November 10, 2025

California Air Resources Board

Landfill Methane Regulation

LMR@arb.ca.gov

Re: Proposed Amendments to the Regulation on Methane Emissions from Municipal Solid Waste Landfills

Dear Chair Sanchez,

Thank you for the opportunity to provide comments to the California Air Resources Board (CARB) on the Proposed Amendments to the Regulation on Methane Emissions for Municipal Solid Waste Landfills (LMR). We commend CARB for its thoughtful and thorough proposal, which incorporates the proven best practices and cost-effective technologies to improve emissions control and protect community health.

In California, the waste sector is the second largest source of methane, a powerful climate pollutant. Remote sensing technologies have observed super-emitting plumes at landfills across the state.[1] Last year was the hottest year on record[2] and the first year that the global average temperature breached 1.5°C above preindustrial levels.[3] The wildfires that occurred in Los Angeles in January are a devastating reminder of our changing climate. Cutting methane pollution is the strongest lever to slow warming over the near term. Scientific imperatives and increasing costs of climate change-related disasters make California's methane leadership essential.[4]

California Municipal Solid Waste (MSW) landfills also pose localized health risks and contribute to regional ozone pollution. Landfill methane is co-emitted with multiple hazardous air pollutants, including health-harming per- and polyfluoroalkyl substances (PFAS) and known carcinogens, such as benzene, vinyl chloride, and formaldehyde. Low-income communities and communities of color are disproportionately impacted by health-harming air and water pollution from landfills. Stronger landfill emissions controls and increased transparency are critical to protect the health and wellbeing of communities and workers.

We broadly support CARB's Proposed Amendments and reiterate the technical recommendations provided by RMI, Environmental Integrity Project, Californians Against Waste, and Industrious Labs in January 2025 in response to CARB's Public Workshop: Potential Updates to the Landfill Methane Regulation. We are pleased to see CARB address many of the suggestions made in these joint comments submitted in January of this year. These comments have been attached to this submission. We encourage CARB to carefully review additional comments submitted by these organizations for this public comment period.

We strongly support the proposed remote monitoring program, improvements to surface emissions and component monitoring, earlier Gas Collection and Control System (GCCS)

installation and expansion, limits on GCCS downtime, enhanced wellfield monitoring, working face and cover improvements, and the additional mitigation requirements at landfills with persistent issues. **We urge the Board to swiftly finalize these vital protections at the hearing on November 20, 2025.**

We are available to answer any questions and/or provide additional information as requested. We appreciate this opportunity to provide comments. Please reach out to Olivia Alves at oalves@rmi.org and Edwin LaMair at elamair@edf.org.

Sincerely,

RMI & EDF

I. Background and Justification

Methane is a potent greenhouse gas that accounts for about a third of the climate change the world is experiencing today. Pound-for-pound, methane has a warming effect that is over 80 times greater than that of carbon dioxide over a 20-year time horizon.[5] Methane also has a much shorter atmospheric lifetime than carbon dioxide, so atmospheric levels of methane respond relatively quickly to cuts in emissions.[6] Rapid cuts in methane emissions are the strongest lever to slow warming over the near term.

California ranks second in the nation for estimated methane emissions from MSW landfills, and the waste sector is the second largest methane source in California.[7] California's municipal solid waste methane emissions in 2023 are estimated at about 22 million metrics tons of carbon dioxide equivalent ("CO_2e").[8] Further, recent scientific studies using direct measurement show that landfill methane emissions are often underestimated in official inventories and that many landfills have large leaks that persist over months and even years.[9]

Landfill methane is also a precursor for tropospheric ozone and is co-emitted with hazardous air pollutants and volatile organic compounds (e.g., benzene, vinyl chloride) that are known to endanger public health.[10] Exposure to landfill pollution is not felt proportionately. Of California's highest-emitting landfills (i.e., those that report estimated methane emissions higher than 500,000 tons of CO_2e and make up the top nine out of 300 active and closed landfills):

- 90% of the highest-emitting landfills are in communities with larger Black, Indigenous, or People of Color ("BIPOC") populations than the national average.
- 70% of the highest-emitting landfills are in communities where more than half the residents are BIPOC.[11]

The benefits of reducing landfill methane pollution far exceed the implementation costs. The climate benefits of CARB's Proposed Amendments are estimated to be about three times higher than the projected implementation costs over three years and impose no direct compliance costs for individuals. However, if 100% of compliance costs to landfill operators were passed on to Californians, it would amount to just $0.31 per person, per year – in exchange for substantial benefits in avoided social cost of methane ($56 million to $178 million from 2027-2029) and improved air quality. Further, analyses from other states found that adoption of landfill methane rules had little impact on tipping fees.[12] This favorable benefit-cost analysis mirrors findings in other states. For example, the State of Colorado found a 6:1 benefit-to-cost ratio in an initial economic impact analysis of their Regulation Number 31 to control methane emissions from municipal solid waste landfills.[13]

Importantly, control strategies to reduce methane emissions will also reduce co-polluted hazardous air pollutants, volatile organic compounds, and the non-methane organic compounds that contribute to ozone formation. Thus, landfill methane controls will provide additional benefits to Californians through improved air quality and public health, as these classes of pollutants are known to cause serious health issues.

The health impacts of landfill pollution and landfill fire risk emerged as pressing concerns for community members during CARB's workshops.[14] We commend the Board for their dedication

to community engagement throughout the rulemaking process, and we urge CARB to maintain a transparent, community-focused approach to landfill emissions regulation.

II. LMR Proposed Amendments

The Proposed Amendments are a strong step forward to cut methane emissions and air pollution from landfills in California. We recognize and appreciate staff's dedication to detail and impact. This comment aims to highlight specific elements of the Proposed Amendments that RMI and EDF support, as well as some elements that can be further strengthened.

The following are areas of strength RMI and EDF urge CARB to maintain throughout the rule finalization process:

- Requiring the inspection and repair of remotely-detected plumes reported to CARB.
- Requiring earlier GCCS installation/operation in new waste areas for landfills accepting more than 200,000 tons of waste per year.
- Limiting GCCS downtime and setting prompt timelines for corrective action.
- Increasing the stringency of landfill surface and component leak monitoring, including expanding coverage to the working face and addressing hotspots in unsafe-to-walk areas.
- Establishing a process to evaluate and approve use of alternative technologies for leak detection that achieve at least equivalent emissions reductions.
- Expanding wellhead monitoring parameters and response requirements for exceedances.
- Creating a robust cover integrity assessment process to monitor and reduce fugitive emissions.
- Requiring more comprehensive reporting and record keeping requirements including standardized electronic reporting.

The following are recommendations to improve the landfill methane rule:

- Create a pathway to *require* the use of advanced monitoring technologies for surface emissions and component leak monitoring across landfills, given their superior performance, reliability, and cost-effectiveness. Specifically, CARB could require their usage once three or more methodologies have been approved by the Executive Officer.
- Increase surface emissions monitoring frequency from quarterly to biweekly with advanced technologies (i.e., twice per month) at all landfills.
- Lower the methane exceedance threshold from 500 ppmv to 200 ppmv. While CARB has proposed using 200 ppmv (or 50 ppm-m) as a hotspot screening trigger for unsafe-to-walk areas, this instantaneous exceedance threshold should be expanded to all areas of

the landfill.

- Require fenceline monitoring at landfills near populations to better assess variable fugitive emissions and ensure adequate community health protections.
- Ensure easy public access to all landfill monitoring data to promote transparency and accountability and protect public health.
- Ban leachate recirculation to prevent flooded wells.
- Further incorporate automated wellhead tuning to improve GCCS uptime and performance.

II.i. Methane Emissions Monitoring

RMI and EDF commend CARB for their updates to strengthen surface emissions monitoring frameworks.

Super-Emitter Response Program

RMI and EDF applaud CARB's proposed adoption of a super-emitter response program requiring inspection and repair of remotely-detected plumes. CARB's proposal takes advantage of readily available remote sensing observations to address large methane plumes that were often missed and unaddressed with quarterly monitoring.

The technology is proven, and this model is already delivering emissions reductions in California and other states. Aerial remote sensing instruments have surveyed more than 300 landfills across the United States to date and identified large methane emissions sources at over 200 of these sites.[15] Overflights conducted by Carbon Mapper in coordination with the California Air Resources Board and the Pennsylvania Department of Environmental Protection (DEP) found large methane releases, often referred to as super-emitters, at multiple landfills. Operators were alerted and took voluntary actions that resulted in successful emissions reductions.[16]

We strongly support CARB's proposal to make investigation and mitigation of large methane plumes mandatory instead of voluntary. However, we encourage CARB to build out programmatic details and operational timelines to include more escalation steps and notification systems, as found in the oil and gas sector. A strong remotely-detected plume response system should feature publicly available data and include notification requirements for relevant local air quality management districts and local enforcement agencies. Including air districts and local education agencies in the notification process will enhance transparency, improve response times, and facilitate a unified approach to addressing emissions that may have regional and community impacts.

Working Face and Unsafe-to-Walk Areas

RMI and EDF applaud CARB's proposal to strengthen working face monitoring to close gaps in existing monitoring protocols. Recent remote sensing surveys have identified significant emissions coming from the landfill's working face.[17] Unmanned Aerial Systems

(UAS)-based methods can safely monitor the working face, which studies have shown contribute significantly to total site emissions and are typically excluded from walking SEM.[18]

We strongly support CARB's proposal to leverage readily available advanced technologies to monitor previously excluded areas, and we urge the Board to maintain this requirement and the proposed hotspot thresholds (200 ppmv or 50 ppm-m).

Surface Emissions Monitoring (SEM) Cadence and Technologies

CARB has taken steps forward to strengthen SEM and component leak requirements. In addition to expanding coverage to previously excluded areas, RMI and EDF support CARB's proposed requirements around barometric pressure, wind and survey speed, advanced notification of monitoring plans, and limited relaxation of spacing requirements. We also support the structured corrective action and re-monitoring framework, including escalating requirements for landfills with persistent issues. These changes will improve monitoring integrity and ensure prompt and effective corrective action.

Further, we strongly support the use of advanced monitoring technologies for SEM and component leak monitoring. We commend CARB's proposed process to evaluate advanced technologies and approve them for use *statewide* once their efficacy is demonstrated. **However, given the superior performance, reliability, and cost-effectiveness of these technologies relative to walking SEM – as noted in presentations by FluxLab and others[19] – we urge CARB to develop a phased process to require advanced methods once approved.** Specifically, we recommend requiring the use of approved alternative SEM procedures once three or more technologies have been approved by the Executive Officer. This would ensure a smooth and clear transition from labor intensive, less efficient manual walking surveys. EPA found that many MSW landfill operators and their contractors are failing to properly follow Method 21 walking SEM requirements. [20]

We also encourage CARB to require *bi-weekly* surface emissions monitoring using approved advanced monitoring technologies to enhance methane detection and repair. Advanced monitoring technologies are generally more affordable than walking surveys. Therefore, operators can cost-effectively and safely monitor *multiple times per month*, as EPA noted in its Aerial Monitoring White Paper: "[i]f aerial technologies could be used as a replacement for, or as a tool to reduce the frequency of manual (ground-level) surface monitoring events, they could result in lower labor costs and increased efficiencies."[21] Several public and private landfill operators in California are already leveraging drones and other available advanced technologies to more frequently and comprehensively monitor fugitive emissions. For example, San Bernardino County and Orange County conduct leak surveys with methane-detecting drones at their landfills.[22] The Proposed Amendments' monitoring frequency is increased for facilities with violations, but not all landfills. CARB should consider requiring monitoring biweekly using advanced technologies instead of quarterly to cover the entire landfill surface area.

We also recommend CARB set an instantaneous surface methane concentration of 200 ppmv as a methane mitigation exceedance threshold for corrective action across the

landfill. We urge CARB to revisit its earlier proposal to lower the mitigation threshold to 200 ppmv across the landfill, instead of just for unsafe-to-walk areas. Alternatively, CARB could require targeted follow-up actions when a grid shows multiple readings above 200 ppm. As noted in prior comments, this threshold was originally proposed in 2009; it is feasible and would unlock further emissions reductions.

Fenceline monitoring

Commenters recommended CARB require fenceline monitoring as a tactic to catch variable fugitive emissions, a current gap in the Proposed Amendments. Monitors should be placed at strategic locations on the landfill perimeter – close to the active face and near impacted communities. This is a gap in the Proposed Amendments that leaves communities vulnerable.

CARB can look to the flyover study and associated modeling conducted by the Michigan EGLE and other agencies to determine the number of monitors needed.[23] CARB should establish an action level for methane and other hazardous air pollutants that triggers root cause analysis and corrective action by the operator. Because methane could be produced by nearby sources—such as farms, wetlands, composting facilities—CARB should allow sources to submit site-specific monitoring plans that include site-specific modeling that assesses the particular landfills' fugitive methane emissions.[24] However, CARB should conduct robust oversight of these site-specific monitoring plans to ensure that they adequately address fugitive emissions from each particular landfill.[25]

Additionally, CARB should require that all data is posted publicly and expeditiously. Data transparency about violations will help communities living near protect themselves during leak events. At landfills in both Michigan and North Carolina, after years of odor complaints and due to other compliance issues, the state agencies required fenceline monitoring and that the results be posted publicly, also requiring robust community engagement.[26] Although the North Carolina landfill fenceline monitoring requirement is new (consent decree was signed in August of 2024), EGLE notes that odors from the Michigan landfill (though complaints are still received) are reduced.[27]

II.ii. GCCS Operations

Earlier GCCS Well Installation

RMI and EDF also applaud CARB's proposal for earlier GCCS installation in new cells for landfills accepting over 200,000 tons of waste per year and reducing the timeline for installation from 18 months to 6 months for open landfills and from 30 months to 18 months for closed landfills. The proposal also includes the options for horizontal collectors or caisson wells once 15 feet of waste is placed over a collector. CARB should maintain these protective requirements. This is a strong proposal that will cut emissions from incoming waste and make California a national leader in protective GCCS regulation. Earlier installation of GCCS systems is one of the biggest ways to substantively cut landfill emissions to capture fugitive gas.[28]

GCCS Downtime and System Vacuum

RMI and EDF strongly support CARB's proposal to reduce emissions caused by gas collection system downtime by creating a 5-day limit for system downtown and limiting the number of wells offline at any one time. CARB research found 43% of landfill methane plumes were caused by downtime.[29] The Board should maintain these reasonable time limits for downtime and repair requirements for GCCS compliance.

RMI and EDF strongly support the requirements to monitor the gas collection system pressure every 15 minutes. The level of available system vacuum directly influences methane capture, and maintaining stability is critical to improve gas collection performance and reduce methane emissions. Significant changes in system vacuum can be early indicators of large problems, and more frequent monitoring is a low-cost intervention to assess the performance of the overall GCCS and enable faster and more effective mitigation. We urge the Board to retain this requirement.

Wellhead tuning requirements

RMI and EDF support the expanded monitoring and reporting of wellhead vacuum, flow, and pressure; the inclusion of trend analyses; and requirements for corrective action in response to out-of-range values. However, we encourage CARB to further incorporate automated wellhead tuning into the rule, especially at landfills with persistent violations, of a certain size threshold, or with an energy project. Automated well-tuning systems can take continuous measurements of LFG composition, flow, temperature, pressure, and liquid levels and make automated adjustments to the gas collection and control system ("GCCS") to increase methane capture and reduce fugitive emissions.[30] In addition, continuous wellhead data can alert operators to other mitigation opportunities, such as remediating an area of damaged cover or de-watering a flooded well.

RMI and EDF urge CARB to adopt the Alternative 2 proposal to require installation and operation of continuous wellhead monitoring with automated tuning at all wells that use energy recovery control devices. A recently published analysis by Energy Vision underscores the significant, cost-effective methane reduction potential of early GCCS installation and automated wellhead tuning.[31] Companies providing this technology include LoCI Controls and Apis Innovation, among others. LoCI Controls deploys its real-time data and control solution at more than 65 landfills, including several landfills in California, both private and county-owned.[32] More than 75 landfills in the U.S. and Canada are actively using Apis Innovation's automated wellhead tuning technology.[33]

Leachate recirculation practices

RMI and EDF support the proposed liquid level monitoring provisions, but we urge CARB to explicitly prohibit leachate circulation activities at landfills. Leachate recirculation is the practice of reintroducing collected leachate into a landfill, which increases the total moisture in the landfill and accelerates methane generation. Liquids impact the integrity and efficiency of gas collection systems and leachate recirculation can increase system downtime and leaks.[34]

II.iii. Landfill Operations

Fires

Fires have emerged as a priority concern for communities across California living near landfills. CARB's LMR revisions include several provisions that will help prevent subsurface elevated temperature ("SET") events and landfill fires, including expanded emissions and GCCS monitoring with corrective action, wellhead temperature monitoring, and cover integrity assessments. We encourage CARB to consider recommendations on mitigating fire risk from Californians Against Waste and the Environmental Integrity Project.

Cover

CARB has proposed cover integrity monitoring, recordkeeping, and reporting requirements that will help to reduce fugitive emissions and fire risk. The cover integrity assessment criteria is a strong proposal, and improving cover monitoring is critical to catching leaks and other problems at landfills. To improve upon this proposal, we recommend that CARB establish minimum performance standards for alternative daily cover (ADC) to ensure effective control of methane, odor, and NMOCs. CARB should also build out specific minimum requirements for cover including permeability, and we continue to recommend biocover as a supplement to GCCS to capture fugitive emissions or to reduce emissions at closed landfills.

Recordkeeping, Reporting and Auditing Requirements

The Proposed Amendments include strong enhanced electronic recordkeeping and reporting requirements. RMI and EDF commend CARB on the comprehensive inclusion of operator reporting on: surface emissions monitoring, meteorology, component leaks, collection frequency, downtime, dates, monthly wellhead readings, wellhead temperature, oxygen readings, corrective action, liquid levels, gas collection system expansion, waste acceptance rate, data sources, leak monitoring plans, cover monitoring, cover integrity, instrument calibration, GCCS pressure, and trends. Reporting requirements should include posting data publicly, particularly methane monitoring data as we recommend earlier in the comment.

III. Conclusion

CARB's Proposed Amendments represent a strong and necessary step forward in reducing methane emissions from California landfills. The proposed integration of remote sensing, improved working-face monitoring, earlier gas collection, and comprehensive reporting will make California a national leader in landfill oversight. To fully realize this potential, however, CARB should strengthen the rule by lowering the surface methane threshold to 200 ppmv, increasing monitoring frequency and phasing in mandatory use of advanced technologies, adding fenceline monitoring for community protection, adopting automated wellhead tuning, and ensuring easy public access to all landfill performance data. These enhancements would ensure the updated rule achieves durable, verifiable methane reductions, improves transparency, and protects the health of nearby communities while maintaining California's leadership on climate policy.

IV. Attachments

RMI and EDF will submit the following resources alongside this comment for the record.

- Californians Against Waste, The Environmental Integrity Project ("EIP"), RMI, and Industrious Labs, Recommendations for Revisions to the Landfill Methane Regulation from Californians Against Waste, The Environmental Integrity Project, RMI and Industrious Labs (January 25, 2025)
- Ayandele, Ebun et al., RMI, Key Strategies for Mitigating Methane Emissions from Municipal Solid Waste (2022), available at https://rmi.org/insight/mitigating-methane-emissions-from-municipal-solid-waste/
- Garland, Ellie et al., RMI, Deploying Advanced Monitoring Technologies at US Landfills (2024), available athttps://rmi.org/wp-content/uploads/dlm_uploads/2024/03/wasteMAP_united_states_playbook.pdf
- Lerner, Michael, Energy Vision, Leading With Landfills (July, 2025), available at https://energy-vision.org/pdf/EnergyVision-LeadingWithLandfills.pdf
- Garland, Ellie et al., RMI, From Waste to Wins: How Orange County's Smart Landfills Are Slashing Methane (January, 2025), available at https://rmi.org/from-waste-to-wins-how-orange-countys-smart-landfills-are-slashing-methane/
- Athar Omidi et al., *Most landfill methane emissions Escape detection in EPA21 surface emission monitoring surveys,* 207 Waste Management 115104 (October 2025), https://doi.org/10.1016/j.wasman.2025.115104.
- US Environmental Protection Agency, Non-regulatory Public Docket: Municipal Solid Waste Landfills: Fenceline Monitoring (December 2024). https://www.epa.gov/stationary-sources-air-pollution/non-regulatory-public-docket-municipal-solid-waste-landfills.

Citations

[1] California Air Resources Board, Potential Updates to the Landfill Methane Regulation, Public Workshop (Dec. 18, 2024) at 7 available at https://ww2.arb.ca.gov/sites/default/files/2024-12/Staff_Presentation_on_Potential_Updates_to_the_Landfill_Methane_Regulation.pdf [hereinafter "CARB 2024 LMR Workshop"].; California Air Resources Board, Summary Report of the 2020, 2021, and 2023 Airborne Methane Plume Mapping Studies (April 2024), https://ww2.arb.ca.gov/resources/documents/summary-report-2020-2021-and-2023-airborne-methane-plume-mapping-studies.

[2] NOAA, 2024 was the world's warmest year on record, https://www.noaa.gov/news/2024-was-worlds-warmest-year-on-record.

[3] IPCC, 2021: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 2391 pp. doi:10.1017/9781009157896.

[4] California Air Resources Board, Potential Updates to the Landfill Methane Regulation, Public Workshop (Dec.

18, 2024) at 7 available at https://ww2.arb.ca.gov/sites/default/files/2024-12/Staff_Presentation_on_Potential_Updates_to_the_Landfill_Methane_Regulation.pdf [hereinafter "CARB 2024 LMR Workshop"].

[5] IPCC, 2021: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 2391 pp. doi:10.1017/9781009157896.

[6] *Id.*

[7] California Air Resources Board, Potential Updates to the Landfill Methane Regulation, Public Workshop (Dec. 18, 2024) at 7 available at https://ww2.arb.ca.gov/sites/default/files/2024-12/Staff_Presentation_on_Potential_Updates_to_the_Landfill_Methane_Regulation.pdf [hereinafter "CARB 2024 LMR Workshop"].

[8] *Data from EPA Greenhouse Gas Reporting Program based on a 20-year global warming potential for methane.*

[9] Nesser et al., *High-resolution U.S. methane emissions inferred from an inversion of 2019 TROPOMI satellite data: contributions from individual states, urban areas, and landfills*, Atmos. Chem. & Physics 1–36 (2024), https://acp.copernicus.org/articles/24/5069/2024/; Cusworth, D.H., Duren, R.M., et al., *Quantifying methane emissions from United States landfills*, 383 Science 1499-1504 (2024), https://www.science.org/doi/10.1126/science.adi7735.

[10] EPA LMOP, Frequent Questions about Landfill Gas, https://www.epa.gov/lmop/frequent-questions-about-landfill-gas#whatcomponents (last visited Jan. 22, 2025).

[11] Statistics derived from CalEnviroScreen 4.0, https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40 (last visited April 2024). Landfill geographic points are derived from the EPA, Greenhouse Gas Reporting Program (GHGRP) 2022 and EPA, Landfill Methane Outreach Program (LMOP) (July 2023).

[12] CARB's Proposed Amendments have a benefit-to-cost ratio of 3.4:1 at the midpoint (ranging from 1.5:1 to 4.8:1, depending on the assumed discount rate and social cost of methane). Benefit-to-cost ratio is pulled from the Proposed Amendment. Benefits are pulled from Table 2. Avoided Social Cost of Methane from 2027-2029 using the lowest and highest values to develop the range on page 115. The cost is from page 128 *"Over a three-year period, the total cumulative costs for all landfills (and third-party gas control systems) covered by the LMR are estimated as $37.0 million."* The $0.31 per person per year in potential pass-through cost to individuals is in Table 3 of the same document. *See* Colorado Department of Public Health and Environment's EIA from April 2025 for information on tipping fees and landfill rules. https://drive.google.com/drive/folders/1oUQ6xyMl5ejJTyIYvmaVF_ijWRqbvjIV.

[13] *See* Colorado Air Pollution Control Division, Landfill Methane Regulation: Initial Economic Impact Analysis, 11 (Apr. 17, 2025). https://drive.google.com/drive/folders/1oUQ6xyMl5ejJTyIYvmaVF_ijWRqbvjIV.

[14] CARB, Community Meeting: Landfill Methane Emissions, Community Perspectives, and Potential Regulation Updates, July 18, 2025, https://ww2.arb.ca.gov/approved-comments?entity_id=43956

[15] Tia Scarpelli, "Testimony before the Committee on Environment and Public Works: Avoiding, Detecting, and Capturing Methane Emissions from Landfills," January 2024, US Senate, https://www.epw.senate.gov/public/_cache/files/c/5/c513d9f3-bbea-4149-94c4-99c63930063c/C9880259163CFB24108D4674647A631B.01-31-2024-scarpelli- testimony.pdf.

[16] Pennsylvania Department of Environmental Protection, Air Quality Technical Advisory Committee, "Methane Overflight Study Overview," March 9, 2023, https://files.dep.state.pa.us/Air/AirQuality/AQPortalFiles/Advisory%20Committees/Air%20Quality%20 Technical%20Advisory%20Committee/2023/3-9-23/AIRBORNE%20 METHANE%20AQTAC%20MEETING%20230309.pdf; and *Summary Report of the 2020 and 2021 Airborne Methane Plume Mapping Studies*, California Air Resources Board, 2023, https://ww2.arb.ca.gov/resources/documents/summary-report-2020-and-2021-airborne-methane- plume-mapping-studies; Garland, Ellie et al., RMI, Deploying Advanced Monitoring Technologies at US Landfills (2024), available at https://rmi.org/wp-content/uploads/dlm_uploads/2024/03/wasteMAP_united_states_playbook.pdf.

[17] *See* Scarpelli et al., *Investigating Major Sources of Methane Emissions at US Landfills*, 58 Env. Sci. Tech.v 21545–21556 (2024), https://doi.org/10.1021/acs.est.4c07572.; Risk, Dave, Advanced Leak Detection Technologies for Landfill Methane (December 18, 2024), 18, available at https://ww2.arb.ca.gov/sites/default/files/2024-12/Session-2_FluxLab.pdf.

[18] *See* EPA, *Enforcement Alert*, https://www.epa.gov/enforcement/enforcement-alert-epa-finds-msw-landfills-are-violating-monitoring-and-maintenance.

[19] Athar Omidi et al., *Most landfill methane emissions escape detection in EPA21 surface emission monitoring surveys,* 207 Waste Management (2025), https://doi.org/10.1016/j.wasman.2025.115104; Risk, Dave, Advanced Leak Detection Technologies for Landfill Methane (December 18, 2024), 18, available at https://ww2.arb.ca.gov/sites/default/files/2024-12/Session-2_FluxLab.pdf.;
Dave Risk as cited in Ellie Garland, Ebun Ayandele, and Tom Frankiewicz, Deploying Advanced Monitoring

Technologies at US Landfills, RMI, 2024, https://rmi.org/insight/ waste-methane-assessment-platform/.
[20] *2024 EPA MSW Landfill Enforcement Alert.*
[21] US EPA, Non-regulatory Public Docket: Municipal Solid Waste Landfills: Aerial Monitoring White Paper (December 2024). https://www.epa.gov/stationary-sources-air-pollution/non-regulatory-public-docket-municipal-solid-waste-landfills.
[22] Patino, Vania, "Drones take flight to tackle methane leaks at Orange County landfill," Spectrum News 1 (Nov. 12, 2024), available at https://spectrumnews1.com/ca/southern-california/public-safety/2; Shackleton, Olivia, "SCS Develops 5-year landfill operations contract for California county," Waste Today (July 16, 2019), available at https://www.wastetodaymagazine.com/news/scs-five-year-landfill-operations-contract-california/.
[23] EPA Fenceline Monitoring White Paper at 4-6.; GFL Environmental "Arbor Hills Landfill Air Monitoring," available at https://arborhillsmonitoring.com/Home/Index (last visited Aug. 6, 2024); See also EPA Fenceline Monitoring White Paper at 4-6.
[24] In September of 2024, EPA's Office of Inspector General ("OIG") conducted an audit of the oversight of the benzene fenceline monitoring requirements for refineries. Env't Prot Agency, Office of Inspector General, Oversight to Ensure that All Refineries Comply with the Benzene Fenceline Monitoring Regulations, Report No. 23-P-0030 (Sept. 6, 2023), https://www.epaoig.gov/sites/default/files/reports/2023-09/_epaoig_20230906-23-p-0030_errata.pdf (last visited Sept. 19, 2023). The report included a finding that site-specific monitoring plans did not include required monitoring needed to verify offsite source contributions to fenceline benzene levels. Id. As a result, EPA approved site-specific monitoring plans for refineries relied solely upon modeling that likely overestimates nearfield source emissions, resulting in unwarranted downward adjustment to the delta c value. Id. CARB should note this OIG report and avoid these and similar issues when approving site-specific monitoring plans.
[25] US EPA, Fenceline Monitoring White Paper at 6-7 available at https://www.epa.gov/stationary-sources-air-pollution/non-regulatory-public-docket-municipal-solid-waste-landfills.
[26] *Id.*
[27] *Id.*
[28] US EPA, GCCS White Paper (December 2024).; Lerner, Michael, Energy Vision, Leading With Landfills (July, 2025), available at https://energy-vision.org/pdf/EnergyVision-LeadingWithLandfills.pdf.
[29] California Air Resources Board, Potential Updates to the Landfill Methane Regulation, Public Workshop (Dec. 18, 2024).
[30] US EPA, GCCS White Paper (December 2024), https://www.epa.gov/stationary-sources-air-pollution/non-regulatory-public-docket-municipal-solid-waste-landfills.
[31] Lerner, Michael, Energy Vision, Leading With Landfills (July, 2025), available at https://energy-vision.org/pdf/EnergyVision-LeadingWithLandfills.pdf.
[32] Loci Methane Capture and Emission Reduction, "LoCI Controls Announces Methane Emission Reductions Across its Portfolio of Environmental Attribute Projects," (Dec. 5, 2024), available at https://locicontrols.com/locinews/loci-controls-announces-methane-emission-reductions-across-its-portfolio-of-environmental-attribute-projects.
[33] See Apis, MSW Landfill Technology Workshop-Presentation 10 (Dec. 9, 2024), available at https://www.regulations.gov/document/EPA-HQ-OAR-2024-0453-0018.

[34] USEPA (September 2014), Permitting of Landfill Bioreactor Operations: Ten Years after the RD&D Rule (EPA/600/R-14/335) at 14; GCCS White Paper at 8.