California Air Resources Board (CARB) Proposed Amendments to its Landfill Methane Regulation (LMR)

CARB's proposed amendments to the Landfill Methane Regulation will materially raise compliance expectations for landfill and GCCS operations to support the state's 2030 methane-reduction goals. However, the changes introduce more rigorous monitoring, tighter operational thresholds, and accelerated implementation timelines, requiring owners and operators to begin strategic planning now for additional staffing, capital investment, infrastructure upgrades, and technology deployment.

In this paper, Senior Vice President and SCS's National Expert on the Clean Air Act, Patrick Sullivan, BCES, CPP, REPA, summarizes the information that landfill and renewable natural gas facilities need to begin planning for compliance.

Overview and Timeline of CARB Landfill Methane Rule Amendments: Pat provides a comprehensive overview of the history, key dates, and anticipated timeline for the CARB landfill methane rule amendments, emphasizing the expected effective date of January 1, 2027, and the impact on various stakeholders, including landfill operators, compliance personnel, and engineers.

- **Rulemaking History and Process:** Pat explained that the landfill methane rule has been in place since 2010, with CARB initiating updates through workshops and hearings, culminating in a draft rule in September 2025 and adoption in November 2025. The 15-day rulemaking period in April 2026 allowed for final comments, with no further changes expected.
- **Effective Dates and Implementation:** The anticipated effective date for the majority of the new requirements is January 1, 2027, with some provisions taking effect on March 15, July 1, or January 1, 2028. Pat noted that CARB will likely announce workshops to explain the changes and interpretations closer to the final rule promulgation.
- **Stakeholder Impact:** Pat highlighted that the amendments will affect a broad range of stakeholders, including field monitoring staff, landfill operators, compliance teams, and engineers, making it essential for all parties to understand the upcoming changes.

Key Regulatory Changes and Definitions: Pat details significant regulatory changes, including new definitions of controlled and uncontrolled landfills, revised exemption criteria, and the removal of certain thresholds, which will impact reporting and compliance obligations for landfill sites.

- **Exemption Criteria Updates:** The language for exemptions was updated from 'received waste' to 'contains waste,' affecting C&D landfills and clarifying that sites with historical non-C&D waste are regulated. This change is expected to impact only a small number of sites.
- **Controlled vs. Uncontrolled Landfills:** A controlled landfill is now defined as any landfill with a gas collection system routing gas to a methane destruction device, removing the previous 450,000-ton threshold for active sites. Uncontrolled landfills are those without gas collection or with passive venting, and they require annual reporting and are subject to new compliance triggers.

- **Reporting and Compliance Triggers:** Uncontrolled landfills must submit annual reports by March 15, and can be required to install gas collection systems if certain thresholds are exceeded or if remotely detected plumes or compliance inspections indicate high emissions.

Gas Collection and Control System (GCCS) Requirements: Pat outlines new requirements for GCCS design, installation, and operation, including shortened installation timelines, early collection mandates, and stricter downtime limits, affecting both new and existing landfill sites.

- **Design Plan and Approval Timelines:** The review period for GCCS design plans has been extended to 180 days, and a new control system design plan is required for new systems after July 1, 2027, to be submitted at least six months before operation.
- **Installation and Early Collection:** Installation timelines have been shortened to 12 months for active landfills and 18 months for closed/inactive sites. Landfills accepting over 200,000 tons in any of the prior three years must install early collection within 180 days of waste placement and operate within 30 days of meeting specific criteria.
- **Downtime and Monitoring:** Downtime for GCCS is now limited to 120 hours per year for large sites and 240 hours for smaller sites, with new requirements for continuous pressure monitoring on the vacuum side of the blower for each flare or device group.

Control Device and Flare Requirements: Pat describes new requirements for flares, engines, turbines, and gas treatment systems, including temperature monitoring, methane destruction standards, and expanded applicability of downtime, affecting equipment operation and compliance.

- **Temperature Monitoring:** Engines and gas turbines must now have temperature monitoring systems, with minimum temperatures established via source testing and ongoing compliance required.
- **Methane Destruction and Downtime:** Treated gas and tail gas not routed for sale must meet the 99% methane destruction requirement and are subject to downtime limits, aligning treatment systems with control device standards.
- **Additional Monitoring Points:** Additional gas monitoring points are required for each device or group of similar devices, necessitating coordination with operators and potential equipment modifications for LFG recovery plants.

Component Leak and Cover Integrity Monitoring Plans: Pat explained the new requirement for detailed component leak and cover integrity monitoring plans, due by July 1, 2027, specifying protocols for leak detection, cover assessment, and corrective actions.

- **Component Leak Monitoring Plan:** Facilities must develop and submit a plan detailing procedures, timelines, and component lists for leak monitoring, formalizing practices previously required but not documented.
- **Cover Integrity Monitoring Plan:** A plan is required for monitoring daily and intermediate cover areas, including protocols for addressing exposed waste, leachate breakouts, and erosion, as well as corrective actions for identified issues.

Wellhead Requirements and Monitoring: Pat reviews significant changes to wellhead requirements, including stricter decommissioning criteria, new temperature and oxygen limits, enhanced monitoring, and protocols for recurring exceedances.

- **Decommissioning and Offline Wells:** Permanent decommissioning now requires meeting specific criteria, including surface emission monitoring, declining methane, and radius of influence analysis, with temporary decommissioning subject to new limits and notification requirements.
- **Temperature and Oxygen Limits:** A new compliance limit of 145°F for wellhead temperature is established, with 131°F triggering enhanced monitoring and corrective actions. Oxygen content is limited to 5%, with recurring exceedances requiring weekly monitoring and additional assessments.
- **Enhanced and Recurring Monitoring:** Recurring exceedances of pressure, temperature, or oxygen trigger collection system and cover integrity assessments within defined radii, with corrective actions and increased monitoring frequency mandated.
- **Liquid Level Monitoring:** Annual liquid level monitoring is required for each well during the wet season, with corrective actions and increased monitoring if levels exceed 50% of the screened interval.

Surface Emission Monitoring (SEM) and Corrective Actions: Pat details new SEM requirements, including procedures for unsafe-to-walk areas, tighter corrective-action timelines, recurring-exceedance protocols, and the use of alternative technologies for inaccessible areas.

- **Unsafe to Walk Areas:** Areas previously excluded as dangerous must now be monitored using alternative technologies such as drones or robots, with defined accuracy and response time standards.
- **Corrective Action Timelines:** Corrective action must be initiated within five days of an exceedance, with re-monitoring required within 10 days and a confirmation step at one month, aligning with federal requirements.
- **Recurring Exceedances:** Five instantaneous or three integrated exceedances in 12 months trigger collection system and cover integrity assessments in the affected and adjacent grids, with increased monitoring frequency until compliance is demonstrated.
- **Remotely Detected Plumes:** Notifications of remotely detected plumes require surface emission and component leak monitoring within 10 days in a defined area, with uncontrolled landfills required to monitor the entire site and potentially triggering loss of exemptions.

Recordkeeping, Reporting, and Test Methods: Pat described expanded recordkeeping and reporting obligations, including new annual and quarterly reports, electronic data submission, and updated test methods for compliance monitoring.

- **Expanded Reporting Requirements:** Annual reports must now include additional data such as topographic maps, SEM pathways, and unsafe to walk areas, with quarterly monitoring data required in CSV format within 30 days of quarter end.

- **Uncontrolled Landfill Reporting:** A new annual uncontrolled landfill report is required, including landfill information, SEM data, climate data, and heat input capacity, with specific notification requirements for scheduled monitoring and remote plume events.
- **Test Methods and Procedures:** New details are provided for heat input capacity calculations, SEM procedures, component leak monitoring, and enhanced wellhead monitoring, with updated methods for temperature, oxygen, CO2, and CO measurements.

Alternative Compliance Options and Re-Review of Approvals: Pat explained the removal of several alternative compliance options and the new requirement for resubmitting previously approved alternatives for CARB review, with the risk of invalidation if not resubmitted by July 1, 2027.

- **Removal of Alternatives:** Alternatives for semi-continuous operation, alternative walking patterns, and exclusions for construction or unsafe areas have been removed, requiring reassessment of SEM planning and compliance strategies.
- **Re-Review and Invalidation Risk:** All previously approved alternatives must be resubmitted with supporting documentation by July 1, 2027, or they will be invalidated on January 1, 2028, with CARB empowered to revoke or deny continued approval.

Recommendations and Preparation Strategies: Pat provided actionable recommendations for landfill operators and compliance teams to proactively assess site status, plan for new requirements, and budget for anticipated operational and capital changes.

- **Proactive Assessment:** Operators are advised to assess current site status against new requirements, review wellhead and SEM data, and address chronic issues before the rule takes effect.
- **Operational Planning:** Recommendations include decommissioning non-essential wells, planning for shortened installation timelines, ensuring equipment and spare parts availability, and preparing for increased monitoring and corrective action demands.
- **Data Management and Budgeting:** Sites should implement robust data management systems to handle increased reporting and coordinate with third-party gas developers, while budgeting for additional operational, maintenance, and equipment costs.

Clarifications on Rule Interpretation and Implementation: During a live session with clients, Pat addressed questions on topics including semi-continuous operation criteria, flow rate measurement, approval processes for decommissioning and higher operating values, and SEM scheduling, providing clarifications and noting areas that require further guidance. We provide his answers below.

- **Semi-Continuous Operation Criteria:** Pat clarified that the 30% methane threshold for five years is based on an annual average, and all sites with previous alternative approvals must resubmit documentation for CARB review. Resubmit documentation for previously approved semi-continuous operation alternatives for closed sites to CARB for review by July 1st, 2027.
- **Flow Rate and Well Monitoring:** Flow rate must be measured at the individual well valve, and horizontal wells may still be subject to temperature monitoring, though further guidance is expected.

- **SEM Scheduling and Notification:** Quarterly SEM can be completed at any time within the quarter for each grid, with notification required only for the initial event, and flexibility allowed for areas transitioning from active to closed status. CARB needs to confirm and communicate the acceptable scheduling flexibility for surface emission monitoring, specifically regarding the definition of "monthly" versus "30 days" under the new rule.
- **Corrective Action and Re-Monitoring:** For surface emission exceedances, corrective action and re-monitoring must follow the new timelines, with a confirmation step required one month after the initial exceedance.
- **Drone Methane Sensor Guidance:** CARB needs to provide clarification on the permitted drone flight height for methane sensor monitoring as per CARB requirements.
- **Closed Site Semi-Continuous Operation Approvals:** Resubmit documentation for previously approved semi-continuous operation alternatives for closed sites to CARB for review by July 1st, 2027.
- **Higher Operating Value Approvals:** Resubmit documentation for wells with higher operating values already permitted to CARB for review under the new rule.

At SCS, we understand the implications and, under the SCS Engineers umbrella, have multiple specialists who work cohesively with your operation to plan, design, permit, staff, and build the infrastructure and technologies you'll need. We've been in this business for over five decades and have developed best practices and technologies specifically for use by renewable natural gas facilities and landfills.

Let's take a moment to remember that the most impactful way to reduce methane is in the hands of American citizens. Together, we can significantly minimize landfill methane by taking action at home and through community programs. Focus on reducing food waste, composting, and recycling cardboard, yard waste, and organic waste. As service providers adapt to stricter regulations, you can help your community by supporting modern waste management in your local area.

For questions specific to your facility, please contact SCS Engineers.

About the Author: Pat Sullivan, BCES, CPP, REPA, is a Senior Vice President and the Business Unit Director of our Southwest Region, encompassing California, Arizona, Nevada, Utah, and New Mexico. Pat is a Harvard-degreed scientist, a Registered Environmental Property Assessor (REPA), Board Certified Environmental Scientist (BCES), Certified Permitting Professional (CPP) in the South Coast Air Quality Management District (SCAQMD), and an accredited Lead Verifier under the California Air Resources Board (CARB) AB 32, Oregon, and Washington Greenhouse Gas (GHG) programs. He is our National Expert on the Clean Air Act and on Odor Management. He has over three decades of professional experience, all with SCS. He is active in 12 industry organizations, including the National Waste and Recycling Association (NW&RA), Solid Waste Association of North America (SWANA), and Air and Waste Management Association (AWMA).