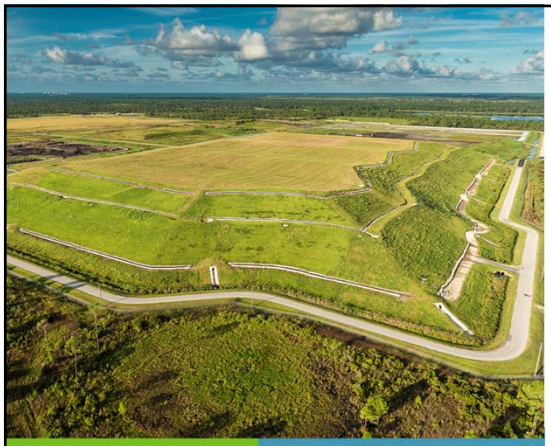


Termination of MSW Landfill Post-Closure Care

Michael D. Caldwell, PG

WM Director, Groundwater and Technical Programs

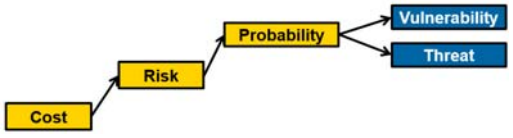
SWANA #822787

Acknowledgements:
Jeff Murray, PE, President, SWANA
Dr. Bryan Staley, PE, President and CEO | EREF

Mississippi "Magnolia" SWANA 2019 Spring Conference
Bay St. Louis, Mississippi
May 15, 2019

SWANA's New Technical Policy T-9.3

- "T-9.3 Termination of MSW Landfill Post Closure Care Requirements"
  - Developed in Collaboration with NWRA
  - Reviewed and Approved by Technical Divisions and 70 Member International Board
- Policy Statement:
  - PCC Term is finite
  - Term should be defined using site-specific data and a performance-based approach
  - Technical evaluation methodology and performance-based criteria should be agreed upon in advance



Why Now?

- PCC permits for some solid waste landfills will expire soon
- EPA – No Guidance on "protection of human health and the environment"
- Certainty – No "Kicking the Can"
  - Industry stakeholders are seeking "certainty" and need an objective process for planning purposes

Where Are We?

- EPA Slow to Change
- States taking the lead
- Subtitle C PCC Guidance Published

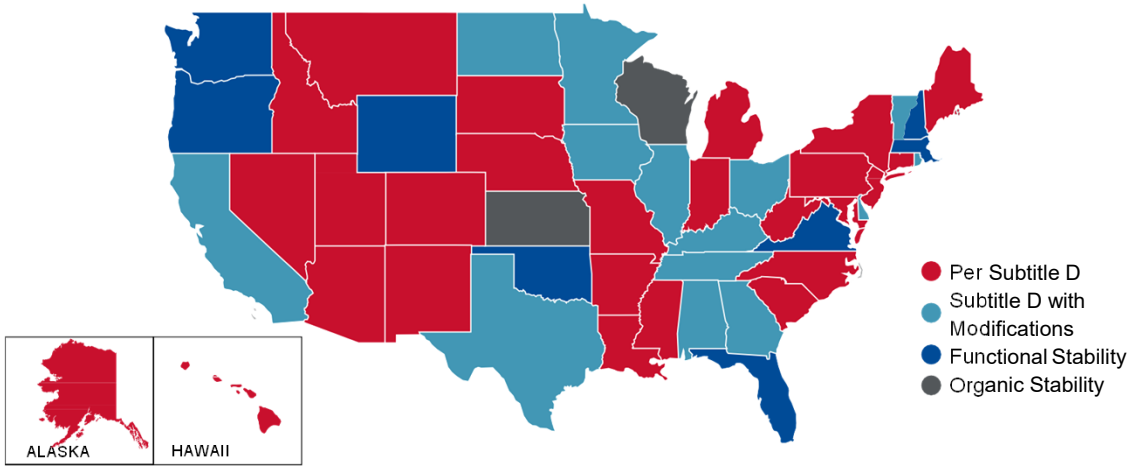
MEMORANDUM

SUBJECT: Guidelines for Evaluating the Post-Closure Care Period for Hazardous Waste Disposal Facilities under Subtitle C of RCRA

FROM: Barnes Johnson, Director
Office of Resource Conservation and Recovery

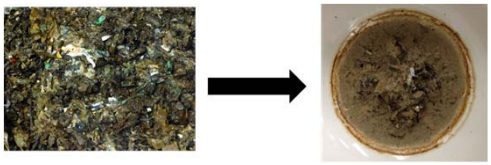
TO: RCRA Division Directors, Regions 1-10
RCRA Enforcement Managers, Regions 1-10
Regional Counsels, Regions 1-10

Current US Landfill Post Closure Care Termination Requirements



Approaches for Performance Based PCC

- Organic Stabilization (WI)
  - demonstration of a relatively inert waste mass



- Functional Stability (FL & WA)
  - considers long-term emissions in context of threat potential WITHOUT active controls
  - measured at a point between landfill and a potential POE

Goal in either case is going from active post-closure care to a point of custodial or *'de minimus'* care where HHE is protected

Organic Stabilization

- Requires near-complete degradation of waste mass (i.e. inert solids in the waste mass)
- May offer maximum protection of HHE but also may be 'overkill'
- Approaches suggested typically do not allow for a 'step down' in PCC activities over time
- Can imply very long-term (30+ years) or near perpetual care under a regulated program (Scharff et al., 2011)
- Little consideration of cost; likely most expensive option

Demonstrating Organic Stability (?)

- Typically two characteristics of concern for waste mass:
  - Extent of biodegradation
    - Remaining LFG production
    - Remaining settlement
  - Leaching potential
    - Assessment of future leachate quality
- Implies characterization of buried solids that is representative of the ***entire*** waste mass
  - No guidance on what testing is appropriate and target levels; wide range of tests could be used (Wagland et al., 2009)
  - Trends in LFG, settlement, leachate generation may provide suitable surrogates

Retrospective Analysis of Wisconsin's Landfill Organic Stability Rule: Is the Rule Meeting Its Objective?
Bareither, Barlaz, Doran, and Benson (May 2014)

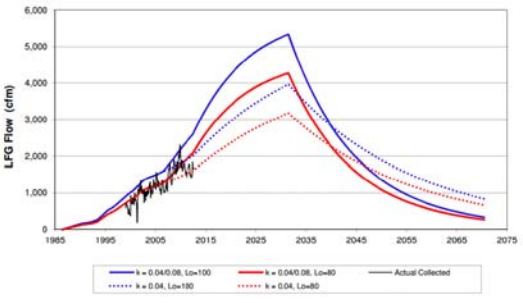
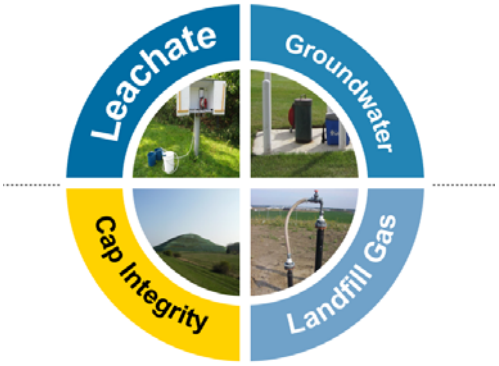


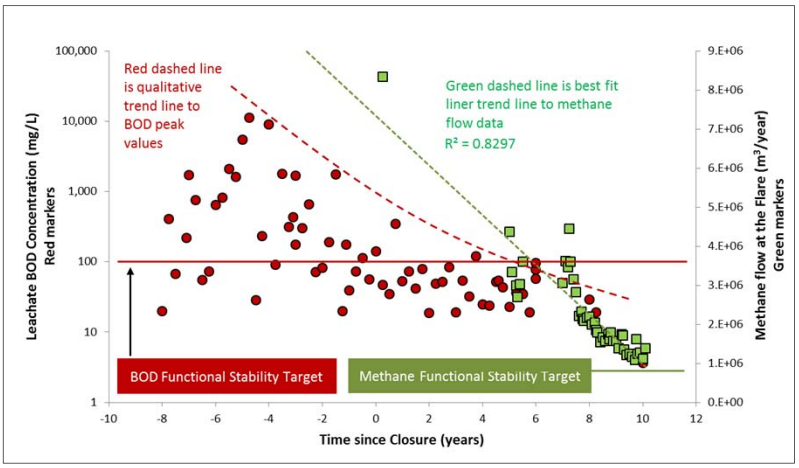
Fig. A7. Comparison of predicted landfill gas and collected landfill gas at Landfill L.

Functional Stability

- Relies on conservative impact assessments to define PCC monitoring and management (Morris and Barlaz, 2011)
- "A landfill is functionally stable when it does not pose a threat to human health and the environment at a point of exposure in the absence of active control systems."
- Key Active and Passive Control elements:
  - Active: Leachate and LFG control systems
  - Passive: Cover system
- Key Confirmation Monitoring Elements:
  - Groundwater and Methane migration monitoring



Demonstrating Functional Stability



Functional Stability and Completion of Post-Closure Care at Municipal Landfills: Findings from Application of a Performance-Based Methodology.
- Morris, J.W.F, Caldwell, M.D., Bull, L.P., Crest, M., and Akerman, A.
- S. Margherita di Pula, Cagliari, Italy 30 September – 4 October 2013

Phased Decreases in PCC

Example regression from active to passive care

Active Aftercare	• Active control of LFG and Leachate
Active to Partial Aftercare	**Scientific data could lead to:** • Reduced number of sampled analytes (indicator parameters) • Employ alternative LFG treatment technologies such as methane oxidation covers • Assess potential for wetlands treatment of leachate vs. offsite disposal
Partial to Passive Aftercare	• Surveillance monitoring • Less frequent sampling • Some reduction in O&M and/or regulatory reporting • Reduced leachate pumping, and/or screening vs. lab analysis
"De minimus" PCC Condition	• Regulated PCC completed • Minimum Surveillance • Negotiated Agreement on PCC with contingencies

Does A Peer-Reviewed Case Study Exist on this Subject?

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journal homepage: www.elsevier.com/locate/wasman

Case study comparison of functional vs. organic stability approaches for assessing threat potential at closed landfills in the USA

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Where Can We Go?

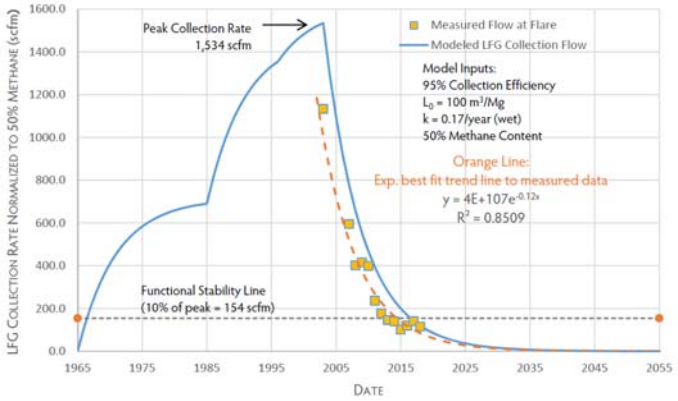
- SWANA/NWRA Policies final
- State Guidelines can be used as templates:
  - Functional Stability – FL or WA
  - Organic Stability - WI
- Begin the data collection process

SWANA Policy Recommendations

- Leachate
  - o Quantity and quality stable
  - o No unacceptable threat to POE
  - o Minimum Data
    - BOD/COD
    - Ammonia
    - pH

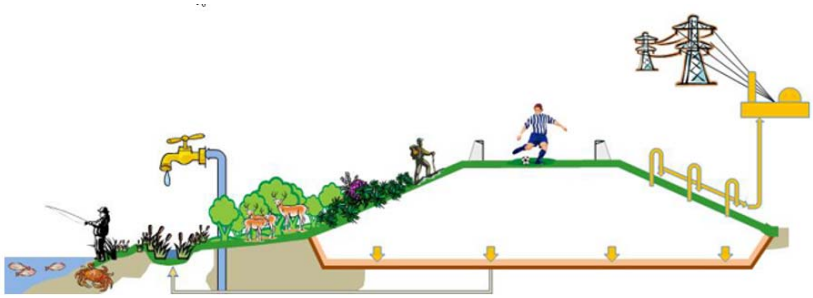
SWANA Policy Recommendations

- Landfill Gas
  - Generation is *de minimus*
  - No threat to HHE at POE
- Stability and Cover Integrity
  - Controlling LFG emissions
  - Reduced leachate
  - Little to no settlement
  - Long-term functional stormwater management



What Else Can We Do?

- Design and Operate with the End-Use in Mind
- Engage your neighbors on how your landfills are designed, constructed, operated, and monitored to protect human health and the environment
  - And this time use data!

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