propyl Mercaptan	ND		ND	ND	ND	ND	ND	ND	ND
Thiophene	ND		ND	ND	ND	ND	ND	ND	ND
Isobutyl Mercaptan	ND		ND	ND	ND	ND	ND	ND	ND
Diethyl Sulfide	ND		ND	ND	ND	ND	ND	ND	ND
t-Butyl Mercaptan	ND		ND	ND	ND	ND	ND	ND	ND
n-Butyl Mercaptan	ND		ND	ND	ND	ND	ND	ND	ND
Dimethyl Disulfide	ND		ND	ND	ND	ND	ND	ND	ND
3-Methylthiophene	ND		ND	ND	ND	ND	ND	ND	ND
Tetrahydrothiophene	ND		ND	ND	ND	ND	ND	ND	ND
2,5-Dimethylthiophene	ND		ND	ND	ND	ND	ND	ND	ND
Diethyl Disulfide	ND		ND	ND	ND	ND	ND	ND	ND
2-Ethylthiophene	ND		ND	ND	ND	ND	ND	ND	ND

ND- Not detected above MDL; MDL values provided on laboratory data sheets
All data in bold is above blank limits

EAS-105	EAS-105	EAS-106	EAS-106	EAS-107	EAS-108	EAS-108	EAS-109	EAS-109	EAS-110	EAS-110
New Aera	New Aera	Old Aera	Old Aera	HW Scrub	Aer Grit	Aer Grit	Replicate	Replicate	Sludge	Sludge
mg/m3	mg/m2,min-1	mg/m3	mg/m2,min-1	mg/m3	mg/m3	mg/m2,min-1	mg/m3	mg/m2,min-1	mg/m3	mg/m2,min-1
ND	ND	0.0016	0.00038	ND	**38**	**16**	**38**	**16**	0.0031	0.00012
ND	ND	ND	ND	**0.043**	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	**0.69**	**0.29**	**0.77**	**0.32**	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.0080	**0.0019**	**0.0039**	**0.00093**	ND	ND	ND	ND	ND	ND	ND
ND	ND	**0.0034**	**0.00081**	**0.0058**	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.11	**0.026**	**0.023**	**0.0055**	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Tab. .. Summary of All Sample Concentration Results for Reduced Sulfur Compounds (mg/m3) and Flux Data for Area Sources (mg/m2,min-1).

EAS-111	EAS-111
Diges Well	Diges Well
mg/m3	mg/m2,min-1
4.5	**0.17**
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND
ND	ND

REFERENCES

US EPA. 1986. "Measurement of Gaseous Emission Rates From Land Surfaces Using an Emission Isolation Flux Chamber, Users Guide." EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada, EPA Contract No. 68-02-3889, Work Assignment No. 18, Radian Corporation, February 1986. NTIS # PB 86-223161.

Card, Tom, CE Schmidt, *Source Test Protocol Assessment Approach*, April 2004.

ENVIRONMENTAL
Analytical Service, Inc.

June 8, 2004
Sample Delivery Groups (SDG): 204270

Tom Card
Environmental Management Consulting
41125 278th Way SE
Enumclaw WA 98022

Dear Tom:

Enclosed is the analytical report for the samples received and analyzed by Environmental Analytical Service, Inc. for the following project:

Project Name: Loveland WWTP CH2M Hill
Project Number: None Given

The report consists of the following sections:

I. Sample Description
II. Laboratory Narrative and Chain of Custody Forms
III. Laboratory Certification
IV. Quality Control Reports
V. Analytical Results

If you have any questions on the report or the analytical data please contact me at (805) 781-3585.

Sincerely,

Steven D. Hoyt, Ph.D.
Laboratory Director

SDH/lims

173 Cross Street
San Luis Obispo
CA
93401-7597
805 781 3588
Fax 805.541 4550

Analytical Report

SDG Number 204270

Client: Environmental Management Consulting **Date Received:** 6/3/2004

I. SAMPLE DESCRIPTION AND ANALYSIS REQUESTED

Client Sample No.	EAS Lab No.	Analysis Requested	Date Sample Rec	Pressure (torr) Final
EAS-101	204270 1	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-102	204270 2	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-103	204270 3	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-104	204270 4	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-105	204270 5	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-106	204270 6	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-107	204270 7	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-108	204270 8	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-109	204270 9	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-110	204270 10	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-111	204270 11	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	
EAS-112	204270 12	EPA TO-14 Reduced Sulfur Compounds	6/2/2004	

II. LABORATORY CASE NARRATIVE and CHAIN OF CUSTODY FORMS

EAS SDG Number 204270

Client: Environmental Management Consul

All analysis met the QC requirements for the method except dimethyl sulfide exceeds QC limits for % recovery on the laboratory control spike and duplicate analysis. The QC limit for % recovery on the laboratory control spike and duplicate analysis is 70-130%. The % recovery of dimethyl sulfide on the laboratory control spike and duplicate is 66% and 65%, respectively. This does not affect data quality.

III. LABORATORY CERTIFICATION

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness other than the condition noted above.

Steven D. Hoyt, Ph.D.
Laboratory Director

Environmental Management Consulting
Chain of Custody Record

Organic Reduced Sulfur

Form Serial Number: EMC F1-00741

Client Name: *Loveland WWTP*, *CH2M HILL*

Project Manager: *Ms. Jennifer Barnes*

Requested Completion Date:

For Information Regarding These Samples Please Contact:
Thomas R. Card
Environmental Management Consulting
41125 278th Way SE, Enumclaw, WA 98022
360-802-5540 Fax: 360-802-5541
E-Mail: trcard@earthlink.com

Client Address and Phone Number: *PO Box 91500*, *Bellevue, WA 98009-2050 425-453-5000*

Laboratory Name: *EAS*
Laboratory Address: *173 Cross Street*, *San Luis Obispo, CA 93401*
Laboratory Phone: *805-781-3585*
Laboratory Contact: *Dr. Steve Hoyt*

Station Number	Date	Time	COMP	GRAB	Sample ID Number	# OF CONTAINERS	Sample Container: Bag	Can	Tube	Analysis Requested: TO-14 for ORS	Remarks H2S
	6/2/2004	0717		x	EAS-101 204270-1	1	x			x	Screen 28 ppmv
	6/2/2004	0750		x	EAS-102 -2	1	x			x	25
	6/2/2004	0815		x	EAS-103 -3	1	x			x	4.1
	6/2/2004	0916		x	EAS-104 -4	1	x			x	18
	6/2/2004	1015		x	EAS-105 -5	1	x			x	0.02
	6/2/2004	1121		x	EAS-106 -6	1	x			x	0.014
	6/2/2004	1150		x	EAS-107 -7	1	x			x	0.003
	6/2/2004	1216		x	EAS-108 -8	1	x			x	60
	6/2/2004	1216		x	EAS-109 -9	1	x			x	60
	6/2/2004	1325		x	EAS-110 -10	1	x			x	2
	6/2/2004	1430		x	EAS-111 -11	1	x			x	10
	6/2/2004	1440		x	EAS-112 -12	1	x			x	0
	~~6/2/2004~~			~~x~~	~~EAS-113~~	~~1~~	~~x~~			~~x~~	

Sampler: [signature]	Date/Time: 6/2/04 1445	Relinquished by: [signature]	Date/Time: 6/2/04 1500	HAZWRAP/NEESA Y N	
Recieved by: B. [signature]	Date/Time: 6/3/04 10:45	Relinquished by	Date/Time	QC Level 1 2 3	
Recieved by	Date/Time	Relinquished by	Date/Time	COC	Ice
Recieved by Laboratory	Date/Time	Sample Shipped Via: UPS FEDEX BUS Hand Other	Air Bill No.	Ana Req	Temp *AMB*
Remarks				Cust Seal	pH
				Sample Condition	

File: Loveland Forms.xls Form: EAS COC D1

IV. QUALITY CONTROL REPORT

SDG Numbers: 204270
Client: Environmental Management Consulting

LABORATORY QC REPORT

QC NARRATIVE

Unless project specific QC was specified, these samples were analyzed with the standard EAS QC for the method as defined in the EAS Quality Manual.

STANDARD LABORATORY QC REPORT

Unless project specific QC reporting was requested, this Section contains the standard laboratory QC supplied with the analytical reports, which includes the daily method blank and the daily duplicate control samples as described below. Each day that samples are analyzed comprises a Daily Analytical Batch for a particular instrument. A Daily Analytical Batch QC report will be supplied for each method and each day samples from this SDG Group were analyzed.

METHOD BLANK

A method blank is a laboratory-generated sample which assesses the degree to which laboratory operations and procedures cause false-positive analytical results for your samples. A copy of each batch Method Blank is included with the report. If a compound is detected in the Method Blank between the RL and MDL, it will be flagged with a "J". If a compound is above the RL, it will be flagged with a "B"

DUPLICATE CONTROL SAMPLES

A duplicate or duplicate control sample (DCS) was analyzed as part of each daily analytical batch. A DCS is a well-characterized matrix (blank water, ambient air, or actual sample) which may or may not be spiked and run in duplicate with your sample batch. The results are on the attached Duplicate Sample/Spike results. Precision is measured in a duplicate test by Relative Percent Difference (RPD) as in:

$$RPD = \frac{[\%\ \text{Recovery Test 1} - \%\ \text{Recovery Test 2}] \times 100}{(\text{Recovery Test 1} + \text{Recovery Test 2}) / 2}$$

METHOD BLANK REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: LABQC

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: B06044

Client: Date Sampled:

Sample ID: METHOD BLANK Date Analyzed: 06/04/04

File ID: B06044B.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	1.0	ND	1.4	ND	
Carbonyl Sulfide	463-58-1	1.0	ND	2.5	ND	
Methyl Mercaptan	74-93-1	1.0	ND	2.0	ND	
Ethyl Mercaptan	75-08-1	1.0	ND	2.6	ND	
Dimethyl Sulfide	75-18-3	1.0	ND	2.6	ND	
Carbon Disulfide	75-15-0	1.0	ND	3.2	ND	
i-Propyl Mercaptan	75-33-2	1.0	ND	3.2	ND	
Ethyl Methyl Sulfide	624-89-5	1.0	ND	3.8	ND	
n-Propyl Mercaptan	107-03-9	1.0	ND	3.2	ND	
Thiophene	110-02-1	1.0	ND	3.6	ND	
Isobutyl Mercaptan	513-44-0	1.0	ND	3.8	ND	
Diethyl Sulfide	352-93-2	1.0	ND	3.8	ND	
t-Butyl Mercaptan	75-66-1	1.0	ND	3.8	ND	
n-Butyl Mercaptan	109-79-5	1.0	ND	3.8	ND	
Dimethyl Disulfide	624-92-0	1.0	ND	4.0	ND	
3-Methylthiophene	616-44-4	1.0	ND	4.2	ND	
Tetrahydrothiophene	110-01-0	1.0	ND	3.7	ND	
2,5-Dimethylthiophene	638-02-8	1.0	ND	4.7	ND	
Diethyl Disulfide	872-55-9	1.0	ND	4.7	ND	
2-Ethylthiophene	110-81-6	1.0	ND	5.2	ND	

Results are accurate to two significant figures

QC REPORT

ENVIRONMENTAL
Analytical Service, Inc.

Spike: QC06044
Spike Dup.: QC06044DUP
QC Lot: 060404-GC4 Method: GC/FPD

Compound	Theoretical Conc.ppbv	Spike ppbv	Spike Dup ppbv	% Recov. Spike	%Recov. Spike Dup.	%RPD	% Rec. Limits
Hydrogen Sulfide	10000	7221	7189	72	72	0	70-130%
Carbonyl Sulfide	NA	ND	ND	NA	NA	NA	70-130%
Methyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
Ethyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
Dimethyl Sulfide	10000	6553	6494	66	65	1	70-130%
Carbon Disulfide	NA	ND	ND	NA	NA	NA	70-130%
i-Propyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
Ethyl Methyl Sulfide	NA	ND	ND	NA	NA	NA	70-130%
n-Propyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
Thiophene	NA	ND	ND	NA	NA	NA	70-130%
Isobutyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
Diethyl Sulfide	NA	ND	ND	NA	NA	NA	70-130%
t-Butyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
n-Butyl Mercaptan	NA	ND	ND	NA	NA	NA	70-130%
Dimethyl Disulfide	NA	ND	ND	NA	NA	NA	70-130%
3-Methylthiophene	NA	ND	ND	NA	NA	NA	70-130%
Tetrahydrothiophene	NA	ND	ND	NA	NA	NA	70-130%
2,5-Dimethylthiophene	NA	ND	ND	NA	NA	NA	70-130%
Diethyl Disulfide	NA	ND	ND	NA	NA	NA	70-130%
2-Ethylthiophene	NA	ND	ND	NA	NA	NA	70-130%

V. ANALYTICAL RESULTS

SDG Numbers: 204270
Client: Environmental Management Consulting

The following pages contain the certified reports for the analytical methods and the compounds requested. The reports are in order of analytical method then EAS ID number. A brief description of the units that appear on the reports is given below:

ppbV, ppmV, Percent

Parts per billion by volume (also known as mole ratio) and other related units. This is the primary reporting unit for all volatile organic compound analysis except the hydrocarbon speciation and total hydrocarbons. This unit is independent of temperature and pressure.

$$ppbV = \frac{\text{nanomoles of compound}}{\text{moles of air}}$$

ug/m3, mg/m3

Micrograms of compound per cubic meter of air and other related units. This is the primary reporting unit for semi volatile organic compounds. It is not a primary reporting unit for volatile organic compounds because it is temperature and pressure dependent, so the result will vary depending on the conditions when the sample was collected. EAS provides the units on its analytical reports as a convenience to the client, but they should be used with caution. The following equation can be used to convert from ppbV to ug/m3.

$$ug/m3 = \frac{ppbV \times MW\ compound}{23.68}$$

23.68 is the molar volume of a gas at 60 F and 1 atm pressure

ppbC, ppmC

Parts per billion by volume as carbon (methane) and other related units. This unit is the primary reporting unit for hydrocarbon analysis, even if it does not appear on the report. This unit is used because the flame ionization detector response is proportional to the number of carbons in the compound, so an accurate concentration can be reported even if the identification of the compound is not known.

$$ppbC = ppbV \times \text{number of carbons in compound}$$

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 12

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-112 Date Analyzed: 06/04/04

File ID: 0427012A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	1.0	10.48	1.4	15.11	
Carbonyl Sulfide	463-58-1	1.0	ND	2.5	ND	
Methyl Mercaptan	74-93-1	1.0	ND	2.0	ND	
Ethyl Mercaptan	75-08-1	1.0	ND	2.6	ND	
Dimethyl Sulfide	75-18-3	1.0	ND	2.6	ND	
Carbon Disulfide	75-15-0	1.0	ND	3.2	ND	
i-Propyl Mercaptan	75-33-2	1.0	ND	3.2	ND	
Ethyl Methyl Sulfide	624-89-5	1.0	ND	3.8	ND	
n-Propyl Mercaptan	107-03-9	1.0	ND	3.2	ND	
Thiophene	110-02-1	1.0	ND	3.6	ND	
Isobutyl Mercaptan	513-44-0	1.0	ND	3.8	ND	
Diethyl Sulfide	352-93-2	1.0	ND	3.8	ND	
t-Butyl Mercaptan	75-66-1	1.0	ND	3.8	ND	
n-Butyl Mercaptan	109-79-5	1.0	ND	3.8	ND	
Dimethyl Disulfide	624-92-0	1.0	ND	4.0	ND	
3-Methylthiophene	616-44-4	1.0	ND	4.2	ND	
Tetrahydrothiophene	110-01-0	1.0	ND	3.7	ND	
2,5-Dimethylthiophene	638-02-8	1.0	ND	4.7	ND	
Diethyl Disulfide	872-55-9	1.0	ND	4.7	ND	
2-Ethylthiophene	110-81-6	1.0	ND	5.2	ND	

Results are accurate to two significant figures.

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 01

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-101 Date Analyzed: 06/04/04

File ID: 0427001A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	50.0	9611.35	72.1	13855.96	
Carbonyl Sulfide	463-58-1	50.0	ND	127.1	ND	
Methyl Mercaptan	74-93-1	50.0	152.72	101.8	310.79	
Ethyl Mercaptan	75-08-1	50.0	ND	131.4	ND	
Dimethyl Sulfide	75-18-3	50.0	ND	131.4	ND	
Carbon Disulfide	75-15-0	50.0	ND	161.0	ND	
i-Propyl Mercaptan	75-33-2	50.0	ND	161.1	ND	
Ethyl Methyl Sulfide	624-89-5	50.0	ND	190.7	ND	
n-Propyl Mercaptan	107-03-9	50.0	ND	161.1	ND	
Thiophene	110-02-1	50.0	ND	178.0	ND	
Isobutyl Mercaptan	513-44-0	50.0	ND	190.8	ND	
Diethyl Sulfide	352-93-2	50.0	ND	190.8	ND	
t-Butyl Mercaptan	75-66-1	50.0	ND	190.8	ND	
n-Butyl Mercaptan	109-79-5	50.0	ND	190.8	ND	
Dimethyl Disulfide	624-92-0	50.0	ND	199.2	ND	
3-Methylthiophene	616-44-4	50.0	ND	207.6	ND	
Tetrahydrothiophene	110-01-0	50.0	ND	186.5	ND	
2,5-Dimethylthiophene	638-02-8	50.0	ND	237.3	ND	
Diethyl Disulfide	872-55-9	50.0	ND	237.3	ND	
2-Ethylthiophene	110-81-6	50.0	ND	258.6	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 02

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-102 Date Analyzed: 06/04/04

File ID: 0427002A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	50.0	9651.81	72.1	13914.29	
Carbonyl Sulfide	463-58-1	50.0	ND	127.1	ND	
Methyl Mercaptan	74-93-1	50.0	415.04	101.8	844.66	
Ethyl Mercaptan	75-08-1	50.0	ND	131.4	ND	
Dimethyl Sulfide	75-18-3	50.0	ND	131.4	ND	
Carbon Disulfide	75-15-0	50.0	ND	161.0	ND	
i-Propyl Mercaptan	75-33-2	50.0	ND	161.1	ND	
Ethyl Methyl Sulfide	624-89-5	50.0	ND	190.7	ND	
n-Propyl Mercaptan	107-03-9	50.0	ND	161.1	ND	
Thiophene	110-02-1	50.0	ND	178.0	ND	
Isobutyl Mercaptan	513-44-0	50.0	ND	190.8	ND	
Diethyl Sulfide	352-93-2	50.0	ND	190.8	ND	
t-Butyl Mercaptan	75-66-1	50.0	ND	190.8	ND	
n-Butyl Mercaptan	109-79-5	50.0	ND	190.8	ND	
Dimethyl Disulfide	624-92-0	50.0	ND	199.2	ND	
3-Methylthiophene	616-44-4	50.0	ND	207.6	ND	
Tetrahydrothiophene	110-01-0	50.0	ND	186.5	ND	
2,5-Dimethylthiophene	638-02-8	50.0	ND	237.3	ND	
Diethyl Disulfide	872-55-9	50.0	ND	237.3	ND	
2-Ethylthiophene	110-81-6	50.0	ND	258.6	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 03

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-103 Date Analyzed: 06/04/04

File ID: 0427003A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	10.0	749.03	14.4	1079.82	
Carbonyl Sulfide	463-58-1	10.0	ND	25.4	ND	
Methyl Mercaptan	74-93-1	10.0	10.98	20.4	22.34	
Ethyl Mercaptan	75-08-1	10.0	ND	26.3	ND	
Dimethyl Sulfide	75-18-3	10.0	ND	26.3	ND	
Carbon Disulfide	75-15-0	10.0	ND	32.2	ND	
i-Propyl Mercaptan	75-33-2	10.0	ND	32.2	ND	
Ethyl Methyl Sulfide	624-89-5	10.0	ND	38.1	ND	
n-Propyl Mercaptan	107-03-9	10.0	ND	32.2	ND	
Thiophene	110-02-1	10.0	ND	35.6	ND	
Isobutyl Mercaptan	513-44-0	10.0	ND	38.2	ND	
Diethyl Sulfide	352-93-2	10.0	ND	38.2	ND	
t-Butyl Mercaptan	75-66-1	10.0	ND	38.2	ND	
n-Butyl Mercaptan	109-79-5	10.0	ND	38.2	ND	
Dimethyl Disulfide	624-92-0	10.0	ND	39.8	ND	
3-Methylthiophene	616-44-4	10.0	ND	41.5	ND	
Tetrahydrothiophene	110-01-0	10.0	ND	37.3	ND	
2,5-Dimethylthiophene	638-02-8	10.0	ND	47.5	ND	
Diethyl Disulfide	872-55-9	10.0	ND	47.5	ND	
2-Ethylthiophene	110-81-6	10.0	ND	51.7	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 04

Client:	Environmental Management Consulting	Date Sampled:	06/02/04
Sample ID:	EAS-104	Date Analyzed:	06/04/04
File ID:	0427004A.D	QC Batch:	060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	50.0	7069.79	72.1	10191.98	
Carbonyl Sulfide	463-58-1	50.0	ND	127.1	ND	
Methyl Mercaptan	74-93-1	50.0	578.62	101.8	1177.56	
Ethyl Mercaptan	75-08-1	50.0	ND	131.4	ND	
Dimethyl Sulfide	75-18-3	50.0	ND	131.4	ND	
Carbon Disulfide	75-15-0	50.0	ND	161.0	ND	
i-Propyl Mercaptan	75-33-2	50.0	ND	161.1	ND	
Ethyl Methyl Sulfide	624-89-5	50.0	ND	190.7	ND	
n-Propyl Mercaptan	107-03-9	50.0	ND	161.1	ND	
Thiophene	110-02-1	50.0	ND	178.0	ND	
Isobutyl Mercaptan	513-44-0	50.0	ND	190.8	ND	
Diethyl Sulfide	352-93-2	50.0	ND	190.8	ND	
t-Butyl Mercaptan	75-66-1	50.0	ND	190.8	ND	
n-Butyl Mercaptan	109-79-5	50.0	ND	190.8	ND	
Dimethyl Disulfide	624-92-0	50.0	ND	199.2	ND	
3-Methylthiophene	616-44-4	50.0	ND	207.6	ND	
Tetrahydrothiophene	110-01-0	50.0	ND	186.5	ND	
2,5-Dimethylthiophene	638-02-8	50.0	ND	237.3	ND	
Diethyl Disulfide	872-55-9	50.0	ND	237.3	ND	
2-Ethylthiophene	110-81-6	50.0	ND	258.6	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 05

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-105 Date Analyzed: 06/04/04

File ID: 0427005A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	1.0	ND	1.4	ND	
Carbonyl Sulfide	463-58-1	1.0	ND	2.5	ND	
Methyl Mercaptan	74-93-1	1.0	ND	2.0	ND	
Ethyl Mercaptan	75-08-1	1.0	ND	2.6	ND	
Dimethyl Sulfide	75-18-3	1.0	3.05	2.6	8.02	
Carbon Disulfide	75-15-0	1.0	ND	3.2	ND	
i-Propyl Mercaptan	75-33-2	1.0	ND	3.2	ND	
Ethyl Methyl Sulfide	624-89-5	1.0	ND	3.8	ND	
n-Propyl Mercaptan	107-03-9	1.0	ND	3.2	ND	
Thiophene	110-02-1	1.0	ND	3.6	ND	
Isobutyl Mercaptan	513-44-0	1.0	ND	3.8	ND	
Diethyl Sulfide	352-93-2	1.0	ND	3.8	ND	
t-Butyl Mercaptan	75-66-1	1.0	ND	3.8	ND	
n-Butyl Mercaptan	109-79-5	1.0	ND	3.8	ND	
Dimethyl Disulfide	624-92-0	1.0	27.01	4.0	107.60	
3-Methylthiophene	616-44-4	1.0	ND	4.2	ND	
Tetrahydrothiophene	110-01-0	1.0	ND	3.7	ND	
2,5-Dimethylthiophene	638-02-8	1.0	ND	4.7	ND	
Diethyl Disulfide	872-55-9	1.0	ND	4.7	ND	
2-Ethylthiophene	110-81-6	1.0	ND	5.2	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 06

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-106 Date Analyzed: 06/04/04

File ID: 0427006A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	1.0	1.07	1.4	1.55	
Carbonyl Sulfide	463-58-1	1.0	ND	2.5	ND	
Methyl Mercaptan	74-93-1	1.0	ND	2.0	ND	
Ethyl Mercaptan	75-08-1	1.0	ND	2.6	ND	
Dimethyl Sulfide	75-18-3	1.0	1.47	2.6	3.86	
Carbon Disulfide	75-15-0	1.0	1.06	3.2	3.42	
i-Propyl Mercaptan	75-33-2	1.0	ND	3.2	ND	
Ethyl Methyl Sulfide	624-89-5	1.0	ND	3.8	ND	
n-Propyl Mercaptan	107-03-9	1.0	ND	3.2	ND	
Thiophene	110-02-1	1.0	ND	3.6	ND	
Isobutyl Mercaptan	513-44-0	1.0	ND	3.8	ND	
Diethyl Sulfide	352-93-2	1.0	ND	3.8	ND	
t-Butyl Mercaptan	75-66-1	1.0	ND	3.8	ND	
n-Butyl Mercaptan	109-79-5	1.0	ND	3.8	ND	
Dimethyl Disulfide	624-92-0	1.0	5.83	4.0	23.24	
3-Methylthiophene	616-44-4	1.0	ND	4.2	ND	
Tetrahydrothiophene	110-01-0	1.0	ND	3.7	ND	
2,5-Dimethylthiophene	638-02-8	1.0	ND	4.7	ND	
Diethyl Disulfide	872-55-9	1.0	ND	4.7	ND	
2-Ethylthiophene	110-81-6	1.0	ND	5.2	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 07

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-107 Date Analyzed: 06/04/04

File ID: 0427007A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	1.0	ND	1.4	ND	
Carbonyl Sulfide	463-58-1	1.0	16.74	2.5	42.54	
Methyl Mercaptan	74-93-1	1.0	ND	2.0	ND	
Ethyl Mercaptan	75-08-1	1.0	ND	2.6	ND	
Dimethyl Sulfide	75-18-3	1.0	ND	2.6	ND	
Carbon Disulfide	75-15-0	1.0	1.79	3.2	5.77	
i-Propyl Mercaptan	75-33-2	1.0	ND	3.2	ND	
Ethyl Methyl Sulfide	624-89-5	1.0	ND	3.8	ND	
n-Propyl Mercaptan	107-03-9	1.0	ND	3.2	ND	
Thiophene	110-02-1	1.0	ND	3.6	ND	
Isobutyl Mercaptan	513-44-0	1.0	ND	3.8	ND	
Diethyl Sulfide	352-93-2	1.0	ND	3.8	ND	
t-Butyl Mercaptan	75-66-1	1.0	ND	3.8	ND	
n-Butyl Mercaptan	109-79-5	1.0	ND	3.8	ND	
Dimethyl Disulfide	624-92-0	1.0	ND	4.0	ND	
3-Methylthiophene	616-44-4	1.0	ND	4.2	ND	
Tetrahydrothiophene	110-01-0	1.0	ND	3.7	ND	
2,5-Dimethylthiophene	638-02-8	1.0	ND	4.7	ND	
Diethyl Disulfide	872-55-9	1.0	ND	4.7	ND	
2-Ethylthiophene	110-81-6	1.0	ND	5.2	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 08

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-108 Date Analyzed: 06/04/04

File ID: 0427008A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	100.0	26113.50	144.2	37645.86	
Carbonyl Sulfide	463-58-1	100.0	ND	254.1	ND	
Methyl Mercaptan	74-93-1	100.0	339.24	203.5	690.40	
Ethyl Mercaptan	75-08-1	100.0	ND	262.8	ND	
Dimethyl Sulfide	75-18-3	100.0	ND	262.8	ND	
Carbon Disulfide	75-15-0	100.0	ND	322.1	ND	
i-Propyl Mercaptan	75-33-2	100.0	ND	322.2	ND	
Ethyl Methyl Sulfide	624-89-5	100.0	ND	381.4	ND	
n-Propyl Mercaptan	107-03-9	100.0	ND	322.2	ND	
Thiophene	110-02-1	100.0	ND	355.9	ND	
Isobutyl Mercaptan	513-44-0	100.0	ND	381.5	ND	
Diethyl Sulfide	352-93-2	100.0	ND	381.5	ND	
t-Butyl Mercaptan	75-66-1	100.0	ND	381.5	ND	
n-Butyl Mercaptan	109-79-5	100.0	ND	381.5	ND	
Dimethyl Disulfide	624-92-0	100.0	ND	398.4	ND	
3-Methylthiophene	616-44-4	100.0	ND	415.3	ND	
Tetrahydrothiophene	110-01-0	100.0	ND	373.0	ND	
2,5-Dimethylthiophene	638-02-8	100.0	ND	474.6	ND	
Diethyl Disulfide	872-55-9	100.0	ND	474.6	ND	
2-Ethylthiophene	110-81-6	100.0	ND	517.1	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 09

Client: Environmental Management Consulting Date Sampled: 06/02/04

Sample ID: EAS-109 Date Analyzed: 06/04/04

File ID: 0427009A.D QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	100.0	26358.88	144.2	37999.60	
Carbonyl Sulfide	463-58-1	100.0	ND	254.1	ND	
Methyl Mercaptan	74-93-1	100.0	376.59	203.5	766.40	
Ethyl Mercaptan	75-08-1	100.0	ND	262.8	ND	
Dimethyl Sulfide	75-18-3	100.0	ND	262.8	ND	
Carbon Disulfide	75-15-0	100.0	ND	322.1	ND	
i-Propyl Mercaptan	75-33-2	100.0	ND	322.2	ND	
Ethyl Methyl Sulfide	624-89-5	100.0	ND	381.4	ND	
n-Propyl Mercaptan	107-03-9	100.0	ND	322.2	ND	
Thiophene	110-02-1	100.0	ND	355.9	ND	
Isobutyl Mercaptan	513-44-0	100.0	ND	381.5	ND	
Diethyl Sulfide	352-93-2	100.0	ND	381.5	ND	
t-Butyl Mercaptan	75-66-1	100.0	ND	381.5	ND	
n-Butyl Mercaptan	109-79-5	100.0	ND	381.5	ND	
Dimethyl Disulfide	624-92-0	100.0	ND	398.4	ND	
3-Methylthiophene	616-44-4	100.0	ND	415.3	ND	
Tetrahydrothiophene	110-01-0	100.0	ND	373.0	ND	
2,5-Dimethylthiophene	638-02-8	100.0	ND	474.6	ND	
Diethyl Disulfide	872-55-9	100.0	ND	474.6	ND	
2-Ethylthiophene	110-81-6	100.0	ND	517.1	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

SDG: 204270

Reduced Sulfur Compounds by ASTM 5504 Laboratory ID: 10

Client:	Environmental Management Consulting	Date Sampled:	06/02/04
Sample ID:	EAS-110	Date Analyzed:	06/04/04
File ID:	0427010A.D	QC Batch:	060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	1.0	2.14	1.4	3.09	
Carbonyl Sulfide	463-58-1	1.0	ND	2.5	ND	
Methyl Mercaptan	74-93-1	1.0	ND	2.0	ND	
Ethyl Mercaptan	75-08-1	1.0	ND	2.6	ND	
Dimethyl Sulfide	75-18-3	1.0	ND	2.6	ND	
Carbon Disulfide	75-15-0	1.0	ND	3.2	ND	
i-Propyl Mercaptan	75-33-2	1.0	ND	3.2	ND	
Ethyl Methyl Sulfide	624-89-5	1.0	ND	3.8	ND	
n-Propyl Mercaptan	107-03-9	1.0	ND	3.2	ND	
Thiophene	110-02-1	1.0	ND	3.6	ND	
Isobutyl Mercaptan	513-44-0	1.0	ND	3.8	ND	
Diethyl Sulfide	352-93-2	1.0	ND	3.8	ND	
t-Butyl Mercaptan	75-66-1	1.0	ND	3.8	ND	
n-Butyl Mercaptan	109-79-5	1.0	ND	3.8	ND	
Dimethyl Disulfide	624-92-0	1.0	ND	4.0	ND	
3-Methylthiophene	616-44-4	1.0	ND	4.2	ND	
Tetrahydrothiophene	110-01-0	1.0	ND	3.7	ND	
2,5-Dimethylthiophene	638-02-8	1.0	ND	4.7	ND	
Diethyl Disulfide	872-55-9	1.0	ND	4.7	ND	
2-Ethylthiophene	110-81-6	1.0	ND	5.2	ND	

Results are accurate to two significant figures

ANALYTICAL REPORT

ENVIRONMENTAL
Analytical Service, Inc.

Reduced Sulfur Compounds by ASTM 5504

SDG: 204270
Laboratory ID: 11

Client: Environmental Management Consulting
Sample ID: EAS-111
File ID: 0427011A.D

Date Sampled: 06/02/04
Date Analyzed: 06/04/04
QC Batch: 060404-GC4

Compound	CAS	MDL	ppbv	MDL	ug/m3	Flag
Hydrogen Sulfide	7783-06-4	50.0	3088.54	72.1	4452.51	
Carbonyl Sulfide	463-58-1	50.0	ND	127.1	ND	
Methyl Mercaptan	74-93-1	50.0	ND	101.8	ND	
Ethyl Mercaptan	75-08-1	50.0	ND	131.4	ND	
Dimethyl Sulfide	75-18-3	50.0	ND	131.4	ND	
Carbon Disulfide	75-15-0	50.0	ND	161.0	ND	
i-Propyl Mercaptan	75-33-2	50.0	ND	161.1	ND	
Ethyl Methyl Sulfide	624-89-5	50.0	ND	190.7	ND	
n-Propyl Mercaptan	107-03-9	50.0	ND	161.1	ND	
Thiophene	110-02-1	50.0	ND	178.0	ND	
Isobutyl Mercaptan	513-44-0	50.0	ND	190.8	ND	
Diethyl Sulfide	352-93-2	50.0	ND	190.8	ND	
t-Butyl Mercaptan	75-66-1	50.0	ND	190.8	ND	
n-Butyl Mercaptan	109-79-5	50.0	ND	190.8	ND	
Dimethyl Disulfide	624-92-0	50.0	ND	199.2	ND	
3-Methylthiophene	616-44-4	50.0	ND	207.6	ND	
Tetrahydrothiophene	110-01-0	50.0	ND	186.5	ND	
2,5-Dimethylthiophene	638-02-8	50.0	ND	237.3	ND	
Diethyl Disulfide	872-55-9	50.0	ND	237.3	ND	
2-Ethylthiophene	110-81-6	50.0	ND	258.6	ND	

Results are accurate to two significant figures

St. Croix Sensory, Inc. **Odor Evaluation Report**

Client: Environmental Management Consulting Project: Loveland WWTP Report No.: **415501**

Sampling Date: 06/02/04 Evaluation Date: 06/03/04

			ASTM E679		ASTM E544	PERSISTENCY	CHARACTERIZATION		
#	Field No.	Sample Description	Detection Threshold	Recognition Threshold	Intensity	Dose-Response Slope	Hedonic Tone	Odor Descriptors	Comments
1	OD - 101		4,400	2,600	100	-0.42			
2	OD - 102		4,400	2,600	65	-0.38			
3	OD - 103		2,400	1,600	65	-0.45			
4	OD - 104		2,700	1,700	90	-0.39			
5	OD - 105		1,500	660	22	-0.26			
6	OD - 106		370	210	35	-0.38			
7	OD - 107		90	50	18	-0.19			
8	OD - 108		4,000	2,400	90	-0.48			
9	OD - 109		4,000	2,600	80	-0.48			
10	OD - 110		3,100	1,700	24	-0.27			

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-2331 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: Environmental Management Consulting

Project: Loveland WWTP

Report No.: **415501**

Sampling Date: 06/02/04

Evaluation Date: 06/03/04

#	Field No.	Sample Description	ASTM E679 Detection Threshold	ASTM E679 Recognition Threshold	ASTM E544 Intensity	PERSISTENCY Dose-Response Slope	CHARACTERIZATION Hedonic Tone	CHARACTERIZATION Descriptor Top Notes	Comments
11	OD - 111		2900	1600	80	-0.46			
12	OD -112		40	25	17	-0.21			

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

SURFACE FLUX MEASUREMENT DATA FORM

DATE 6/2/04 SAMPLERS CES/TC

LOCATION LOVELAND WWTP

SURFACE DESCRIPTION AERATION CHANNEL - PRIMARY

CURRENT ACTIVITY AERATION

INSTRUMENT TYPE J631X I.D. NO. _____ TYPE _____ ID NO. _____

INSTRUMENT BASELINE _____

PROJECT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
AMBIENT CONCENTRATIONS _____

CHAMBER I.D. 2 COLAC PHOTO TAKEN: Yes ☐ No ☒ _____

CHAMBER SEAL Y CONDENSATION: Yes ☒ No ☐ BARM PRESS _____

AMBIENT CONDITIONS: Sun ☐ P.Sun ☒ Cloudy ☐ Wind at 5', 0-1 mph Wind at Seal, ____ mph

TEMP 56° RAIN: Yes ☐ No ☒ Comment _____

PRIOR CHAMBER CLEANING: Full Wash ☒ Wet Wipe ☐ Dry Wipe ☐ None ☐ _____

SAMPLE LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☒ Used ☐

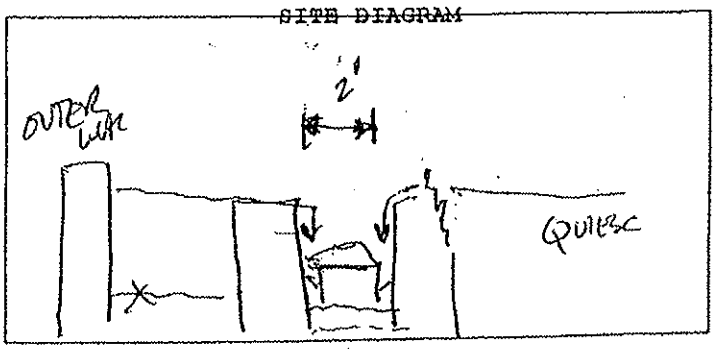
SWEEP AIR UAP CC _____ SUPPLIER SM PSIG START _____ PSIG STOP _____

Time	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) H_2S	Real-Time (ppmv) NH_3 TVRC	Sample Number	Comments
0647	50	0								LIQ 62
0653	↓	1								N=1
0659		2								5 PULL <0.01
0705		3					27			
0711	↓	4				0				
0717		5	62°		62	56°	28	<0.05		OD-101
								(TR@FRONT END)		EAS-101

COMMENTS: D.O. IN 1.1 ppm @ 15.9 °C
D.O. OUT 1.4 ppm @ 16.1 °C
(WEIR) 3
AMBIENT ON CATWALK 0.27 ppmv
0.46 "

WEIR CHANNEL 2' WIDE @ BOTTOM

SITE DIAGRAM



SURFACE FLUX MEASUREMENT DATA FORM

6/2/04 SAMPLERS CB/TC

TION LOVELAND WWTP

ACE DESCRIPTION QUIESCENT - PRIMARY

ENT ACTIVITY NA

RUMENT TYPE JEROX I.D. NO. _____ TYPE _____ ID NO. _____

RUMENT BASELINE _____

ECT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☐
ENT CONCENTRATIONS _____

BER I.D. D ASUR PHOTO TAKEN: Yes ☐ No ☒ _____

BER SEAL 4 CONDENSATION: Yes ☒ No ☐ BARM PRESS _____

ENT CONDITIONS: Sun ☐ P.Sun ☒ Cloudy ☐ Wind at 5', 3-5 mph Wind at Seal, ____ mph
57° RAIN: Yes ☐ No ☒ Comment _____

CHAMBER CLEANING: Full Wash ☐ Wet Wipe ☐ Dry Wipe ☐ None ☒ _____

E LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☐ Used ☐

AIR UHP CC 12968 SUPPLIER SM PSIG START 2000 PSIG STOP _____

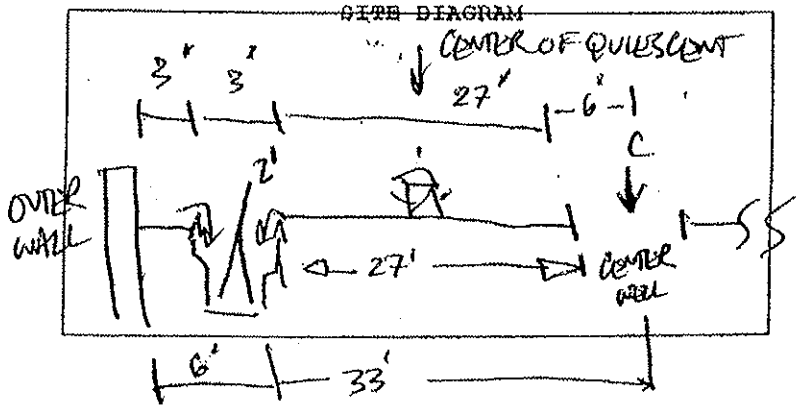
e	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) JEROX H_2S	Real-Time (ppmv) probe NH_3	Sample Number	Comments
5	5.0	0								HQ 62°
1	↓	1								N=1
7	↓	2								5 PICS (0.4)
3		3								
9		4					4.0	TRACE 0.1		
1		5	62°		62°	57°	4.2	BETWEEN 0.1		OD-103
							4.1	AND 0.05		EAS-103

ITS: WEIR CHANNEL 2'

H_2S LIQ PHASE 3 MG/L

PH 7.04

SITE DIAGRAM

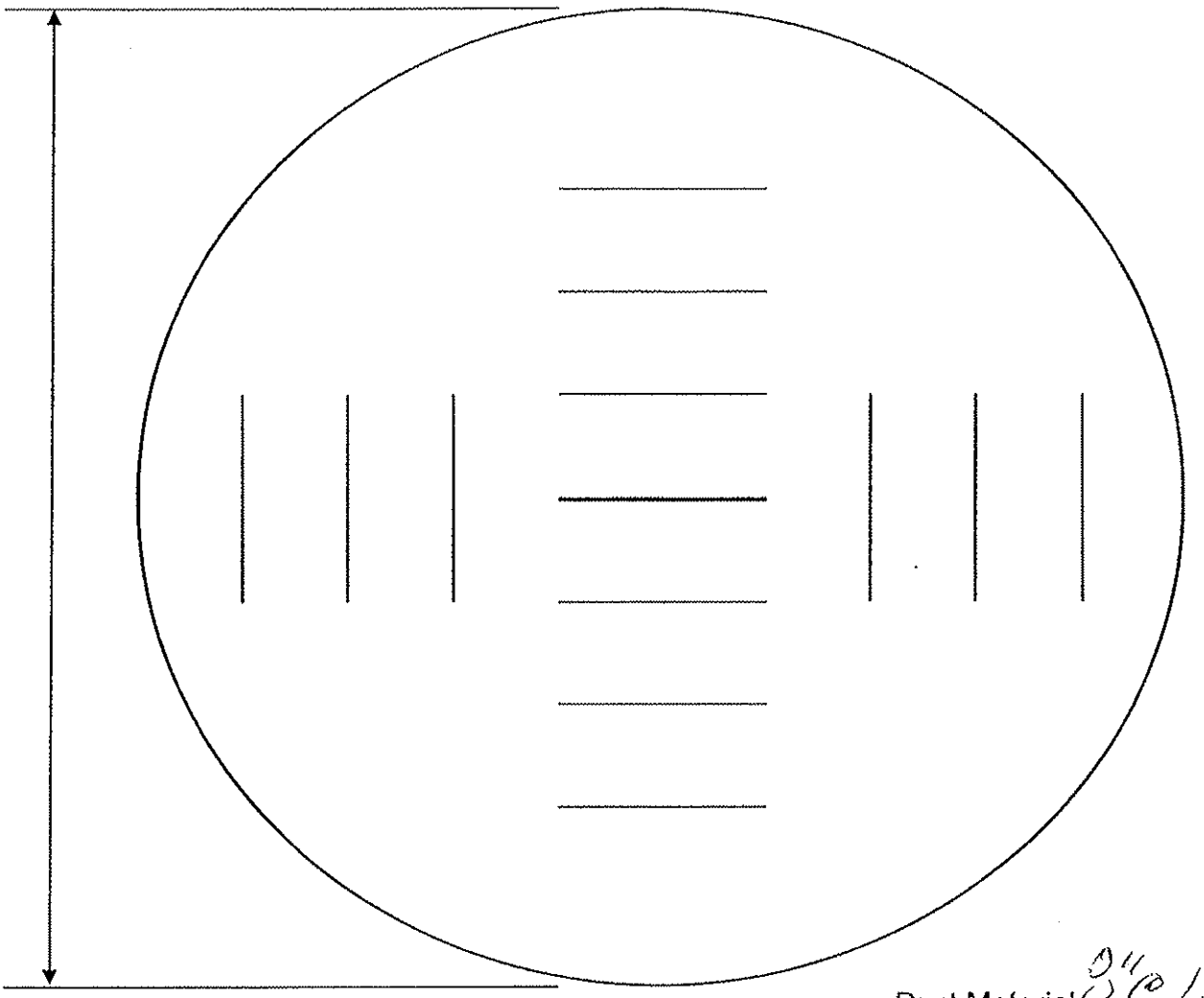


Duct Measurement Data Sheet

Project Lovelace WWTP

Location DAF

Date 6/2/04
Time 750
Sampled By JKR



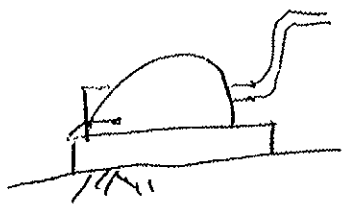
Duct Material 3" @ 1,500 fpm
Flow Rate _____
Temperature _____

Velocity Instrument Used _____

Sample Data

Type of Sample	Time	Value/Sample ID	Comments
ODOR	750	OD-102	
Sulfur	757	CAS-102	
H_2S	758	24/27	
NH_3	8:03	0.2	

Location Sketch



SURFACE FLUX MEASUREMENT DATA FORM

6/2/04 SAMPLERS CES/TC

TION LOVELAND WWTP

ACE DESCRIPTION TRICKLING FILTER

ENT ACTIVITY FILTRATION

RUMENT TYPE J631X I.D. NO. _____ TYPE _____ ID NO. _____

RUMENT BASELINE _____

ECT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
ENT CONCENTRATIONS _____

BER I.D. 1 PHOTO TAKEN: Yes ☒ No ☐ _____

BER SEAL Y CONDENSATION: Yes ☒ No ☐ BARM PRESS _____

ENT CONDITIONS: Sun ☐ P.Sun ☐ Cloudy ☒ Wind at 5', ____ mph Wind at Seal, ____ mph

_____ RAIN: Yes ☐ No ☒ Comment _____

. CHAMBER CLEANING: Full Wash ☐ Wet Wipe ☐ Dry Wipe ☐ None ☒ _____

E LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☐ New ☐ Used ☐

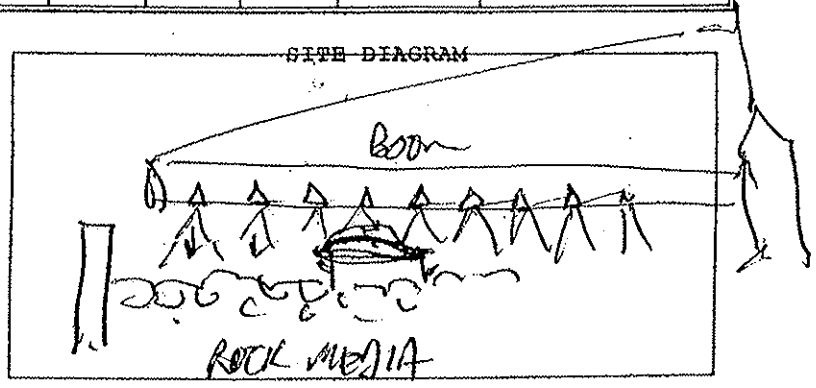
AIR UHP CC — SUPPLIER SM PSIG START 1800 PSIG STOP _____

e	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) J631X	Real-Time (ppmv) NH_3	Sample Number	Comments
5	5.0	0								N=1
2	↓	1								5 PUMPS
3		2								MDL ~ 0.05 ppmv NH_3
1		3								
		4								OD-104
		5					16	0.2		BAS-104
							19			
							18			

ITS: CHAMBER @ MEDIA LEVEL
10'-12' INTO MEDIA.

H_2S LIQ PHASE 1 mg/L @ 16.1°C
PH 7.04

SITE DIAGRAM



SURFACE FLUX MEASUREMENT DATA FORM

DATE 6/2/04 SAMPLERS CBS/TC

LOCATION NEW AERATION BASIN

SURFACE DESCRIPTION AERATION - FINE BUBBLE

CURRENT ACTIVITY

INSTRUMENT TYPE 1631X I.D. NO. _____ TYPE _____ ID NO. _____

INSTRUMENT BASELINE

PROJECT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
AMBIENT CONCENTRATIONS

CHAMBER I.D. D COLLAR PHOTO TAKEN: Yes ☒ No ☐

CHAMBER SEAL Y CONDENSATION: Yes ☒ No ☐ BARM PRESS _____

AMBIENT CONDITIONS: Sun ☒ P.Sun ☐ Cloudy ☐ Wind at 5', 3-7 mph Wind at Seal, ____ mph

TEMP 70° RAIN: Yes ☐ No ☒ Comment

PRIOR CHAMBER CLEANING: Full Wash ☒ NO SOAP Wet Wipe ☐ Dry Wipe ☐ None ☐

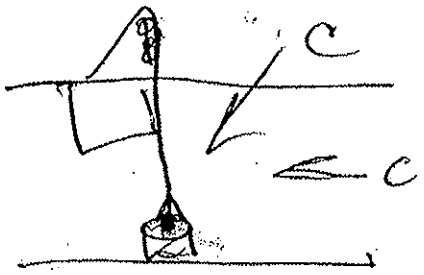
SAMPLE LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☒ Used ☐

SWEEP AIR VHP CC _____ SUPPLIER SM PSIG START _____ PSIG STOP _____

Time	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) 1631X	Real-Time (ppmv) TUBE NH3	Sample Number	Comments
0945	5.0	0								N=1 78ppm
0951	↓	1								5 RMS
0957		2								
1003	↓	3								
1009		4					0.019	0		
1015		5	63°		63°	78°	0.020	<0.05 ppmv		OD-105
							0.018			OB-105

COMMENTS: CONTROLS O_2 2.4 ppm O_2 0948
1750 CFM TOTAL 2 BASINS
BASIN 60x60 ~ 850CFM
NEW BAR 35'
41'
44'
120 ÷ 40' 0.66 MIN
= 26 LPM

SITE DIAGRAM



SURFACE FLUX MEASUREMENT DATA FORM

6/2/04 SAMPLERS CES/TC

[...]ION LOVELAND WWTP

[...]CE DESCRIPTION OLD AERATION BASIN

[...]NT ACTIVITY CENTER/CENTER

[...]UMENT TYPE J631X I.D. NO. ________ TYPE ________ ID NO. ________

[...]UMENT BASELINE ________

[...]CT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
[...]NT CONCENTRATIONS

[...]ER I.D. D COLLAR PHOTO TAKEN: Yes ☒ No ☐

[...]ER SEAL Y CONDENSATION: Yes ☒ No ☐ BARM PRESS ________

[...]NT CONDITIONS: Sun ☒ P.Sun ☐ Cloudy ☐ Wind at 5', 1-3 mph Wind at Seal, ____ mph

RAIN: Yes ☐ No ☒ Comment ________

CHAMBER CLEANING: Full Wash ☒ (NO SOAP) Wet Wipe ☐ Dry Wipe ☐ None ☐

[...]E LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☒ Used ☐

AIR UHP CC ―― SUPPLIER SM PSIG START ________ PSIG STOP ________

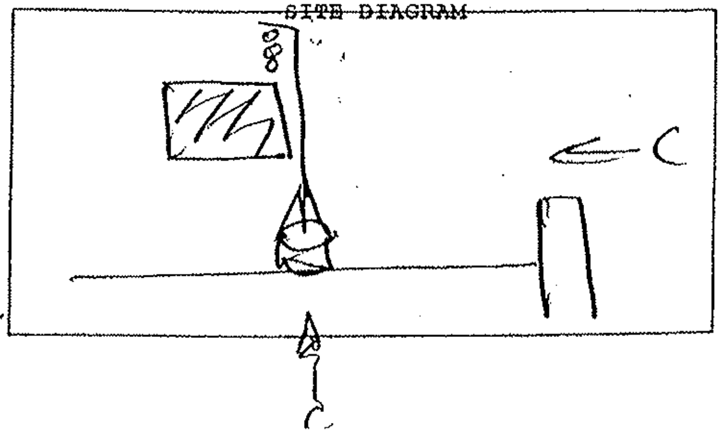
[...]e	Sweep Air (L/min)	Residence Number	Temperature (°F)				Real-Time (ppmv)		Sample Number	49 64°
			Chamber		Ambient		J631X	TUBE		
			Surf	Air	Surf	Air	H_2S	NH_3		Comments
1	5.0	0								N=1 78F
[illegible]	↓	1								5 Pulls
[illegible]		2								
[illegible]		3								
		4					0.12	0.012	<0.05 ppm	
[illegible]	*26 LPM	5	64°		64°		0.14	0.014		OD-106
							0.17	0.015		BKG-106

[...]TS: OLD AERATION BASIN
D.O. 6 PPM O_2

R TIMES 29
[...] 42
52
33
BKG

156 = 39 sec
39/60 = 0.65 m
≈ 26 L/m

SITE DIAGRAM



Duct Measurement Data Sheet

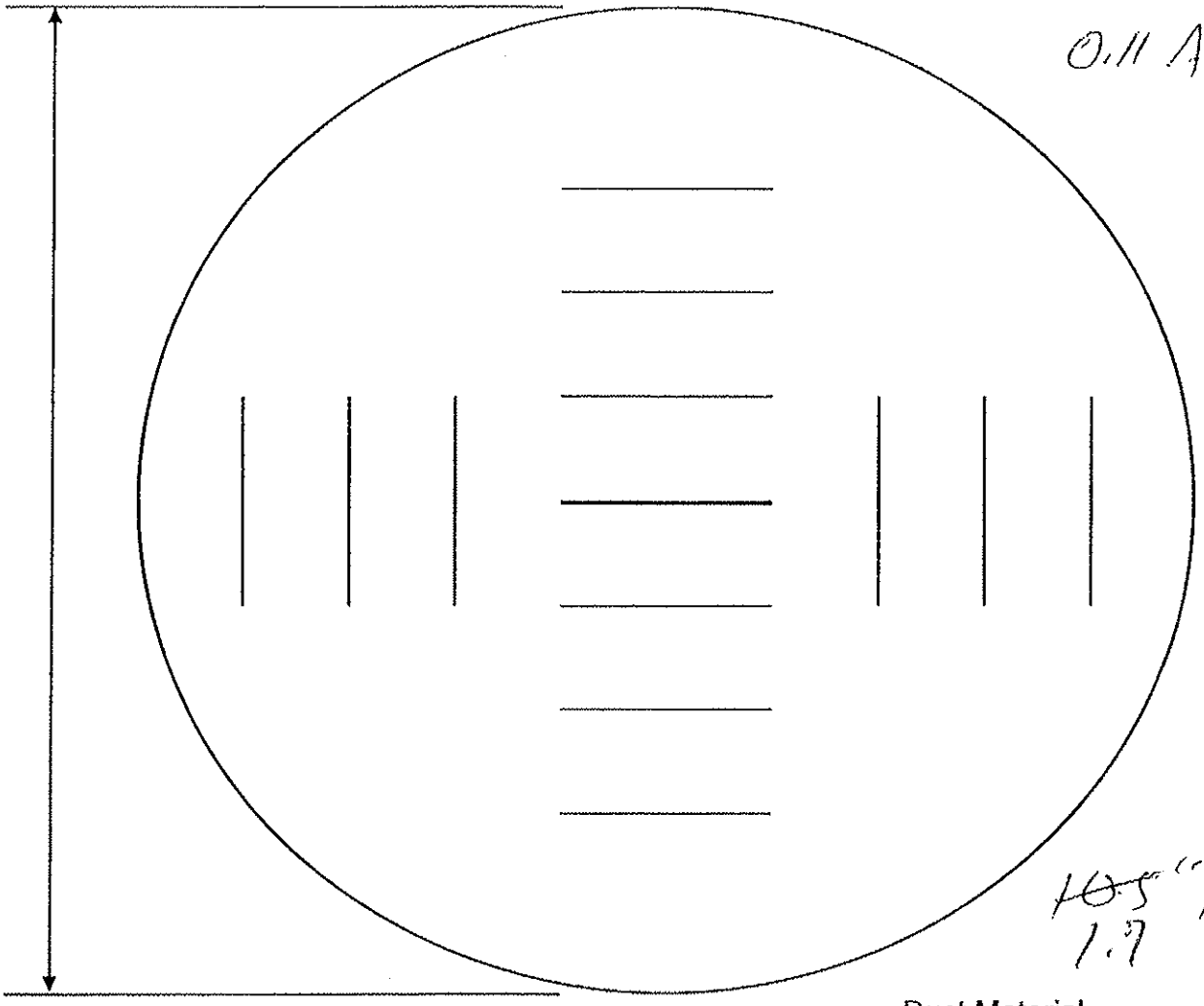
Project Lovelock

Location MW Scrubber

Date 6/2/04

Time 11:45

Sampled By TLL



Duct Material _____

Flow Rate _____

Velocity Instrument Used _____

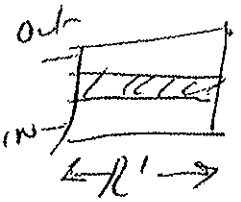
Temperature _____

Sample Data

Type of Sample	Time	Value/Sample ID	Comments
ODM	11:51	OD-107	
ORS	11:56	ERS-107	
H_2S	11:59	0.003/0.003	
MB	12:00	ND <0.05	

H_2S in 0.87/0.97/1.1

Location Sketch



SURFACE FLUX MEASUREMENT DATA FORM

6/2/04 SAMPLERS GBS/TC

ION LOVELAND WWTP - AERATED GRIT CHAMBER

CE DESCRIPTION TURB. MIXED ~~INFLUENT~~ AERATED

NT ACTIVITY WELL - ENTRAINED AIR

UMENT TYPE JB31X I.D. NO. ______ TYPE ______ ID NO. ______

UMENT BASELINE ______

CT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
NT CONCENTRATIONS

ER I.D. D COLLAR PHOTO TAKEN: Yes ☒ No ☐

ER SEAL Y CONDENSATION: Yes ☒ No ☐ BARM PRESS ______

NT CONDITIONS: Sun ☒ P.Sun ☐ Cloudy ☐ Wind at 5', 3 mph Wind at Seal, ____ mph

66° RAIN: Yes ☐ No ☒ Comment ______

CHAMBER CLEANING: Full Wash ☒ NO SOAP Wet Wipe ☐ Dry Wipe ☐ None ☐

E LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☒ Used ☐

AIR UHP CC — SUPPLIER SM PSIG START — PSIG STOP ______

e	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) JB31X	TUBE NH3	Sample Number	Comments
	5.0	0								LIQ - 61°
	↓	1								5 PULLS NH3 N21
		2					>50			
		3					HL			
	#49L	4					HL			
		5	61°		61°	66	4.3	0.2 ppm	OD-108/109	
									EA3-108/109	
						H2S TUBE				
							60 ppm	N3 2 PULLS		REPL

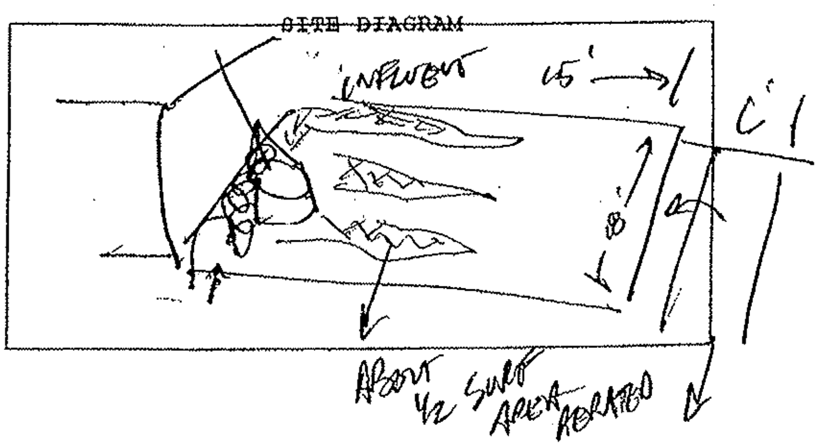
TS: ENTRAINED AIR

pH 7.05 18.05°C HYDROGEN SULFIDE 2 MG/L

R. TRUE CH4 RENTAL

ME

17
21 21 SEC
25 0.35 MIN ≈ 49 L/MIN



SURFACE FLUX MEASUREMENT DATA FORM

DATE 6/2/04 SAMPLERS CES ITC

LOCATION DIGESTED SLUDGE / SLUDGE TRUCK

SURFACE DESCRIPTION SLUDGE IN TUB

CURRENT ACTIVITY —

INSTRUMENT TYPE JB31X I.D. NO. _____ TYPE _____ ID NO. _____

INSTRUMENT BASELINE _____

PROJECT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
AMBIENT CONCENTRATIONS _____

CHAMBER I.D. D-TUB PHOTO TAKEN: Yes ☒ No ☐ _____

CHAMBER SEAL SEALED IN TUB CONDENSATION: Yes ☒ No ☐ BARM PRESS _____

AMBIENT CONDITIONS: Sun ☒ P.Sun ☐ Cloudy ☐ Wind at 5', 3-5 mph Wind at Seal, _____ mph

TEMP 80° RAIN: Yes ☐ No ☒ Comment _____

PRIOR CHAMBER CLEANING: Full Wash ☒ WATER Wet Wipe ☐ Dry Wipe ☐ None ☐ _____

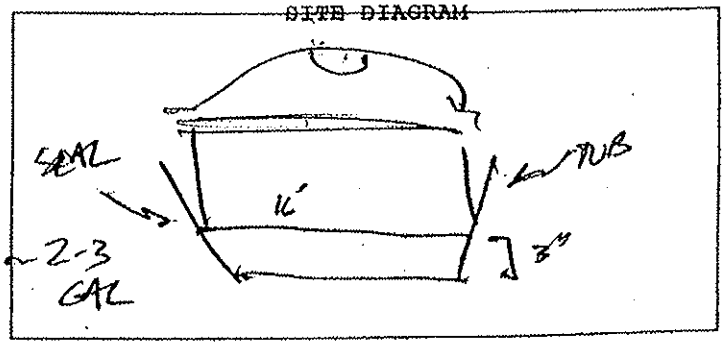
SAMPLE LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☒ Used ☐

SWEEP AIR UHP CC — SUPPLIER SM PSIG START _____ PSIG STOP _____

Time	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) JB31X	Real-Time (ppmv) TUBE NH3	Sample Number	Comments
1255	5.0	0								SLUDGE 99°
1301		1								
1307		2								
1313		3							V=1 L Rec 500ppmv	
1319		4					1.8	85		
1325		5	94°	94°		80°	2.1			OD-110
							2.1			PAS-110

COMMENTS:

SITE DIAGRAM



SURFACE FLUX MEASUREMENT DATA FORM

6/2/04 SAMPLERS CES/TC

TION Loveland WWTP

ACE DESCRIPTION DIGESTER OVERFLOW WELL

ENT ACTIVITY GRAB SAMPLE - FUGITIVE WELL EMISSIONS

RUMENT TYPE TVA1X I.D. NO. _____ TYPE _____ ID NO. _____

RUMENT BASELINE —

ECT QC: BACKGROUND MEASUREMENTS ☐ BLANK MEASUREMENTS ☒ REPLICATE MEASUREMENTS ☒
ENT CONCENTRATIONS _____

BER I.D. D PHOTO TAKEN: Yes ☒ No ☐ _____

BER SEAL NO - ON GRATE CONDENSATION: Yes ☐ No ☒ BARM PRESS _____

ENT CONDITIONS: Sun ☒ P.Sun ☐ Cloudy ☐ Wind at 5', ____ mph Wind at Seal, ____ mph

_____ RAIN: Yes ☐ No ☒ Comment _____

CHAMBER CLEANING: Full Wash ☒ WATER ONLY Wet Wipe ☐ Dry Wipe ☐ None ☐ _____

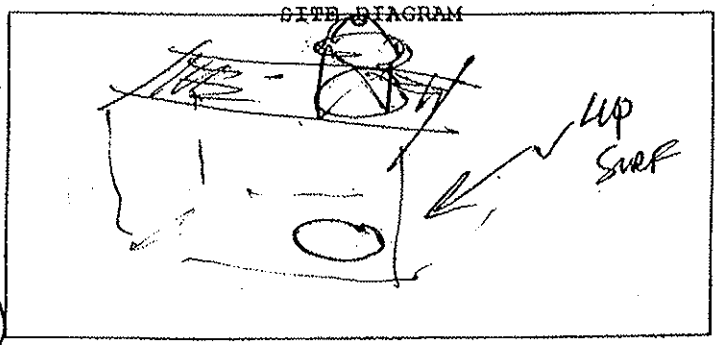
E LINE: BACK FLUSHED PRIOR TO START ☒ PURGED PRIOR TO SAMPLING ☒ New ☒ Used ☐

AIR UHP CC — SUPPLIER SM PSIG START 900 PSIG STOP _____

e	Sweep Air (L/min)	Residence Number	Temperature (°F) Chamber Surf	Chamber Air	Ambient Surf	Ambient Air	Real-Time (ppmv) TVA1X	Real-Time (ppmv) TVA1X NH3	Sample Number	Comments
	5.0	0								N=1
	↓	1								5 PUMPS
		2								
		3			NA					
		4					11	0.8 ppmv		
		5					18			OD-111
							6			EAS-111

NTS: * DIGESTER GAS
4000 PPMV H_2S
MEDIA
443 BLANK OD-112
CHECK EAS-112
FLOW
3' 20" 3.33 MIN
5 16.5 LITERS 16.7L OR 17L

SITE DIAGRAM



Environmental Management Consulting
Chain of Custody Record

Organic Reduced Sulfur

Form Serial Number EMC F1-00741	For Information Regarding These Samples Please Contact:	Client Address and Phone Number	Laboratory Name
Client Name: Loveland WWTP, CH2M HILL	Thomas R. Card Environmental Management Consulting 41125 278th Way SE, Enumclaw, WA 98022 360-802-5540 Fax: 360-802-5541 E-Mail: trcard@earthlink.com	PO Box 91500 Bellevue, WA 98009-2050 425-453-5000	EAS
Project Manager: Ms. Jennifer Barnes		Analysis Requested: TO-14 for ORS	Laboratory Address: 173 Cross Street, San Luis Obispo, CA 93401
Requested Completion Date			Laboratory Phone: 805-781-3585
			Laboratory Contact: Dr. Steve Hoyt

Station Number	Date	Time	COMP	GRAB	Sample ID Number	# OF CONTAINERS	Bag	Can	Tube	TO-14 for ORS	Remarks H_2S
	6/2/2004	0717		x	EAS-101	1	x			x	Screen 28 ppmv
	6/2/2004	0750		x	EAS-102	1	x			x	25
	6/2/2004	0815		x	EAS-103	1	x			x	4.1
	6/2/2004	0916		x	EAS-104	1	x			x	18
	6/2/2004	1015		x	EAS-105	1	x			x	0.02
	6/2/2004	1121		x	EAS-106	1	x			x	0.014
	6/2/2004	1150		x	EAS-107	1	x			x	0.003
	6/2/2004	1216		x	EAS-108	1	x			x	60
	6/2/2004	1216		x	EAS-109	1	x			x	60
	6/2/2004	1325		x	EAS-110	1	x			x	2
	6/2/2004	1430		x	EAS-111	1	x			x	10
	6/2/2004	1440		x	EAS-112	1	x			x	0
	~~6/2/2004~~			~~x~~	~~EAS-113~~	~~1~~	~~x~~			~~x~~	

Sampler [signature]	Date/Time 6/2/04 1745	Relinquished by [signature]	Date/Time 6/2/04 1520	HAZWRAP/NEESA Y N
				QC Level 1 2 3
Recieved by	Date/Time	Relinquished by	Date/Time	COC / Ice
				Ana Req / Temp AMB
Recieved by	Date/Time	Relinquished by	Date/Time	Cust Seal / pH
				Sample Condition
Recieved by Laboratory	Date/Time	Sample Shipped Via: UPS FEDEX BUS Hand Other	Air Bill No.	

Remarks

Chain of Custody Record

Odor

Form Serial Number	EMC F1-00741
Client Name	Loveland WWTP, CH2M HILL
Project Manager	Ms. Jennifer Barnes
Requested Completion Date	
For Information Regarding These Samples Please Contact:	Thomas R. Card, Environmental Management Consulting, 41125 278th Way SE, Enumclaw, WA 9802, 360-802-5540 Fax: 360-802-5541, E-Mail: trcard@earthlink.com
Client Address and Phone Number	PO Box 91500, Bellevue, WA 98009-2050 425-453-5000
Laboratory Name	St. Croix Sensory
Laboratory Address	3549 Lake Elmo Avenue North, Lake Elmo, MN 55042
Laboratory Phone	651-439-0177
Laboratory Contact	Ms. Donna McGinley

Analysis Requested

Station Number	Date	Time	COMP	GRAB	Sample ID Number	# OF CONTAINERS	Bag	Can	Tube	ASTM E-679 Det.	ASTM E-679 Rec.	ASTM E-544 Intensity	Dose-Response	Remarks
	6/2/2004	0717		x	OD-101	1	x			x	x	x	x	
	6/2/2004	0750		x	OD-102	1	x			x	x	x	x	
	6/2/2004	0815		x	OD-103	1	x			x	x	x	x	
	6/2/2004	0916		x	OD-104	1	x			x	x	x	x	
	6/2/2004	1015		x	OD-105	1	x			x	x	x	x	
	6/2/2004	1121		x	OD-106	1	x			x	x	x	x	
	6/2/2004	1150		x	OD-107	1	x			x	x	x	x	
	6/2/2004	1216		x	OD-108	1	x			x	x	x	x	
	6/2/2004	1216		x	OD-109	1	x			x	x	x	x	
	6/2/2004	1325		x	OD-110	1	x			x	x	x	x	
	6/2/2004	1440		x	OD-111	1	x			x	x	x	x	
	6/2/2004	1440		x	OD-112	1	x			x	x	x	x	
	~~6/2/2004~~			x	~~OD-113~~	~~1~~	~~x~~			x	x	x	x	

Sampler [signature]	Date/Time 6/2/4 1430	Relinquished by [signature]	Date/Time 6/2/04 1500	HAZWRAP/NEESA Y N
Recieved by	Date/Time	Relinquished by	Date/Time	QC Level 1 2 3
Recieved by	Date/Time	Relinquished by	Date/Time	COC / Ice; Ana Req / Temp AMB; Cust Seal / pH
Recieved by Laboratory	Date/Time	Sample Shipped Via: UPS FEDEX BUS Hand Other	Air Bill No.	Sample Condition
Remarks				

File: Loveland Forms.xls Form: SCS COC D1