US EPA ARCHIVE DOCUMENT

Outer Loop Landfill, Louisville, KY Bioreactor Project

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Presentation Content

- Purpose and Objectives
- Experimental Design
- Interim Results
  - Gas
  - Leachate
  - Solids
- Next Steps

Project Objectives

- Quantify and evaluate the performance of Aerobic-Anaerobic and Facultative Landfill Bioreactors versus that of a conventional control landfill.
- Will be large enough and last long enough to evaluate economic and operational issues.
- Will generate credible data based on statistically designed studies.

Experimental Design

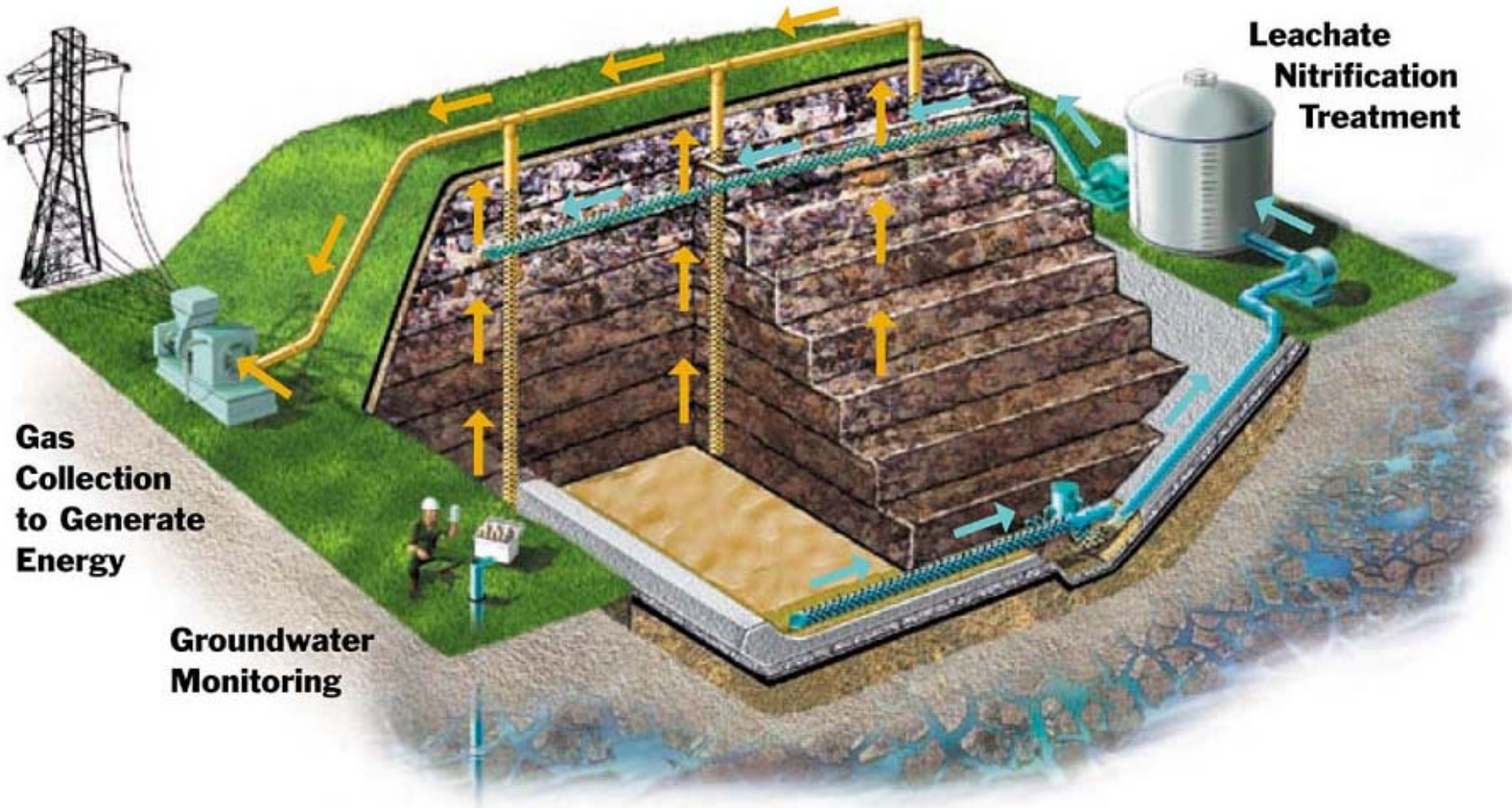
FLB 51A	FLB 52B	AALB 74A	AALB 74B	CTL 73A	CTL 73B
5-7 years old		2 years old		3-4 years old	

- FLB: Facultative Landfill Bioreactor and
- AALB: Aerobic- Anaerobic Landfill Bioreactor treatments
- CTL: Control (no liquid addition) conventional landfill
- Units composed of independent, paired cells


Anaerobic
Unit 7.4
New
Aerobic/Anaerobic Sequence
Unit 7.3
Control

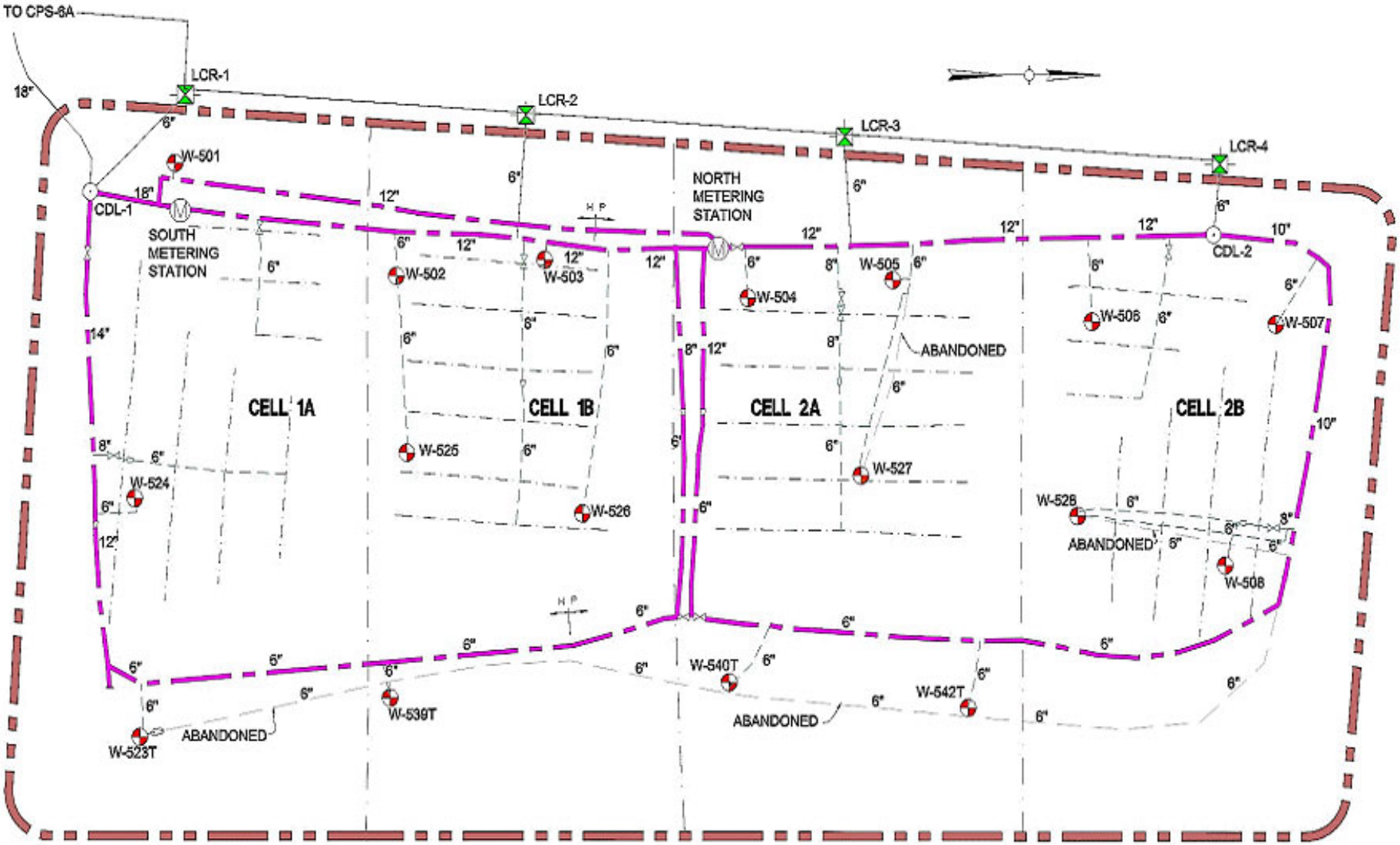
FLB: Facultative Landfill Bioreactor

Facultative Bioreactor



Leachate / Liquids Addition
Gas Collection

WASTE MANAGEMENT
Bioreactor Program



LEGEND

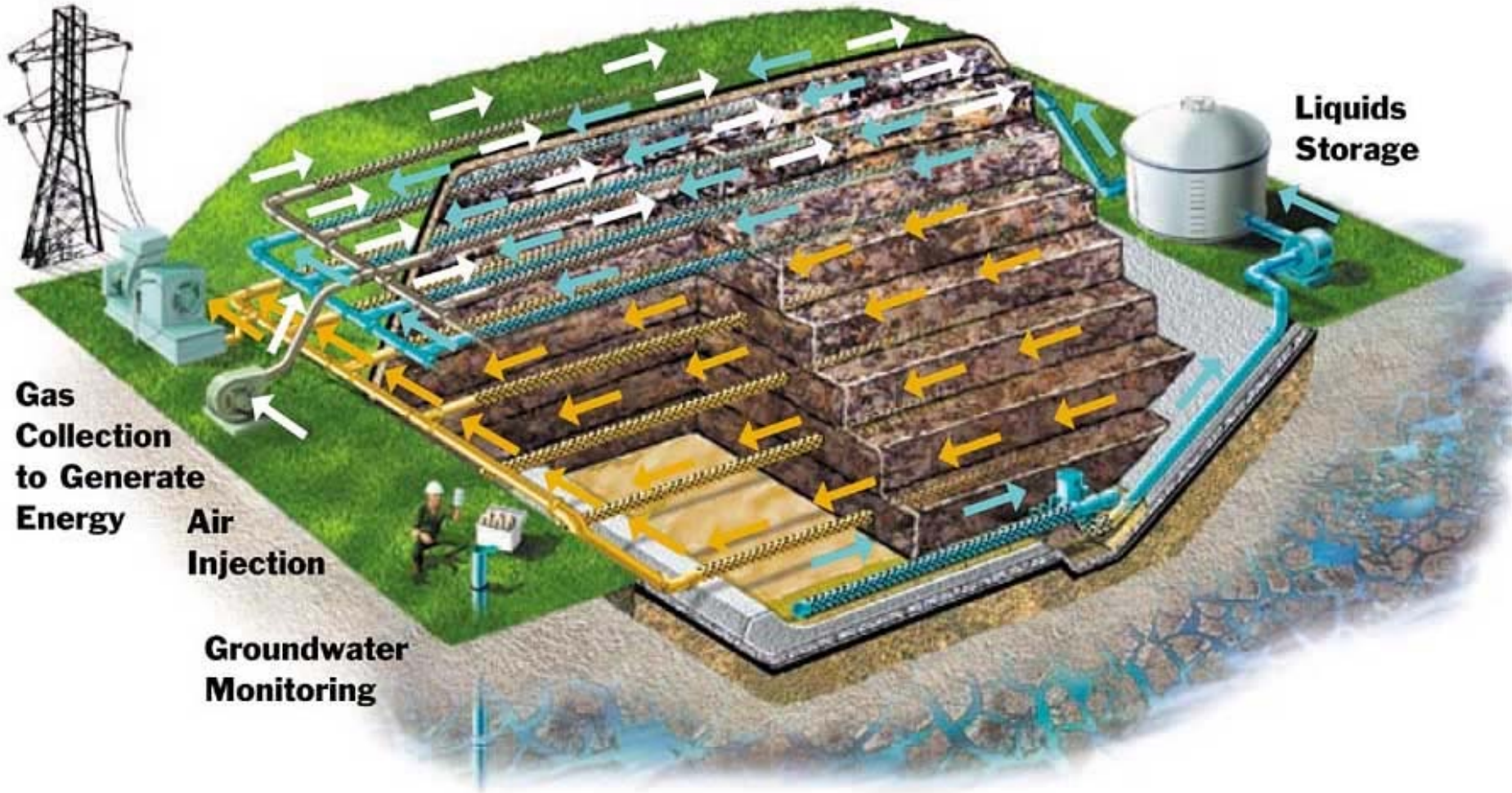
LCR-4	LEACHATE COLLECTION RISER		CONSTRCUTED UNIT LIMITS
W-542T	GAS WELL		CELL LIMITS
CDL-1	CONDENSATION DRIP LEG		ABANDONED GAS LINE
	CONTROL VALVE		GAS HEADER
	REDUCER		GAS LATERALS
6"	PIPE DIAMETER		GAS COLLECTION PIPES
M	METERING STATION		

UNIT 5 LANDFILL GAS COLLECTION SYSTEM

NO SCALE

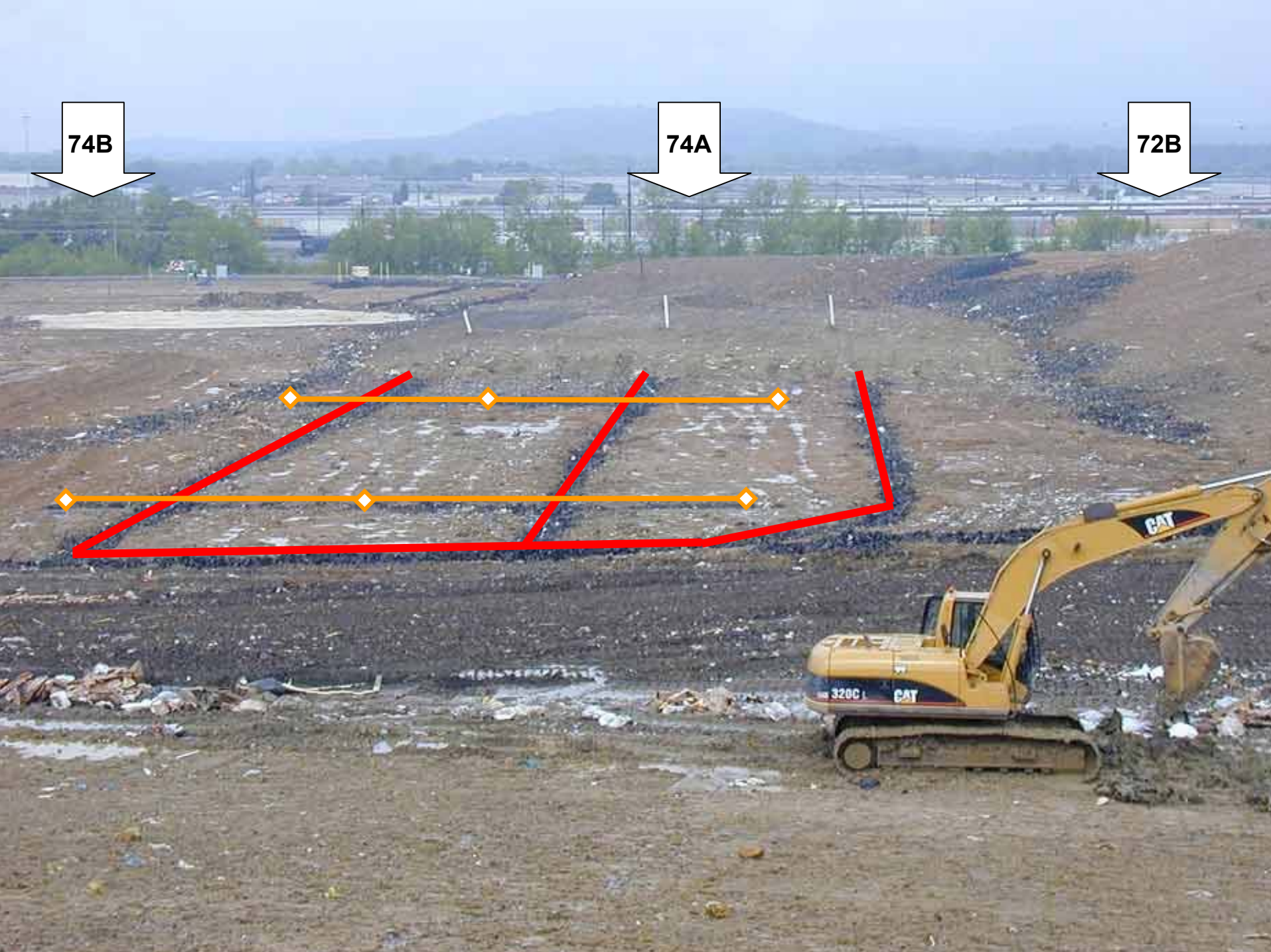
AALB: Aerobic-Anaerobic Landfill Bioreactor and Control

Aerobic-Anaerobic Bioreactor

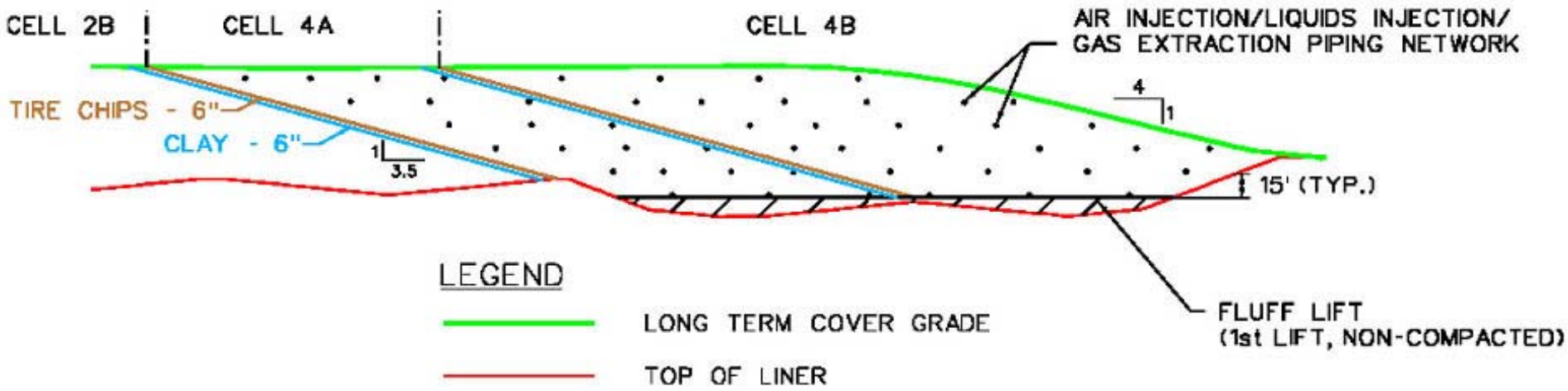


Leachate / Liquids Addition
Gas Collection
Air Injection

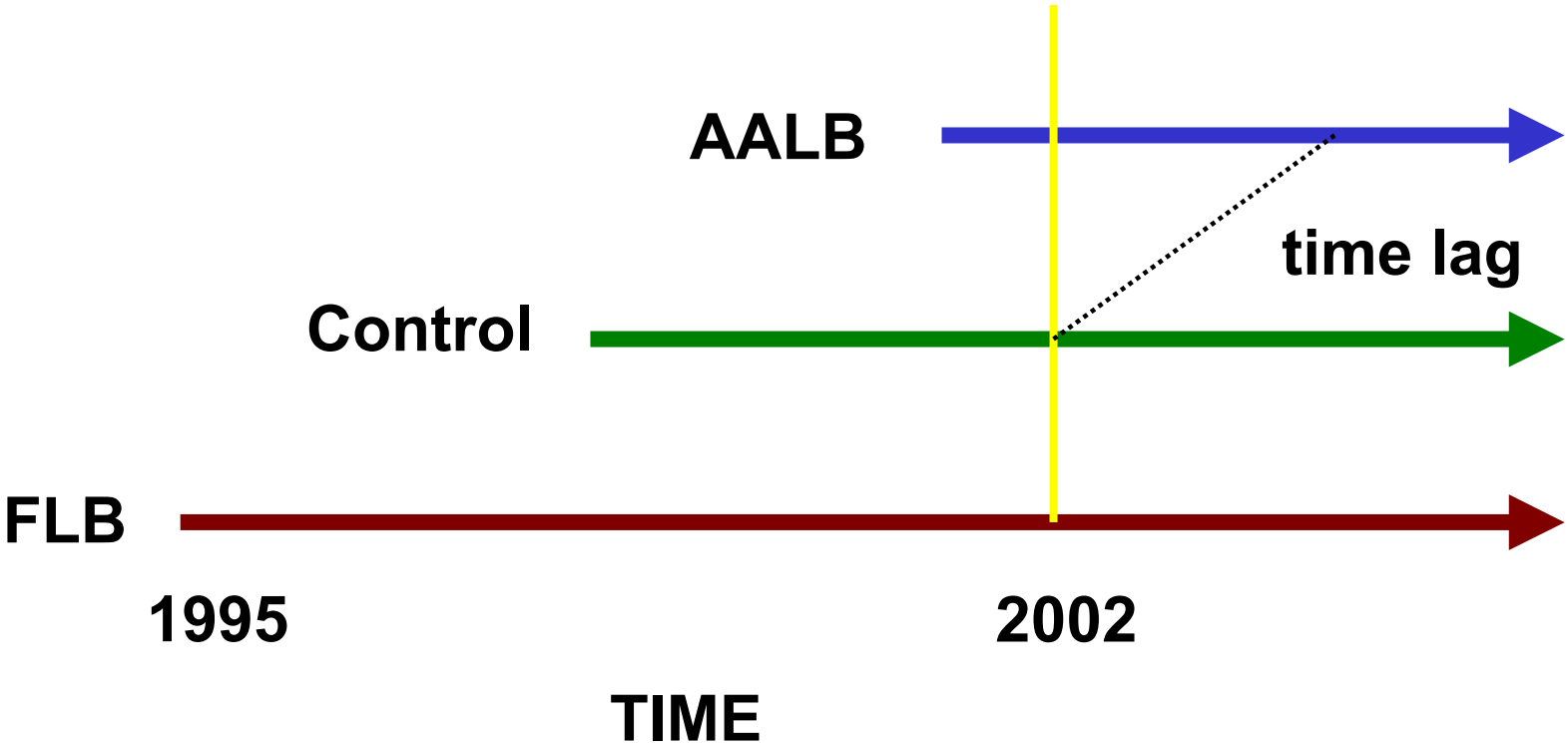
WASTE MANAGEMENT
Bioreactor Program


74B
74A
72B
CAT
320C
CAT

AALB Cross-Section



Experimental Design: Treatment-Control Comparisons

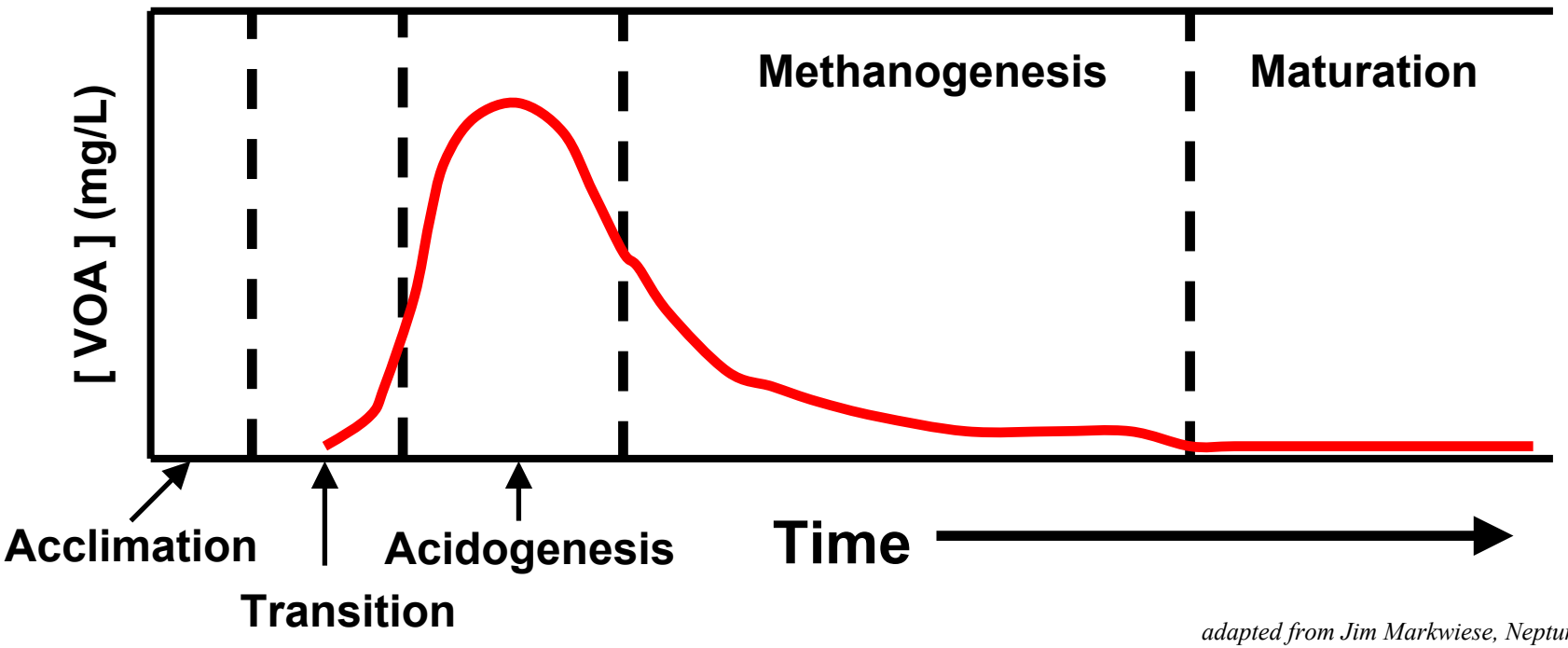


adapted from Jim Markwiese, Neptune and Co., Inc.

Critical Measures

Critical measures were selected to capture waste stabilization.

Example: Volatile Organic Acids



adapted from Jim Markwiese, Neptune and Co., Inc.

Critical Measures: Gas and Leachate

Gas

- Gas production rate, CH_4, CO_2, O_2, and balance

Leachate

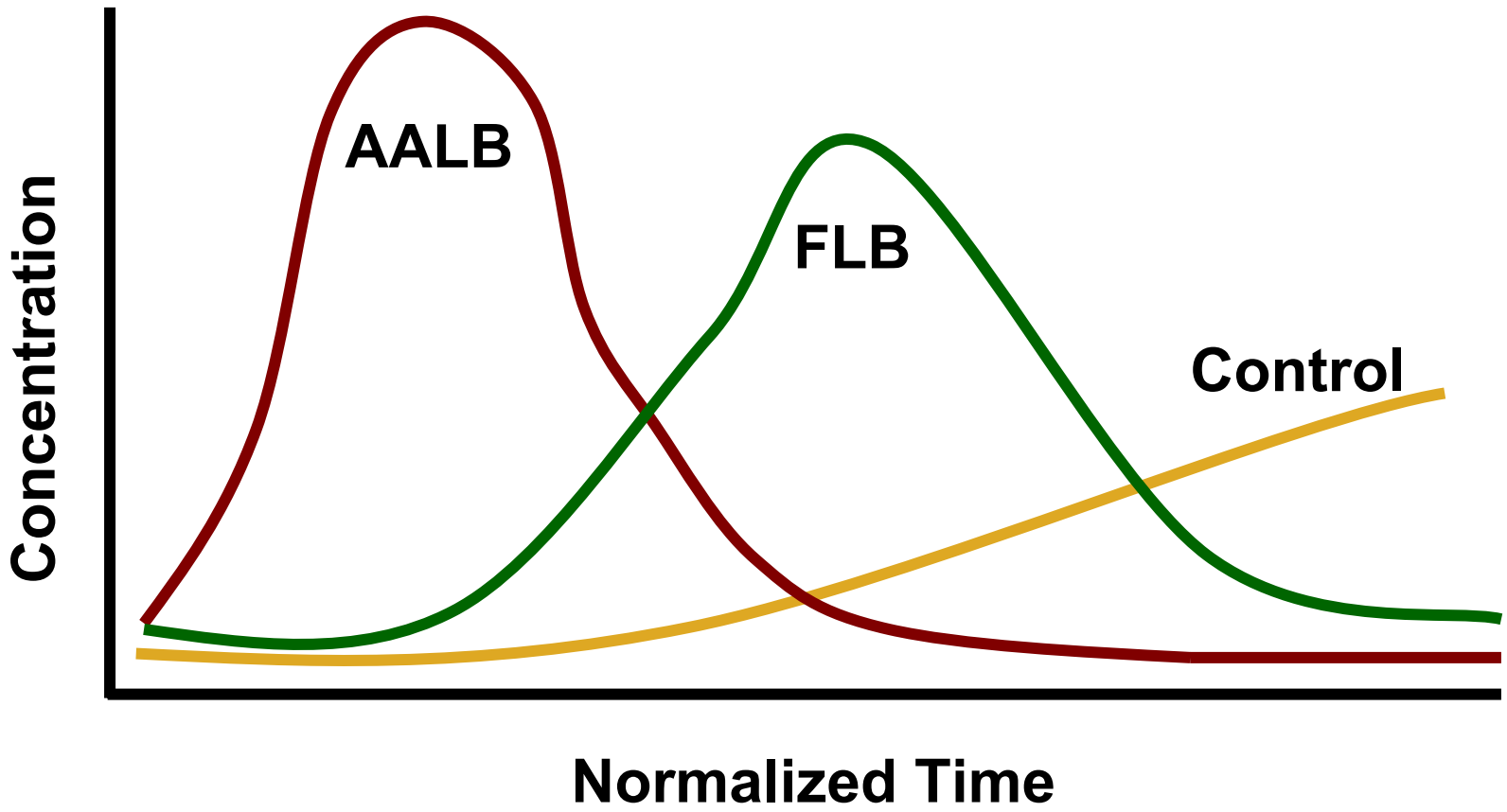
- Head on liner
- Leachate production
- COD, BOD, Temperature, pH, VOA

Critical Measures: Solids

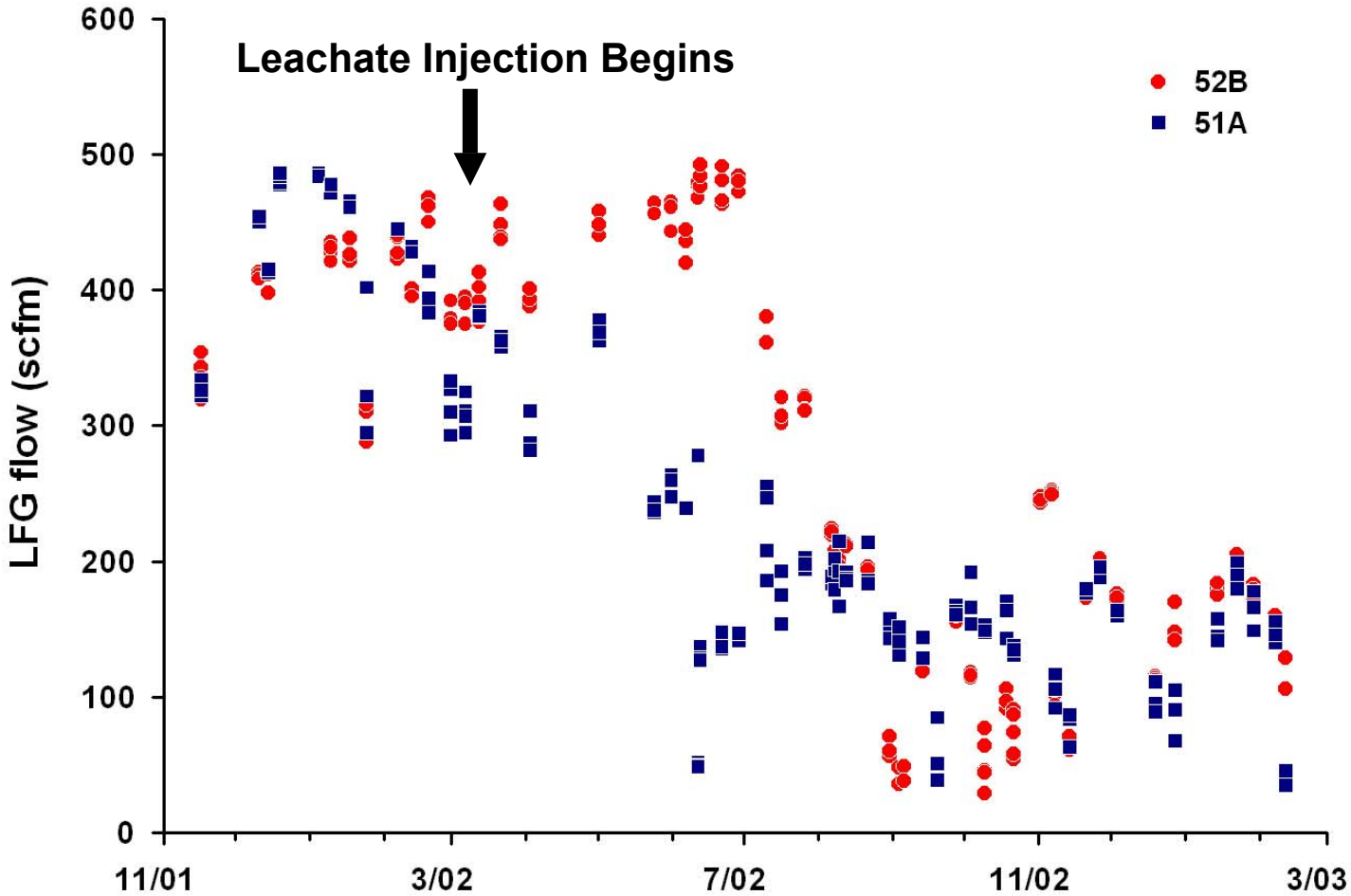
Solid Waste

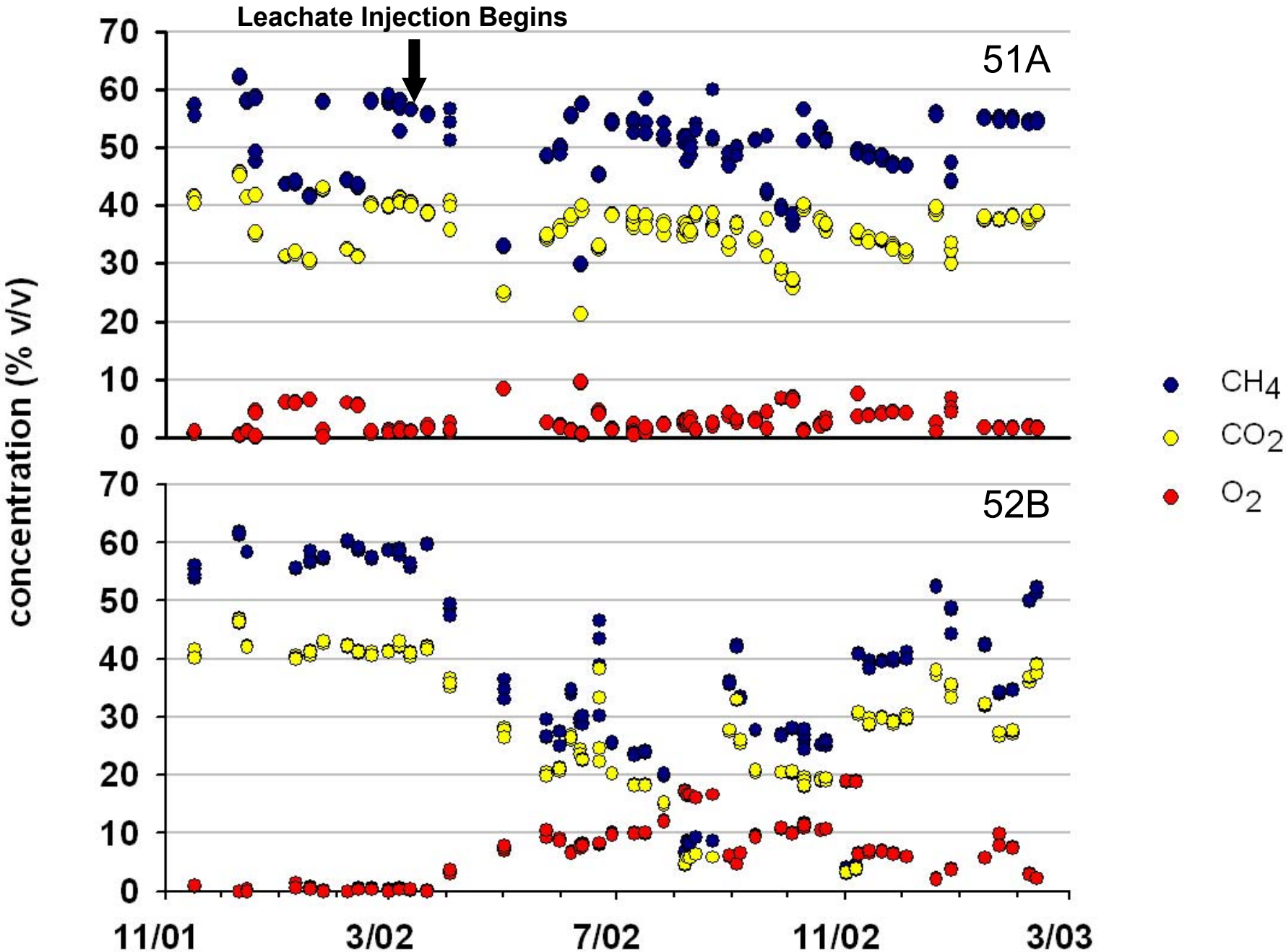
- Temperature
- Settlement
- Density
- Volatile solids, BMP, moisture content, pH

Statistical Analyses:
Visualizing Critical Measures



Unit 5 FLB Landfill Gas Flow




Leachate Injection Begins
51A
52B
concentration (% v/v)
70
60
50
40
30
20
10
0
11/01
3/02
7/02
11/02
3/03
CH_4
CO_2
O_2

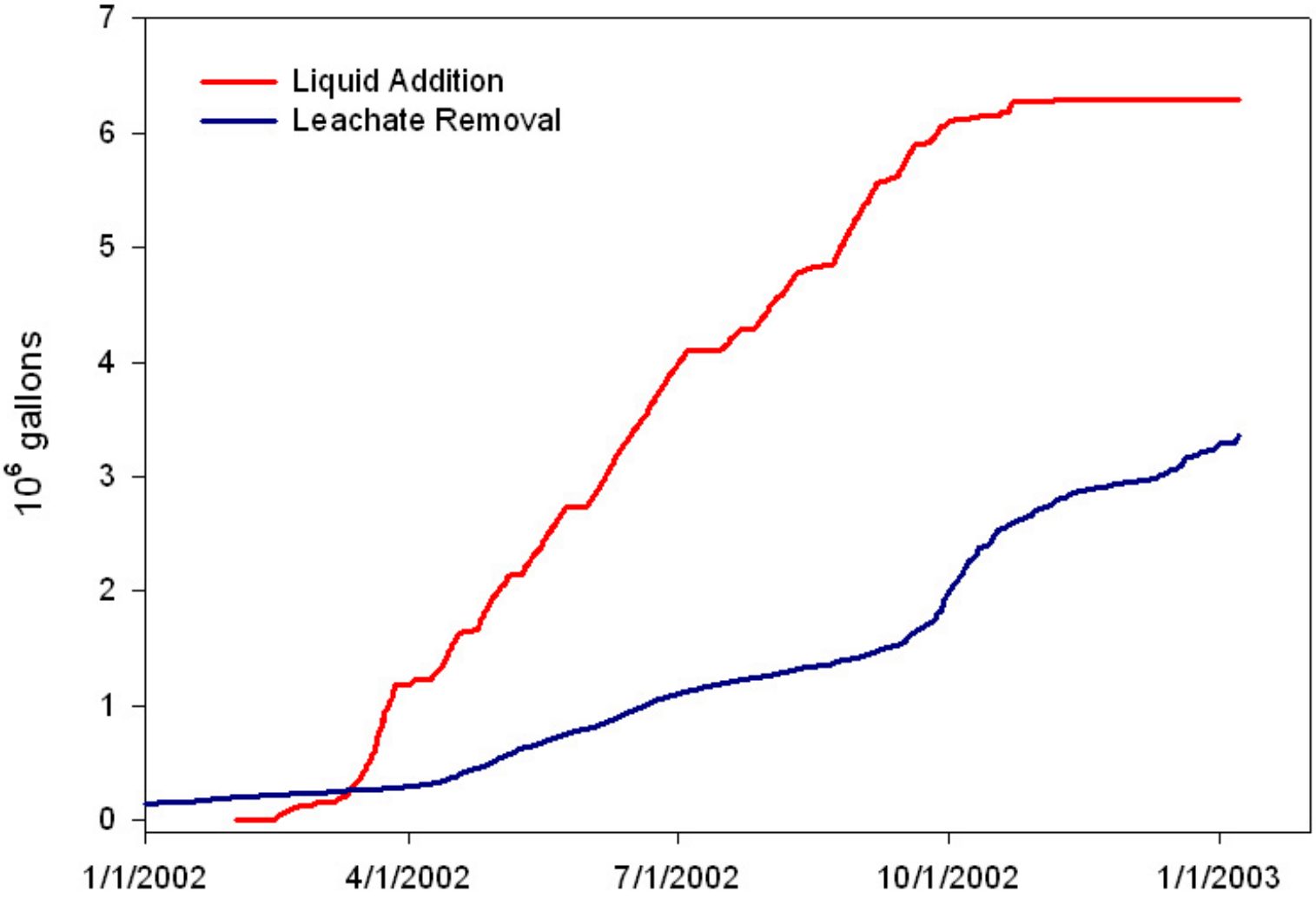
Interim Leachate Results
Unit 5 FLB, Unit 7 AALB

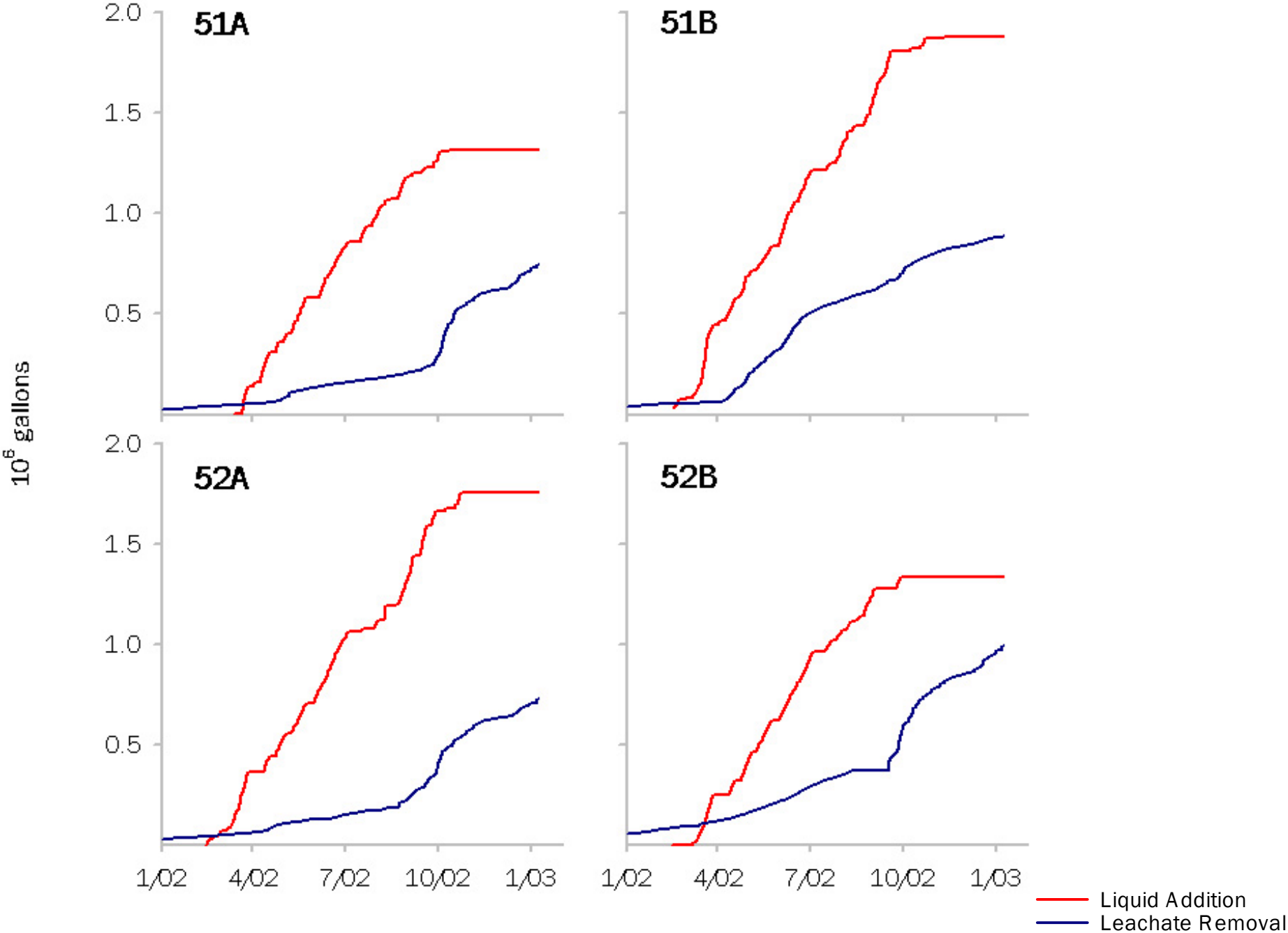
Area 5 Water Balance

- 2.5 million yd^3 in place
- Average moisture content = 35%
- Density = 1,650 lb/yd^3
- Moisture required to achieve 45%
  = 36 gal/yd^3

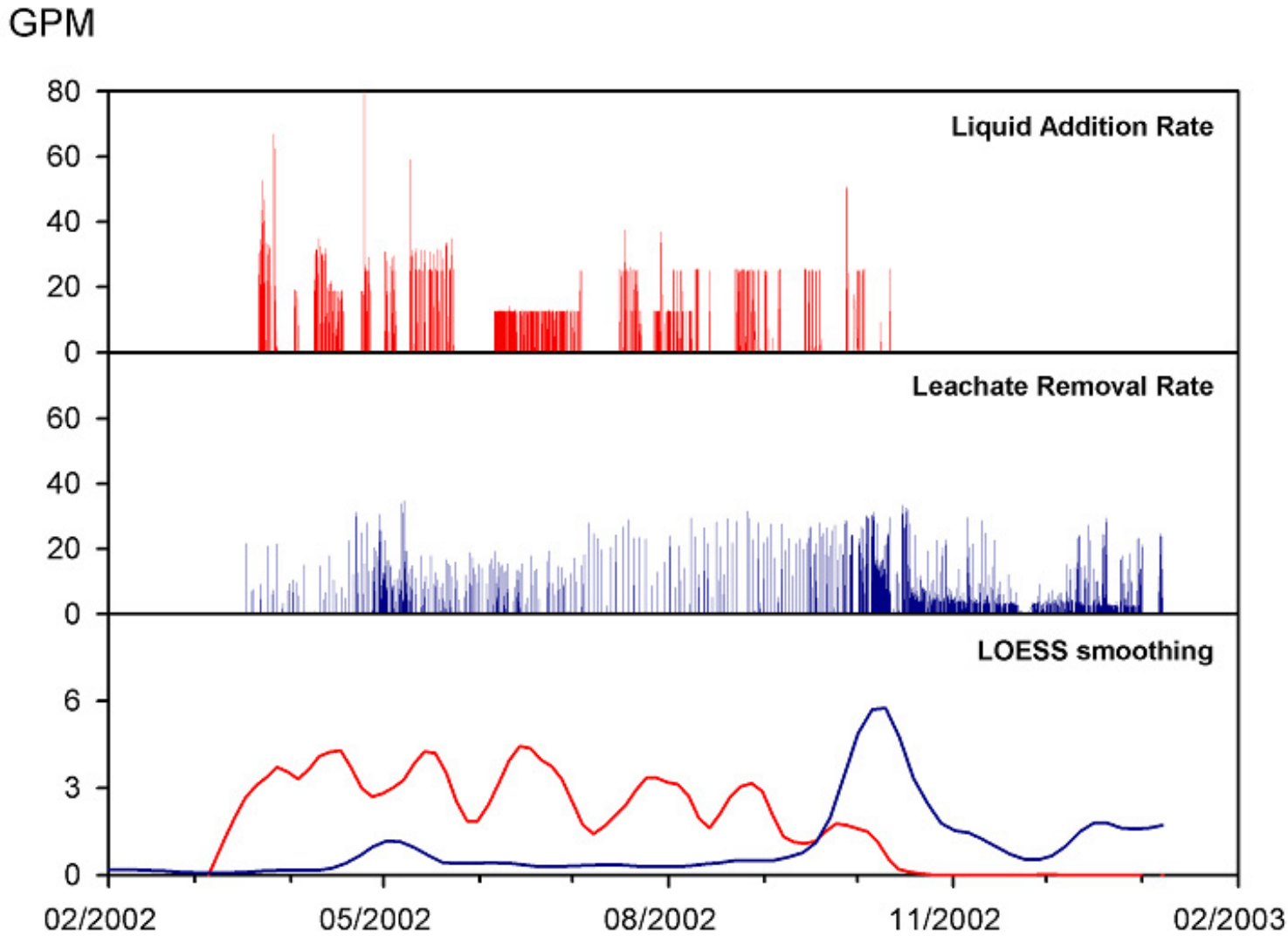
2.5 million yd^3 x 36 gal/yd^3 = 91 Mgal

Cumulative Liquid Addition and Removal for the FLB

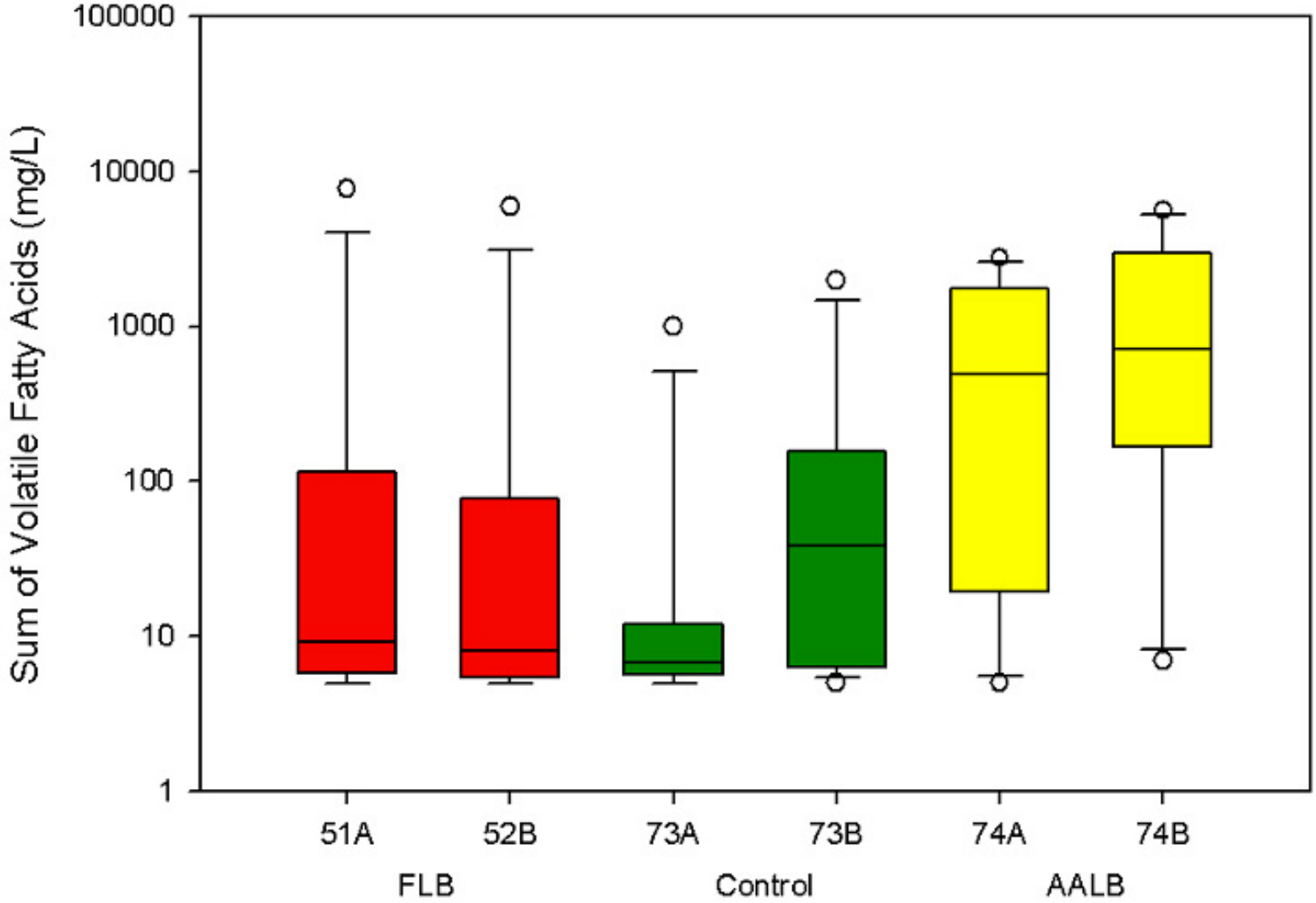


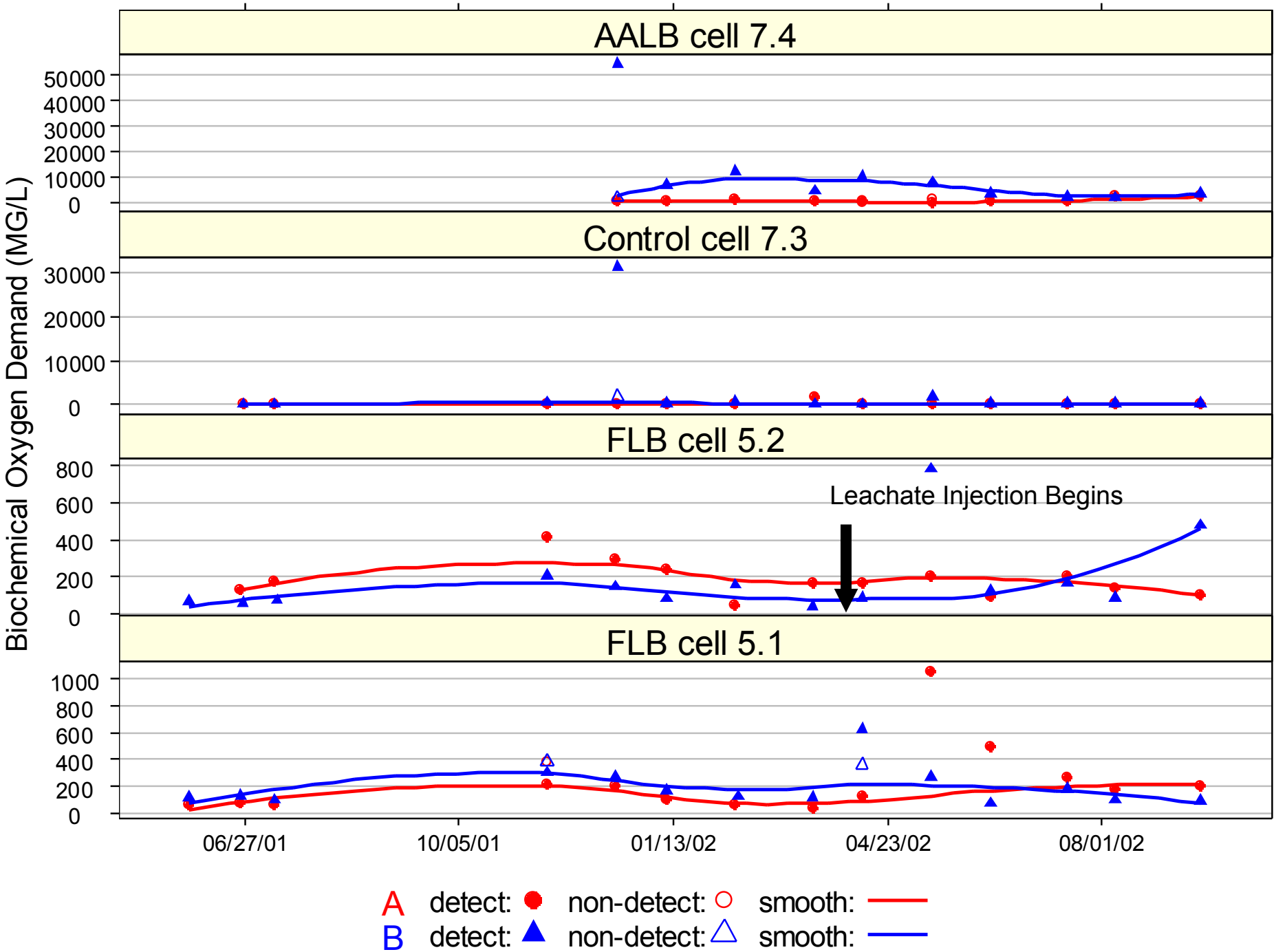

51A
51B
52A
52B
2.0
1.5
1.0
0.5
10^6 gallons
1/02
4/02
7/02
10/02
1/03
Liquid Addition
Leachate Removal

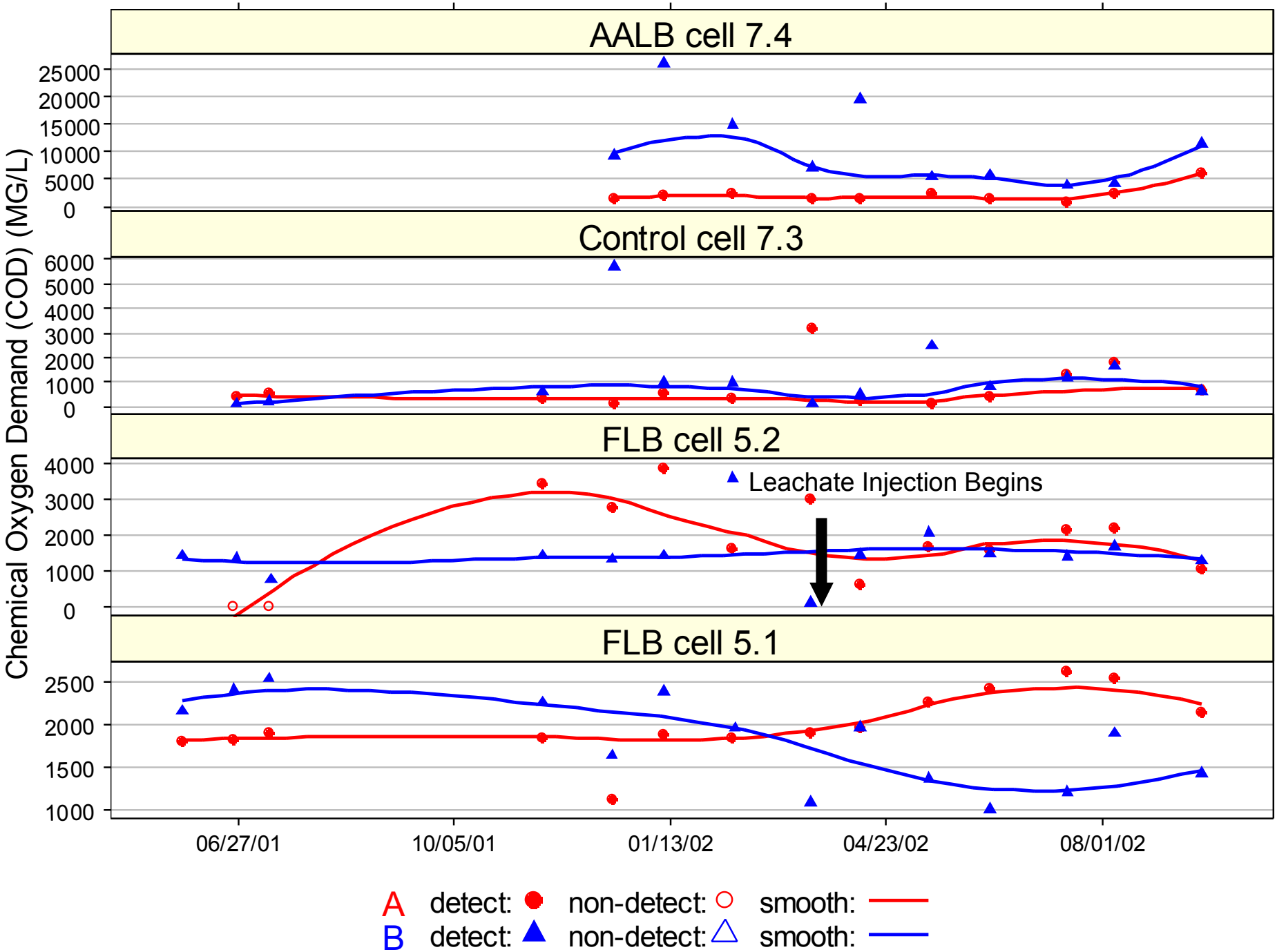
Liquid Addition Rate Summary for Cell 51A



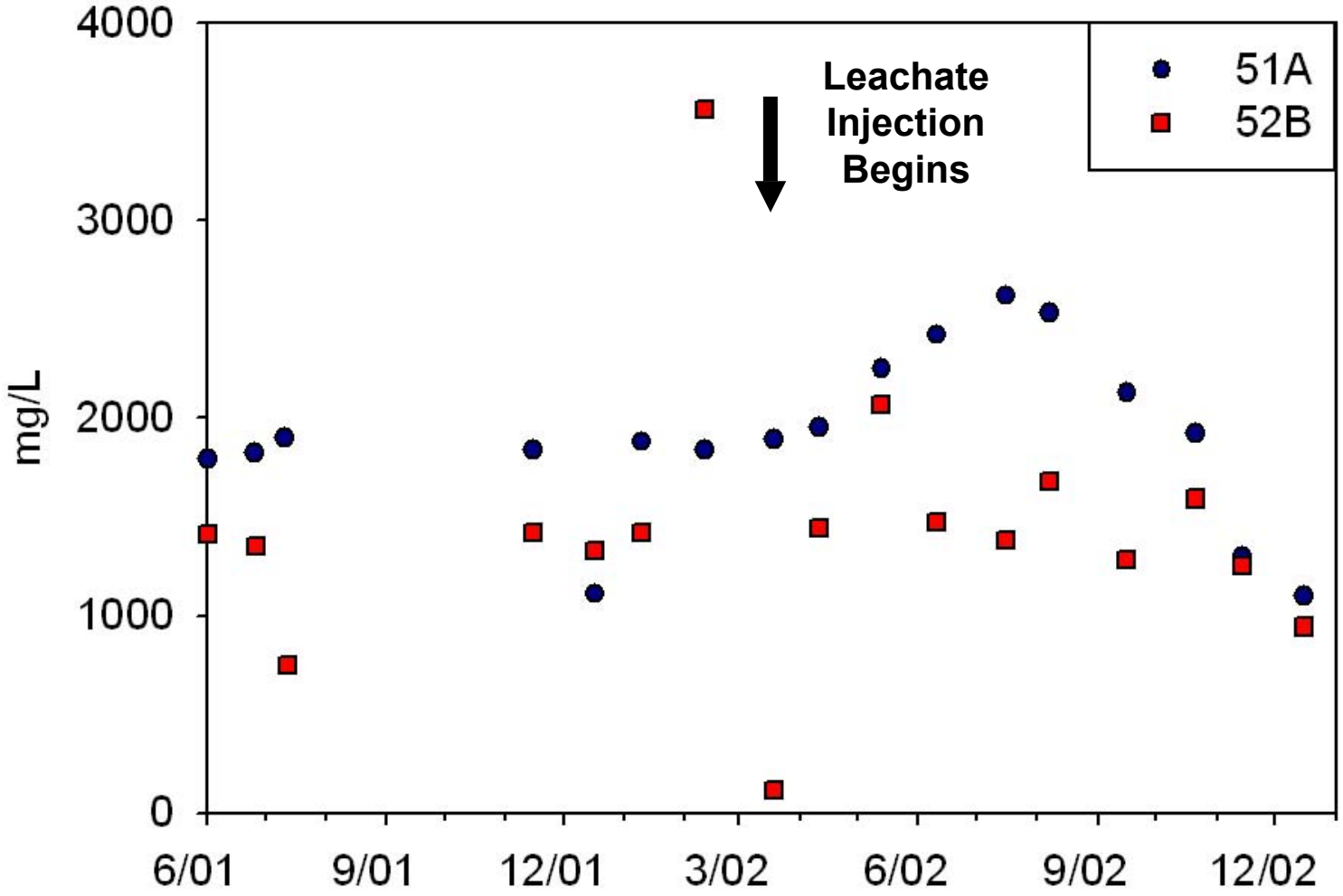
Volatile Organic Acid Comparison

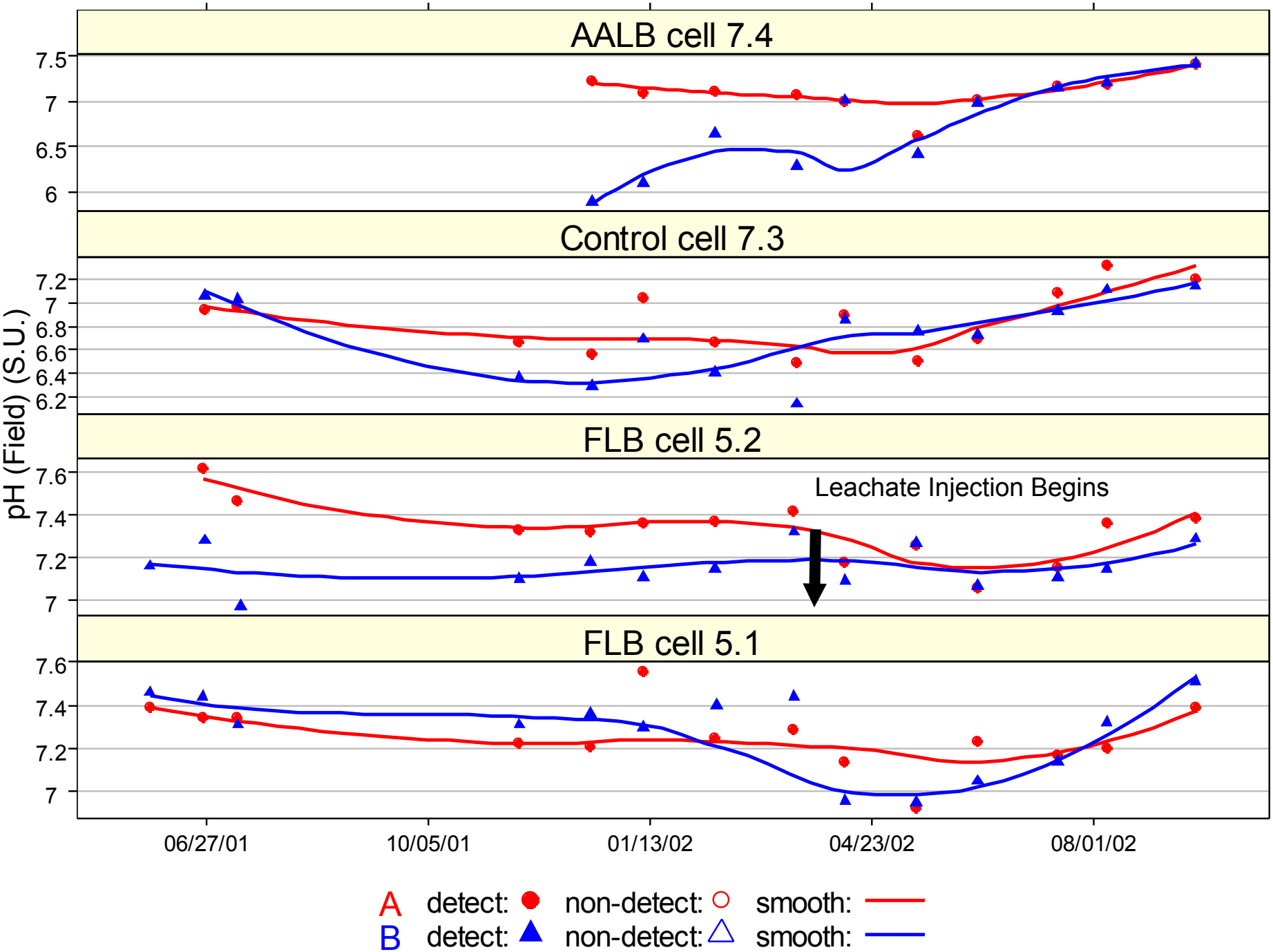


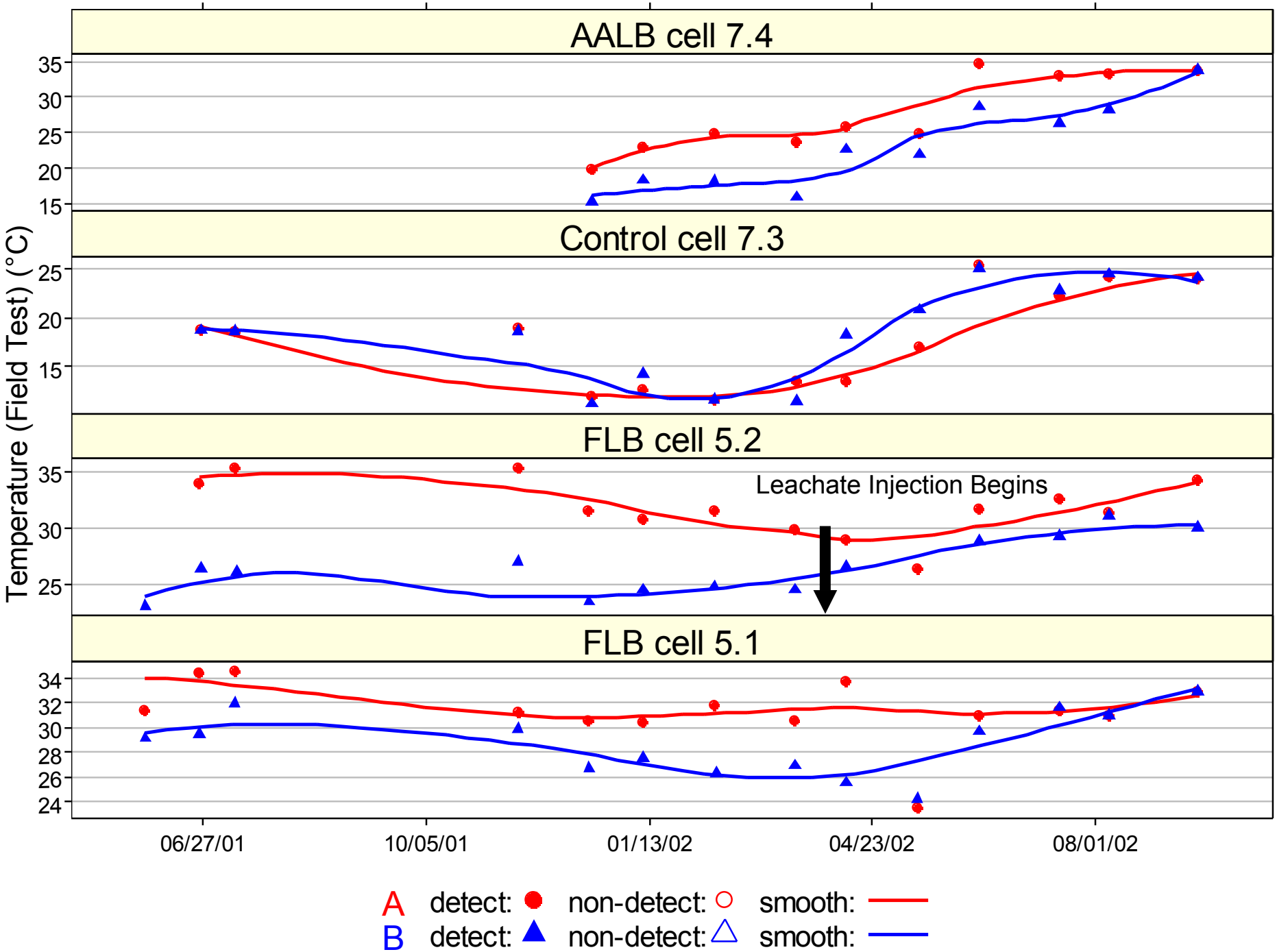

AALB cell 7.4
Control cell 7.3
FLB cell 5.2
FLB cell 5.1
Biochemical Oxygen Demand (MG/L)
Leachate Injection Begins
06/27/01
10/05/01
01/13/02
04/23/02
08/01/02
A detect: non-detect: smooth:
B detect: non-detect: smooth:


AALB cell 7.4
Control cell 7.3
FLB cell 5.2
FLB cell 5.1
Chemical Oxygen Demand (COD) (MG/L)
25000
20000
15000
10000
5000
0
6000
5000
4000
3000
2000
1000
0
4000
3000
2000
1000
0
2500
2000
1500
1000
Leachate Injection Begins
06/27/01
10/05/01
01/13/02
04/23/02
08/01/02
A detect: non-detect: smooth:
B detect: non-detect: smooth:

COD: FLB Cells

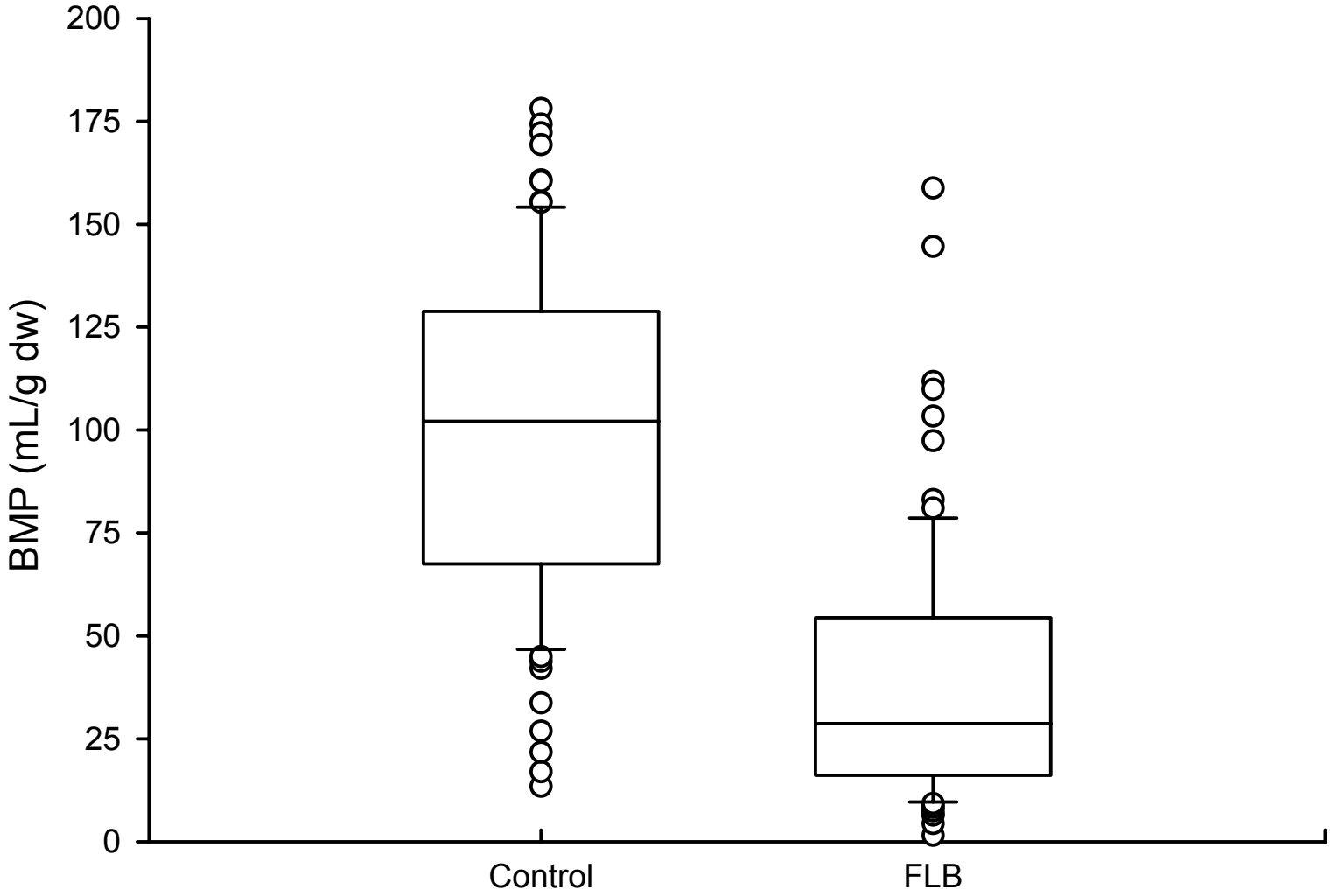



AALB cell 7.4
Control cell 7.3
FLB cell 5.2
FLB cell 5.1
pH (Field) (S.U.)
Leachate Injection Begins
06/27/01
10/05/01
01/13/02
04/23/02
08/01/02
A detect: non-detect: smooth:
B detect: non-detect: smooth:

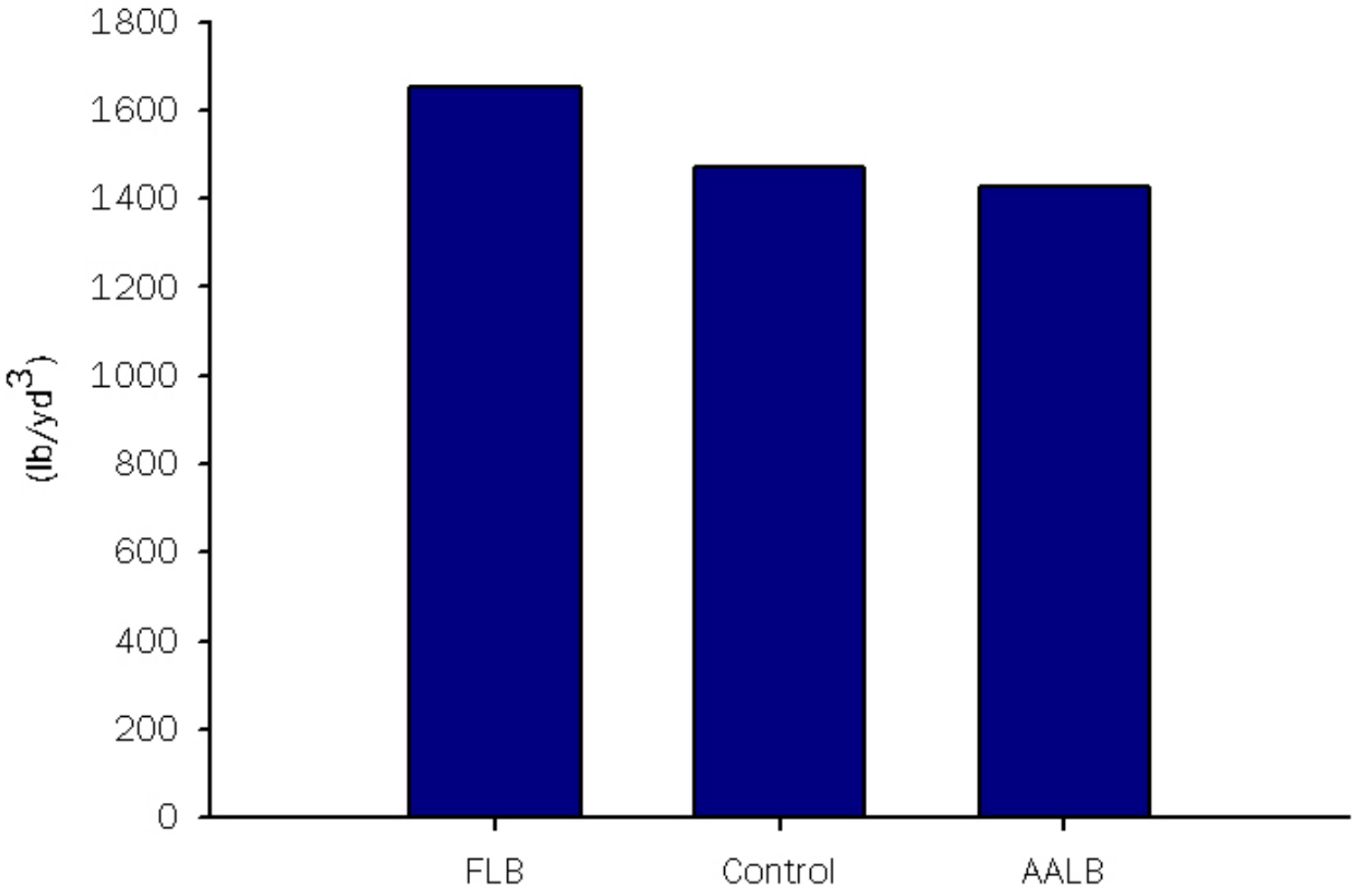

AALB cell 7.4
Control cell 7.3
FLB cell 5.2
FLB cell 5.1
Temperature (Field Test) (°C)
Leachate Injection Begins
06/27/01
10/05/01
01/13/02
04/23/02
08/01/02
A detect: non-detect: smooth:
B detect: non-detect: smooth:

Interim Solids Results

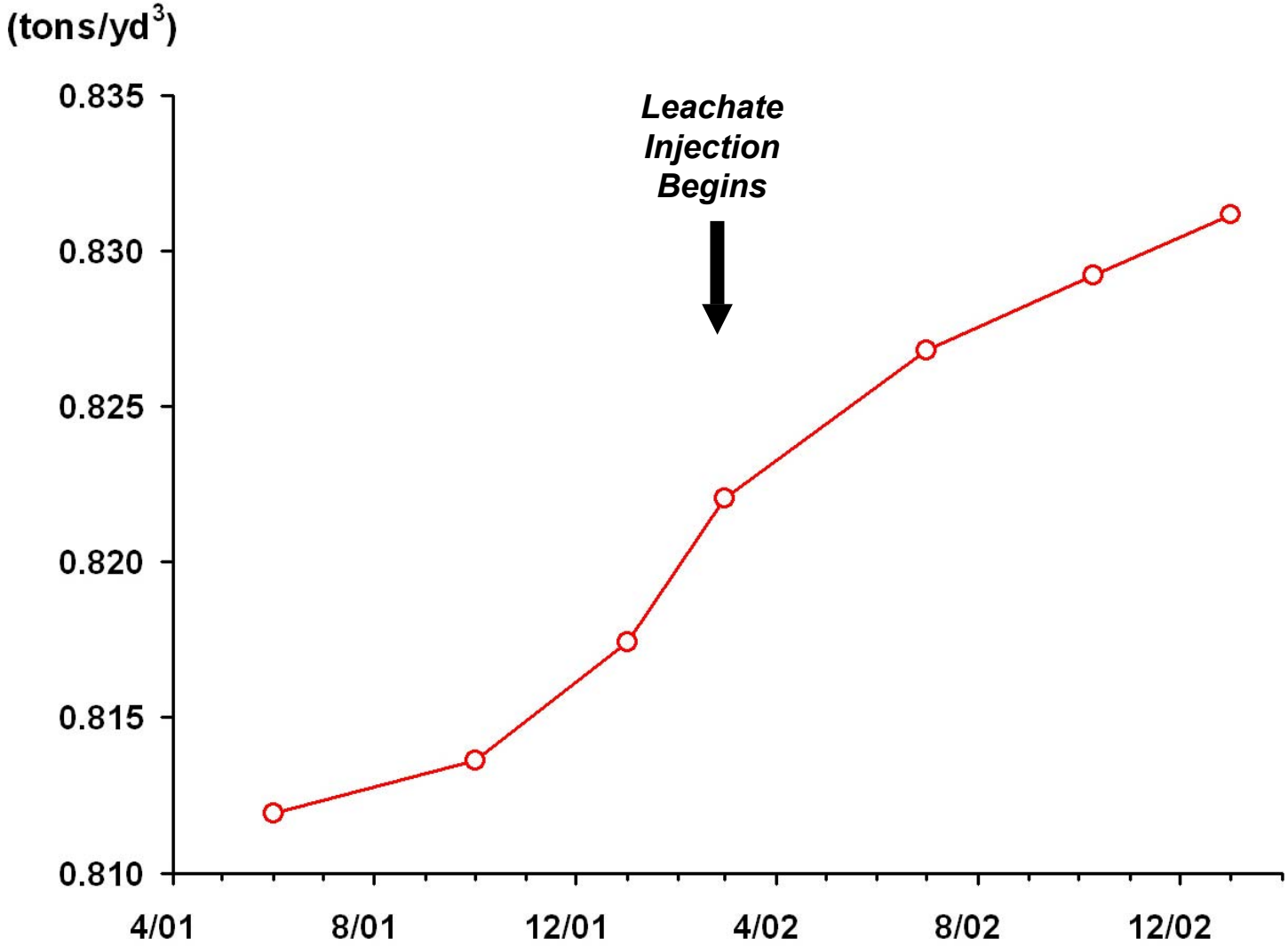
Biochemical Methane Potential: Baseline



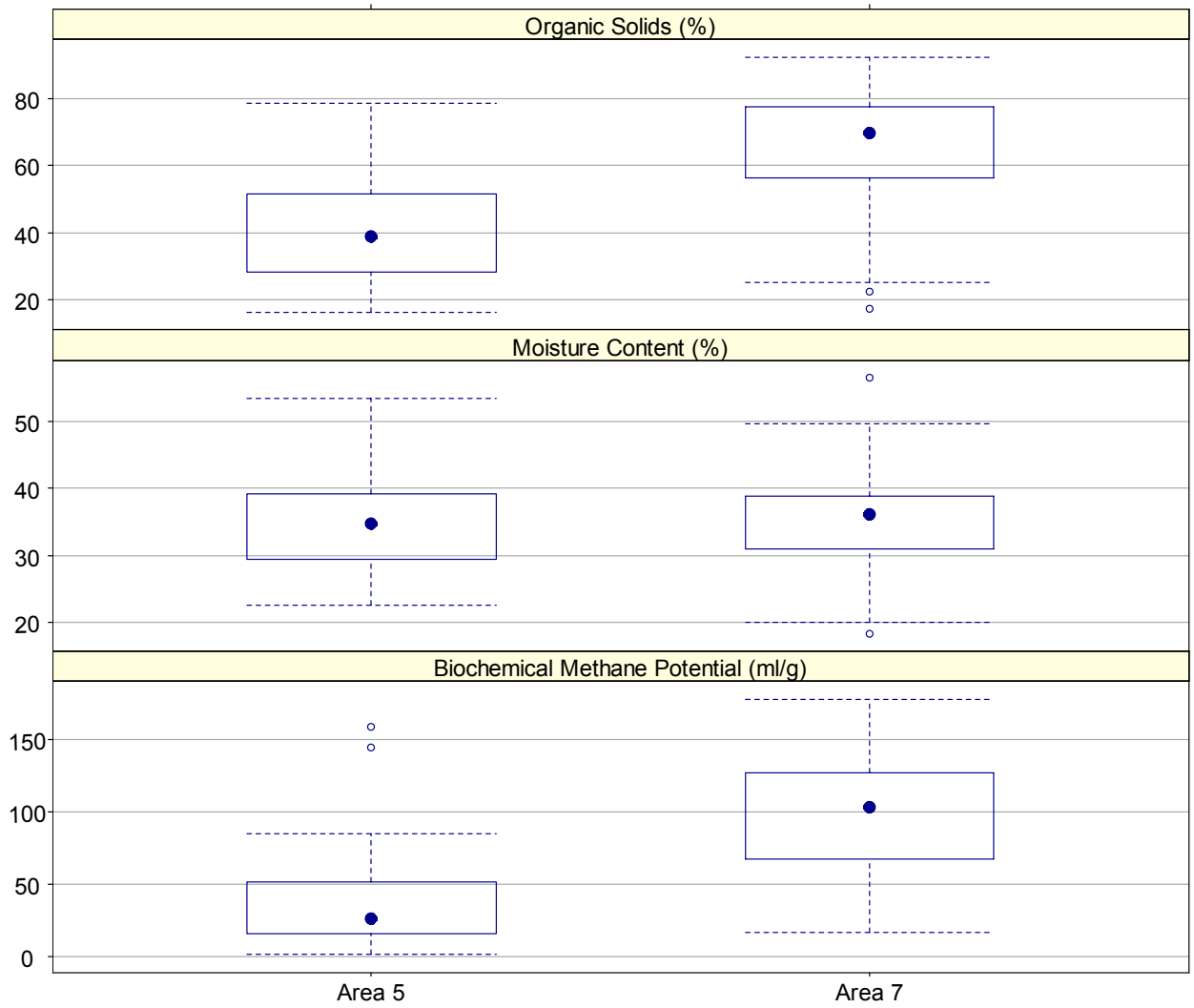
Waste Density Comparison



Waste Density: Unit 5



Organic Solids, Moisture and BMP



Critical Measures as Expected?

Parameter	FLB (Unit 5)	AALB (Unit 7)	Comments
<u>Gas</u> Production Rate, CH_4, CO_2 , O_2 , Balance Gases	Some inhibition may be taking place, injection rate may be too high, O_2 intrusion in desiccated cover	Early stages of experiment	Changes Made in Operations at Unit 5
<u>Leachate</u> Head on liner, Leachate production COD, BOD, Temperature, pH, VOA	Early in process, but as expected	Early stages of experiment	
<u>Waste</u> Temperature, Settlement Density, Volatile solids, BMP, moisture content, pH	Early in process, but as expected	Early stages of experiment	

Future of Project

- Continue monitoring until at least 2005
  - Modify monitoring parameters and/or frequency?
  - Interim Report this year
- Add new bioreactor site(s)?

Acknowledgements

- Kentucky Department for Environmental Protection
- Doug Goldsmith, Alternative Natural Technologies, Inc.
- Morton Barlaz, N.C. State University
- University of Cincinnati
- Neptune Inc.

Thank You

Contacts:

- David Carson: carson.david@epa.gov
  - EPA Bioreactor Website: http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/bioreactors.htm
- Roger Green: rgreen2@wm.com