APPENDIX A

PHASE I FIELD NOTES

PBR
PILOT STUDY

NATIONAL
416
FIELD / TRANSIT BOOK

Property of Foster Wheeler Environmental

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This Book is manufactured of a High Grade 50% Rag Paper having a Water Resisting Surface, and is sewed with Nylon Waterproof Thread.

INDEX

11/17/01 NOTES

- Confirm wattage of influent tank heater (check w/ manufacturer)

- Water transfer pumps
  - need pump curves for 1/2 hp units

- Check FLA reqts for system vs. panel (M. Gab)

- Electrical for WTP
  - See if lowest flow (0.5 gpm) is feasible w/o VFD (which controls impeller speed)
  - Plug in vs. relay

3122101 "Start-up" Begins

815 Arrived onsite. M. Goh and D. Hemans already onsite.

850 Purging lines from Aerobic bioreactor
Fill EQ Tank 2
Pump through bioreactor, sand filter (currently empty) and into EQ Tank 3 + Baker Tank
ΔP through aerobic bioreactor v. high - shut down & check bioreactor for plugging

915 Dave Hemans finished installing heat trace - all plug in-s to receptacle #33 (no breaker, but GFCI)
Install union (wait for glue to dry)

940 Dave Hemans departs site. Prepare to backwash IX units

1005 Begin process of flushing anaerobic bioreactors

P-4
~~Pressure on outlet (discharge v. low~~
Pressure on outlet of bioreactors low (1-2 psi), but sufficient to pump into EQ-1

1050
IX-1 - pumped about 150 gal through in backwash
Reverse flow direction (inlet → outlet) to test ΔP
Vessel IX-1 ΔP about 10 psi (10 on outlet)

1105 - Begin backwashing IX-2

Observed pressure on outlet of bioreactors increase to about 7 psi/each

1120 - IX-2 - finish backwash
Reverse flow direction
ΔP about 10 psi through column (20 in, 10 out)

1145 Depart site to PU Insulation for T-1, Insula Tanks, and lunch

1340 Return to site.

1345 Work on installing tank insulation

1620 Finish installing insulation except for roof of T-1 (need 1 more roll + rope)

1650 Depart site.

→ Tiely

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3-22-01

805 Arrived onsite. M. Goh already onsite.

Brought fire extinguisher from office to use for project duration.

815 Begin working on moving bag filter from immediately downstream of EQ Tank 1 to immediately downstream of EQ Tank 2 (after aerobic bioreactor, sand filter).

900 Complete re-installation of bag filter.

— Drawing Aerobic Bioreactor Tank (Need to re glue water inlet)

930 Working on priming metering pumps

Needed to repair check valves — gasket was floored to ball preventing flowthrough —

in process broke acrylic block flowmeter. Need to order 1 additional along w/ possibly a (1/2" x 1/4") ~~adaptor~~ reducing bushing.

1030 Begin installing secondary containment.

1115 Departed site for ICI

1315 Return to site

Assist w/ loading sand in filter drum, filling sand bags.

1445 Testing flow through of bioreactor + sand filter

For Monday, need 1/2" x 3/4" adapters (x 2) to install "vent" for aerobic bioreactor

1530 Clean up + depart site. M. Goh ~~[illegible]~~ remains onsite.

Sand Test

3-26-01

0815
Arrive onsite. M. Gelb already onsite.

Prep. to drain water from second holding tank. Need to flush fines from tank.

930
Preparing to circulate hose water through GAC + into the inocula tanks.

1005
Begin pumping GAC-filtered hose water into R-1 inocula tank.

Tank filled w/ 155 gal tap water

1100 Energize thermostats for R-1 to R-3 inocula tanks @ 90°F

1130 M Losi arrives onsite w/ media, bacterial cultures, etc.

1145 - 12N Break for lunch

Begin setting up "lab"

Unload pH meter and standards, bottles for PCR analysis, 6 perchlorate standards and reactor additives

R-1:
Na Ac
Perclace

R-2:
Food Processing waste & Compost
EtOH

R-3:
JPL Isolates
NaAc

- Mineral Salts (for each reactor, 1 L water)
- Sodium Perchlorate (for each reactor, 23.25 g)

1225 Check T, pH, conductivity of inocula tanks

I R-1: 17.5°C
I R-1: 17.7°C
I R-3: 17.6°C

1230 Begin inocul. Tank circulation through bioreactors (R-1, R-3). Problems initially w/ R-1 (R-2 start ~ 1255).

1345

Adding ClO_4^-, mineral salts, trace element solutions (still yet to add: carbon source
bacterial cultures)

1355 Tutorial on use of ClO_4^- probe

Black probe – ClO_4^- standard
Yellow probe –

1. Fill D.I. bottle about ½ full from stock sol'n
2. Check perchlorate standards (6 bottles) pull out of refr. + let equilibrate to room temp.
3. Pull out + rinse off both electrodes w/ D.I. water into waste container; shake off excess water
4. Put both probes in D.I. water bottle
5. Set instrument to "mV"
6. Place electrodes in ClO_4^- standard #6 (100 ppm);
7. Put #6 standard on magnetic stirrer;
   calibrate instrument to 150 mV [if possible]
8. Pull electrodes out of #6 sol'n; rinse w/ D.I. water

$$\frac{51.5}{160} = \frac{x}{150}$$

$$x = 51.5 \times 150 / 160 = 47.9$$

$$\frac{51.5}{160} = \frac{x}{100} \rightarrow x = 31.9$$

(9) Record reading in table

(10) Test remaining standards (repeat steps 6-9)
Start w/ standard #6, then run 1→5.

1415
Prepare to collect samples to test for ClO_4^- –

100 mL grad. cylinder – measure 98 mL into sample bottle

(11)
Collect samples from R-1, R-2, R-3 into bottles; add ammonium sulfate (ISA) 2 mL, into each bottle, using pipet

(12) Decon. pipet w/ D.I. water

(13) Mix R-1 sample
Test / Record

(14) When finished testing samples, dump contents of bottle into cup + rinse thoroughly w/ D.I. water.

1500 Working on insulation for air compressor

Possible Options for relieving air pressure in aerobic bioreactor –

(1) Install PRV on discharge line of bioreactor

(2) pipe discharge of bioreactor directly to EQ tank (bypass sand filters)

1540 Took temp readings in T-1,2,3
28.2 – 29.2 °C ; T gauges
Inlet/outlet reading about 82°F / ~~78~~ 78°F
Turned down thermostat to ~~90~~ 80 or 85 °F
on each Inocula Tank

1545 Prepare to collect ClO_4^- samples.

1600 Takings readings – All ~50 mV
(something is awry – these are much too low)

– Test Std. #6

– Retest R1 – 177
R2 – 176
R3 – 174

1630 Clean up + depart site.

Paul Trent

3-27-01

0730 - Lost on-site. Measured temps in start up tanks @ 35°C. Reduced thermostats to 20°F.

0745 - Calibrated pH meter w/ Frankenberger's probe - works fine

0805 Take temp. readings

I/ R1 - 35.4°C
I/ R2 - 33.1°C
I/ R3 - 34.2°C

0830 - called Mark Cutler - GW pH's over 1994 - 1995 → 7.2 → 7.8

0845 Collected ClO_4^- samples from R-1, R-2, R-3

0850 pH readings:
R-1 → 7.61
R-2 → 7.50
R-3 → 7.55

0920 Add approx. 7 lb ice to each reactor to cool contents.

0936
0942 - added 5 ml of ClO_4^- probe working fine

0940 took ClO_4 readings
R-1 131 mV
R-2 167
R-3 170
~ 50 rpm

Roughly the same as yesterday
0942 added 11.625 g $NaClO_4$ to each reactor tank need to get to ~ 157 mV (100 rpm)

0950 Added 14 lb ice to each inoculum tank (additional to original 7 lb added per tank)

1025 Measured ClO_4^- cons. in samples.
R1 - 168 mV
R2 - 163 mV
R3 - [illegible] mV

1030 Adding 11.625 g ClO_4^- to each reactor

1050 Collect samples from R-1 / R-2 / R-3

Measuring for ClO_4^-:
R1 - 161 mV
R2 - [illegible] mV
R3 - 156

* T of standards + samples should be approx. equal (w/ 5°C) b/f taking ClO_4^- reading

pH meter calibration:

For pH 7 std. — use "calibrate" knob to adjust

For pH 10 std. — use "slope" knob to adjust

1100 Add Acetate/Ethanol

PCR samples

Sample	#	Time (t = 0)
PCR —	R-1 — 0	11:30
PCR —	R-2 — 0	11:30
PCR —	R-3 — 0	11:30

→ Resample test ClO_4^- conc. 1120

R-1 ~~161~~ 156 mV

R-2 — 157 mV

R-3 159 mV

1130 Check inlet/outlet pressures

R1 In — 18 psi → 26 psi
Out — 4 psi → 0 psi

R2 In — 26 psi
Out — 0 psi

R3 — In 26 psi
Out 0 psi

1130 Add food processing waste to R2

1135 Add perclase to R1
Add JPL to R3
~~mixed~~ culture

1142 Throttled up system flow INCLINATE REACTORS

ΔP — R1: 18-3
R2: 20-5
R3: 18-5

1225 Taking samples for pH and conductivity and ~~to collect~~

ClO_4^-

R-1: T — 30.1°C
pH — 7.5[illegible] — 7.65
cond. — ~~N~~ mV ~~/cm~~ → inaccurate (probe must be submerged)

R-2: T — 29.[illegible]°C
pH — 7.46
cond. — ~~[illegible]~~ ~~m~~ ~~/cm~~ → inaccurate

R-3 T – 30.1°C
pH – 7.67
cond. – ~~X~~

1390 Check conductivity –

R-1 2.32 dS/m –
R-2 1.57 dS/m
R-3 2.32 dS/m –

1500 Checked T of Inocula tanks
T ranges btwn. 32.7 – 33.6°C
90.9–92.5

Removed most of insulation (except bottommost strip) from 3 Inocula tanks.

1510 Clean up + depart site.

~~Pond Tech~~

Tomorrow
1– Install baffles to minimize turbulence in Inocula tanks (OK to shut down pumps for a few minutes) Pipe inlet flow to below surface
2– seal openings where heat trace bulb is wired through ✓
3– back down flow as far as possible ✓

4– recheck T in AM
If low – install insulation
If high – may need to add ice

3/27
3– Backed down flow to about 2–3 gpm
ΔP ~ 28 psi per vessel

3-28-01

745 D. Tietje arrived onsite.

Take standards out of refr.

Check system Parameters

R-1 / I-1

ΔP = 28 psi

T = 74°F (from gauge)

23.1°C (73.6) (from probe)

R-2 / I-2

ΔP = 29 psi ~~(from gauge)~~

T = 74°F (from ~~probe~~ gauge)

23.0°C (73.4) (from probe)

R-3 / I-3

ΔP = 28 psi ~~(from gauge)~~

T = 78°F (from ~~probe~~ gauge)

24.5°C (76.1) ~~from~~ probe

- Collecting samples for ClO_2 - readings + parameters check

- Had to open up valve for R-2 - insufficient flow to collect sample

check / Calibrate pH meter w/ 7 and 10 standards

pH 7 standard - probe reading 7.01 - ok

pH 10 standard - probe reading 10.00 - ok

Check pH, T, EC of samples (collected in polystyrene cups)

R-1

T : 21.8°C

pH : 7.39

EC : 2.05 ~~mS/cm~~ dS/m

R-2

T : 21.6°C

pH : 7.04

EC : 1.46 dS/m

R-3

T : 22.8°C

pH : 7.30

EC : 2.30 dS/m

845 Spoke w/ Los1 - told me to record T I took from inside tanks; told me to install insulation + check T inside the tanks again b/f I leave site.

850 Begin working on installing toilet piping in I-11

915 Finished installing inlet pipe in I-1
... waiting for glue to dry
Shut off flow into I-2
Begin I-2 inlet pipe installation

925 Finish installing inlet pipe in I-2

935 Begin installation of inlet pipe in I-3 – Shut off flow into I-3
Using 90° Sch 80 from US F)

1000 Finish installing inlet pipe in I-3

1010 Begin checking ClO_4^- calibration standards

Standard # 6 – 157
#1 – 262-3
#2 – 215
#3 – ~~190~~ 189 DT
#4 – 173
#5 – 165

1030 Adding ISA to each of 3 samples to be tested

Added 2 mL to R-1, R-2; 3 mL to R3
(may need to retest)

Checking ClO_4^- conc. of R-1 – 258 → 263
R-2 – 148 –
R-3 – 238 (-4)

R-1 = 1.5 ppm
R-3 = 3.0 ppm

Called Mark Leal: He requested I restart the circulation in each reactor & collect another sample in 30 – 60 min.

100 Re-started Inocula Circulation Systems – Difficulty getting P-1 to prime, open valve to Mixing Tank 1 + allow pump to pull some fresh water into system.

Working on installing insulation on I-1, I-2, I-3

150 Collecting samples from R-1, R-2, R-3
Preparing samples for ClO_4^- probe
Add 2 mL 2M $(NH_4)_2SO_4$

R-1 – ~~297~~ → 303 .. *

R-2 – ~~154~~ (steady)

R-3 – 290 – 43 ...

* may be reading low due to dilution from tap water introduced during system re-start

1215 Lv site to go pu lunch, pu duct tape / get gas

Continued sampling results w/ Lori – said we will want to sample / read results again tomorrow AM

1315 Working on cleaning up from sampling.

Work on completing insulation for I-3.

1345 Checking System Parameters –

Temp.

R1 (T1) Probe – 262 °C (504.2 °F)
Gauge – 80°F

R2 (T2) Probe – 275 °C (81.5 °F)

R2 (T2) (cont'd)
Gauge – 81°F

T3
Probe – 28.7 °C → (83.7 °F)
Gauge – 84°F

ΔP –

P1 – 10 psi
P2 – 20 psi
P3 – 25 psi

Leaks – ✓

Flow –

1400 –

Throttled valves back on T1/R1
T2/R2

ΔP – 20 – 25 psi / all 3 systems

Flow out into T-2, low flow into T2

Opened valve for T-2/R-2, decr. ΔP. to ~ 15 psi.
T-1/R-1 (?)

Clean up & Depart site.

[signature]

3-29-01

800 Arrive onsite, D. Tietje.

Take standards out of refrigerator.

Equipment check — OK

ΔP — R1/T1 — 18
(psi) R2/T2 — 24
R3/T3 — 27

TEMP.	GAUGE		PROBE	
	R1/T1	78°F	R1/T1	25.5°C
	R2/T2	80°F	R2/T2	25.8°C
	R3/T3	82°F	R3/T3	27.2°C

[Note Air Temp ~ 16.9°C]

815 Collect samples for parameters check/ ClO_4^- probe.

820 Check pH probe calibration

pH 7 standard — reading 7.04 ⟹ adjust cal knob until reading is 7.00.

check pH 10 standard — reading 10.01 — OK.

[illegible] Checking parameters for R-1 w/ YSI 3500 monitor

Temp. — 23.4°C
pH — 7.55
Cond. — 1.93 dS/m

840 Checking parameters for R-2

Temp. — 23.4°C
pH — 7.14
Cond. — 1.54 dS/m

Checking parameters for R-3

Temp. — 24.2°C
pH — 7.57
Cond. — 2.17 dS/m

Waste samples —
Record parameters —

900 Observed small amount of air/water leakage at outlet fitting of drum/R-2 — very little water / this is nothing new
Added a little glue in this area; may want to consider adding a sealant —

920 Backed off pressure on T2/I2 to ~ 20 psi

930 Check standards + samples - all about same temp.

Checking calibration standards w/ pH probe

Std #	Rdg (mV)
6	155
1	2684
2	214
3	193
4	176
5	163

940
Add 2 mL 2 M $(NH_4)_2SO_4$ to each system sample.

945

R1	reading w/ ClO_4^- probe	-	296 (306)	mV
R2	"	" -	151	mV
R3	"	" -	294 (300)	mV

1000 Spoke to M. Losi

- Need to pickup chemicals from CEM:

✓ ClO_4^-

✓ Acetate

- need to add ClO_4^- today and measure ClO_4^- today and tomorrow, and possibly ~~measure~~ add ClO_4^- tomorrow along w/ acetate to reactor #2

Mark is checking to confirm lab availability of chemicals

1005 Spoke w/ M. Goh concerning researching/order an air pressure relief valve - he will be looking into this

210 E to 10 E to 15 S to 60 E

Exit Spruce, turn left;
Turn left on Chicago
on Chicago 1660 Ste M-2
(909) 788-6808
Heidi /

Balance, Electronic

Na ClO_4^-, 150 g

Acetate,

Spatula Boats
Weighing Boa

1055 Depart site for CEM – Riverside

1200 Pick Acetate, 10 kg, ClO_4^-, weighing boats, spatula, lab equipment at CEM – Riverside

1350 Return to site.

1400 Spoke to M. Losi – $NaClO_4$ – weigh out 24 g – 23.25 g add to R1, R3; let circulate for 30 min.; collect sample + read (+ do not need to re-test standards).

1415 Added 23.25 g $NaClO_4$ to R-1

1425 Added 23.25 g $NaClO_4$ to R-3

1430 Prepare to test Cal. Std. # 6 – rdg. is 150 (note: standard was in refr. for 4 h since tested)

1445 Checking system temperature, based on gauge –

T1/R1: 88 °F

T2/R2 – 88 °F

T3/R3 – 90 °F

+ ΔT since AM reading ~ 8–10 °F

1455 Retesting Std. #6 → Reading 154

1500 Collect samples from R-1, R-3
Add 2 mL $(NH_4)_2SO_4$
Test for ClO_4^-

1503 R1 – Reading [illegible] mV ⇒ [illegible] ppm

1506 R3 – Reading [illegible] ⇒ [illegible] ppm

Spoke to Losi to report results.

Add 23.5 g additional to each reactor

Wait 30 min. + remeasure

1515 Add 23.5 g to R1 ($NaClO_4$)

1520 " " R3 ($NaClO_4$)

1605 Collect samples from R-1, R-3 effluent

1610 Add 2 mL each $(NH_4)_2SO_4$

1613 Read ClO_4^- to R-1 sample w/ ClO_4^- probe

⇒ 199 mV (~ 17.1 ppm)