

Landfill Methane Generation and Gas Collection & Control Systems

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Organized by Timothy D. Stark, PhD

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Executive Summary

The FGI's eighth webinar of 2026 featured Dr. Tarek Abichou of Florida State University on the transition from generation-based design to measurement-informed landfill gas management. The presentation framed methane as both an environmental liability and a potential asset through energy recovery, climate benefits, and the value of captured gas. The presentation examined why modeled methane generation and conventional well-spacing calculations alone cannot establish how effectively a landfill captures its gas.

A study of 178 landfills in 26 states combined aircraft methane detections with reported waste, collection, and infrastructure data. In the selected dataset, humid-climate landfills faced a double challenge: faster modeled methane generation early in the waste's life and liquid-related restrictions that impaired gas movement toward collection wells. Earlier installation and effective operation of collectors emerged as important complements to well density.

Abichou repeatedly distinguished detected methane plumes from total landfill emissions. The comparisons presented are useful indicators of operational challenges, but they do not by themselves establish annual emissions or collection efficiency.

Key Takeaway for Engineers & Students

Collection infrastructure must match both methane-generation timing and the ability of gas to move through the waste. In wet landfills, liquid management and early collector installation can be as important as the total number of wells. Measured collection is valuable, but it cannot establish collection efficiency without a defensible estimate of generation.

1. From Generation-Based Design to Measured Performance

1.1 The Methane Balance

Once methane is generated, it can be collected, stored within the waste, oxidized while moving through the cover, or released as fugitive emissions. Abichou explained that collection is the component most directly measured in conventional operations using flow meters. The remaining terms are harder to quantify, making it difficult to close the methane balance.

The management objectives are to increase recovery, enhance oxidation, and reduce emissions. These outcomes should be evaluated separately: improving one does not automatically demonstrate improvement in the others.

1.2 Why Generation Is Uncertain

Generation is modeled rather than directly measured. The methane-generation potential, L_0 , describes the total methane that a waste stream can produce and depends on its composition, degradable organic fraction, and decomposition history. The rate constant, k , describes how quickly generation occurs and is influenced by moisture, temperature, climate, and operating conditions.

Those uncertainties carry into design. Abichou described the conventional workflow as estimating waste quantities, forecasting gas generation with tools such as LandGEM or IPCC methods, establishing a peak generation rate, and sizing pipes, pumping equipment, and the collector network accordingly.

1.3 Limits of Radius-of-Influence Design

Well spacing is commonly determined using a calculated radius of influence. These calculations depend on waste permeability, gas generation, well geometry, and operating conditions, many of which are uncertain or spatially variable. Abichou characterized this approach as a simplified representation of a complex landfill rather than a sufficient demonstration of capture performance.

1.4 Collection Is Not the Same as Collection Efficiency

A metered collection rate shows how much gas is recovered. It does not establish what fraction of the generated methane was captured, because the generation denominator remains uncertain. A higher collection rate can be encouraging without proving a particular efficiency, such as 80% or 90%.

2. Aircraft Observations and Climate-Related Performance

2.1 Study Scope and Interpretation

The study examined 178 landfills across 26 states where methane had been observed from aircraft. Most observations were associated with Carbon Mapper, with some from MethaneAIR. The team linked observations to EPA-reported information for the corresponding years, including waste in place, recent waste disposal, annual gas and methane collection, total wells, and recent well additions.

Dataset limitation: These were landfills with detected methane. The analysis did not establish performance for landfills without detections. Abichou used the phrase "visibility index" to emphasize that observed plume intensity should not be treated as total landfill emissions.

2.2 Main Comparisons Reported by the Speaker

Indicator	Reported finding and interpretation
Early modeled generation	Over the first five years, humid-climate landfills generated about 1.7 times the methane of moderate-climate sites and about 3 times that of dry sites in the model comparison.
Collection infrastructure	Humid sites had roughly 1.3-1.4 times as many wells on the comparison discussed, rising to about 2 times on the recent-waste comparison. Infrastructure did not scale with the modeled 3-fold early-generation difference.
Individual-well performance	Abichou reported approximately 80% lower collection for a humid-site well in a normalized dry-versus-humid comparison. The transcript does not supply the normalization details.
Detection relative to collection	Reported detected-intensity comparisons were about 24-25% of collection for dry/moderate sites, versus a median near 150% for humid sites. These were plume observations, not annual emissions fractions.

2.3 Why Wetter Waste Challenges Collection

Humid sites showed stronger methane detections even after normalization by total waste in place or waste deposited during the preceding five years. Abichou linked poorer well performance to reduced gas permeability as waste becomes saturated, condensate obstructing gas flow, trapped leachate increasing pressure, and flooded wells losing effective connection to the surrounding waste.

The engineering implication is that more available methane does not guarantee proportionally more recovery. Gas must be able to reach a functioning collector. Liquid accumulation can restrict that pathway and allow methane to escape elsewhere.

3. Earlier Recovery and Operational Evidence

3.1 Timing Matters Alongside Well Count

Within the humid-climate group, better-performing sites tended to install wells earlier, even where overall well totals were similar. Abichou argued that early recovery remains an important opportunity for innovation because a substantial share of generation occurs before conventional infrastructure fully catches up.

Horizontal collection pipes installed as waste is placed were presented as one possible approach. The operational challenge is to capture gas sooner without excessive extraction that draws oxygen into the waste. Simply increasing well count does not resolve installation timing, liquid blockage, or operating constraints.

3.2 Using Operational Data to Motivate Improvement

A subsequent investigation examined internal landfill operating data to explore whether documented field performance could support collection-efficiency claims above default assumptions. The proposed direction was a scoring approach that rewards demonstrated optimization rather than relying only on a generic assigned efficiency. The effort aims to connect documented operating performance with more defensible efficiency claims.

The indicators discussed included collection-system downtime or disturbances, positive pressure at wells, collector density, and exceedances recorded during quarterly surface-emission monitoring. Outcomes included total collected gas, collection per well, and collection per acre.

3.3 Overall Trends Can Hide Operating Differences

Across the broader dataset, greater collector density correlated with greater gas collection, including normalized comparisons. Within the humid-climate subset, however, relationships were weak: the speaker reported R-squared values below 0.1 and around 0.2 for the comparisons normalized by waste in place or area. Abichou also introduced the idea of performance clusters reflecting differences in landfill management practices.

4. Announcements

At the opening, Tim Stark stated that the recording and presentation slides would be made available on the FGI website and that PDH certificates would be sent automatically to attendees who remained for the entire webinar. Questions from the Japan, Australia, and South Africa time-zone sessions could be submitted during the presentation or follow-up survey for a later podcast.

Source: User-supplied TurboScribe transcript of FGI Webinar: Landfill Methane Generation and Gas Collection & Control Systems, Recording: youtube.com/watch?v=B477R7gWs6k.

Disclaimer: This AI-generated partial summary reflects the speaker's presentation, not necessarily the position of FGI. Numerical comparisons are reported as described in the supplied transcript; figures, normalization methods, and study details should be checked against the presentation slides before engineering use.