



June 19, 2023
California Air Resources Board
1001 I St.
Sacramento, CA 95814

RE: “Public Workshop on Potential Improvements to the Landfill Methane Regulation” Comments

Dear Chair Rudolph,

We, the undersigned organizations, appreciate the opportunity to comment on the material presented in the “Public Workshop on Potential Improvements to the Landfill Methane Regulation” meeting held May 18th. We support staff’s recognition of the need to incorporate new best practices into the landfill methane regulations (LMR) with the new information and data that has been introduced in the years following the 2009 update. Enclosed are comments on several of the presentation topics. We urge the adoption of these recommendations, which would ultimately ensure the state is pursuing the highest standard of methane emissions management practices.

Remote Sensing

We endorse staff’s proposal to factor remote sensing into the LMR monitoring procedures given the accelerated implementation these technologies offer for identification and remediation. The quick identification and subsequent mitigation of a leak detected at Sunshine Canyon Landfill serves as a success story for how these methods are effective tools for emissions reduction. CARB’s outreach to operators following 2020-21 overflights resulted in voluntary mitigation of methane plumes at multiple landfills across the state. Of the incidences CARB shared with operators, about half were stopped or repaired. Requiring operator follow-up with ground monitoring and mitigation would maximize emissions reductions as CARB scales up its satellite and aerial monitoring programs.

Near-ground technologies, such as drones, rovers, and continuous emissions monitoring systems, can also improve the coverage and frequency of landfill methane monitoring. Recognizing the potential of these new technologies, Canada has recently proposed landfill methane rules which include drone emissions monitoring (DEM). Compared to conventional ground-based methods, DEM is “less labor intensive, safer and offers the ability to more comprehensively measure the landfill surface”.¹ Canada’s DEM regulations include the following:

¹Government of Canada. “Reducing Canada’s landfill methane emissions: Proposed regulatory framework” (2023). <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/reducing-landfill-methane-emissions.html>

- Monitoring of “side slope” or steep slope areas, which are excluded by California regulations.
- Drone-based surveying at a height of 5 meters with a serpentine pattern and spacing no greater than 15 meters.
- Protocol for ground-based monitoring to verify drone-based exceedances.
- The required monthly visual inspection can include drone-based surveys as a monitoring method.

These procedures underscore how DEM can enable more comprehensive coverage than traditional walking methods. We encourage CARB to incorporate drones into regulatory monitoring requirements and adopt procedures like Canada's. CARB should also develop a process to continually evaluate and approve other technologies, from aircraft to rovers to continuous emissions monitoring systems, that can improve monitoring coverage and frequency.

In addition to remote sensing procedures related to DEM, we recommend requiring using remote sensing to safely monitor the working face, as the Board has previously identified that high emissions are associated with large areas under daily and intermediate cover.² This method would bypass the safety concerns associated with the heavy machinery present at a landfill's working face, which makes this area inaccessible for monitoring on foot. Indeed, Canada's environmental agency has noted in technical guidance that drone surveys can be conducted in areas that “include[] the working face” of the landfill.³ When performing monitoring while walking, operators can walk up to 10 miles a day and average 14-18 miles per 100 inspected acres.⁴ This process is ultimately time-consuming and subject to human error as the handheld monitoring device must maintain a specific distance from the landfill surface.

Surface Emission Monitoring **SEM Standard**

In the CARB Staff Report from May 2009, the proposal of a 200 ppmv SEM standard was put on hold, citing concerns from stakeholders over potential to cause landfill fires, decrease the ability to meet federal wellhead monitoring limits for oxygen and nitrogen, and interfere with landfill gas-to-energy projects. The report states “Staff will analyze this data and return to the Board at a future date if the collected data indicates that a lower surface emission standard is feasible and does not result in landfill fires.” Data presented during the May 18 workshop demonstrates landfills are largely operating below 200 ppmv. A reduced limit is therefore both feasible and warranted as there is no evidence to suggest increased risk of landfill fires at this lower threshold. Recognizing the risk that lower emission thresholds can still pose, Oregon's regulations require a baseline recording threshold of 100 ppmv.⁵

² California Air Resources Board. “Greenhouse Gas and Criteria Air Pollutant Emissions and Gas Collection System Efficiencies at California Landfills” (2022). https://ww2.arb.ca.gov/sites/default/files/2022-12/Landfill_GHG_VOC_and_GCCS_0.pdf

³ Env't and Climate Change Can., *Estimating, Measuring and Monitoring Landfill Methane-Technical Guidance Document* (last updated April 17, 2023) at 35 available at <https://drive.google.com/file/d/1fqodsOnXDSEUEmZu7nnkHZwXfGtemWPr/view?usp=sharing>.

⁴ Barron, David. “Drones for Surface Emission Monitoring – The New EPA ALT-150 and Why it Matters.” *MSW Managements* (2023). <https://www.mswmanagement.com/home/article/21292584/drones-for-surface-emission-monitoring-the-new-epa-alt150-and-why-it-matters>

⁵ Department of Environmental Quality. “Chapter 340: Division 239 LANDFILL GAS EMISSIONS”. *Oregon Secretary of State*. <https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=6533>

Barometric Pressure During SEM

Additionally, the SEM requirements should be revised to ensure that monitoring is conducted when barometric pressure is representative of normal site conditions.

As wellheads are operated with respect to atmospheric pressure, short-term variability in the local pressure can impact the effectiveness of the GCCS, where the vacuum pressure is set monthly, and thus impact surface emissions. When atmospheric pressure rises, emissions would be lowered, and emissions would increase when the pressure falls.⁶ Therefore, SEM conducted during periods of elevated atmospheric pressure would result in atypical measurements.

The Board should ensure that SEM is conducted when barometric pressure is within the range of average daily variation at the site. We suggest landfill operators be required to:

- (1) submit information showing this range; and
- (2) record and report the barometric pressure at the site during each sampling event to demonstrate that it is within the required range.

Monitoring/Reporting Requirements

To better utilize data from ground-based SEM surveys and allow for meaningful enforcement, we recommend the following protocols:

- (1) Persons conducting monitoring must wear a GPS tracker while conducting monitoring so regulators can recreate the locations where they monitored.
- (2) Persons conducting monitoring must file a report within 30 days after sampling. The report should identify the path they walked, all locations monitored, and the readings they obtained during monitoring regardless of whether those readings exceed a certain threshold.

Without this information, it is impossible to meaningfully evaluate how the landfill is fulfilling its obligations.

Earlier Design of Gas Control System

The current threshold that requires installation of a gas collection and control system (GCCS) is 3 million Btu/hr heat input and 450,00 tons of waste-in-place. We recommend requiring landfill operators to conduct planning and engineering of GCCS prior to reaching this threshold to facilitate a proactive mitigations approach.

Cover Improvements

Mentioned in the staff presentation was “use of lower permeability covers” as an improved control measure. Per the 2020 Cal Poly methane flux data presented on Slide 19, the lower permeability covers are ultimately more effective at limiting methane emissions. Analysis from the same study also stated “cover categories was the most significant factor affecting LFG surface fluxes as compared to site specific operational practices/scale and seasons”.⁷ Per the study’s cover recommendations, we advise a

⁶ Hanson, James L. et al. “Estimation and Comparison of Methane, Nitrous Oxide, and Trace Volatile Organic Compound Emissions and Gas Collection System Efficiencies in California Landfills”. Department of Civil and Environmental Engineering, California Polytechnic State University (2020). https://ww2.arb.ca.gov/sites/default/files/2020-06/CalPoly_LFG_Flux_and_Collection_Efficiencies_3-30-2020.pdf

⁷ *Id.*

requirement of earlier installation of these more efficient cover types, per the goal to minimize the duration of daily cover use. The study specifically suggests placing interim cover as quickly as possible.

Additionally, cover improvements should also include appropriate use of biocovers, which mitigate methane emissions by filtering landfill gas through a layer of porous material and mature compost with high oxidation capacity.⁸

Leachate Recirculation

Lastly, while not mentioned in the presentation, another best practice that the Board should take into consideration is prohibiting leachate recirculation and bioreactor landfills. The practice of drawing leachate from the bottom of landfill and injecting it back into a landfill deliberately speeds up decomposition, with the end goal of creating more space within landfill. With sped-up decomposition comes accelerated methane generation resulting in more fugitive emissions. While the presentation emphasized the value of captured landfill gas, it would be unwise to tolerate practices that increase emissions, as well as odor, instability of the landfill itself, and risk of fires.⁹ “Bioreactor landfills”, the most aggressive example of recirculation, are largely experimental for a reason, with only one in the state per a special U.S. EPA permit. The goals of bioreactor landfills, and leachate recirculation more broadly, are contradictory to the proposed concepts for improved LMR, which seek to minimize opportunity for methane leaks.

Given the developments in technology and data that have occurred since last updates to the LMR, it is crucial that the updated regulations reflect these additional best practices. California has the opportunity to both catch up to more effective regulations established outside of the state, as well as lead on improvements with the implementation of current technology. For these reasons, we urge you to adopt these recommendations in the LMR updates that will be brought before the Board.

Sincerely,



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⁸ UN Climate Technology Centre & Network. “Biocovers of Landfills.” <https://www.ctc-n.org/technologies/biocovers-landfills>

⁹ U.S. EPA. “Bioreactor Landfills” (2022). <https://www.epa.gov/landfills/bioreactor-landfills>