SWANA NEW YORK CHAPTER
Landfill/Bioreactor/Leachate Recirculation Design and Operations Training Session

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Presentation Agenda

- Site Background
- History of Recirculation at Lanchester
- Current Application Methods
- Design Issues
- Operational Issues
- Monitoring Results
- Economics

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Site Background

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Site Background

Disposal Area	Approximate dates of filling	Approximate date of closure
Mountain Top Landfill	1962-1975	1989
Municipal Site Landfill	1975-1991	1994
Area B	1991-1999	2001
Area C	1997- date	2004 (partial)
Area D	2005-date	-

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Site Background (cont'd)

- Existing gas to energy system (Granger Energy, Inc.)
- Ultra filtration/reverse osmosis leachate treatment system
- GPS guidance system for waste placement and compaction
- Picnic/overlook areas

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History of Recirculation at Lanchester

- Permit application submitted to PADEP in 2001
- System started operating in Sept/Oct 2001
- Reviewed capacity analysis, submitted addendum in 2003 and 2005
- Temporary suspension of liquid application during final cover system construction

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Current Liquid Application Methods at Lanchester

- Horizontal trenches installed at various elevations
- Spray application of leachate at the working face
- Leachate infiltration blankets
- Assorted wetwells and pumping systems to deliver leachate to application structures
- Robust leachate collection system

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Leachate Collection System Layout

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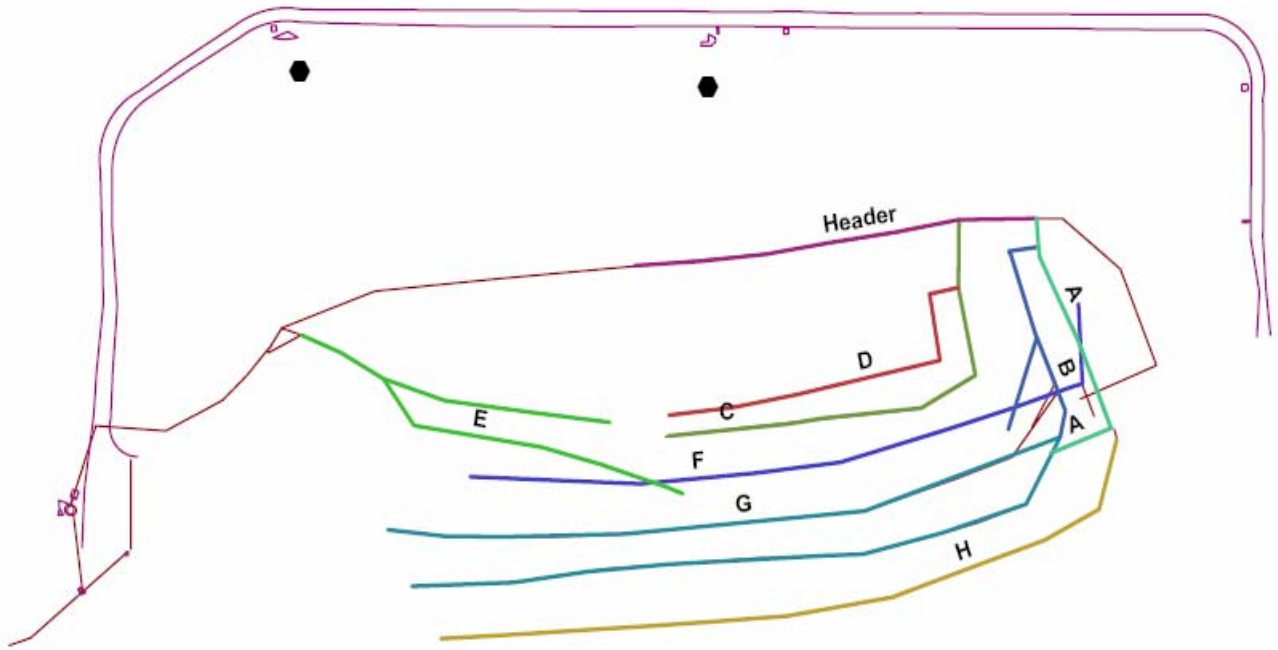
Horizontal trench layout



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Horizontal Trench Installation

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Tire Chips

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Horizontal Trench Installation

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Spray Application at Working Face

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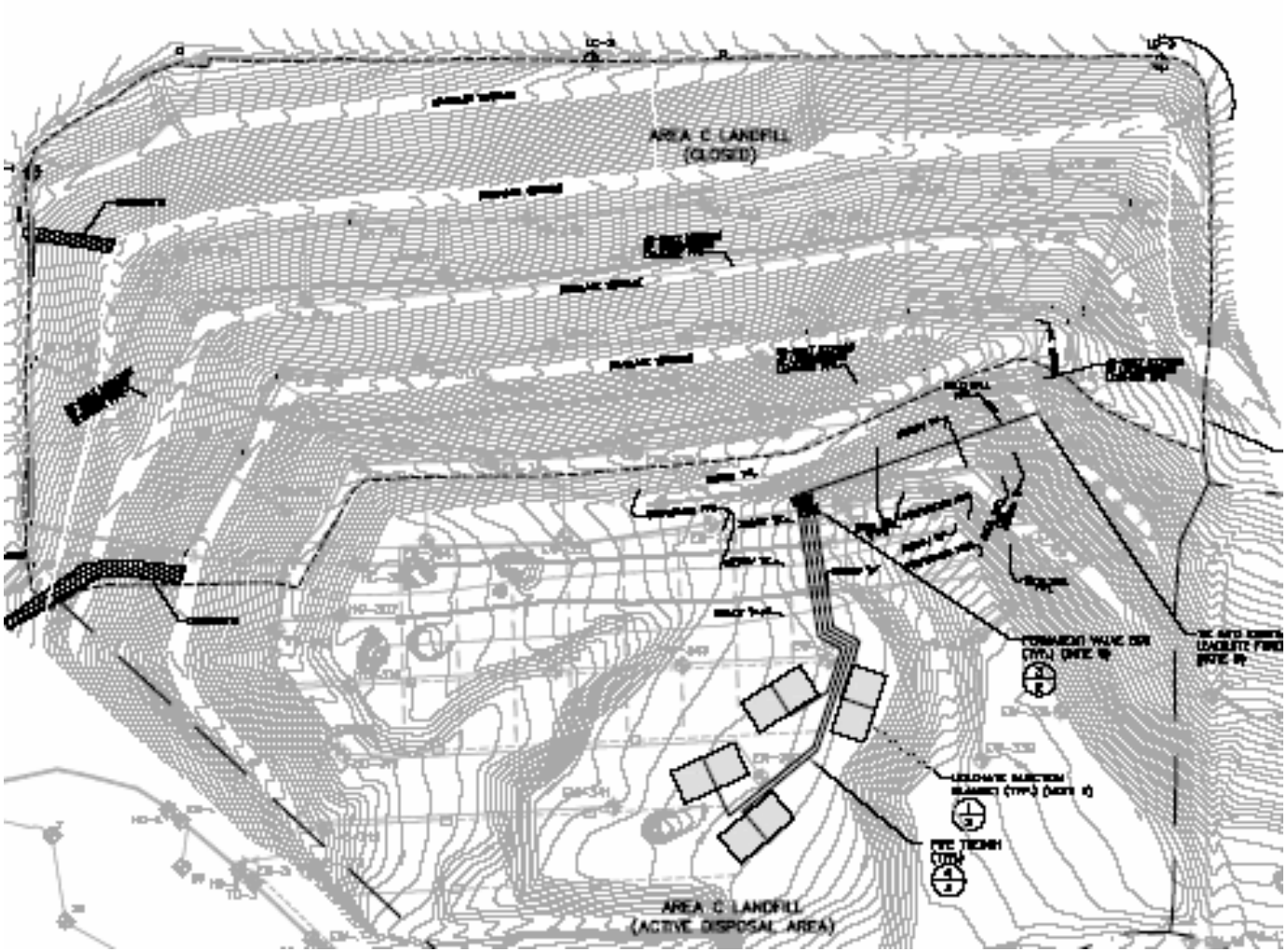
Leachate infiltration blanket layout



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Leachate Infiltration Blankets

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Design Considerations and Issues

Potential Problem	Prevention
Seeps	Don't inject close to slopes Monitor extent of lateral saturation / leachate movement Visually inspect slopes on a regular basis
Slope Instability	Inject liquids away from slope face and minimize use of daily cover Consider pore pressure buildup in slope stability analysis Monitor liquid levels in distribution systems to avoid overloading waste with leachate
Clogging of Leachate Collection Features (physical and biological)	Monitor leachate quantity and quality in liquid injection areas Use high permeability components in the leachate collection system
Increased Head on Liner	Prevent clogging of leachate collection system Pump from sumps more frequently as needed
Increased Landfill Gas Generation	Monitor methane level over area of liquid injection and around perimeters of landfill Be proactive with installation of odor control systems Proactively expand or improve on landfill gas extraction systems
Waste Disposal Operational Difficulty	Allow sufficient time for alternative waste placement when injection trenches are being constructed

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Leachate Seeps

- Recirculation of leachate increases potential for leachate seeps and breakouts (i.e., leaking of leachate out of landfill side slopes)
- Leachate seeps can constitute a significant and expensive problem
- Seeps may be the most common recurring problem with bioreactors and leachate recirculation landfills

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Unique Features of Leachate Recirculation that affect Stability

- Additional Weight of Applied Liquid
- Increased Pore Pressure Caused by Liquid or Gas
- Changed Characteristics of Waste Mass
  - Reduced particle size, greater density, lower permeability
  - Shear strength appears to be similar to undegraded waste
  - Greater potential for development of excess pore pressure

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Stability Analysis Methods

- Two dimensional limit-equilibrium method is the most common type of analysis
- Analysis methods – we want a method of analysis that satisfies moment and force equilibrium
  - Janbu and Spencer's methods are widely used in the stability analysis of waste facilities.
  - Janbu simplified satisfies overall moment and vertical and horizontal force equilibrium but does not satisfy individual slice moment equilibrium.
  - Spencer's – satisfies all states of equilibrium

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Design Parameters

- Fluid Injection
  - Hydraulic properties of waste
  - Characteristics of injection system (e.g., trenches, piping, pumps, etc.)
  - Injection pressure
- Waste Degradation
  - Gas generation potential and timeline
- Gas Extraction
  - Head losses in extraction system

Injection and Infiltration Rates

Key Design Issue:

Injection Rate < Infiltration Rate + Storage Capacity

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2 Key Points:

Causes of Problems

- Poor understanding of liquid flow through landfills
- Aggressive, unsupervised liquids application

Prevention of Problems

- Operational planning for liquids application
- Monitoring of operating practices

Current operating practices do not require major changes to satisfy these requirements

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Operational Issues

- Typical Application Rates
- What is involved in an application event
- Use of alternative covers
- Stormwater management/leachate generation
- Odor control
- Problems

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Typical Application Rates at Lanchester

- Try to recirculate all leachate that is generated
- Leachate from different areas can be mixed prior to recirculation
- Average application rate over last year is approximately 2,500 gallons per calendar day

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Application Events

- Header/pump system to application area
- Valves to isolate individual trenches
- Trench capacity depends on cross section
- Quantity limited by amount of leachate available
- Try to recirculate every day, rotate between trenches
- Periods of little to no recirculation

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Alternative Daily and Intermediate Covers

- These materials can cause perching of recirculated leachate and other liquids
- To address this issue:
  - Utilize removable daily covers (tarps)
- Soils used for daily and intermediate covers often have low permeability
  - Use high permeability materials

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Stormwater Management/Leachate Generation

- Stockpile locations and flat areas
- Installation of final cover system on lower portion of sideslopes
- Use of alternate daily covers
- Rain flaps in open cells

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Stormwater Management/Leachate Generation

- Drawbacks to alternative daily and intermediate covers
- Settlement around stockpiles
- Relationship between rain events and leachate generation
- Changes to operating practices

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Odor Control

- Partial closure of Area C
- Aggressive gas collection
- Surface scans
- Timing of application events
- Operator/personnel awareness

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Operational Problems

- Stormwater Management
- Slope along bottom of trenches
- Reduction in trench infiltration capacity
- Application system features near sideslopes
- Operator availability
- Geotextile around entire trench

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Monitoring Data Collected

- Leachate application
- Leachate quality
- Landfill gas quality
- Landfill gas quantity
- Odors/Surface emissions monitoring
- Settlement

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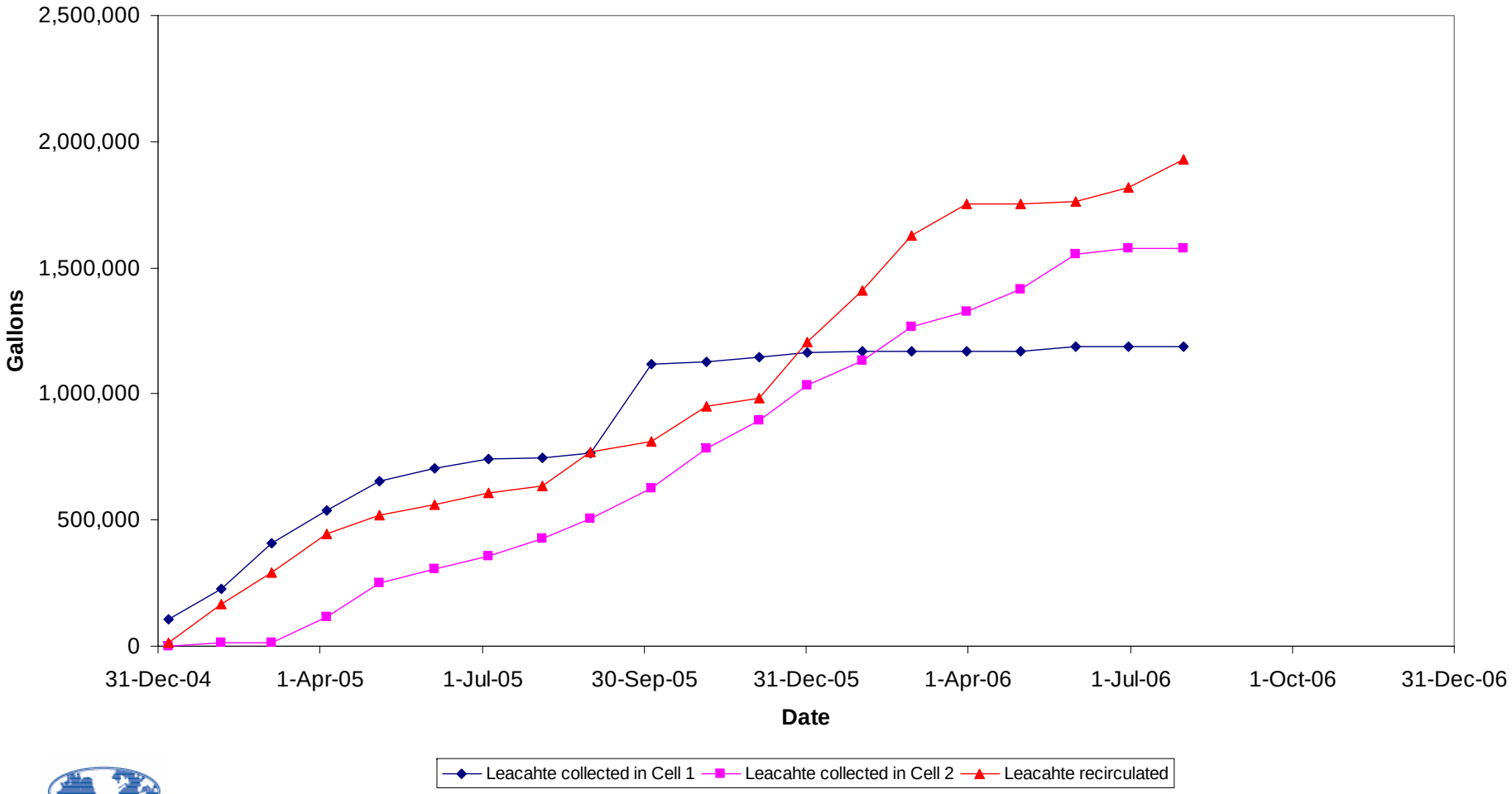
Leachate Application



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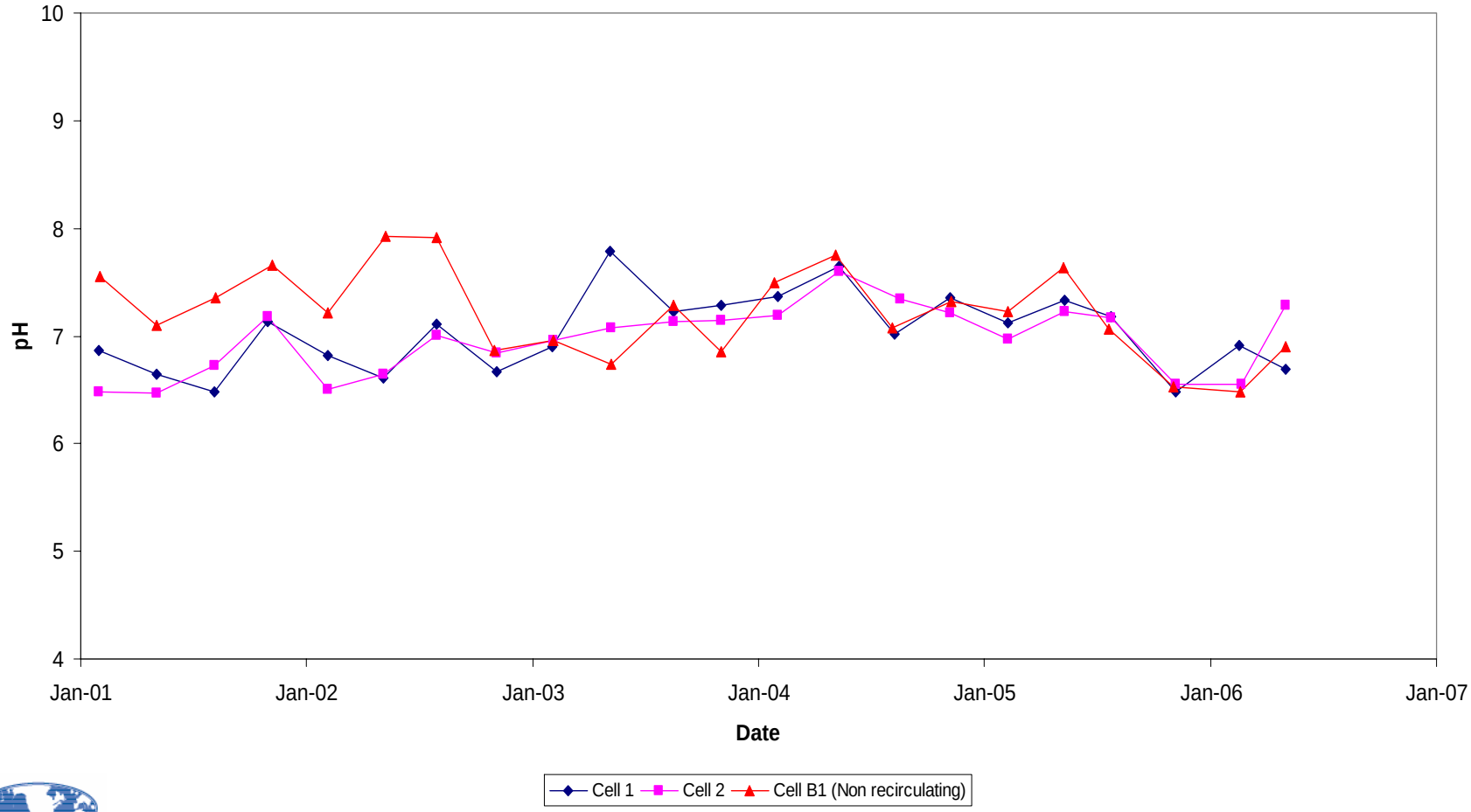
Leachate Application

Application Method	Frequency of Use
Horizontal Trenches	> 95%
Spray Application at Working Face	<5%
Infiltration Blankets	-

Leachate quality - pH



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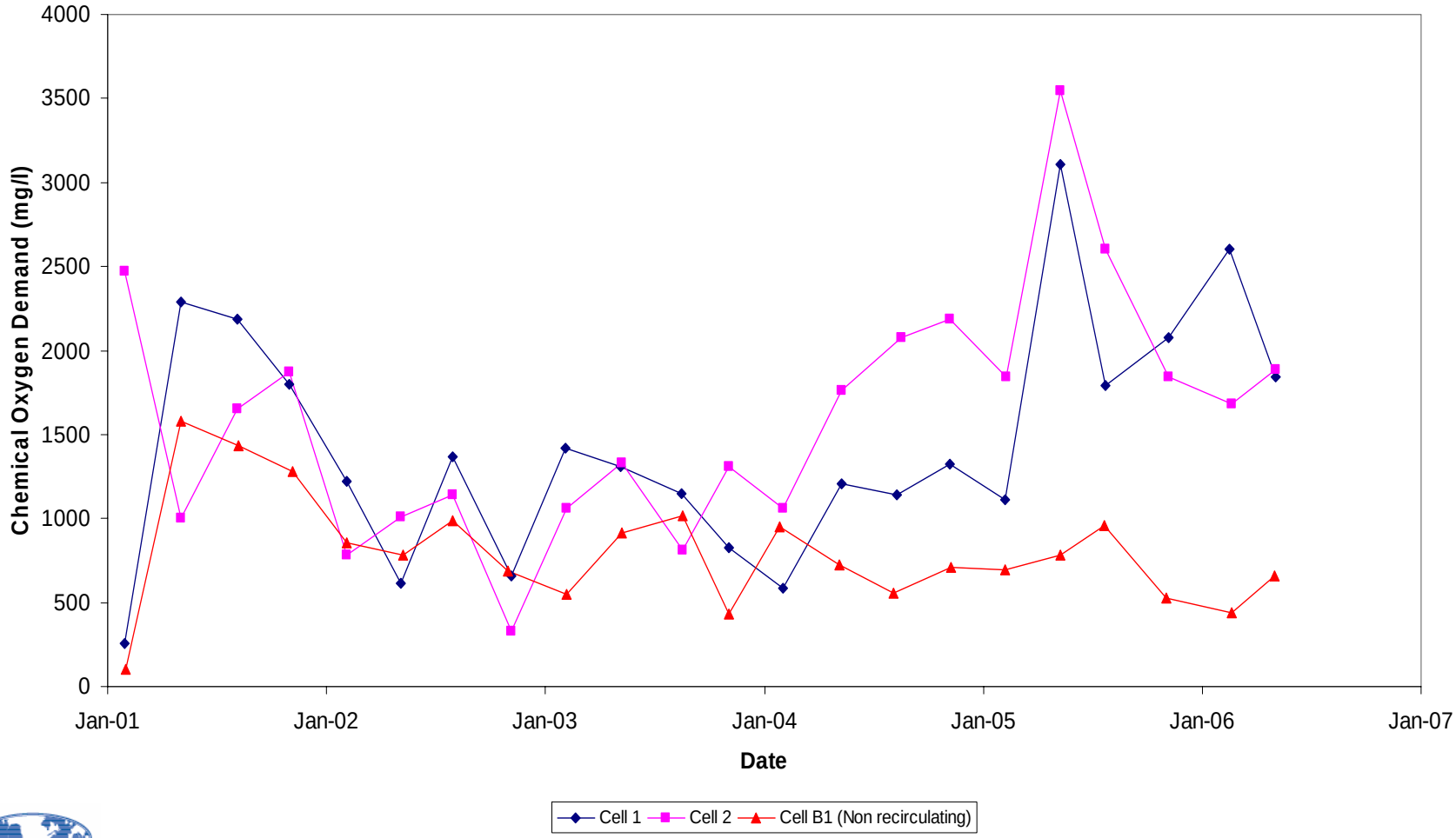
Leachate quality - COD



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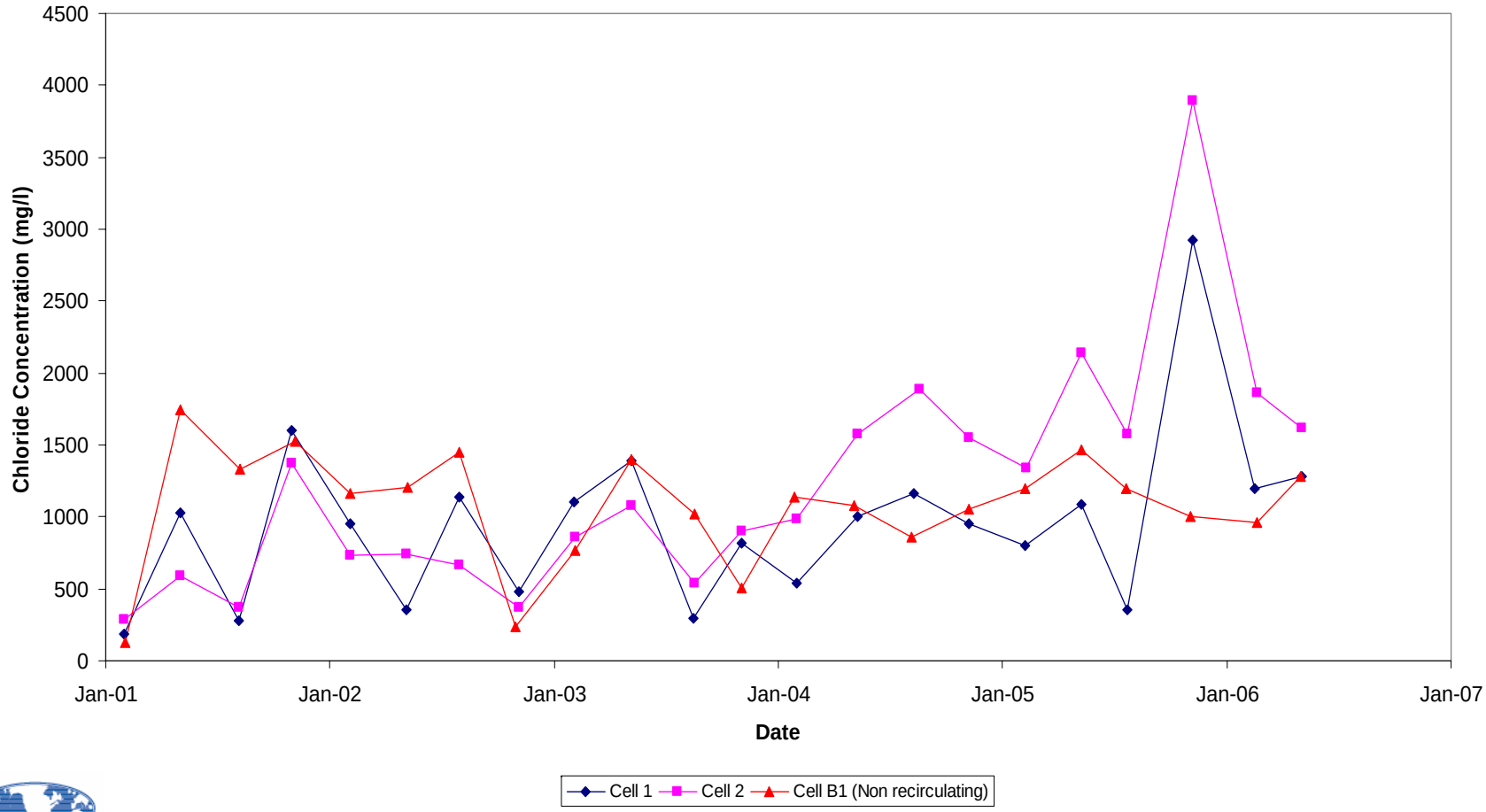
Leachate quality – chloride



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Monitoring

- Monitoring occurs on a daily, weekly, monthly, or quarterly basis, depending on the parameter
- Interaction between operator and engineer
- Reports prepared on an annual basis
- Have a data management system in place

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Monitoring Summary

- Leachate quality is improving
- Increase in gas generation
- Settlement is occurring
- Trenches are performing as designed

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Engineering, Permitting, Construction Costs

	Approximate Cost
Engineering and Permitting	$100,000
Original Infrastructure	$600,000
Modifications/Additions	$400,000
Engineering Support	$15,000/yr

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Operating Costs

Method	Approximate Cost
Trucking/off-site disposal	$0.05/gal
UV/RO system	$0.10/gal
Recirculation	$0.05/gal

CCSWA Impressions

- Valuable addition to leachate disposal options
- Good community support
- Ramp up efforts over next year
- Settlement and gas potential

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Summary

- Able to operate system without significant negative environmental impacts
- Leachate quality is improving
- Important to stay up to date with gas collection system

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