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Improvements to Working Face and Daily Cover to Reduce LFG Emissions

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White Paper for Evaluating Revisions to the Municipal Solid Waste (MSW) Landfills New Source Performance Standards (NSPS) and Emission Guidelines (EG)

- This series of white papers examines ways to improve the NSPS/EG for MSW landfills using new information and new technology to further control and reduce landfill gas (LFG) emissions.
- Topics include applicability (size of landfill), controls, (emission rate and timing of controls), operating practices (cover practices, working face), waste composition (organic waste), and monitoring (technology).

Topic: Improvements to Working Face and Daily Cover to Reduce LFG Emissions

This paper describes techniques that can be implemented to minimize LFG emissions from the working face of the landfill and from the application of daily cover. The "working face" or "active face" is where waste is unloaded on a daily basis and where waste-moving equipment and compactors operate.

Landfill covers are essential components in waste management, serving to minimize gas emissions, control odors, reduce leachate formation, and prevent water infiltration into the landfill. There are three main types of covers: daily, intermediate, and final. Daily cover is applied at the end of each operational day to limit odor, deter pests, and reduce the potential for waste scattering. Intermediate cover is used when sections of the landfill are not actively being filled for an extended period, providing a more durable solution than daily cover. Daily cover is required to have 6 inches of earthen cover, while intermediate cover is required to have a 12-inch cover, serving as a barrier until the final cover is installed. Final cover is a permanent, multi-layered system applied once a landfill reaches its capacity. Final cover usually includes a compacted clay or geomembrane layer to prevent water infiltration, a drainage layer, and a vegetative layer that stabilizes the surface and reduces erosion.

Field flux measurements indicate that methane emissions from landfills predominantly originate from the working face area or areas with intermediate or final cover that lack active gas collection wells. This paper reviews working face area emissions and offers an overview of potential solutions to mitigate methane emissions from working face areas and areas with daily cover.

Rationale and Possible Results

One potential solution to mitigate methane emissions from working face areas and areas with daily cover involves limiting the size of the working face area to reduce the area from which methane can be emitted (see Figure 1 for an example landfill). Additionally, implementing an operational plan for adjacent gas collection wells near the working area can partially mitigate emissions. Horizontal gas collection trenches beneath the active working face area can also be utilized to collect methane from the local area.

Furthermore, alternative daily cover (ADC) is reviewed to determine suitable options for mitigating gas emissions from these areas. Traditional methods of managing landfills involve daily covering, historically with soil, to ensure landfill safety and minimize hazards. However, EPA introduced ADC as an option for daily cover (U.S. EPA, 1993), thereby diversifying cover materials for landfills. ADCs are crafted from various materials, with varying compositions. Typically, ADCs include shredded tires, green waste or compost, foam products, fabric panels, or construction waste. Some ADC systems can create a crust over the landfill, offering protection against scavenging, runoff, disease, and pollution. However, emissions of other gases from these ADC systems that negatively impact public health must be considered.

Figure 1. Working face area at an Ohio landfill using a tarp for daily cover.

Investigations

This paper reviews literature about methane emissions from working face areas compared to other landfill areas. It also considers ways to manage the working face area of a landfill to enhance environmental protection. For instance, limiting the size of the working face can decrease the potential for emissions. Additionally, capturing the gases emitted from the working face area as a preferential pathway to escape into the atmosphere is critical. Implementing systems to collect these gases effectively prevents their release and facilitates their use as a renewable energy source. In addition, utilizing a less permeable daily cover can decrease gas emissions.

Emissions from the Working (Active) Face

Working face areas have been identified as methane emission hotspots in landfills. Maasakkers et al. (2022) utilized satellite data from GHGSat to detect emission hotspots at landfills in Buenos Aires, Delhi, Lahore, and Mumbai. This study revealed that landfill methane emissions may originate from various sources such as working faces, gas collection wells, cover gaps, and others.

Yeşiller et al. (2022) conducted methane field measurements and found that the highest methane emissions flux (mass of emissions per unit area) at the landfill come from working face areas with daily cover. This study was designed to assess the emissions from the working face. The experimental techniques in this study did not directly measure emissions from the working face due to safety and setup limitations.

In the Yeşiller et al study (2022), the difference in emissions (14,000 tonnes/year) between the in-situ ground measurements (flux chamber) and aerial measurements considerably exceeded their estimate for the working face using inverse modeling (3,000 tonnes/year). When converted to flux (using the 3,010 square meter (m^2) working face), the resulting 13,300 grams per square meter per day (g/m^2-day) far surpassed the highest daily cover flux recorded at the site (54 g/m^2-day), the highest flux reported for a California landfill (86 g/m^2-day), and the highest known working face flux from literature (207 g/m^2-day in a humid subtropical climate per Goldsmith et al. (2012)). This study and other similar investigations reveal the importance of the working face area in mitigating high methane flux intensity from landfills.

According to federal regulations, landfill waste must be covered with at least six inches of soil at the end of each operating day, which is the standard method for covering exposed waste to control issues like odors, disease vectors, and scavenging animals (U.S. EPA, 1993). Different types of landfill covers are utilized based on the stage of the landfill cell. Daily cover, which often consists of loosely placed coarse-grained soils or similar alternative materials (such as textiles, foams, or organic waste), provides minimal resistance to flux due to its open, interconnected pore structures. Daily cover does not have specific hydraulic conductivity requirements but can affect gas migration within the landfill. During operational hours, the working face remains uncovered, and fresh waste, which initially produces little methane, is added. However, the primary methane emissions originate from the older waste beneath and adjacent to the working face. If daily cover is not removed after the placement of new fresh waste, it becomes buried under subsequent layers of waste and form non-waste barriers. These barriers allow gas transport but limit extremely high flow rates.

Types of Alternative Daily Cover

ADC and intermediate/final cover systems serve distinct purposes in landfill management, each playing a crucial role in waste containment and environmental protection. ADCs are designed to meet daily regulatory requirements for waste cover while facilitating ongoing waste disposal operations. ADC materials are often lightweight and easily applied, focusing on daily cover requirements rather than long-term durability.

There are a diverse range of materials used for ADCs that provide flexibility and effectiveness in landfill management strategies.

Exposed geomembrane covers (EGCs) have emerged as a viable alternative to conventional daily cover systems in landfill management. An EGC is a geomembrane cover that is not covered with soil or vegetation. EGCs serve as interim or temporary covers applied to landfill surfaces, providing effective containment of waste while minimizing percolation of precipitation and containment of LFG. Unlike traditional cover systems, EGCs do not incorporate overlying drainage layers or topsoil, making them well-suited for short-term applications. By reducing percolation rates, EGCs minimize leachate generation, resulting in lower costs associated with leachate management and environmental remediation. Additionally, EGCs help protect steep slopes from erosion, enhancing landfill stability and long-term performance.

Despite their benefits, EGCs are subject to degradation over time due to factors such as ultraviolet radiation, elevated temperatures, and atmospheric oxidation. The lifespan of exposed geomembranes may be significantly shorter compared to non-exposed geomembranes, necessitating periodic maintenance and monitoring to ensure integrity and performance.

Results

Emissions from the Working (Active) Face

In a study conducted by Shen et al. (2018) on methane emissions from a landfill, a wide range of methane concentrations were observed. The study found that high methane concentrations were mainly located in temporary cover areas (see Figure 2). Barometric pressure and regional characteristics influenced methane levels, with more than 95 percent of high-concentration zones found in areas with daily cover, where waste generates more methane compared to areas with final cover.

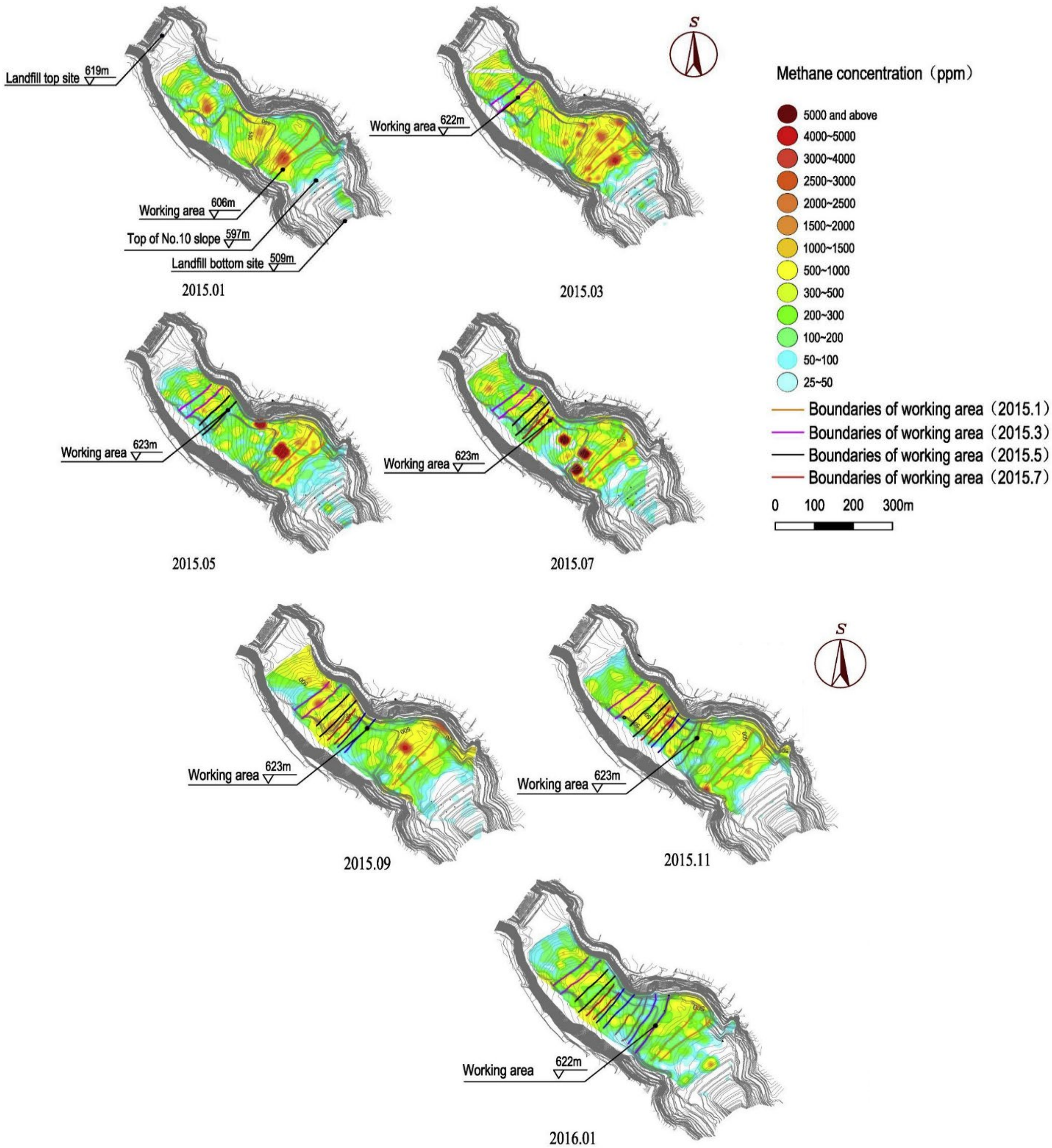

Figure 2. Methane distribution on landfill surface in 2015 and 2016 (adapted from Shen et al., 2018)

High-concentration zones shifted over time as the working face area moved, with notable hotspots near newly installed gas collection wells. After implementing measures like geomembrane repairs and using compacted loess for daily covers, methane concentrations decreased, with no areas exceeding 1,000 ppm. Measures such as replacing damaged geomembranes and using compacted loess for daily cover were implemented to reduce the extent of high-concentration zones, leading to their gradual disappearance. Eventually, no locations with methane concentrations exceeding 1,000 ppm were detected.

Influence of Climate

Goldsmith et al. (2012) conducted a comprehensive study covering various landfill cover types, including the exposed working face, temporary soil covers, intermediate soil covers, and final covers (either soil or synthetic). Their findings underscored the influence of both cover type and climate on methane emissions. Landfills situated in humid subtropical climates exhibited the highest methane emissions across all cover types, with methane fluxes of 207, 127, 102, and 32 g/m^2-day for the working face, temporary, intermediate, and final covers, respectively. In contrast, humid continental climates with warm summers displayed lower emission rates for temporary, intermediate, and final cover areas. Cooler summer climates within the same zone exhibited varying emission rates, with the working face showing significantly higher emissions. Mediterranean climates, evaluated only for intermediate and final covers, demonstrated the lowest emission rates, while semiarid climates showcased a wider range of emissions across all cover types. The results of fluxes from working face and daily cover areas across various climates are depicted in Figure 3 and Figure 4.

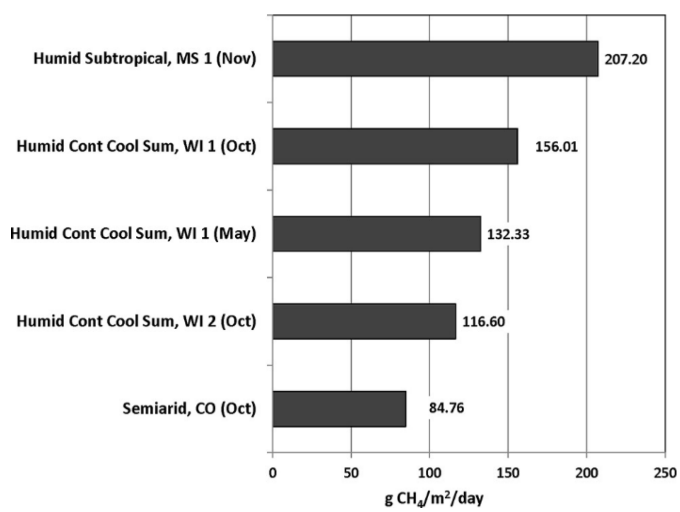

Figure 3. Working face flux results for three climate types (Goldsmith et al., 2012).

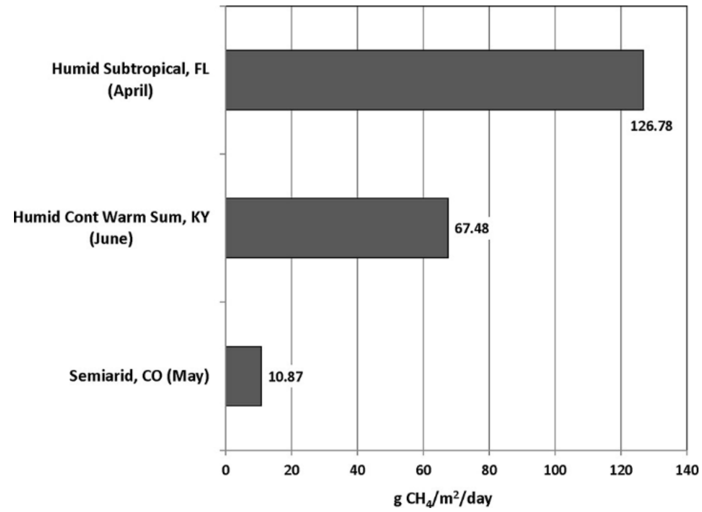

Figure 4. Temporary soil cover flux results for three climate types (Goldsmith et al., 2012).

Controlling Emissions from Working Face Areas

Controlling methane emissions from the working face areas of landfills is critical for reducing greenhouse gas impacts and improving air quality. One effective approach is to minimize the size of the working face, which reduces the exposed area and the potential for methane release. Additionally, installing horizontal gas collectors beneath the active waste layer can capture methane before it escapes into the atmosphere. Regular monitoring of emissions from working face areas ensures that any fluctuations in methane release are detected early, allowing for timely adjustments in operational strategies and enhanced efficiency of methane capture systems. Together, these methods provide a comprehensive approach to managing landfill methane emissions from working face areas.

Minimizing and Managing the Working Face Area

Minimizing the working face area reduces methane emissions, decreases litter and pest activity, and streamlines the application of daily cover materials. This approach simplifies management, increases efficiency, and enhances environmental safeguards. Establishing clear truck routes and unloading zones within a minimized working face reduces delays and truck idling times, which cuts down on fuel consumption and emissions, contributing to cleaner operations. Efficiently sorting and layering different types of waste in the same working face area can enhance operational efficiency and improve waste stabilization, beneficial for both current management and future recovery operations.

Compaction increases the stability of waste, reduces its volume, accelerates anaerobic activity, and lowers risks associated with fires and odors. This process maximizes the use of available airspace, extending the landfill operational lifespan. Proper compaction is essential for these benefits, but questions remain on the best practices for achieving appropriate compaction levels. Key factors include equipment choice, compaction technique, and the required number of passes. Clarifying these details is important for establishing standards in operational procedures.

A proper slope on the working face, another critical element of managing the working face, prevents rainwater infiltration, reducing the generation of leachate and minimizing environmental risks. However, determining the proper slope angle is essential to ensure stability while maintaining operational efficiency. Further discussion is needed to establish what the appropriate slope should be and how it should be managed on site to optimize waste placement and drainage.

Additionally, the size of the working face itself must be tailored to the amount of waste received daily. Minimum size requirements may vary based on waste volume, and a more detailed examination is necessary to determine the optimal size to balance operational efficiency and environmental impact. Addressing these factors in more detail can create clearer work practices aligned with NSPS/EG requirements, ensuring both operational and environmental gains.

Minimizing the working face of a landfill to reduce methane emissions is a logical strategy, but implementing it presents several logistical challenges. Determining how to minimize the working face would first require a thorough evaluation of current operational practices, including waste delivery schedules, equipment capabilities, and site layout. A landfill might need to adjust its daily cover methods or streamline waste placement to reduce the exposed area without disrupting operations.

To make this approach enforceable, clear regulations could be established that define acceptable working face sizes relative to the volume of incoming waste, perhaps setting a standard based on daily tonnage. Implementing these measures would likely involve several steps: assessing current practices, identifying areas for improvement, and creating a plan for daily operations that minimizes the working face while maintaining efficiency. This could also involve training staff on new procedures and investing in equipment or technologies that support more controlled waste placement. The key challenge lies in balancing these adjustments with the practical needs of a landfill, including maintaining operational flow and ensuring safety. Addressing these issues as part of an industry-wide best management practice would require collaboration between regulatory bodies and landfill operators to develop flexible yet effective solutions.

Collecting LFG Using Horizontal Gas Collectors

Once the working face area of a landfill is minimized, another approach to reduce emissions is to install horizontal gas collection trenches below this area to effectively manage LFG. These trenches help in capturing methane and other gases as the waste decomposes, reducing the risk of fugitive emissions to the environment and potentially utilizing the methane as an energy source (U.S. EPA, 2024; Wong and Zawadzki, 2023). Alongside these horizontal gas collection trenches, specific vertical gas collection systems, including caisson wells and remote wellhead systems can play a significant role. These vertical wells manage gases from deeper layers of waste that horizontal trenches cannot reach, thus preventing the build-up of gases which could lead to increased pressure and emissions. If during daily operations, there are periods when vertical wells are shut off to avoid employee safety hazards, horizontal wells can be an option to continue collecting gas.

Horizontal collectors can be placed in active landfill sections and may not significantly interfere with landfill operations compared to vertical wells, as they are installed at or beneath the surface of a waste layer. Unlike vertical wells, horizontal collectors can be installed using standard earthmoving equipment instead of specialized drilling rigs. Horizontal collectors often serve as a temporary solution to begin gas collection from newly filled landfill sections, sometimes while additional waste placement is still underway. For optimal performance, it is necessary to cover these collectors with adequate waste to prevent air from entering from the collection system through the surface. The placement, frequency, and length of horizontal collectors are usually site-specific.

An excavated horizontal collector typically involves digging a trench 1.5 to 5 feet deep into the waste, making them prone to flooding due to their horizontal layout and placement in areas susceptible to surface water infiltration, particularly in damp landfills. To combat this risk of flooding, the trench should be sloped as much as possible to facilitate drainage of liquids. Designing the trench with a central low point or sloping it towards the landfill outer slope can help manage liquid drainage, provided the wellhead is designed to handle passing liquids without disrupting operations. Additionally, installing stone sumps or drains at low points or using a gravel backfill can enhance drainage and ensure good contact with the waste. It is also crucial to avoid placing trenches in saturated low-lying areas and to ensure the landfill leachate system efficiently removes liquids from the waste, preventing blockages in the gas collection system.

Horizontal wells can be designed with gas collection from both sides to reduce the impact of potential formation of low points (bellies) in the collector. Ideally, by the time lower layers of horizontal collectors deform due to waste settlement or compaction, or are otherwise obstructed by liquids, newer layers of horizontal collectors above will be operational and collecting gas. Once an area has reached final grade or there will be an extended period without additional vertical lifts of waste, some operators may find it necessary to drill vertical wells in addition to the existing horizontal wells.

There are other techniques that can be used in addition to horizontal collection to ensure effective gas collection in active areas. For vertical lifts above areas with existing vertical well gas collection, remote wellheads may be used to route a lateral pipe from a wellhead being buried under the fill area to a wellhead outside the fill area. This allows for continued gas extraction from the layers below the vertical lift and prevents damage to gas extraction equipment. Collection of gas from leachate collection and removal systems can be part of a system of early LFG collection in active areas.

Caisson wells are a way to extend vertical extraction wells, where perforated pipe is added but the upper level has a larger slip casing around the perforations to prevent air infiltration that can be raised upward with vertical lifts. If a vertical well is extended without using this approach and no additional collection (such as horizontal collectors) is installed, the gas generated in these upper lifts will not be collected or controlled (U.S. EPA, 2024). It is worth noting that vertical extensions cause temporary and long-term collection gaps in the landfill. For very deep landfills (e.g., canyons), vertical wells are sometimes abandoned during filling, and replaced once filling is completed. However, the new vertical wells are often not as deep as the previous wells, creating a gap in collection at the lowest depths.

Monitoring Emissions from the Working Face

To ensure the effectiveness of minimizing the working face area and horizontal gas collection systems, it is essential to implement a system to monitor methane emissions from the working face area. This monitoring helps in detecting and responding to gas concentrations that could pose risks and ensures continuous safety and compliance with environmental regulations for hazardous air pollutant emissions. Placing fixed methane concentration sensors downwind of the minimized working face area allows for the continuous monitoring of methane emissions. The placement of methane concentration sensors must consider the fetch distance, which is the distance downwind from the source where the sensor can reliably capture the center of the gas emission plume. This fetch distance is influenced by several factors, including wind speed, atmospheric stability, and terrain. For example, under stable atmospheric conditions with low wind speeds, the plume tends to disperse vertically, requiring the sensor to be positioned closer to the emission source to detect the peak concentrations. In contrast, in high wind conditions, the plume spreads more horizontally, necessitating a greater fetch distance for accurate detection.

The sensor should also be placed sufficiently far from the working face to prevent damage from operational activities or machinery. This ensures that the sensor remains intact and does not interfere with landfill operations. Additionally, it may be beneficial to consult specific vendors or use specialized equipment designed to withstand harsh environments near landfills, ensuring the accuracy and longevity of the monitoring system.

The data collected by methane concentration sensors are crucial for assessing the effectiveness of gas collection systems and the overall environmental impact of the landfill. This information can be used to make informed decisions on system adjustments, operational improvements, and compliance with environmental standards.

Effectiveness of Alternative Daily Covers

ADCs can offer some advantages that go beyond traditional soil covers, addressing key challenges such as odor control, fire prevention, and disease transmission (Adams et al., 2011; Yun et al., 2018). These solutions not only enhance the operational efficiency of landfills but also contribute to the overall environmental sustainability of waste disposal practices.

There are various methods for implementing ADC at landfills, each offering unique advantages in terms of efficiency and effectiveness. These methods streamline the application process while meeting regulatory requirements (including the Resource Conservation and Recovery Act) for waste containment:

- **Spray-on covers (hydromulching)**: Utilizing a slurry of water mixed with recycled paper, wood, polymers, and enzymes, spray-on covers form a thin, cement-like crust over the landfill surface. This method offers speed and cost savings compared to traditional soil cover methods. The application process is swift, requiring minimal manpower and equipment, thus reducing labor costs and equipment maintenance expenses.
- **Geosynthetic covers:** These covers, made of plastic or fabric materials, are rolled out over the landfill surface, functioning like tarps. While relatively inexpensive and space-efficient, geosynthetic covers may tear easily and have a limited lifespan. However, they offer a practical solution for daily cover applications, especially in areas where spray-on methods may not be feasible.
- **Tarping:** This method involves manually laying tarps over the landfill surface to provide daily cover. While straightforward and cost-effective, tarping requires significant manpower for installation and removal, making it less efficient than spray-on or geosynthetic covers.
- **Foam and slurry application**: Foam or slurry-based ADCs are applied using specialized equipment to create a protective layer over the landfill surface. While effective in reducing odors and controlling dust, foam and slurry application methods may require more extensive setup and maintenance compared to other options.
- **Mechanical spreading:** Utilizing machinery equipped with spreading mechanisms, such as conveyor belts or rotary spreaders, allows for efficient and uniform distribution of ADC materials across the landfill surface. This method is suitable for larger landfills with extensive areas to cover, minimizing labor requirements and ensuring consistent coverage.

Some landfills may employ a combination of different application methods based on factors such as landfill size, terrain, and regulatory requirements. For example, a landfill may use spray-on covers for large open areas and manually applied ADCs for perimeter or sensitive areas where precision is paramount. By leveraging these diverse types of ADCs and methods for applying them, landfill operators can tailor their approach to specific site conditions and regulatory requirements, ultimately optimizing waste containment and environmental stewardship practices within the landfill.

While ADCs can offer several advantages over traditional soil-based covers, their implementation is not without challenges and considerations. Many of these materials do not offer the same oxidative capacity as soil and some allow for more liquid infiltration leading to higher leachate levels. Additionally, it is important to consider the organic and chemical compounds that may exist within these materials to account for potential gas emissions. Landfill operators and regulators must navigate these factors to ensure the effectiveness, regulatory compliance, and environmental sustainability of ADC usage:

Material Selection: Choosing suitable ADC materials involves consideration of factors such as cost, availability, performance characteristics, and environmental impact. Conducting thorough assessments of material properties and compatibility with landfill conditions is essential to mitigate potential risks and optimize cover effectiveness.

Performance Monitoring: Monitoring the performance of ADCs over time is critical to assess their effectiveness in controlling odors, preventing litter, minimizing disease transmission, and addressing other landfill concerns. Regular inspections, field testing, and data analysis enable proactive management of ADC application and adjustment as needed.

Environmental Impact: Evaluating the environmental impact of ADC materials requires consideration of factors such as biodegradability, leachate generation, air emissions, and habitat disruption. Assessing the life cycle impacts of ADC usage aids in identifying sustainable options and minimizing the ecological footprint.

Operational Challenges: Implementing ADCs may present operational challenges related to application equipment, labor requirements, and site logistics. Addressing issues such as equipment maintenance, operator training, and material handling protocols is essential to ensure efficient and safe ADC application.

States are responsible for establishing and enforcing standards for cover under solid waste regulations, including the approval of ADCs. Though many states rely on subjective judgements of suitability and effectiveness (U.S. EPA, 1993), some states have identified performance-based standards for evaluation of suitability of alternative daily covers. Ohio EPA (2023) identified that ASTM D 6826 and 7008 provide methods for evaluating certain types of ADC, including efficacy for odor control based on ASTM E 96 Test Methods for Water Vapor Transmission of Materials. Wisconsin Department of Natural Resources (2014) similarly recommends use of ASTM E 96 to evaluate potential odor control, and notes that certain ADC types can contribute to odors and emissions issues. Direct evaluation of ADC effectiveness in control of methane or nonmethane organic compound (NMOC) emissions is not typically considered.

Peeling Daily Cover

The term *'peeling the cover'* pertains to examining how soil intermediate and daily covers affect gas pressure dynamics within landfills. Although these covers are effective in reducing leachate generation by limiting rainfall infiltration, their low permeability hinders the escape of LFG, which can lead to increased gas pressure inside the waste pile. If the low-permeability soil cover remains partly in place between the addition of waste layers, it can isolate the waste from other landfill elements. This isolation hampers LFG collection and leachate drainage, raises the risk of LFG emissions, and causes leachate to pool above impermeable layers within the waste mass (Cusworth et al., 2020).

Regulation Changes

Potential regulation changes to the NSPS/EG could involve requiring landfill owners/operators to submit a detailed plan for working face operations. This plan could include an estimation of the operational area of the working face and describe approaches for how the landfill owner/operator plans to mitigate the size of the surface area.

For landfills subject to NSPS/EG control requirements, minimum standards and test methods for NMOC and methane mitigation from ADCs could be established to ensure equivalency to six inches of soil, or a stricter standard. This would not conflict with state approval of ADC for all landfills in the solid waste context, but rather would be establishing further standards for landfills required to mitigate their NMOC and methane emissions under the NSPS/EG framework.

Additionally, the design of horizontal collector trenches and the tuning of vertical gas collection wells adjacent to and in the working face area could be explicitly addressed in the gas collection system plan. This potential approach could ensure that the systems are tailored to effectively manage methane emissions from these dynamically changing areas. Current regulations require the collection of gas from all areas of the landfill where waste has been in place for five years or more regardless of whether waste is being actively added to a particular area or an area is entirely closed and capped. This creates a situation where horizontal expansion areas have no gas collection requirements at all, vertical lifts have the same gas collection system requirements as closed areas, and difficulties collecting gas and monitoring in areas with active filling operations are not addressed.

Potential regulation changes could also entail eliminating the time-based requirements of the gas collection system and replacing them with requirements tailored for each stage of a landfill cell's development (i.e., when it's actively being filled, under intermediate cover, and under final cover).

Furthermore, potential regulation changes could incorporate the requirement to monitor emissions from the working face area. This would be helpful for assessing safety risks and the effectiveness of emission control measures in the working face area. Current regulations exempt "dangerous areas" from surface emission monitoring (SEM), typically resulting in a lack of data on emissions from within and near active areas and impeding the ability to properly manage emissions from these areas. With technological advancements in SEM such as the exploration of UAS/drone technology, potential regulation changes could eliminate the slope exemption policy that prevents measurement in dangerous areas. Potential regulation changes could balance the needs for having actionable emissions data from these areas with operational and safety considerations.

Implementation

All the necessary technology and approaches for reducing methane emissions from landfill working face areas are currently available, but the implementation of best practices is crucial for maximizing their effectiveness. Managing the size of the working face requires a well-coordinated operation that minimizes waste exposure to air, thereby reducing the potential for methane emissions. Best practices for reducing emissions include maintaining a minimal and compact working face and applying effective compaction techniques that limit the volume of waste exposed to the atmosphere.

The application of daily cover, whether using soil, geosynthetic materials, or ADC, plays a critical role in reducing methane emissions. Best practices for daily cover involve applying it uniformly and promptly at the end of each working day to seal off the working face, thus minimizing emissions and preventing oxygen intrusion. Regular monitoring and adjustment of the daily cover based on the type and volume of waste received further help reduce emissions.

Moreover, horizontal gas collection wells placed beneath the waste, in conjunction with adjustable vertical gas wells that respond to oxygen concentrations, are widely available and can be optimized through these practices. Fixed methane sensors designed to monitor emissions from the working face are also well-developed and enhance the overall safety and efficiency of methane management.

Collaborating with stakeholders to establish best practice guidance for minimizing emissions from the working face and refining the application of daily cover could further advance the effectiveness of methane mitigation in landfill operations.

Next Steps

EPA continues to review data and recommendations concerning the best management practices for reducing methane emissions from working face areas. A potential approach for the upcoming NSPS/EG rulemaking is to work closely with stakeholders to develop industry best management practices that could be implemented to reduce emissions from the working face of the landfill, the application of daily cover, and the use of horizontal gas collection wells. The performance of ADCs could be compared to typical six-inch soil cover and a combination of both could be evaluated to more effectively mitigate emissions from working face areas. As part of the white paper review process, EPA expects to hold an ongoing dialogue about the most effective approach to mitigating emissions at the working face. This consultation could occur both through public comments on the white papers and during the Landfill Methane Technology Workshop in October 2024. The objective is to gather a wide range of insights and expertise to inform the development of the best possible practices surrounding the working face.

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