



Coordinated Emissions Sampling for Postclosure Care Concerns



**SWANA/BWM Solid Waste Management
Conference & Operator Training Course
October 22, 2015; Mayetta, KS.**

Our Mission: To protect and improve the health and environment of all Kansans.

Status Report

- The BWM is continuing to perfect the proposed reduction &/or termination methodology for PCC as per Bill's remarks in yesterday's AM session.
- Existing policies and TGDs are being reviewed to reflect these considerations which are ultimately based on **a scientifically defensible emission sampling plan** that can substantiate the proposed strategy for PCC reduction &/or termination. Today's presentations explore another aspect of the plan.



Presentation Format

- 1. Coordinated emission sampling & leachate sampling options & protocols – 15 minutes (Carl Burkhead)**
- 2. Landfill gas sampling options & protocols – 15 minutes (Brett Clements)**
- 3. Audience discussion – 15 minutes**

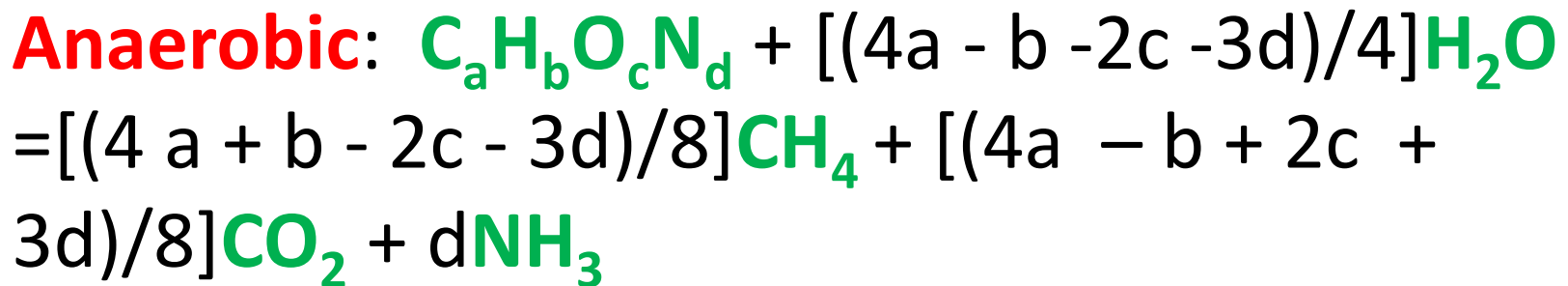
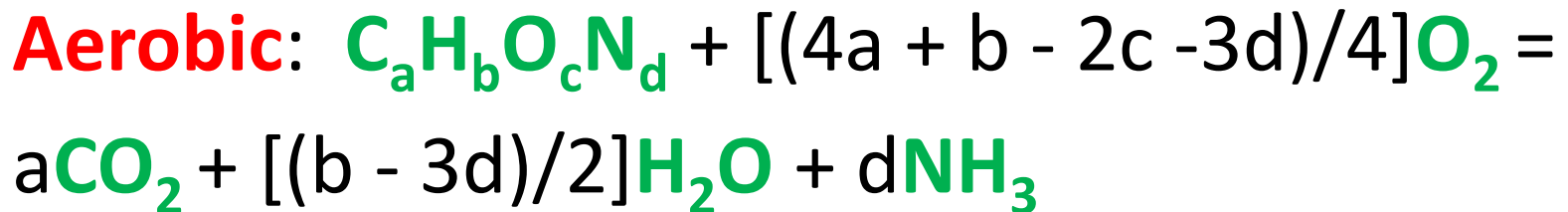
Introduction

- **Emission sampling** is the heart of a PCC Reduction &/or Termination Plan
- Financial assurance cost estimates include a sampling component and other related activities which can result in **early PCC reduction &/or termination**.
- **Sampling protocols** are available for leachate and LFG emissions.
- **Coordinated sampling** is potentially advantageous.

Definition of **Coordinated Sampling**

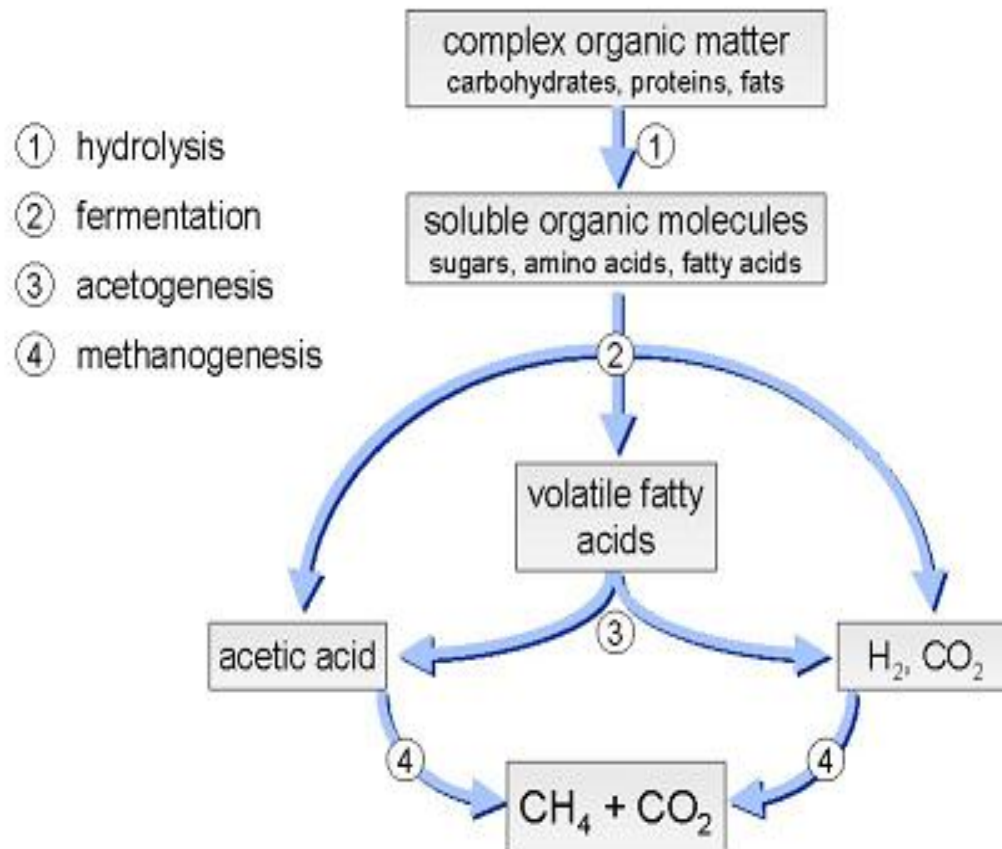
- Coordinated sampling is the taking of leachate and LFG samples from a landfill unit at **a point in time** when **the emission samples represent the same end products** of the MSW biostabilization reactions which are given in the following two slides. These concepts are illustrated the third slide which represents the changes of MSW biostabilization with time in a landfill unit.

MSW Stabilization Reactions* as per Tchobanoglous et al (1977)



* Note the role of H_2O in each reaction.

Anaerobic Stabilization Diagram



A point in time

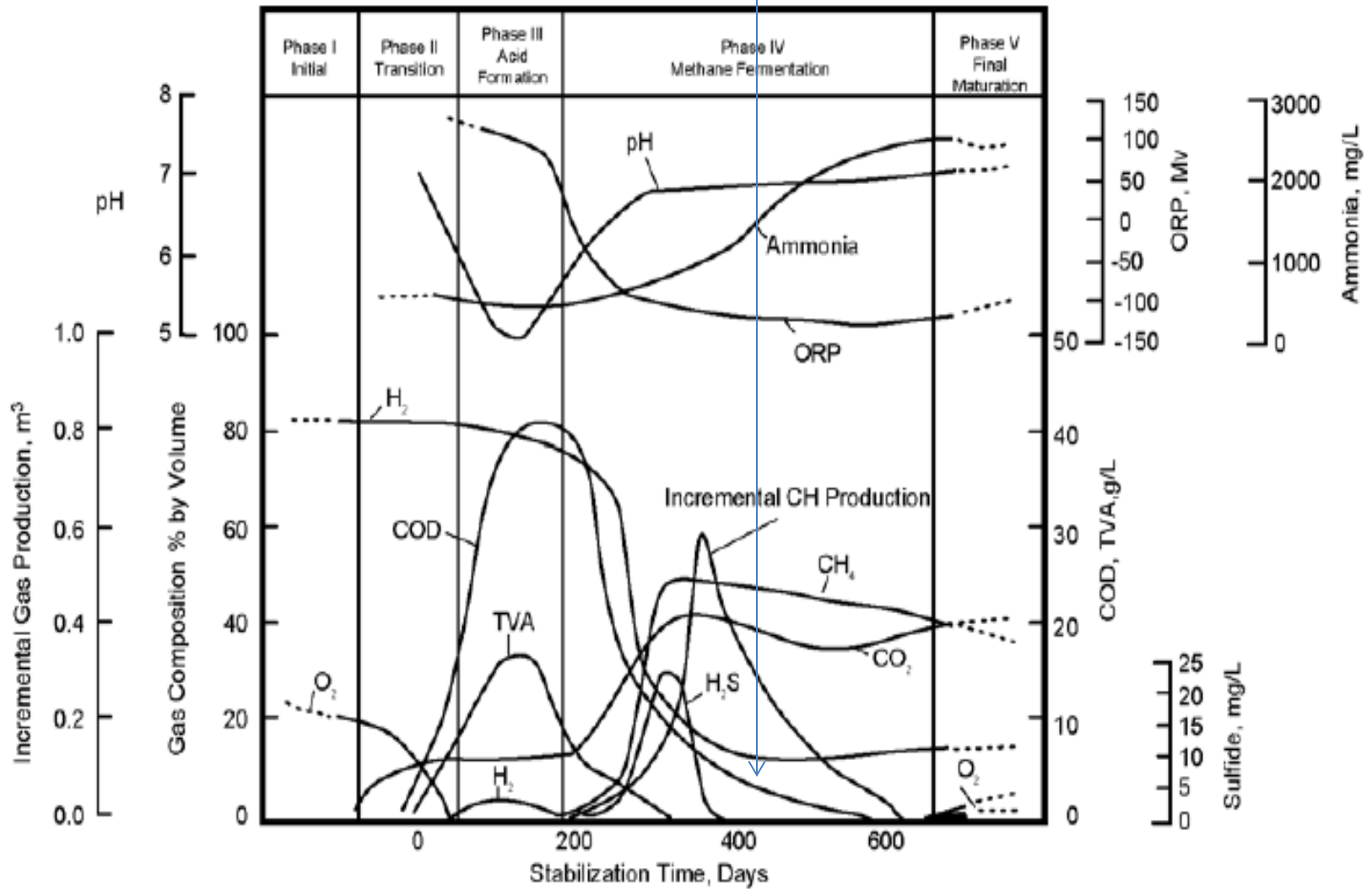


Figure 1: Phases of anaerobic decomposition in MSW landfills (adopted from Pohland and Kim 1999).

Diagram No. 1 - Separate Leachate Discharges

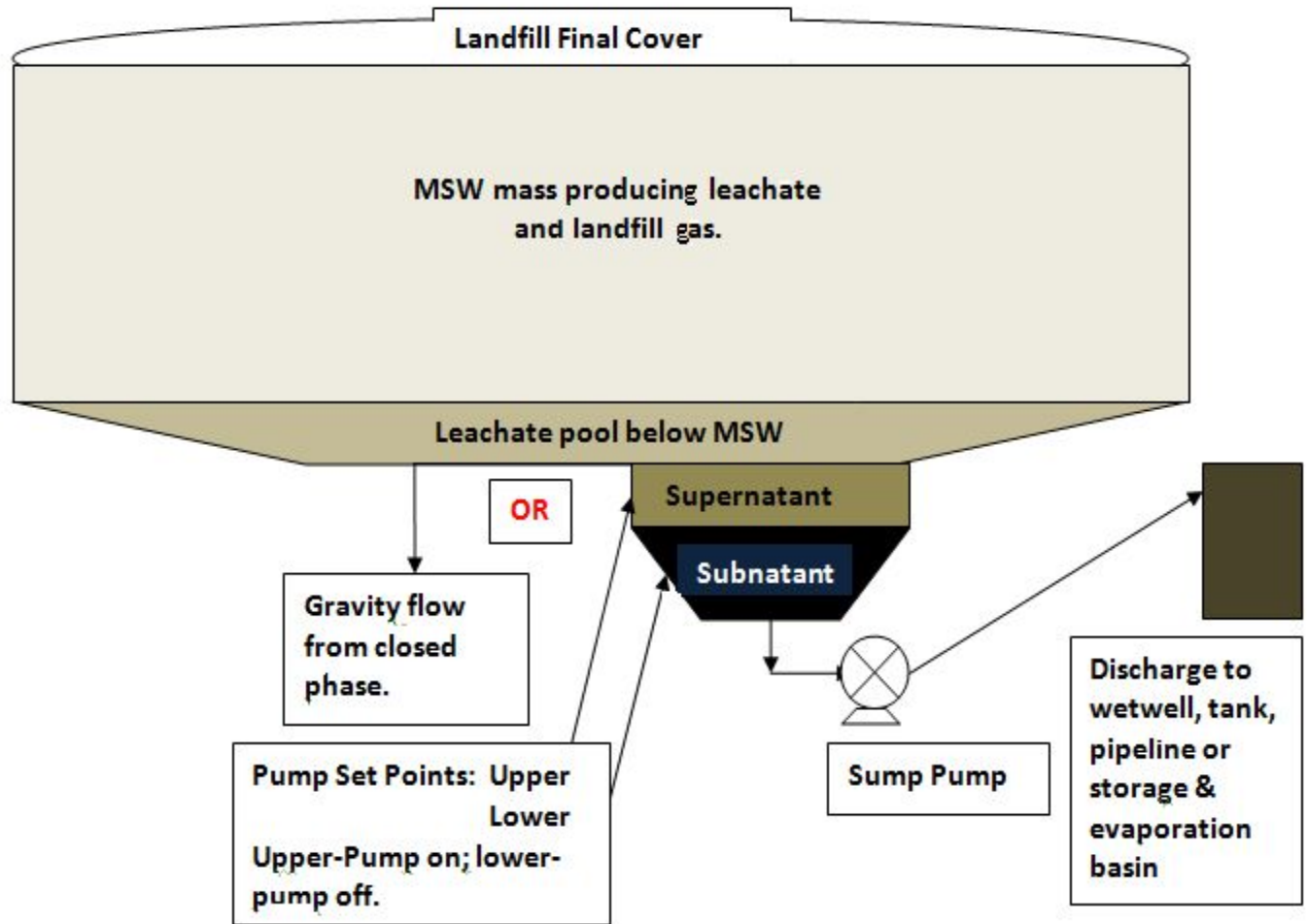
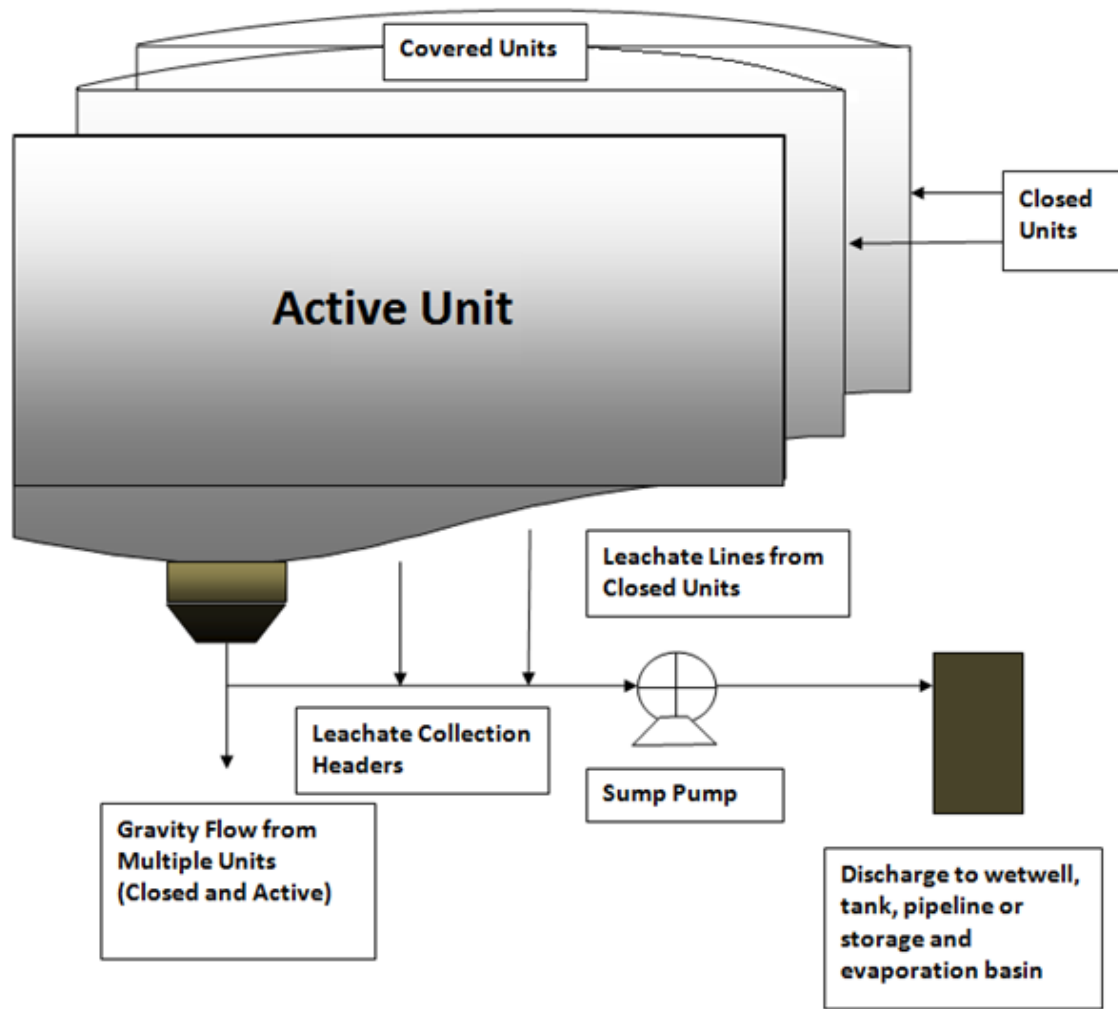


Diagram No. 2 – Common Collection System



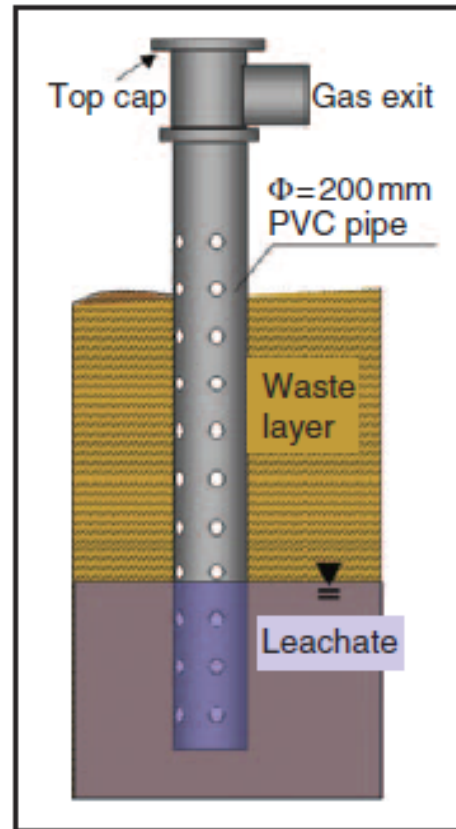
An Alternative Approach for Sampling Leachate Emissions re Stabilization

by Yasumasa Tojo et al, Waste Management & Research, 29(1)41-49(2011)

- **What?** To determine if leachate collection in LFG wells could be used to judge MSW stabilization?
- **Where & How Much?** Hokkaido, Japan; population $>5 \times 10^6$; MSWLF opened in 1979 & closed in 2003; volume = $7 \times 10^6 \text{ m}^3$ (or $9.2 \times 10^6 \text{ yd}^3$); study area = 56 ha (138 ac); 68 (of 73) 20 cm (7.8 in) unconnected, PVC ventilation pipes.
- **Measured?** Leachate depth & quality (pH, EC, T, TOC, IC, TN, Cl^{-1} & NH_4^{+1}); 6X at 3 week intervals.

Gas Ventilation Pipe

On-site leachate measurements of pH, EC & T; **off-site** of TOC, IC, TN, Cl^{-1} & NH_4^{+}



Average installation depth = 20 m

Figure 3. Schematic diagram of gas ventilation pipe installed by countermeasure work.

Plan View of Hokkaido MSWLF

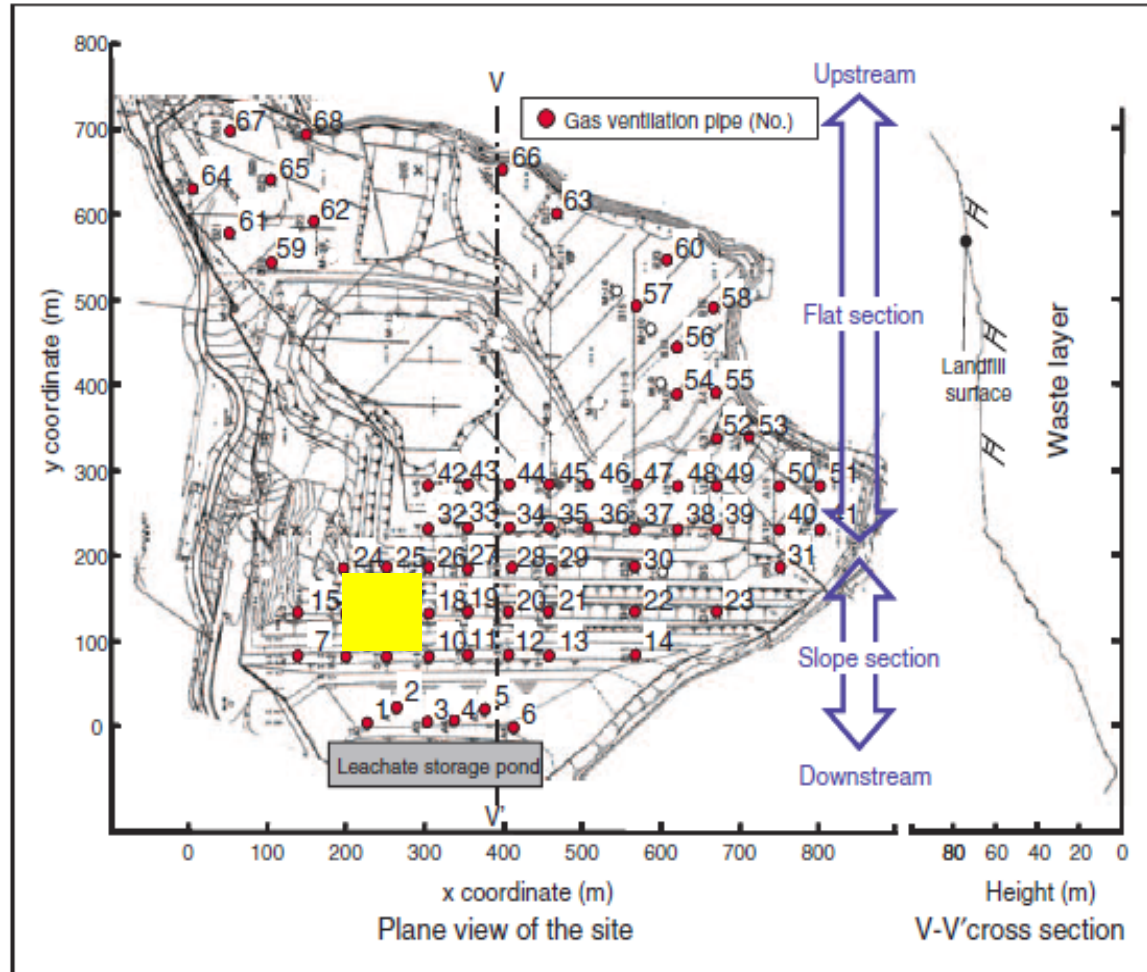
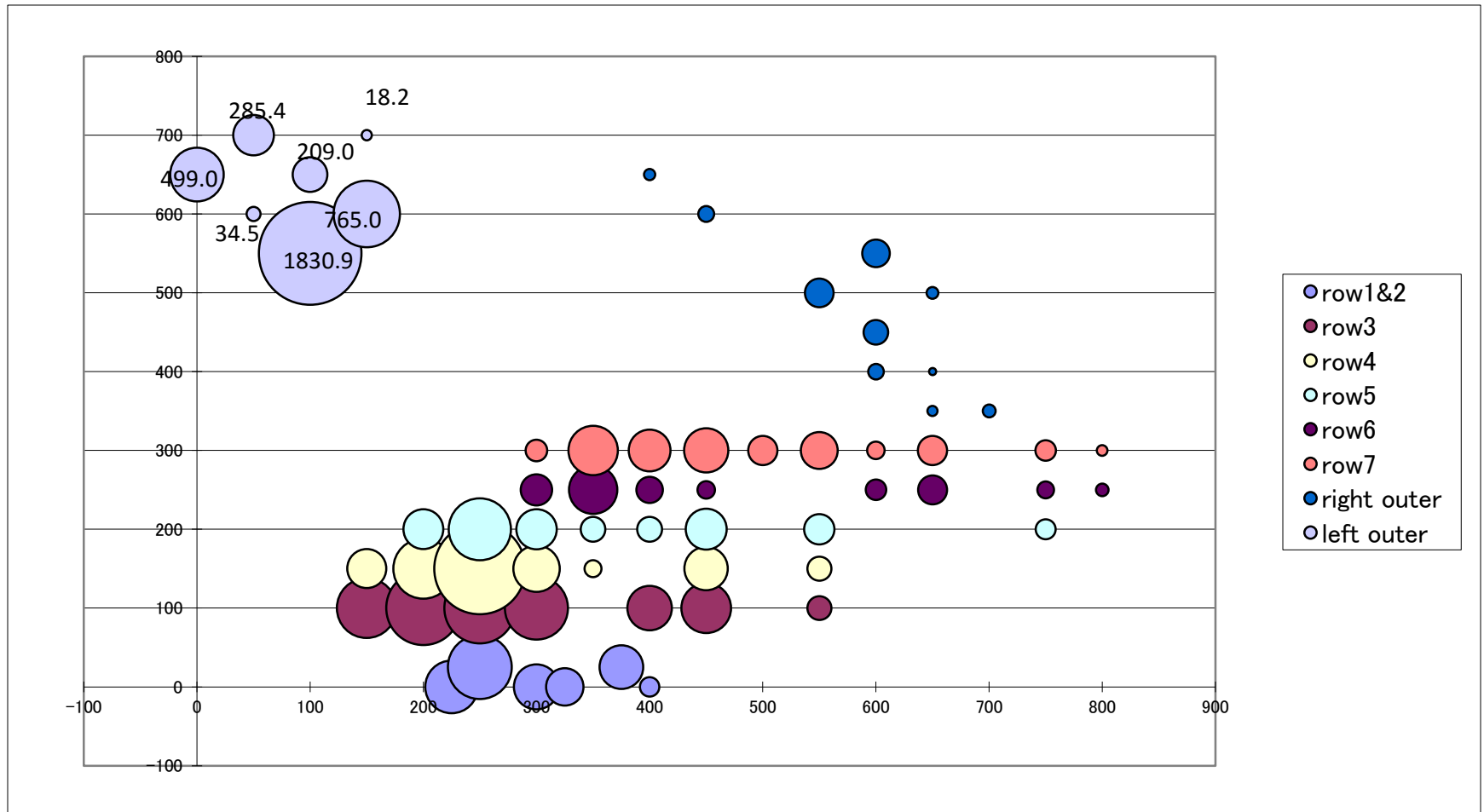
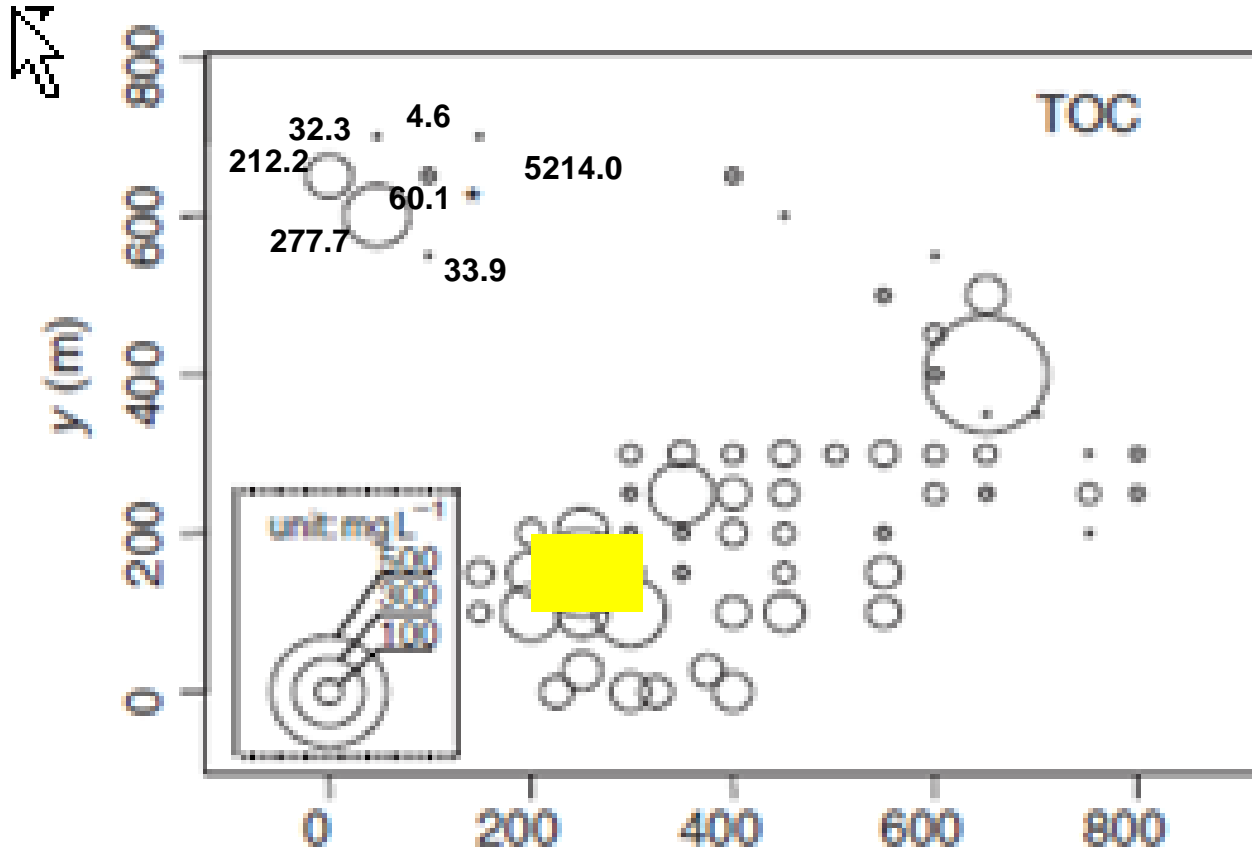


Figure 2. Plane view and V-V' cross section view of the investigated site.

Plot of Cl^{-1} for **Left Outer Pipes: 67, 68, 64, 65, 61, 62 & 59** on 11-16-10.

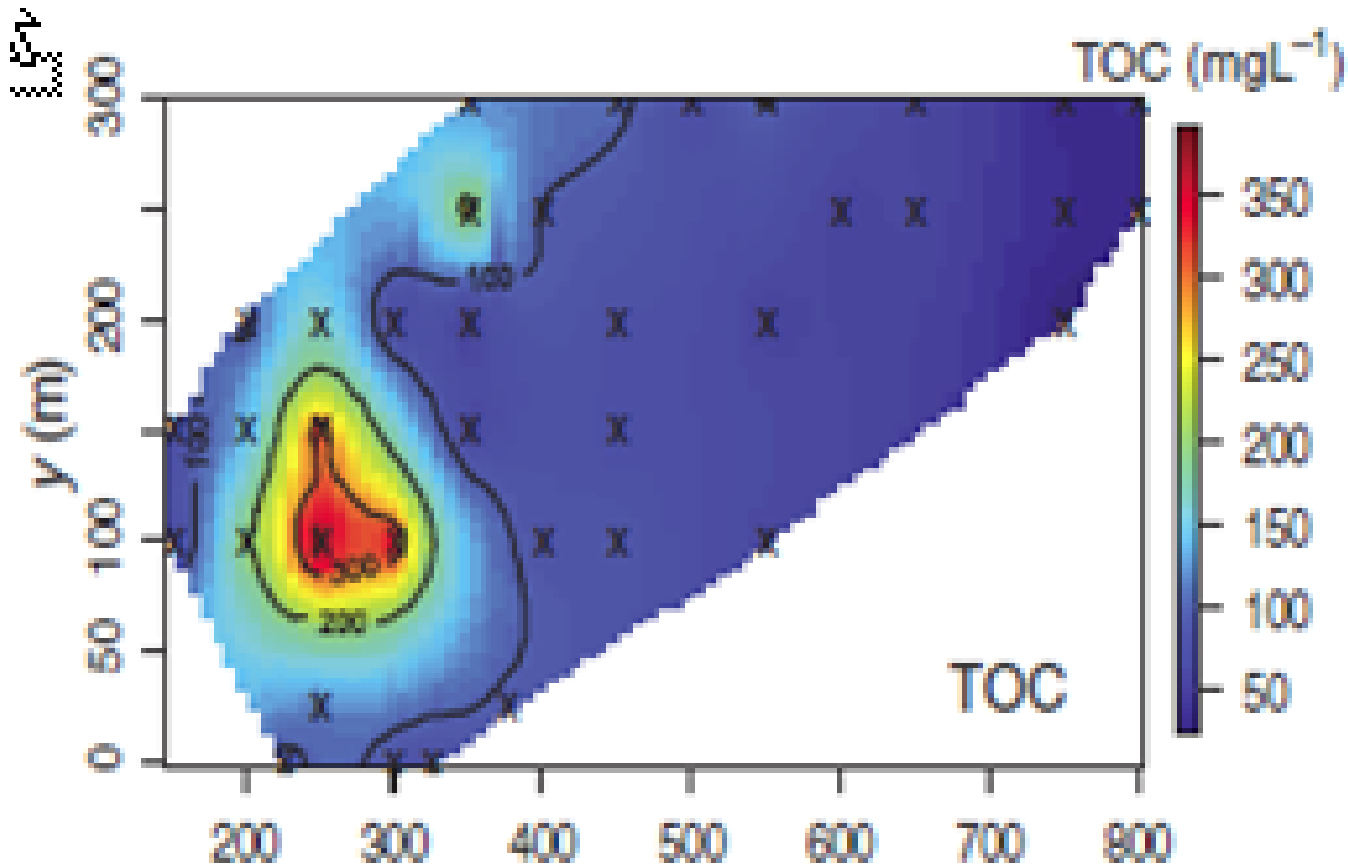


TOC Comparison for **LOP** on 9-7-10



Spatial distribution of TOC on one sampling day where X axis is x(m).

Results: 2nd TOC Comparison



Spatial distribution of TOC at central part (21 %) of site where the X axis is x(m).

Vs. Raw Leachate Prior to Treatment

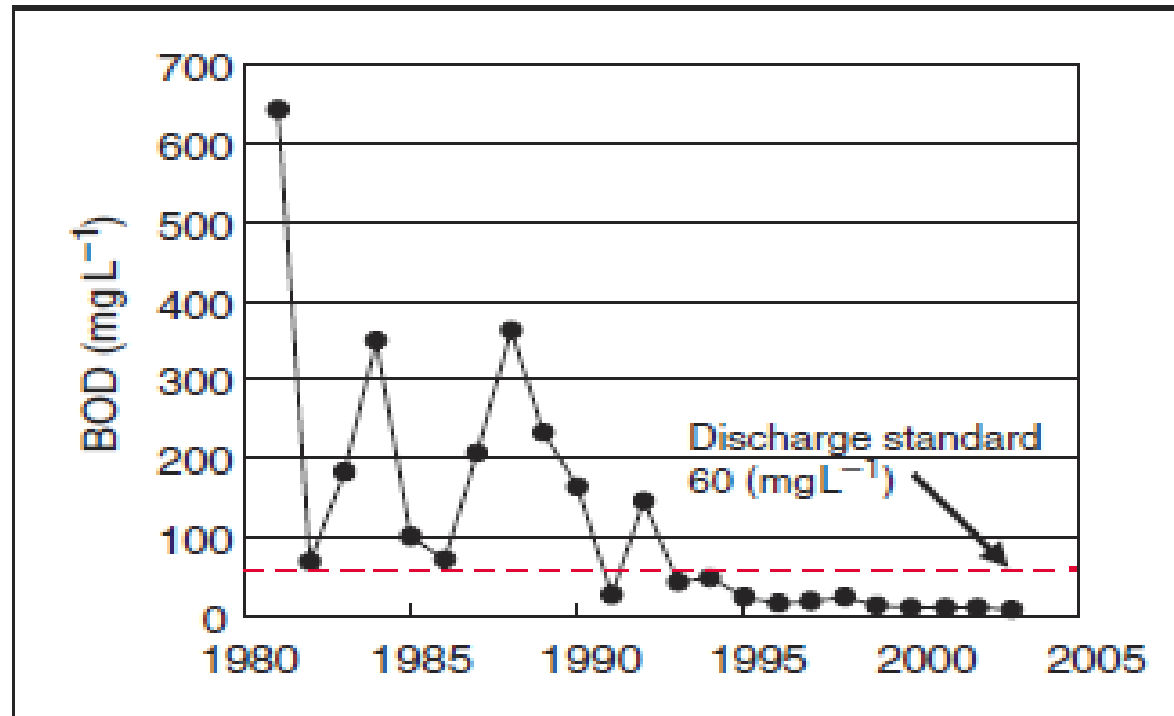


Figure 1. BOD concentration of raw leachate routinely monitored at the leachate treatment facility.

Note: As per Alvarez-Vazquez & Burkhead; COD > TOC > BOD

Selected conclusions **by Tojo et al**

- Leachate concentrations varied significantly for each pipe but reflected well cone of influence qualities.
- Leachate concentrations responded well to cumulative precipitation of 8 to 10 days before leachate sampling.
- Analyte correlation was high with wells in the central part of the site.
- TN values exceeded the stabilization criterion of 120 mg/L within most parts of the landfill.
- Statistics was a useful tool in analyzing the spatial and variation part of leachate quality

Comments of paper **by Burkhead**

- Leachate quality effects of gas condensate was not mentioned; hence, not considered?
- BOD was not measured which is the key stabilization parameter vs. Figure 1 results.
- Figure 1 leachate BOD data were not viewed as representative of MSW stabilization; hence, a poor indicator of **true stabilization**.
- Leachate dilution masks **true stabilization** quality but Figure 1 type data (BOD et al) is the **true leachate** which impacts health & environment.

BWM Website: http://www.kdheks.gov/waste/p_pcc.html

- [Leachate Sampling Plan for Reduction and/or Termination of Post-closure Care - Technical Guidance Document SW-2013-G3](#)
- [Landfill Gas Sampling Plan for Reduction and/or Termination of Post-closure Care - Technical Guidance Document SW-2014-G2](#)
- [Comprehensive List of Leachate Parameters for Post Closure Care Termination](#)
- [Training Primer for Sampling of MSWLF Emissions as Part of a Post Closure Care Reduction and/or Termination Plan](#)
- [Leachate Sampling Checklists with Figures](#)

Presentations (pdf) - May 7, 2014, Salina, Kansas

- [Developing a Leachate Sampling Plan - Carl Burkhead, KDHE](#)
- [Developing a Landfill Gas Sampling Plan - Carl Burkhead, KDHE](#)



Carl Burkhead: cburkhead@kdheks.gov

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