1618 Read [$CrO_4^-$] in R-3 sample w $CrO_4^-$ probe — 180 mV (~32.4 ppm)

1625 Recollected samples, R-1 & R-3 effluents

Pipet 2 mL $(NH_4)_2SO_4$ to each sample.

Rdg for R-1 — 217 mV (16.15 ppm)
R-3 —

* Don't think that $CrO_4^-$ has completely mixed — this is reason for up + down results.

1640 $CrO_4^-$ reading — 190 mV (~25 ppm)

1645 Final Equipment check

R-1 ΔP = 21-3 psi ; T = 90°F
R-2 ΔP = 19-4 psi ; T = 90°F
R-3 ΔP = 26-0 psi ; T = 92°F

Clean up & depart site.

David Tietje

3-30-01

750 D. Tietje onsite

Equipment check — OK

R-1 ΔP — 21-3 psi
T — 80°F

R-2 ΔP — 19-4 psi
T — 80°F

R-3 ΔP — 26-0 psi
T — 91°F

Consider ① Opening valve to incr. flow Through R-3
② Removing insulation from Inocula tanks

805 Collect samples from R-1, R-2, R-3 effluent

810 Calibrate pH probe

• Check pH 7 standard — pH 6.98 — OK
Adjust to 7.00 ✓

• Check pH 10 standard
– reading 10.00 ✓

Checking parameters – R1

T – °C – 23.2 °C → 73.8 °F
pH – 7.47
cond (mS/m) – 2.07

R2 parameters

T – °C – 23.7 → 74.7 °F
pH – 7.05
cond – 1.55

R3 parameters

T – °C – 24.0 → 75.2 °F
pH – 7.39
cond – 2.31

920 Tried to reduce ΔP through R1 However, even by opening valve 100%. Inlet pressure does not decrease.

930 Preparing to test $ClO_4^-$ standards w/ $ClO_4^-$ probe
Readings
#6 Std – 157 mV 935 ✓
#1 Std. – 268 mV 939 ✓
#2 Std. – 212 mV 942 ✓
#3 Std. – 192 mV 945 ✓
#4 Std – 174 mV 949
#5 Std. – 164 mV 951

952 Add 2 mL $(NH_4)_2SO_4$ to each system sample

958 ✓ Checking $ClO_4^-$ conc. in R-2 sample. Reading is 453 mV, indicating 0 ppm $ClO_4^-$.

1005 ✓ Checking $ClO_4^-$ conc. in R-1 sample. Reading is 296 mV, indicating < 1 ppm $ClO_4^-$.

1007 ✓ Checking $ClO_4^-$ conc. in R-3 sample. Reading is 295 mV indicating < 1 ppm $ClO_4^-$.

1095 Spoke w/ Mitch. He advised I will be adding some Acetate to R-2, and we will be introducing some groundwater into the system possibly Monday, and that Mark will call me back to discuss.

Spoke w/ Mark Losi

1115
- Open vlds to Inocula tanks & cut off inlet lines - reactor in aerobic mode
- Add Acetate to ~~R-1~~ Reactors - ~~762~~ g to R-1 and R-3 131.3
- Remove Insulation ✓

1130 Begin work on the above tasks

1230 Added 131.5 g NaAc to R-1
Throttled back flow through R-1 to match (as closely as possible) flow through R-3

1250 Confirmed w/ Losi - leave R-2 as is

Record Temps. & ΔP's

| | | |
|---|---|---|
| R-1 | T - 88°F | ΔP ~ 28 psi |
| R-2 | T - 88°F | ΔP ~ 16 psi |
| R-3 | T - 90°F | ΔP ~ 28 psi |

Increased ΔP through R-2 by closing valve slightly → ΔP now 23 - 3 = 20 psi.

1300 - Clean up / depart site.

Round Trip

2APRIL 01

0730 Losi + Goh on-site
Losi brings aquarium pump
+ equip for aerobic reactor

0800 Take readings –

| | R1 | R2 | R3 |
|---|---|---|---|
| pH | 8.3 | 6.92 | 8.40 |
| TEMP | 18.2 | 19.0 | 19.2 |
| EC | 1.91 | 1.52 | 2.19 |

0830 M. GOH WORKING ON SYSTEM.
PLAN TO START-UP TOMORROW

0915 LOSI LEAVES TO GET SANDBAGS
+ SAMPLE BOTTLES. $ClO_4^-$
samples + STDS EQUILIBRATING
(TEMP)

~~1030~~ Losi Back w/ Sand + Bottles
Stdize $ClO_4^-$ probe

| Readings: | MV |
|---|---|
| R1 | 295+ |
| R2 | 216 |
| R3 | 296+ |

unload sand + Bottles

1:30 Losi to CEM to get chemicals

1:30 Losi back on-site; GOH
still working on system

2APR01

Need to bring $[ClO_4^-]$ in R1 + R3 to ~
100ppm to verify presence + health
of inoculum. mL 46.6 ~
Added ~~23.3~~ g to each reactor.

| measure | | $[ClO_4^-]$ (mV) | TEMP |
|---|---|---|---|
| measured @3:30 | R1 | 158 | 21.1 |
| | R2 | ~~157~~ 297 | 22.2 |
| | R3 | ~~297~~ 157 | 21.9 |

~~Temps R1~~

Added 118.3 mL EtOH to reactor 2
(additional 0.5 g/L) to ensure
carbon/substrate not limiting, as
per today's $ClO_4^-$ reading, $[ClO_4^-]$
is dropping.

*Noticed a lot of scum on surface
of water in R2 startup tank, looks
like lots of growth/Biomass but not a
high percentage of $ClO_4^-$ reducers

2:30 Lable bottles & Numbering scheme:

PBR - 1 - I/E - ___ } experimental
DAY, influent or effluent, sampling port

3:30 take $ClO_4^-$ Readings

DPBR - 1 - E - ___ } DISCHARGE
day, eff, port (16)

Added 46.6g $NaClO_4$ to R2 as $[ClO_4^-]$ is now below 1 ppm

Final $ClO_4^-$ readings, R2 after adding $ClO_4^-$

R2 - MV = 156 mV

Summarize $[ClO_4^-]$ readings:

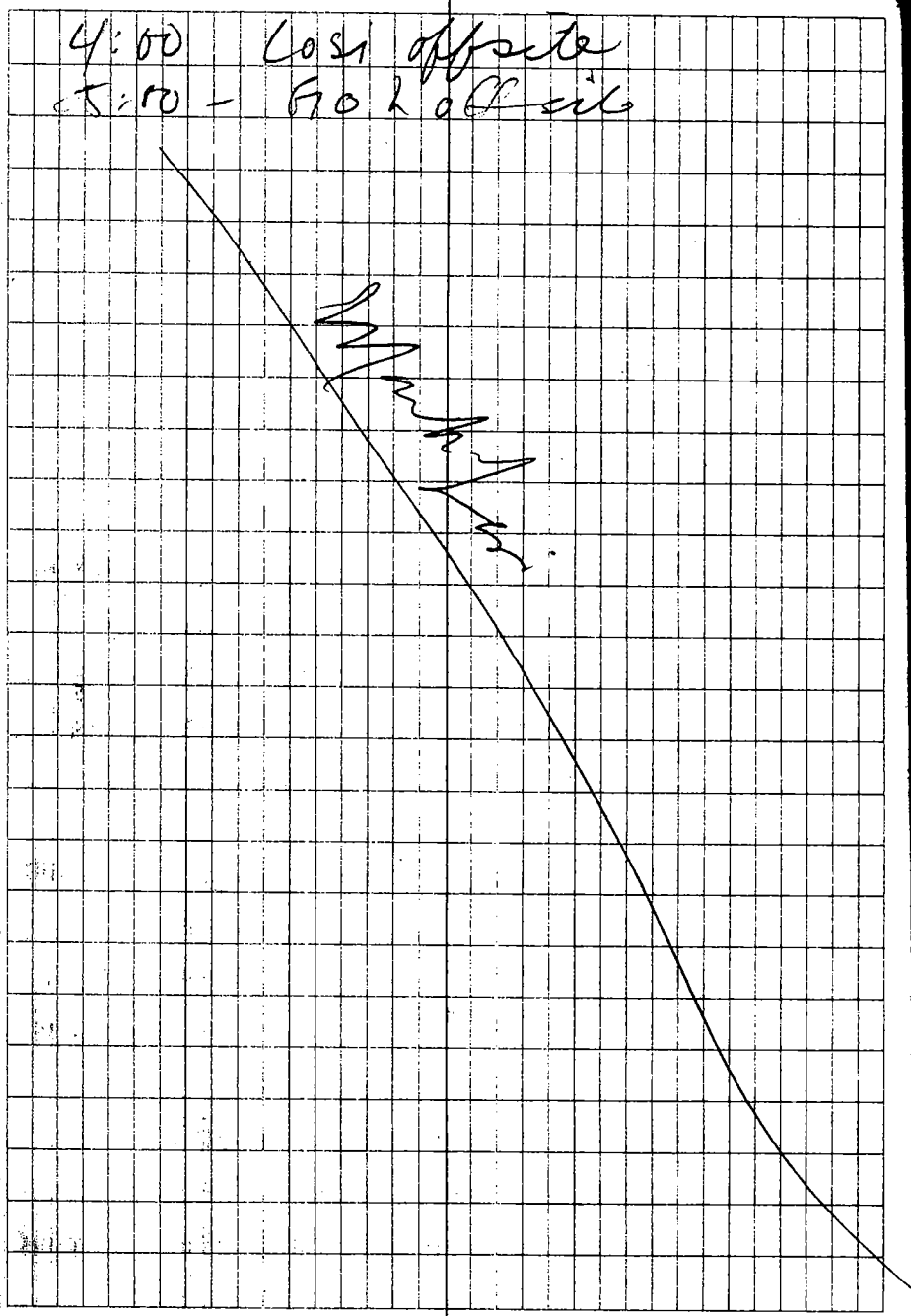
| | R1 | R2 | R3 |
|---|---|---|---|
| 10:30 | ②295+ | ①216 | ②296+ |
| 3:30 | 158 | ③297+ | 157 |
| 4:00 | 160 | 156 | 159 |

① added 0.5 g/L EtOH @ 1:30
② added 100 mg $ClO_4^-$/L @ 1:30
③ added 100 mg $ClO_4^-$/L @ 3:30

Goh having problems w/ back pressure in sand filter

close lids on Reactors, back to anaerobic

4:00 Cost effects
5:00 - H2O2 off site



3-APR-01

0745 GOA on site

0810 D. Metje onsite

Remove standards 1 & 6 from fridge

845 Collect samples from R-1, R-2, R-3 effluent. Water pressure v. low at outlet of R-3. Checked I-3 – water still circulating in/out of I-3. Opened valve at pump outlet – increased water pressure at R-3 outlet to facilitate sampling.

Check Temps. – Gauges
R-1 – 66 °F
R-2 – 68 ° F
R-3 – 68 ° F

850 Checking parameters – filled Styrofoam "cups" w/ R-effluent water at time samples were collected.
*
R-1: T – 17.0 °C
pH – 8.41
cond. – 1.87

R-2: T. – 17.5°C
pH – 4.96 → 4.97 (re-test)
cond. – 1.55

R-3: T. – 17.3 °C
pH – 8.88
cond. – 2.21
* first checked pH probe calibration

pH 7 standard – read 7.16 – calibrated to 7.00

pH 10 standard – read 9.93 – calibrated to 10.00

– rechecked pH 7 standard – OK (6.98)

910 Preparing to test $CrO_4$ standards/samples w/ $CrO_4$ probe

Standards # 6 – 158 mV ✓
# 1 – 265 mV ✓
(Per Lori, do not to read all standards to establish calibration is satisfactory).

920

Samples - ↓ w/o 2 mL $(NH_4)_2SO_4$ ↓ w/ 2mL $(NH_4)_2SO_4$

| | | | | |
|---|---|---|---|---|
| R-1 | 174 mV | 9:25 | — | |
| R-2 | 194 mV | 9:38 | 175 mV | 955 |
| R-3 | 166 mV | 9:32 | 153 mV | 945 |

Note: - Spilled most of R-2 sample. Recollected @ 935. Did not allow to reequilibrate.

- Did not add 2 mL $(NH_4)_2SO_4$ to R-1 sample.

- Added ~2.4 mL $(NH_4)_2SO_4$ to R-3 sample.

947 Recollected R-1 sample. Added 2 mL $(NH_4)_2SO_4$. Did not allow to equilibrate.

Reading w/ $ClO_4^-$ probe — 163 mV.

1010 Called Monk to discuss results + how to proceed —

① Turn on heaters

Monitor T

② Take $ClO_4^-$ rdgs. again when T's are back up in 70°s, if possible

③ Take 1/2 gal Nashua water from R-2

Fill 50 mL grad. cylinder w/ 10 M NaOH

Add dropwise into R-2 (a few mL)

Check pH

Try to adjust to 7-8

Note how much NaOH it is taking

1015 Turned on heaters for I-1, I-2, I-3; set thermostats @ 80°F

1020 Collect 1/2 gal water from I-2

1027 Test pH of I-2 water

Start: 4.89

1030 Add ~2.0 mL 10M NaOH

pH — 10.6

— start over

1035 Collect 1/2 gal water from R-2 Eff.

1040 Initial pH rdg — 4.97

Begin adding 10M NaOH

Add 15 drops - pH of 500 mL
sample is ~7.40 → 7.26

1045 Spoke to Mark Lost -

$\frac{15}{1/2 \text{ gal}} \times \frac{150 \text{ drops}}{100 \text{ gal}}$ 10 drops/mL
1/2

☆ Add 5 mL to I-2; measure pH let circulate for 15 minutes + re-test.

1055 Measure pH - 4.89

1110 Check pH - 4.93

1115 Check T of I-2 → 20.4 °C

1145 I-1 → 20.7 °C
I-2 → 20.7 °C
I-3 → 20.9 °C

1200 Depart site to PU mats to install air compressor hose into Baker Tank, encapsulate air compressor.

1345 Return to site.
Check T, pH in I-2

T - 22.3 °C
pH - 4.78

1400 Spoke to Mark
Told me to add 10 mL 10M NaOH to I-2, then check after a while, and add incrementally as needed to get the pH up to 6-6.5.

Keep heat on until just 6/7 I leave; at that time sample + take readings w/ $CO_2$ probe.

Add 10 mL 10M NaOH to I-2; pH jumps to ~5.1 initially.

1435 T-2:
Temp.: 22.9 °C
pH: 4.93

Add 10 mL additional 10 M NaOH

pH initially increases to ~ 5.4

1500 T-2:
Temp. - 23.0 °C
pH: 5.07

→ Add 20 mL NaOH
Initially, pH rises to 6.27, then starts to fall off.

1535 I-2 pH – 5.47
Temp. – 23.3 °C

→ Add 20 mL 10 M NaOH to I-2

pH initially jumps to ~6.8, then falls.

1555 Take $CH_4$ lab standards #1, #6 out of refrigerator.

1635 pH in I-2 – 5.94
T – 23.7 °C

→ Add 15 mL 10 M NaOH
pH initially @ 6.75, then falls.

1655 Collect samples for $CH_4$ analysis

1700 Pipet 2 mL 2 M $(NH_4)_2SO_4$ into each sample.

(Need more $(NH_4)_2SO_4$)

1705 Checking standard 6 –

reading is 153 mV

1715 Reading R-1 Effluent
(samples not equilibrated w/ stds.)
→ Reading : 166 mV (72.2 ppm)

1715 Took final Temp. & pH readings on I-2 –
T – 24 °C
pH ~ 6.3

1720 – Reading R-2 Effluent (28.0 ppm)
Reading : 157 mV, which indicates a reduction from this AM

1725 – Reading R-3 Effluent
Reading 161 mV, which indicates a reduction from this AM
(51.7 ppm)

1730 Spoke w/ Lost – told me to turn off heat overnight & recheck $CH_4$ concs. AM

1735 M. Goh & D. Tietje depart site.

David

4-4-01

0800 D. Tietje onsite.

0815 Check inocula tank system parameters.

Gauge Temps. ~ 66-67°F

Turn on heat trace on inocula tanks to 80.9°F

820 Collect samples to check parameters & measure $ClO_4^-$.

830 Check calibration of pH meter

pH 7 standard: reading is 6.92 - calibrate to 7.00

pH 11 standard: reading is 10.02 - calibrate to 10.00

837 Begin checking parameters

R-1: T- 16.9 °C (62.4°F)
pH- 8.14
cond- 1.95

R-2: T- 17.1 °C (62.8°F)
pH- 5.78
cond- 1.69

R-3: T- 17.0°C (62.6°F)
pH- 8.18
cond- 2.23

850 Set up water quality monitor at I-2

855 Spoke to M. Lott - told me to continue to try to bring pH up in R-2, and if we do not see any reduction in $ClO_4^-$ in R-1/R-3 to add NaAc later today.

905 Added 20 mL 10 M NaOH to I-2

915 Begin A Week on engineering tasks
① Install flowmeter for MX-3

925 Preparing to check $ClO_4^-$ standards & measure reactor samples for $ClO_4^-$

- Plot 2 mL 2 M $(NH_4)_2SO_4$ into each reactor sample.

933 Begin testing standards. Rinse + place $ClO_4^-$ probes in D.I. water bottle.

| | | | |
|---|---|---|---|
| #6 - | 160 | TIME - | 939 |
| #1 - | 2676 | | 952 |
| #2 - | 213 | | 956 |
| #3 - | 193 | | 1002 |
| #4 - | 177 | | 1007 |
| #5 - | 166-7 | | 1013 |

942 Checking pH / T of I-2

pH - 6.23

T - 18.7°C

Add 10 mL 10M NaOH to I-2

Noticed heat cable not warm / cold to touch? Checked breaker (OK).

Tested aquarium pump at both male receptacles (current #33) where heat cable is connected - no juice!

1015 Checking pH in I-2 → 6.53

1015 Testing samples w/ $ClO_4^-$ probe

R-1: 156 mV ; 1020 ; 0% $ClO_4^-$ reduction

R-2: 293+ mV ; 1026 ; 100% $ClO_4^-$ reduction

R-3: 159 mV ; 1032 ; 0% $ClO_4^-$ reduction

1040 Throttle back flows through R1/I1 and R3/I3.

Connect heat cable for I-2 to male receptacle for pump

R-3 - cable "warm" to touch after a few minutes (set thermostat to 80°F).

1045 Called Lori to discuss results -

Add NaAc to R-1, 3:

131.0 g

- ~~open up~~ R-2 - Added 96.4 g $NaClO_4$
- OK for future $ClO_4^-$ sample collection to add 1mL ISA to 50 mL sample

1100 Measured + added 131.1 g NaAc to R-1
Connected heat cable for I-1 to outlet; set thermostat @ 80°F

1120 Added 96.9 g $NaHCO_3$ to R-2

Observed heat cable for R-1/I-1 is warm

1130 Depart site to PA extension cord + lunch.

1205 Return to site.

Hook up extension cord to power heat cable for I-3 (R-3) (thermostat dial broken)

Break for lunch —

1230 Begin working on installation of aquarium air pump

1300 Begin working also on testing aerobic bioreactor/sand filter

Pump down EQ Tank 3 → into Bunker Tank
Start — 150 gal
Stop — 50 gal

1315 Check pH/temp. to I-2
— T — 21.8°C; pH — 6.32 @ outlet
Per gauges, T in line for R-1, R-2, R-3 is ~ 70°F.

1340 Aquarium Air pump installed. May need to add additional weight to keep diffuser suspended during pump down operation

Begin cycling through aerobic bioreactor & sand filter, from EQ-2 to EQ-3 —

Throttled back pump to ~ 15 psi @ inlet to Aerobic bioreactor

ΔP V small through aerobic bioreactor.

Water flowing into EQ Tank 3.

After a few minutes, observe "siphoning" of flow from outlet of sand filter.

Water comes out in surges w/ pockets of air.
Shut off air pump in EQ-2 + continue pumping.

1350
Pressure buildup in aerobic bioreactor - hear load "pop." - Turn off pump. Note leak on outlet side of drum (as well as fitting above water inlet.

1425 Per conversation w/ Vithal / Mark / Mike - repipe outlet of EQ Tank 2 to bypass aerobic bioreactor. Need to make sure a check valve is installed after the pump.

1510 Completed repiping effort -

1515 Collect samples from R1, R2, R3 effluents

1525 Check pH / Temp. in I-2
T - 23.3°C
pH - 6.14
Add 10 mL 10M NaOH to I-2

1610 Check pH / Temp. in I-2 (final check)

pH - 6.31
T - 23.6 °C
Remove probes from I-2.

1412 Check standard # 6
reading is - 157 mV

1415 Pipet 2 mL 2M $(NH_4)_2SO_4$ each into R-1, R-2, R-3 samples

1420 Reading R-1
→ 169 mV
corresponding to 58.8 ppm, indication a reduction in $ClO_4^-$ since this AM's reading + addition of acetate / hcut to R-1.

DID NOT TABULATE

1423 Reading R-2
→ 171 mV
indicating an increase in $ClO_4^-$ from the reading taken this AM, + since $ClO_4^-$ was added to the reactor.

1432 Reading R-3
→ 157 mV
indicating no change in $ClO_4^-$ conc. from this AM, despite addition of NaAc

1640 Spoke to M. Loss. Told me to turn off heaters + depart site.

1650 Departed site.

David Tietje

4-5-01

805 D. Tietje onsite. M. Goh already onsite. He collected samples from R-1 eff, R-2 eff, R-3 eff + set them out to equilibrate w/ the $CO_4^-$ stds. as per my instruction.

815 Check T's - Temp. of R-1-3 range from 65-67°F

☆ Turn on heat trace for all 3 reactors - set thermostat @ 80°F for R-1, 2

820 M. Goh working on testing secondary treatments -
Collect water from reactor effluents for parameter rdgs -

825 - Check calibration of pH probe
pH 7 standard : — reading 7.01 - ok
pH 10 standard : — reading 10.00

Checking parameters

832 R-1
T - 17.2°C
pH - 7.58
cond. - 2.14

834 R-2
T - 17.7 °C
pH - 5.502
cond. - 1.89

836 R-3
T - 17.2
pH - 7.20
cond - 2.46

840 Set YSI 3500 inside R-2 (I-2) to monitor pH / Temp.

850 Add 20 mL 10 M NaOH to I-2.

0915 Preparing to test $CO_4^-$ standards

✓ ① #6 - 159 mV 920

— ② #1 - 262 mV 925

— Make continuing to work on testing secondary treatments —

— 925 Prepare to take $CO_4^-$ readings from samples —

930 Pipet 2 mL 2M $(NH_4)_2SO_4$ each into samples (100 mL).

932 Test R-1 sample w/ $CO_4^-$ probe → reading of 213 mV, indicating a reduction in $[CO_4^-]$ since the last reading.

9.6 ppm

940 R-2 reading w/ $CO_4^-$ probe - 280 mV - indicating a reduction to <1 ppm $CO_4^-$ & representing a decrease since the last rdg.

<1 ppm

945 R-3 reading w/ $CO_4^-$ probe - 185 mV, indicating a significant reduction in $[CO_4^-]$ since the last reading

30.4 ppm

1020 Test from EQ 2 to EQ 3 OK, although pumpout rate/P is pretty low.

8.

Prepare to test IX/Carbon System from EQ 3 to Baker Tank.

1090 Test going OK
Pressure ~ 10 psi @ outlet of GAC drum
+ ~ 7 psi at outlet of IX
Flow into Baker Tank – OK ✓

1100 Pressures increase to 20, 19, 10 psi, respectively (note: suspended test for a few minutes).

1115 Spoke w/ M Losi
✓ – Do not discharge to storm drain
→ all water to Baker Tank

⊖ @ end of day, open up start-up tanks, add acetate + ethanol; cut pipe in I-2
→ ✓ pH adjust I-2 to near neutral, if possible
– sample & test for $ClO_4^-$ @ end of day

– ✓ keep on heaters for day only (until we can verify $ClO_4^-$ concs. are down)
– start-up delayed until next week

1120 Begin pumping down tap water inside EQ-1 to Baker Tank

1125 Shut off P-6, air compressor

1145 Check pH/T in I-2
pH – 5.70
T – 23.1 °C
* Add 20 mL 10 M NaOH

1200 Terminated pump-down of T-1 water level @ ℄ of outlet – pump beginning to draw air

Tank has ~ 4" water remaining; tank is 87" (D)

$$V = \frac{\pi (87/12)^2}{4} \times (4/12) = 13.8 \text{ ft}^3 \cong 103 \text{ gal}$$

1215 Depart site for lunch.

1305 Return to site

- Check pH / T of I-2

T - 24.6 °F

pH - 6.19

1315 Add 20 mL 10 M NaOH

1325 Spoke w/ M. Losi; he confirmed it is OK for me to sample in ~ 1 hour.

1330 Working on cleaning up site

1425 Prepare to collect samples
- R1, R2, R3 eff 1
- will collect 50 mL samples this go-around - will fill bottle to normal level, then measure out 50 mL in grad. cylinder (worried grad. cylinder contains residual NaOH)
- collected 100 mL per container

1435 Took standards out of refr. - set out w/ samples to allow to equilibrate

1440 Check pH / T R-2
pH - 6.67 ; T - 26.1

- Cut heat trace for all 3 reactors

1445 Add 20 mL 10 M NaOH to I-2

1500 Work on cutting inlet pipe for I-2

1505 Throttle back flow into I-2 slightly

1530 Checking standard # 6 - reading is 156 mV - OK

1538 Checking standard # 1 - reading is 267 mV - OK

1545 - Pipet 2 mL 2 M $(NH_4)_2SO_4$ each into R-1, R-2, R-3 effluent samples

Measure R-2 Eff for $ClO_4^-$ - reading is 293+ mV, indicating <1 ppm $ClO_4^-$ (no change from this AM, as expected)

DID NOT RECORD

1550 Measure R-2 Eff for $ClO_4^-$ reading is 212 mV, indicating essentially no change from this AM's

reading. DO NOT RECORD

1600
1555 Measure R-3 — reading is 187 mV, indicating a slight reduction in [$CCl_4^-$] from this morning.

1610 Discussed results w/ Lori

- Add 236.6 mL [= 1 g/L] EtOH to R-2

- Add 131.3 g NaAc to R-1 + R-3

- Add 11.6 g $CCl_4^-$ to all 3 reactors → add tomorrow

- Measure $CCl_4^-$ concs. in AM; Add $CCl_4^-$ if necessary.

1615 Added 131.35 g NaAc to R-1

1620 Added 131.3 g NaAc to R-3

236.6
- 4 x 50 mL
- 1 x 36.6 mL

- Could not measure + add precisely. Difficult to pour from source container + from "cup" into grad. cylinder. Need beaker for future.

Added ~ 200-250 mL

1640 Final check pH / T - R-2
pH - 7.09
T - 25.7°C

1650 Depart site.

Final Test

4/6/01

805 D. Tietje onsite

815 Collect samples for parameters check & $CeO_4$ readings.

Needed to open up valve on inlet to reactors 2&3 to increase flow through sample ports. Did not observed a significant increase in flow into the ~~reac~~ I-2, I-3 tanks.

830 Take standards out of refrigerator — set out to allow to equilibrate w/ samples.

835 Calibrate pH probe —

- pH 7 standard
  reading is 7.05 — calibrate to 7.00
- pH 10 standard
  reading is 9.99 — OK

840 Checking parameters —

R-3 T- 16.3°C 842
pH - 8.27
cond - 2.54

R-1 T- 14.9 °C 845
pH - 8.19
cond - 2.22

R-2 T- 15.0 °C 850
pH - 6.28
cond - 1.87

900 Spoke w/ Lisa — told me to add HCl to R-1 R-3 to bring pH down to as close to 7 as possible. and likewise add NaOH to R-2 as I have been doing.

910 Added 30 ml NaOH to R-2
Added 20 ml HCl each to R-1, R-3
w/ sample + measure pH again at ~ 10:30.

got check # + amt. data mailed
925-673-0330 — Bill V. 1 wk.

930 Prepare to test $CrO_4^{2-}$ standards

935 First checking Std. # 6 — reading is 157 mV

942 Checking Std. #2 — reading is 268 mV

945 Pipet 2 mL $(NH_4)_2SO_4$ conc. into 100 mL water for samples R-1, R-2 R-3 effluent.

* Only a few mL left of ISA soln *

950 Testing sample #2 (R-2) — reading is 285+ mV, indicating <1 ppm $CrO_4^{2-}$

955 Testing sample #1 (R-1) — reading is 286+ mV, indicating <1 ppm $CrO_4^{2-}$ + representing a reduction since the last sample taken yesterday, measured.

1000 sample #3 (R-3) — reading is 282 mV+ → <1 ppm $CrO_4^{2-}$ ; this is a reduction in $[CrO_4^{2-}]$ since last sample measured yesterday.

1015 Collect samples from R-1, R-2, R-3 effluent to check pH.

1020 Measuring pH of { R-1 — 7.88, R-2 — 8.01, R-3 — 8.07

1025 Spoke w/ Mark Losi
— Add 23.25 g $Na_2CrO_4$ to each Measure + reactor
— continue to adjust / monitor pH — want as close to 7.5 as possible
— told him we need more ISA soln

1035 Add the following —
20 mL NaOH to R-2
20 mL HCl to R-1
30 mL HCl to R-3

1045 Added 23.25 g $NaCrO_4$ to R-1

1052 Added 23.25 g $NaCrO_4$ to R-2