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Deputy Executive Officer

California Air Resources Board

1001 I Street, Sacramento, California 95814

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Submitted electronically via the SB 1137 public comment docket

Re: Comments on the Discussion Draft Performance Standards for Continuously Operating Emissions Detection Systems Required by Senate Bill 1137, proposed 17 CCR §§ 93500–93506

Dear Ms. Chang and Members of the SB 1137 Rule Development Team:

Sensirion Connected Solutions (SCS) submits these comments in response to the California Air Resources Board's request for alternative approaches to the Discussion Draft Performance Standards for Continuously Operating Emissions Detection Systems. CARB requested information concerning alternatives that may provide the **same or greater benefits as the proposed requirements or achieve the regulatory objectives at lower cost.**

SCS is a subsidiary of Sensirion AG, a publicly listed company and a global leader in environmental sensing solutions. SCS develops continuous emissions-monitoring systems, including methane point-sensor networks, imaging systems, accessories and the associated cloud and data infrastructure used to collect, analyze, and report monitoring results. SCS continuous monitoring solutions are deployed across the US, Canada and internationally to monitor oil and gas sites for methane emissions. Our comments draw on experience with the technical performance and field operation of continuous monitoring systems and focus on whether the proposed requirements can be implemented in a technically reliable, reproducible, and cost-effective manner.

Our analysis identifies several areas in which the Discussion Draft could be improved without reducing protection for sensitive receptors. In some instances, the proposed alternative would provide greater protection because it would more accurately distinguish facility-related emissions from changing background conditions, better align alert thresholds with actual dispersion conditions, or establish clearer minimum performance requirements for monitoring equipment. In other instances, the alternative would maintain the intended level of protection while avoiding requirements that add cost without materially improving detection or response.

The recommendations address standardized dispersion modeling and sensor siting; treatment of within-hour plume variability; near-source applicability of modeled sensor concentrations;

condition-responsive alert thresholds; contemporaneous background determination; reproducible sensitive-receptor coverage; sub-hourly data collection; technology-neutral sensor qualification; meteorological measurements limited to operationally relevant parameters; a defined response and leak-identification sequence; corrective action and disposition of non-leak events; availability based on continued receptor coverage; standardized quality assurance and audits; proportionate plan updates and reporting; structured portfolio plans and review; and clarification of scope and definitions.

These recommendations are intended to improve the technical consistency of the program. Standardized modeling assumptions, defined performance criteria, structured records, and clear response procedures would allow operators, technology providers, auditors, CARB, and CalGEM to evaluate systems against the same requirements. They would also reduce the need for site-specific interpretations and repeated review of functionally equivalent methodologies.

The cost effects generally arise from avoiding unnecessary equipment or testing, reducing responses to exceedances that do not represent facility leaks, allowing common technical and administrative elements to be used across multiple sites, and replacing undefined site-specific methods with standardized procedures. These reductions do not depend on relaxing the underlying health-protection objective. They result from directing monitoring and response resources toward conditions that are technically relevant to detecting, identifying, and correcting emissions that could affect sensitive receptors.

The 16 comments that follow address the monitoring process in sequence. Each identifies the relevant provision, explains the technical or administrative issue, recommends an alternative, evaluates its protection and cost effects, and proposes regulatory language where appropriate. The corresponding consolidated clean and redline regulatory text for every comment is provided in Appendix A to this letter. Several recommendations are interdependent; in particular, the modeling, threshold, background, coverage, and response recommendations form a connected measurement-and-response framework and should be evaluated together.

Sensirion Connected Solutions appreciates the opportunity to provide these technical comments and would welcome further discussion with CARB staff concerning the supporting analysis, implementation details, or potential revisions to the proposed language.

Respectfully submitted,



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Comment 1 — Air dispersion modeling on one defined basis

Issue

Section 93504(h)(1) requires that AERMOD be used to determine REL-level leak rates and the ground-level concentrations that govern siting and threshold setting, but the draft specifies neither the model configuration, the meteorological basis, the receptor grid, the source characterization, the governing statistic, permissible topographic data sources, nor the acceptance criteria. Section 93504(e)(2) then relies on the modeling output to establish detection siting.

Deficiency

As drafted, each of the covered plans would be produced as an independent modeling study, with no two studies necessarily using the same inputs or conventions. The results are therefore neither comparable across operators nor reviewable at the scale of the covered population.

Technical basis

Meteorological basis. The proposed rule requires facilities to operate a meteorological station as part of the EDS, providing site-specific meteorological data during system operation. Those measurements are not available when the LDRP is initially developed and the sensor network is designed. For that design-stage AERMOD modeling, CARB and California air districts already maintain AERMOD-ready meteorological datasets suitable for regulatory dispersion modeling. Five consecutive years from the nearest representative CARB or air-district dataset should therefore provide a default safe-harbor basis for LDRP development, while allowing a closer or more representative historical dataset where available and appropriately documented.

Model inputs and conventions. The same facility can produce different modeled concentration fields depending on how sources are represented, how terrain is treated, how finely receptors are spaced, and how the hourly AERMOD results are reduced to the concentration value used for siting and threshold calculations. Because those choices directly determine sensor locations and alert thresholds, CARB should define them explicitly so that equivalent facilities are evaluated on the same basis and to avoid costly approval delays and re-modelling efforts.

Handling of potential leaks from pipelines in AERMOD simulation. The representation of potential leak points from pipelines and flowlines is unaddressed. The specifics of the assumptions around this will have a significant impact on siting of EDS sensors. A modeling protocol should clearly describe how to handle this topic.

Recommended alternative

CARB should publish a safe-harbor modeling protocol including model configuration, standard input and output templates, a defined receptor grid, a defined source-characterization method (especially for pipelines), acceptable geospatial data sources, and defined acceptance criteria. CARB should specify the meteorological basis for the simulation as five consecutive years of the most recent representative data from the nearest public weather station, or an agency-supplied AERMOD-ready dataset, with no site-specific weather data collection required. Beyond the safe-harbor modeling protocol, CARB should permit the use of custom AERMOD parameter settings as this may be warranted in specialized corner cases. For the rule to be implementable in the target timeline without bespoke AERMOD simulations, CARB must publish this modeling protocol no later than the next for-review publication of this regulation (i.e., beginning of 2027). We also suggest that CARB request feedback on the modeling protocol (formally or informally).

A delayed publication of the modeling protocol will result in increased costs due to uncertainty about how to conduct SB 1137-compliant modeling.

Basis

AERMOD is the model already specified by the draft and is the U.S. EPA preferred regulatory dispersion model; the alternative fixes its configuration rather than changing the model. A multi-year public meteorological basis is the established convention for regulatory dispersion modeling. The recommended alternative is an important refinement of CARB's proposed regulation, not a change in direction.

Effect

- **Protection:** Equal or greater. A single, representative multi-year meteorological basis is more representative than any single collected year.
- **Cost:** Substantial reduction. LDRPs based on AERMOD methods that are not comparable across sites and operators can be expected to result in lengthy review delays and repeated modeling reruns and may endanger the ability to meet the regulation's timeline.

Proposed regulatory language

§ 93504(h) Air dispersion modeling. The following amendments apply to subsection (h). Air dispersion modeling shall conform to the OEHHA Air Toxics Hot Spots Program Guidance Manual, read together with a modeling protocol incorporated by reference in this subchapter.

(1) AERMOD shall be used in accordance with a modeling protocol incorporated by reference in this subchapter. The protocol shall specify the model version and options; source-characterization methods, including methods for wells, equipment, pipelines, and flowlines; receptor-grid design; terrain and geospatial-data requirements; the governing concentration statistic; standard input and output formats; quality-control procedures; and acceptance criteria.

(5) The meteorological basis for design-stage modeling shall be five consecutive years of the most recent representative data available from the nearest representative public meteorological station or an AERMOD-ready dataset supplied or approved by the Executive Officer. Site-specific meteorological data collection shall not be required for design-stage modeling. An operator may use a different historical dataset upon demonstrating that it is more representative of the site.

(8) A digital siting tool implementing the published AERMOD algorithms may be used if its inputs, calculations, and outputs are reproducible under the incorporated modeling protocol. The operator may use custom AERMOD settings where justified by site-specific conditions and documented in the LDRP.

The Executive Officer shall publish the modeling protocol, standard templates, and acceptance criteria sufficiently in advance of required LDRP preparation to permit consistent implementation and review.

Full clean and redline text: Appendix A.

Comment 2 — Treatment of within-hour plume variability

Issue

Using a single hourly mean wind direction in AERMOD can produce unphysically narrow hourly plumes, particularly under stably stratified conditions, because it does not capture the actual within-hour variability and meandering of the plume. Modeled concentrations can therefore decrease sharply immediately off the mean plume direction, creating an unrealistic representation of EDS coverage. For facilities with multiple potential emission sources and sensitive receptors, this artifact could effectively require an unreasonably large number of sensors. It can also distort alert thresholds, which depend on the modeled concentration relationship between a sensor and a sensitive receptor.

Deficiency

The proposed rule does not specify how within-hour wind-direction variability should be incorporated when hourly AERMOD results are used for EDS siting, coverage, and alert thresholds. This is particularly problematic near a source, where narrow plumes make modeled sensor concentrations highly sensitive to small angular changes and the hourly mean concentration may not be uniquely determined by the hourly mean meteorology.

Technical basis

Within-hour plume movement: Sub-hourly wind-direction variability and plume meandering are well established, particularly under stable and weak-wind conditions [1-3]. Mahrt [1-3] documents large directional changes on time scales of minutes to an hour, precisely when modeled plumes tend to be narrowest. Thus, an hourly mean wind direction represents mean transport but not a stationary plume axis.

Observed within hour directional variability: Analysis of wind measurements from the ADED methane controlled-release experiments at METEC confirms that this effect is substantial at scales relevant to EDS operation. At mean wind speeds of approximately 2.5-6 m/s, the median 95% directional half-angle was approximately 30-45 degrees, corresponding to a total angular range of approximately 60-90 degrees. The range increased substantially at lower wind speeds. Thus, a narrow plume aligned with the hourly mean direction can substantially underrepresent the area sampled by the plume during the hour.

Consequences for siting and alert thresholds. Ignoring this movement can create numerous artificial narrow source-to-receptor pathways and therefore require more sensors without increasing actual receptor protection. It also affects alert thresholds: at short source-to-sensor distances, different sub-hourly directional histories with the same hourly mean meteorology can produce substantially different hourly mean sensor concentrations. This non-uniqueness decreases with distance as the plume spreads. A defined treatment of within-hour variability is therefore needed both for determining coverage and for establishing robust sensor-to-receptor concentration relationships used to set alert thresholds.

References

[1] L. Mahrt, "Weak-wind mesoscale meandering in the nocturnal boundary layer," *Environmental Fluid Mechanics*, vol. 7, pp. 331-347, 2007. [2] L. Mahrt, "Mesoscale wind direction shifts in the stable boundary-layer," *Tellus A*, vol. 60, no. 4, pp. 700-705, 2008. [3] L. Mahrt, "Surface Wind Direction Variability," *Journal of Applied Meteorology and Climatology*, vol. 50, no. 1, pp. 144-152, 2011.

Recommended alternative

CARB should define a safe-harbor method for incorporating within-hour wind-direction variability into hourly AERMOD results used for sensor siting, coverage, and alert thresholds. The method should account for the broader angular region sampled by a meandering plume during the hourly averaging period when determining sensor coverage and sensor-to-receptor concentration relationships.

Basis

This approach retains AERMOD while addressing the mismatch between a narrow hourly modeled plume and actual within-hour plume movement. Established observations and the ADED analysis demonstrate substantial directional variability on time scales shorter than the hourly averaging period. Accounting for this variability preserves the hourly averaging basis of the proposed rule while providing a more physically representative basis for EDS siting, coverage, and alert-threshold calculations.

Effect

- **Protection:** Equal. Coverage would reflect realistic plume movement, while the minimum source-to-sensor distance prevents alert thresholds from being based on poorly constrained near-source concentrations.
- **Cost:** Substantial reduction. Accounting for within-hour plume movement avoids sensor layouts driven by artificial narrow source-to-receptor rays and can substantially reduce the number of sensors required at facilities with multiple potential sources and sensitive receptors.

Proposed regulatory language

§ 93504(h)(6) Within-hour wind-direction variability. When hourly dispersion-model results are used to establish EDS sensor siting, sensitive-receptor coverage, sensor-to-receptor concentration relationships, or alert thresholds, the analysis shall account for within-hour wind-direction variability using the method specified in the incorporated modeling protocol or another method approved by the Executive Officer. The method shall represent the angular region sampled by the plume during the hourly averaging period and shall be applied consistently to siting, coverage, and threshold calculations.

Full clean and redline text: Appendix A.

Comment 2A — Near-source applicability of modeled sensor concentrations

Issue

The proposed framework uses modeled concentrations at sensor locations to relate emissions to concentrations at sensitive receptors and to establish alert thresholds. At very short source-to-sensor distances, those modeled concentrations can depend strongly on source-scale conditions that are not known when the EDS is designed.

Deficiency

The actual location and geometry of a future leak, including release orientation, aperture characteristics, initial momentum, buoyancy, and interaction with nearby equipment, are generally unknown and therefore cannot be represented accurately in a prospective AERMOD simulation. These uncertainties are most important close to the source and diminish as the plume develops downstream. As a consequence, no reliable alert criteria can be established at short source-to-sensor distances.

Technical basis

Near the source, concentration is highly sensitive to the details of the initial release and local plume trajectory. A point sensor located immediately adjacent to a potential source can therefore measure a one-hour mean concentration that is strongly affected by source geometry and unresolved plume movement, making direct comparison with the modeled hourly mean concentration poorly constrained. At greater separation, the effects of the unknown initial release conditions diminish and the measured and modeled concentration fields become more representative of the developed atmospheric plume.

Recommended alternative

CARB should mandate a minimum source-to-sensor separation of at least 3 meters for any sensor using AERMOD or AERSCREEN to evaluate concentrations or establish alert thresholds. EPA's AERSCREEN enforces a 1 m minimum distance floor because Gaussian dispersion equations collapse at the source origin—a 1 m separation is acceptable only under ideal conditions where the release parameters are fully specified. In practice, the initial momentum, buoyancy, location, aperture size, and orientation of an unintended leak are unknown a priori, as are its spatial interactions with the equipment. Additionally, plume filaments at this close proximity match the sensor sampling volume, introducing severe temporal spike distortion into hourly averages. Because the physical near-field zone—where initial jet momentum and turbulent obstacle wakes dominate over ambient atmospheric dispersion—extends beyond 1 m due to the characteristic scale of production equipment, moving the minimum separation to 3 meters is the necessary conservative step to account for these unresolved variables and ensure reliable model-to-measurement relationships.

Basis

This requirement does not restrict the use of near-source sensors for leak detection. It applies only when a sensor concentration is used as a quantitative anchor for the modeled relationship between an emission source and a sensitive receptor.

Effect

- **Protection:** Greater. Requiring concentration-anchor sensors to be located outside the poorly constrained near-field region improves confidence that modeled and measured

concentrations are physically comparable and that alert thresholds reflect atmospheric transport toward sensitive receptors.

- **Cost:** No added cost, with potential cost reduction. The requirement affects where existing EDS sensors are used to anchor modeled concentrations, rather than requiring additional equipment. More representative concentration relationships can also reduce false alarms caused by poorly constrained near-source model-to-measurement comparisons.

Proposed regulatory language

§ 93504(h)(7) Near-source applicability. A modeled concentration at an EDS sensor location may be used to establish a sensor-to-receptor concentration relationship or an alert threshold only if the sensor location is separated from each associated potential emission source by at least three (3) meters. A shorter separation may be used if the operator demonstrates, in accordance with the incorporated modeling protocol, that the modeled concentration is not materially sensitive to uncertainty in leak location, release geometry or orientation, initial momentum or buoyancy, nearby equipment or wakes, or unresolved plume position. This paragraph does not prohibit use of a sensor located within three meters for qualitative leak detection, source localization, or other purposes that do not rely on the sensor location as a quantitative modeled-concentration anchor.

Full clean and redline text: Appendix A.

Comment 3 — Dynamic alert thresholds

Issue

Section 93504(e)(3)(B) provides that alert threshold values “shall be set using one of the following options”: detection of leaks exceeding REL-level leak rates, or the acute REL of the toxic of highest concern. Section 93502(a)(2) defines an alert threshold as the “predetermined threshold” at which the EDS signals a potential leak event. In application, a single fixed per-sensor threshold is derived by combining worst-case or near-worst-case assumptions for the methane-to-toxic ratio, the wind direction, and the atmospheric stability class.

Deficiency

The alert threshold at the sensor position significantly depends on the source ratio as well as the atmospheric stability class. Because the fixed threshold combines several worst-case assumptions simultaneously, it lies below routine, non-leak concentrations for most hours in a year. Sensirion has conducted AERMOD simulations based on continuous monitoring data collected at a production site in an HPZ in California. The results for this site indicate almost daily exceedances generated despite actual air-toxic concentrations far below any health-relevant level.

Technical basis

The threshold combines independent worst-case assumptions. A fixed per-sensor threshold is not derived from a single condition; it is the product of several conservative assumptions applied at the same time. Each is defensible as a bounding case, but their simultaneous combination describes an hour that rarely occurs.

Source ratio (up to roughly 100× span). The methane-to-toxic ratio varies by approximately three orders of magnitude across on-site equipment. A single facility-wide threshold set on the smallest ratio (the tank) requires every fenceline sensor to alarm at a level appropriate only for the single worst source, even when the wind carries air from a much higher-ratio source. The implied methane alert level, in the worked California example, spans approximately 0.50 ppm (tank) to 44.7 ppm (compressor):

Emission source	CH ₄ / C ₆ H ₆ ratio (vol.)	Implied CH ₄ alert (ppm, stable atm.)	Relative headroom
Tank	300	0.50	Lowest (binding)
Wellhead	3,600	6.1	~12× tank
Separator	15,000	24.4	~49× tank
Compressor	27,000	44.7	~89× tank

Illustrative values only. The specific source ratios and resulting alert thresholds will vary by site, source characteristics, geometry, meteorology, and modeling assumptions. The important point is that both source ratios and applicable methane-equivalent alert thresholds can vary substantially, supporting the need for a dynamic rather than a single fixed threshold.

Atmospheric stability (roughly 10× span). AERMOD dispersion modeling shows that the concentration ratio between the concentration at the location of the sensitive receptor and the sensor location significantly depends on the atmospheric stability class. Holding source and

geometry constant, the threshold implied by dispersion modeling varies by approximately an order of magnitude ($\times 10$) between stable and unstable conditions. A fixed threshold must adopt the stable-atmosphere value (the lowest), although stable conditions prevail only part of the time:

Atmospheric stability class	Implied alert threshold (ppm CH ₄ enhancement)
Stable	0.50
Neutral	3.8
Unstable	6.6

Illustrative alert thresholds (ppm CH₄ enhancement) by stability class, worked example.

A fixed alarm threshold based on the worst-case stable dispersion condition would be overly restrictive under prevailing meteorological conditions. In five years of direct turbulence measurements at the US-Ton FLUXNET site (a representative location in CA), approximately 92% of valid half-hour periods were near-neutral, neutral, or unstable. Thus, for roughly 92% of the time, an alarm threshold established for the strongly stable case would be lower than warranted by the prevailing dispersion conditions, increasing the likelihood of unnecessary alarms.

This is an important limitation of an approach that selects a conservative worst-case meteorological condition and applies the resulting alarm threshold continuously. Because the proposed framework already calls for meteorological measurements and AERMOD modeling, those same inputs could instead be used to establish stability-dependent alarm thresholds that vary dynamically with prevailing meteorological conditions. This would preserve the conservative threshold during strongly stable conditions, when it is needed, while allowing appropriately higher thresholds under conditions that provide greater atmospheric dispersion.

Wind direction and source attribution. A fixed threshold applies the facility-wide worst-case source assumption regardless of which source is actually influencing a sensor. In many EDS configurations, the combination of wind direction, source-sensor geometry, and the spatial pattern of sensor response can provide robust source localization or exclusion. Where those data rule out the worst-case source and identify a different source group as the likely origin, the threshold appropriate to that source can be applied instead of the facility-wide worst-case threshold.

Recommended alternative

Add a third option at § 93504(e)(3)(B): a dynamic alert threshold that is adjusted in real time on the basis of any or all of (i) the atmospheric stability class, (ii) the wind direction, and (iii) demonstrated source pinpointing or exclusion (including exclusion of low-REL source types), computed using the incorporated AERMOD protocol. Permit alert thresholds set per equipment group where the EDS demonstrates sufficient attribution accuracy to the group of origin, or excludes a low-REL source type. Where fenceline geometry makes a compliant fenceline threshold infeasible (for example, a distant fenceline, a close receptor, and a low-REL source), permit a near-proximity source-based configuration for the affected group. No alert shall be suppressed in any hour except one in which the recorded meteorological data demonstrate that a REL-level leak from the associated source(s) would not be transported toward any sensitive receptor.

Basis

The draft already frames threshold-setting as a choice among options (§ 93504(e)(3)(B)) and already requires thresholds to be “quantifiably resolved from temporal variation in the baseline” (§ 93504(e)(3)(F)), which is a recognition that the governing quantities vary in time. The meteorological inputs the dynamic threshold consumes are already mandated: § 93502(a)(5) and § 93504(i) require continuous wind measurement at one-minute resolution, stored for five years. PRC § 3283(a)(2)(A) requires siting “consistent with local meteorology,” and § 3283(f) requires ten-year retention of meteorological and emissions records — the auditable basis a dynamic threshold produces. Where stability class is used by an EDS, the regulation should state which stability-class scheme applies. In implementation with an EDS, real-time stability determination may be supported by a three-dimensional anemometer (see Comment 8).

Effect

- **Protection:** Equal. In every hour in which a leak could reach a receptor, no alert is suppressed, and detection of genuine, receptor-directed REL-level leaks within one hour is unchanged.
- **Cost:** Substantial reduction. Avoidance of costs related to false alarms.

Proposed regulatory language

§ 93504(e)(3)(B)3. Set a dynamic alert threshold, evaluated at an averaging time of one hour or less, that is adjusted using one or more of the following: atmospheric stability class; wind direction measured under subsection (i); and demonstrated source attribution or source exclusion. The threshold shall be calculated under subsection (h).

(G) A dynamic alert threshold shall not suppress an alert during an averaging interval unless the meteorological data recorded under subsection (i) demonstrate that a REL-level leak from the associated source or source group would not be transported toward any sensitive receptor during that interval.

(H) Alert thresholds may be established by equipment group where the EDS demonstrates sufficient attribution accuracy to the group of origin or reliably excludes a source type demonstrated to lack REL-level leak potential. If a compliant fenceline threshold is infeasible because of site geometry, a near-proximity source-based configuration may be used for the affected equipment group, subject to subsection (g), the source-localization demonstration, and the near-source modeling limitation in subparagraph 93504(h)(7).

(I) An operator using a dynamic alert threshold shall document in the LDRP the algorithm and inputs; the source groups to which it applies; any stability-class scheme; source-attribution and exclusion criteria; data-quality requirements; and quality-assurance procedures sufficient to reproduce the threshold applicable to any averaging interval. The threshold policy used in operation shall be the same policy used in the coverage demonstration under subparagraph 93504(e)(2)(A)2.

Full clean and redline text: Appendix A.

Comment 4 — Background determination by contemporaneous subtraction

Issue

For plume-detecting systems, § 93504(g)(4) provides that the baseline detection target concentration shall be calculated as the arithmetic mean of baseline measurements accumulated over twelve months of valid hourly data and subsequently applied as a fixed baseline. During the accumulation period, § 93504(g)(2) establishes an interim monthly baseline. Separately, § 93504(e)(3)(F) requires alert thresholds to be quantifiably resolved from temporal variation in the baseline concentration.

Deficiency

A fixed annual arithmetic mean does not represent the actual methane background experienced by a plume-detecting system. Methane concentrations at oil and gas sites vary continuously because of diurnal atmospheric mixing, seasonal meteorology, nearby oil and gas operations, naturally occurring methane seeps, landfills, agricultural activities, and other intermittent off-site methane sources. As a result, the true background concentration can differ substantially from the annual mean during any individual hour.

This creates two opposing failure modes:

- False negatives. When the actual background is lower than the annual mean, subtraction of the annual mean removes part of a genuine facility contribution before comparison with the alert threshold.
- False positives. When the actual background is higher than the annual mean, subtraction is insufficient and ordinary background fluctuations may be reported as facility emissions.

Recommended remedy — contemporaneous background subtraction

The background concentration should be determined from a contemporaneous upwind measurement rather than from a historical annual average. For each averaging interval, the methane concentration measured at an eligible upwind monitor is subtracted from the concentration measured at the alerting monitor, and the alert threshold is applied to the resulting methane increment. This approach removes temporal variation caused by regional background, meteorology, and nearby off-site methane sources by design, because those influences are measured at the same time as the alerting concentration. The resulting increment more directly represents the monitored facility's contribution.

Dynamic selection of the upwind monitor. A fixed upwind monitor is not required. Instead, dynamic subtraction should be permitted whenever a valid monitor exists within the upwind wind cone of the alerting monitor for the relevant averaging interval. The wind cone should be determined using the within-hour variability of the wind direction as measured during this hour. The selected monitor must satisfy normal QA/QC requirements and must not be located downwind (or within the influence) of an on-site emission source under the measured wind conditions. If no valid upwind monitor is available, contemporaneous subtraction is not applied for that interval, and the background concentration is instead taken as a representative regional atmospheric background methane concentration published or approved by the Executive Officer.

This performance-based approach avoids prescribing a fixed number of sensors to determine background emissions while allowing operators to improve background characterization by

deploying additional monitors where site geometry or nearby methane sources warrant additional coverage.

Regulatory precedent

- SCAQMD Rule 1466. South Coast AQMD Rule 1466 defines its action level using the contemporaneous difference between downwind and upwind concentrations rather than a historical baseline, demonstrating that California regulatory programs already use real-time spatial differencing to isolate site contributions from changing background conditions.
- EPA refinery fenceline monitoring (40 CFR § 63.658). EPA's refinery fenceline program likewise relies on contemporaneous spatial concentration differences and permits approved correction mechanisms where off-site sources materially affect measured concentrations.

Both programs recognize that background concentrations are spatially and temporally variable and are therefore more accurately characterized through contemporaneous measurements than through historical averages.

Elimination of the interim baseline. Because the background is determined contemporaneously — from an upwind monitor where available, and otherwise from a published regional atmospheric background value — no baseline accumulation period is required, and a plume-detecting EDS can begin operation immediately after installation. The twelve-month arithmetic-mean baseline of § 93504(g)(4) and the interim monthly baseline of § 93504(g)(2) are therefore unnecessary for plume-detecting systems and should be deleted rather than retained as a fallback. Retaining the annual mean as a fallback would reintroduce the same temporal-mismatch error the contemporaneous method is designed to remove.

Recommended alternative

Replace the fixed twelve-month arithmetic-mean baseline in § 93504(g)(4) with contemporaneous background subtraction. The alert threshold should be applied to the methane increment calculated as the difference between the alerting concentration and the contemporaneous background. The contemporaneous background should be the upwind concentration measured during the same averaging interval whenever a valid monitor exists within the approved upwind wind cone and all applicable QA/QC requirements are satisfied; where no valid upwind monitor is available for a time interval, the background should be a representative regional atmospheric background methane concentration published or approved by the Executive Officer. Delete the twelve-month accumulation requirement of § 93504(g)(4) and the interim baseline requirement of § 93504(g)(2) for plume-detecting systems.

Effect

- **Protection:** Greater. Contemporaneous subtraction reduces both false positives and false negatives caused by temporal variability in methane background concentrations and better isolates the facility-attributable methane increment relevant to leak detection.
- **Cost:** Substantial reduction. By removing background-driven exceedances from nearby methane sources and ordinary atmospheric variability, the proposal reduces unnecessary investigations while preserving detection of genuine facility emissions.

Proposed regulatory language

§ 93504(g)(1) For a plume-detecting EDS, the alert threshold shall be applied to the background-subtracted methane increment determined under paragraphs (4) and (6). No baseline-accumulation period is required, and subparagraphs 93504(g)(1)(A) and (B) do not apply to a plume-detecting EDS.

- (2) The interim monthly baseline requirement does not apply to a plume-detecting EDS.
- (4) For each averaging interval, the background-subtracted methane increment equals the concentration at the alerting monitor minus the contemporaneous background concentration. If a valid monitor is located within the approved upwind wind cone of the alerting monitor, the contemporaneous background concentration shall be the concentration measured by that monitor during the same averaging interval. The upwind wind cone shall be determined from the wind direction and within-hour wind-direction variability measured for that interval. An upwind monitor is valid only if applicable meteorological, completeness, and quality-assurance requirements are met and the monitor is not within the influence of an on-site emission source under the measured conditions.
- (5) The methodology used to establish the background-subtracted increment shall be documented in the LDRP.
- (6) If no valid upwind monitor is available for an averaging interval, the contemporaneous background concentration shall be a representative regional atmospheric background methane concentration published or approved by the Executive Officer. The substituted background value, the reason for substitution, and the applicable quality status shall be recorded in the system event log.

Full clean and redline text: Appendix A.

Comment 5 — Sensitive-receptor coverage

Issue

Section 93504(e)(2)(A)2. requires a plume-detecting EDS to be “sited to achieve detection on an hourly basis of at least 90 percent of leaks that exceed the REL-level leak rate(s) ... that are transported in the direction of sensitive receptors.” This ninety-percent coverage requirement is one of the central provisions of the regulation: it governs the protection delivered to sensitive receptors and, because it determines how many sensors a facility must deploy, it is the single largest driver of implementation cost.

Deficiency

The coverage requirement is not defined precisely enough to be computed or reviewed consistently. “90 percent of leaks” has no stated population over which the fraction is taken; “transported in the direction of sensitive receptors” has no defined wind-sector width, measurement height, or treatment of hours in which no plume reaches a receptor; and no demonstration method is specified. As a result, similar facilities can be evaluated on different bases, and neither CalGEM nor an independent auditor can objectively determine whether a proposed sensor layout satisfies the same standard. Because sensor count and cost follow directly from this calculation, the ambiguity is highly consequential for the implementation cost of the regulation.

Technical basis

Coverage is the same calculation already used to set alert thresholds. The AERMOD modeling required by § 93504(h) already produces, for each source and each hour of the modeled year, the concentration a leak would produce both at the sensitive receptor and at each sensor. Setting an alert threshold is precisely the act of choosing, for each sensor, the concentration at which it should alarm so that a leak reaching the acute REL at the receptor is detected. Coverage can therefore be read directly from the same simulation: for each hour, a leak large enough to reach the acute REL at the receptor should already trigger the alert threshold of at least one sensor, and the hour is covered when it does. No additional model run, and no separate margin factor, is required.

Coverage should be defined per hour, per source, and per receptor. The protective intent of the statute is that a sensitive receptor is protected throughout the year. Coverage is therefore expressed as the fraction of the hours of a representative modeled year, computed for each combination of a monitored source and a sensitive receptor, in which a leak large enough to reach the acute REL at the receptor would already trigger the chosen alert-threshold policy at one or more sensors. Requiring the ninety-percent condition for each source-and-receptor combination prevents a well-covered receptor from masking a poorly-covered one. As discussed in Comment 1, a modeling protocol for how to model potential sources, especially from pipelines, is required for a systematic calculation of the coverage. The method for the coverage calculation should also be part of the modeling protocol.

Hours in which the wind does not carry the plume to the receptor are considered covered. When the wind blows away from a receptor, no leak at the modeled REL-level rate threatens the receptor and the hour is covered automatically. This is the intended result: in such hours the receptor is protected by the meteorology rather than by a sensor, and the definition correctly records the receptor as protected. No separate treatment of these hours, and no upper bound on the modeled leak rate, is required. A receptor that is frequently downwind is therefore held to

a correspondingly stricter effective standard than one that is rarely downwind — a consequence of geography that an oil and gas operator cannot influence.

Coverage must be computed against the facility's actual alert-threshold policy. Because whether an hour is covered depends on the alert thresholds in force, coverage shall be computed using the alert-threshold policy the LDRP actually proposes, including any dynamic threshold established under § 93504(e)(3). Where a dynamic threshold varies with atmospheric conditions, it shall be applied in the coverage calculation exactly as it would be applied in operation, so that the demonstrated coverage reflects the system as deployed. This makes the coverage requirement the constraint that prevents an operator from raising alert thresholds so high — for example, to suppress false alerts — that the network would no longer detect a receptor-directed leak; the ninety-percent condition is the point at which threshold relaxation begins to reduce receptor protection. The AERMOD configuration, including the treatment of within-hour wind-direction variability, shall be identical to that used elsewhere in the modeling, so that coverage, sensor siting, and alert thresholds all rest on one consistent modeling basis.

Detection reliability at the threshold is addressed separately. Whether a sensor reliably resolves a concentration at its own alert threshold is governed by the sensor-performance requirements of § 93504(d) — the detection-limit margin, precision, and field-verification tolerance addressed in Comment 7. Coverage therefore need not carry its own measurement-uncertainty margin, and none is proposed: coverage measures whether the chosen thresholds would detect a receptor-directed REL-level leak, while § 93504(d) ensures the sensors can resolve those thresholds in the field. Keeping the two requirements separate avoids double-counting the same uncertainty and leaves each independently auditable.

Recommended alternative

Define sensitive-receptor coverage explicitly as the fraction of the hours of a representative modeled year, computed for each monitored source and each sensitive receptor, in which a leak large enough to cause a concentration equal to the acute REL of the toxic of highest concern at the receptor would trigger the facility's proposed alert-threshold policy at one or more sensors, using the AERMOD basis of § 93504(h). Require that the ninety-percent condition be met for each source-and-receptor combination and for the five-year historical weather dataset as described in the modeling protocol.

Basis

The definition uses only quantities the regulation already requires — AERMOD dispersion modeling under § 93504(h), alert thresholds under § 93504(e)(3), and the acute REL of the toxic of highest concern — and expresses the ninety-percent standard already in § 93504(e)(2)(A)2. in a form that any two modelers would compute identically. It introduces no new parameter: coverage is read from the same simulation that sets the alert thresholds.

Effect

- **Protection:** Equal or greater. Coverage becomes a reproducible, receptor-specific, health-anchored test rather than an undefined figure, and the per-source-and-receptor condition prevents a well-covered receptor from masking a poorly-covered one.
- **Cost:** Reduction. A single defined calculation replaces bespoke and inconsistent coverage demonstrations, while the crediting of meteorologically safe hours avoids sensor layouts driven by hours in which no receptor can be affected.

Proposed regulatory language

§ 93504(e)(2)(A)2. A plume-detecting EDS shall achieve at least ninety (90) percent sensitive-receptor coverage for each monitored source and each sensitive receptor within the health protection zone. Coverage shall be calculated using subsection (h), including the five-year meteorological dataset, the within-hour variability method, and the alert-threshold policy proposed in the LDRP.

For each modeled hour and each source-and-receptor combination, determine the leak rate that would produce a concentration equal to the acute REL of the toxic of highest concern at the sensitive receptor. The hour is covered if either: (a) the modeled meteorology would not transport the leak toward the sensitive receptor; or (b) the leak would cause at least one valid EDS sensor to reach the alert threshold applicable for that hour. Coverage is the number of covered hours divided by the total number of modeled hours for the source-and-receptor combination.

The same model configuration and treatment of source characterization, terrain, meteorology, within-hour variability, and alert thresholds shall be used for sensor siting, coverage, and threshold-setting. Sensor measurement performance at the applicable threshold shall be demonstrated separately under subsection (d).

Full clean and redline text: Appendix A.

Comment 6 — Detection frequency and time coverage

Issue

The draft requires measurement intervals of one hour or less and evaluates the alert threshold on a one-hour average. A system reporting a single value per hour is therefore compliant.

Deficiency

A one-hour measurement interval is insufficient because a single measurement per hour is an unreliable estimator of the one-hour average to which the alert threshold is applied. Methane emissions are frequently intermittent and of short duration; a large-magnitude short-duration event can fall between widely spaced samples and be omitted from the hourly mean, or a single sample can overweight it, so that the computed hourly average diverges from the true hourly average. The deficiency is therefore the collection frequency, not the one-hour averaging basis, which is retained. Sub-hourly data are separately required by the analytics elsewhere in the program — persistence confirmation, wind-sector attribution, and duration estimation — which cannot operate on one value per hour.

Recommended alternative

Establish a maximum collection interval of five (5) minutes, with the alert-threshold comparison remaining on a one-hour average consistent with § 93504(e)(3), aligned with the one-minute meteorological resolution the draft already requires at the meteorological station (§ 93504(i)). Define a valid hour as one containing at least nine (9) valid measurements at the required five-minute interval, corresponding to at least 45 minutes of coverage (75 percent completeness). Only valid hours shall count toward CARB's requirement that the EDS provide coverage of at least 90 percent of sensitive receptors under § 93504(e)(2). Scanning or imaging systems may be used as an aid during the leak-identification period, where they assist identification, but shall not be the sole basis for alerting unless they have a 5 minute or faster image repeat time. The requirement should therefore apply to all EDS solutions, including cameras.

Basis

The minimum collection frequency follows from the physics of estimating a one-hour mean: given the characteristic duration of large emission events, a sampling interval well below one hour is required for the computed hourly average to reliably represent the true hourly average. The five-minute floor and the 75-percent completeness criterion follow established continuous-monitoring practice, and the one-minute meteorological requirement already in the draft establishes that sub-hourly collection is feasible and expected.

Precedent for a 75-percent "valid hour." The 75-percent completeness rule adopted here — at least 45 valid minutes of data for an hour to count as a valid hour — is the long-established convention in California and federal continuous ambient and fenceline air-monitoring programs, not a new construct. Federal ambient monitoring under 40 CFR Part 58 and its data-handling conventions, and continuous-monitoring quality-assurance practice generally, treat an hour as valid only when a defined minimum fraction (commonly 75 percent) of the sub-hourly samples in that hour are valid, and roll that hourly-completeness test up into daily, quarterly, and annual completeness thresholds. California refinery fenceline air-monitoring programs adopt the same architecture: South Coast AQMD Rule 1180 and Rule 1180.1 and the associated Fenceline Air Monitoring Plan Guidelines require continuous, real-time measurement with defined data-capture and quality-assurance completeness criteria and a defined valid-hour construction before data are used for notification or reporting. Adopting the same 45-minute/75-percent valid-

hour convention here keeps SB 1137 EDS data handling consistent with the monitoring conventions California agencies already apply and audit, rather than inventing a program-specific completeness rule.

Effect

- **Protection:** Greater. Sub-hourly collection produces an accurate estimate of the one-hour average, capturing large, short-duration events that a single hourly sample can miss, and supplies the data the identification and attribution analytics require.
- **Cost:** Neutral. Continuous monitoring systems from most vendors already collect at one- to five-minute intervals (see, for example, the technology descriptions published in EPA's oil and gas alternative test methods portal, <https://www.epa.gov/emc/oil-and-gas-alternative-test-methods>).

Proposed regulatory language

§ 93504(c)(1) Irrespective of monitoring technology, the EDS shall collect measurements at intervals not exceeding five (5) minutes. The alert-threshold comparison shall be based on an average of one (1) hour or less under paragraph 93504(e)(3).

(A) A valid hour shall contain valid measurements representing at least forty-five (45) minutes of the hour and, for a system operating at a five-minute collection interval, not fewer than nine (9) valid measurements. Only valid hours shall count as sensor-provided coverage under subparagraph 93504(e)(2)(A)2.

Conforming amendment — § 93504(e)(2)(A)1. A scanning or imaging EDS shall scan or image all monitored production equipment and report measurements at a minimum frequency of five (5) minutes. A scanning or imaging system may assist leak identification but shall not serve as the sole basis for alerting unless it completes a valid measurement or image cycle for the relevant monitored area at least once every five (5) minutes.

Full clean and redline text: Appendix A.

Comment 7 — Sensor performance floor**Issue**

Section 93504(d) establishes a detection-limit margin of at least three times below the alert threshold, a manufacturer-documented precision of ± 15 percent at the alert threshold, and quarterly field verification within ± 25 percent using a NIST-traceable standard, with an exemption for automated built-in verification. These provisions establish an important minimum performance floor and should be retained. The numerical performance targets are appropriate and are not proposed for change. However, the section does not define the technology-neutral conditions under which those targets must be met, so that a stated ± 15 percent value does not yet constitute an enforceable floor.

Deficiency

The performance floor is underspecified in six respects. First, and most importantly, the ± 15 -percent precision requirement does not state a confidence level, a minimum test-batch basis, or the environmental conditions for which it must be met. A precision figure is meaningless without a confidence level: a manufacturer reporting “ ± 15 percent at one sigma” and a manufacturer reporting “ ± 15 percent at three sigma” describe materially different products, yet both satisfy the provision as drafted. Requiring only that the manufacturer state its chosen confidence level, rather than fixing that level, therefore establishes no floor at all. Second, the draft requires quarterly verification but does not define the stability that must be maintained during the three-month interval; verification identifies performance at the time of the test and does not by itself establish that accuracy was maintained between tests. Third, the draft does not regulate automatic baseline correction, although an incorrectly designed correction can interpret a persistent methane enhancement as sensor drift and suppress the reported concentration. Fourth, cross-sensitivity to co-present gases is not specified, including negative interference that reduces a methane response. Fifth, no environmental operating envelope is required, so laboratory performance and data collected outside validated temperature, humidity, or pressure conditions are not clearly distinguished. Sixth, the draft does not address dynamic response in a fluctuating plume; unequal rise and decay behavior can bias the reported hourly mean even where static-gas accuracy is acceptable.

Technical basis

Accuracy, precision, and device-to-device variation. A regulatory precision value is reproducible only if the statistics and population are fixed rather than left to the manufacturer. The specification should require a defined confidence level rather than merely its disclosure. A three-standard-deviation (≥ 99.7 percent) basis across a defined production population provides a conservative and auditable measure of device-to-device variation, and is the basis on which fixed continuous methane sensors are already characterized in practice: manufacturer characterization data submitted to U.S. EPA and CARB report limit of detection and accuracy as three-sigma values of fitted distributions across full production batches (for example, 100 production units tested at 2, 10, and 90 ppm methane concentration). The specification should also fix a minimum test population and batch basis, so that the reported precision reflects genuine production spread rather than a small hand-selected sample, and should require demonstration at concentration points bracketing the alert threshold across the declared environmental operating envelope. Each of these requirements is technology-neutral: it constrains the statistics and the sampling, not the sensing principle. Test methods consistent with the principles of ASTM D8406-22 may be used where applicable, but the regulation should

permit equivalent methods because ASTM D8406-22 was not developed specifically as a complete qualification standard for fixed continuous methane sensors.

Long-term stability and verification interval. Quarterly bump testing is an appropriate default performance floor where longer-term stability has not been demonstrated. The corresponding minimum stability requirement is that the sensor remain within the field-verification acceptance criterion throughout the three-month interval. A longer verification interval should be permitted only where the manufacturer demonstrates that the sensor type maintains the required performance over the proposed interval, supported by field data or accelerated lifetime testing, or a combination, and should not exceed five years.

Accelerated lifetime testing referenced to recognized standards. To keep the interval extension both rigorous and technology-neutral, the accelerated testing should be conducted in accordance with recognized reliability-qualification standards rather than a manufacturer-defined protocol. Established, sensor-agnostic frameworks include the JEDEC JESD22 methods for temperature cycling, high-temperature operating life (HTOL), and temperature-humidity-bias (THB); JEDEC JEP122 for failure-mechanism acceleration models; the ZVEI Handbook for Robustness Validation of Automotive Electrical/Electronic Modules; and AEC-Q100. The relationship between the applied stress and the claimed field interval must be justified for the failure mechanism concerned using an accepted acceleration model, such as the Coffin-Manson model for thermal-cycling fatigue and the Peck (damp-heat) model for combined temperature and humidity stress. Accelerated testing should compare accuracy, sensitivity, and functional status before and after stress using production-equivalent devices and predefined acceptance criteria; exposure to stress alone is not evidence of maintained calibration.

Baseline correction and drift compensation. Automatic baseline correction is a common method for compensating offset drift, but it depends on correctly identifying periods in which the sensor is exposed to atmospheric background. At oil and gas sites, a sensor may experience elevated methane for days or longer because of low-wind pooling, nocturnal accumulation, persistent off-site emissions (such as naturally occurring methane seeps or nearby landfills), or continuing on-site emissions. A baseline correction operating on a timescale of days or less may therefore treat a genuine methane enhancement as a new baseline and subtract it from subsequent measurements. The result is systematic under-reporting rather than random error. The risk can be particularly severe for non-linear sensing technologies such as metal-oxide sensors, because a baseline error may affect the concentration-response relationship beyond a simple additive offset. Baseline correction should therefore be permitted only where the method, selection criteria, update rate, maximum correction, and safeguards are documented, and testing demonstrates that persistent methane enhancements and low-wind accumulation do not cause systematic underestimation. Baseline correction must not be accepted as the sole evidence of sensor stability.

Cross-sensitivity. A performance floor should require quantified interference data for major constituents and field interferents relevant to the intended deployment. The challenge set should include, as applicable, hydrogen, hydrocarbons, carbon monoxide, carbon dioxide, water vapor, and hydrogen sulfide, together with any technology-specific interferents identified by the manufacturer. Positive and negative effects should be reported separately. Any interference that reduces the methane response should be included conservatively in the demonstration that the sensor can resolve the applicable alert threshold.

Environmental operating envelope and dynamic response. The manufacturer should declare the temperature, humidity, and pressure range over which the detection limit, accuracy, precision, and response specifications remain valid, and should demonstrate performance across that range. Data outside the validated envelope should be flagged. The sensor should also have documented rise and recovery characteristics under a defined step or pulse challenge. Where rise and fall behavior is asymmetric, the manufacturer should demonstrate that the asymmetry does not materially bias the concentration average used for alerting in a fluctuating plume.

Recommended alternative

Retain the structure and the numerical floor of § 93504(d) unchanged, and complete it with technology-neutral qualification requirements: (1) a precision specification set at a fixed three-sigma confidence level, with a defined minimum production-equivalent test population and batch basis, concentration points bracketing the alert threshold, and the declared environmental operating envelope; (2) a long-term stability requirement linked directly to the field-verification interval; (3) accelerated lifetime testing referenced to recognized reliability standards (JEDEC JESD22 and JEP122, ZVEI Robustness Validation, AEC-Q100, or equivalent) with a justified acceleration model; (4) explicit documentation and validation of any baseline-correction or drift-compensation method; (5) quantified positive and negative cross-sensitivity for relevant interferents; (6) a validated environmental operating envelope; and (7) documented dynamic response characteristics. Quarterly bump testing remains the default pathway and the minimum performance floor. A longer interval is allowed only where sufficient stability has been demonstrated for that interval through accepted field or accelerated lifetime testing, up to a maximum interval of five years. None of these additions alters CARB's ± 15 -percent precision or ± 25 -percent verification targets; each constrains only the conditions under which those targets are demonstrated.

Basis

The confidence-level, population, and accelerated-testing requirements are drawn from established, technology-neutral engineering practice rather than from any single sensing principle. Manufacturer characterization already submitted for continuous methane sensors demonstrates that a three-sigma basis across full production batches, combined with the JESD-class stress battery (on/off cycling, thermal cycling, HTOL, and THB) and functional diagnostics, provides an auditable basis for linking verification frequency to demonstrated stability, and applies acceptance models such as Coffin-Manson and Peck (damp-heat) that are standard across the electronics industry. Referencing these recognized standards, rather than a fixed number chosen by any one manufacturer, keeps the floor technology-neutral: any sensor type may use the default quarterly verification pathway or support a longer interval with an equivalent stability demonstration. The same characterization also shows why the regulation should distinguish sensitivity stability from baseline correction, because functional checks and offset compensation address different failure mechanisms and cannot substitute for a demonstrated accuracy requirement.

Effect

- **Protection:** Greater. A fixed confidence level and defined test population make precision genuinely comparable across manufacturers rather than a self-selected statistic; drift and baseline-correction failure modes become auditable; negative cross-sensitivity and operation outside the validated envelope are made visible; and dynamic-response bias is addressed.

- **Cost:** Substantial reduction. Quarterly bump testing remains available as the default pathway, while demonstrably stable sensor types may use a verification interval supported by their stability evidence, avoiding unnecessary field tests without reducing the required measurement performance.

Proposed regulatory language

§ 93504(d)(4) The manufacturer-documented accuracy and precision specifications shall identify the confidence level, methane concentration points, environmental operating envelope, production-equivalent test population, and production-batch basis used to demonstrate compliance. The precision required by this subsection shall be expressed at a three-standard-deviation confidence level across the tested device population. Compliance shall be demonstrated using not fewer than thirty (30) production-equivalent devices from not fewer than three (3) production batches, at not fewer than three (3) methane concentration points that bracket the alert threshold and lower concentrations relevant to detection, across the declared environmental operating envelope. The distribution of results shall be reported.

(5) Quarterly field verification is the default compliance pathway. The sensor type shall be demonstrated to maintain the applicable accuracy and precision requirements throughout each three-month verification interval.

(6) The Executive Officer may approve a field-verification interval longer than three months where field data, accelerated lifetime testing, or both demonstrate maintained compliance over the proposed interval. Accelerated testing shall follow a recognized reliability-qualification standard, including JEDEC JESD22, JEDEC JEP122, the ZVEI Handbook for Robustness Validation, AEC-Q100, or an equivalent documented standard, and shall justify the relationship between applied stress and the claimed interval using an accepted acceleration model. The interval shall not exceed the demonstrated stability period or five (5) years, whichever is shorter.

(7) If the reported concentration uses automatic baseline correction or other ambient-data-based drift compensation, the manufacturer shall document the method, input-selection criteria, update timescale, maximum correction, and suspension conditions, and shall demonstrate that persistent methane enhancement, low-wind accumulation, and elevated off-site background do not cause systematic under-reporting. Baseline correction alone does not satisfy paragraph (5) or (6).

(8) The EDS shall have documented cross-sensitivity specifications for relevant co-present gases and environmental interferents. Positive and negative interference shall be quantified separately. Any interference that reduces reported methane concentration shall be incorporated into the demonstration that the applicable alert threshold can be detected.

(9) The manufacturer shall declare the temperature, humidity, and pressure envelope over which the detection-limit, accuracy, precision, and response specifications are valid. Compliance shall be demonstrated across that envelope, and data collected outside it shall be flagged.

(10) The EDS shall have documented rise and recovery characteristics under a defined dynamic challenge. If response is asymmetric, the manufacturer shall demonstrate that the asymmetry does not materially bias the concentration average used for alerting under fluctuating-plume conditions.

Full clean and redline text: Appendix A.

Comment 8 — Meteorological measurement

Issue

Section 93504(i) requires a meteorological monitoring system recording five parameters (wind speed, wind direction, temperature, pressure, relative humidity) at one-minute resolution, sited under EPA meteorological siting guidance written for 10-metre open-terrain towers.

Deficiency

The one operationally necessary meteorological input for the EDS is wind (speed and direction, optionally as a three-dimensional measurement if atmospheric stability class is used by an EDS). Temperature, pressure, and relative humidity feed no EDS threshold computation, and the 10-metre open-terrain tower geometry is not representative of wind conditions near most equipment or leak sources. The wind speed relevant for calculating alert thresholds and concentrations at sensitive receptors is wind closer to the ground, representative of the height of the plume connecting emission sources and sensitive receptors. The requirement therefore imposes a regulatory-grade weather station where a single wind sensor supplies the data the EDS actually consumes.

Recommended alternative

Require one wind sensor per facility (speed and direction) at a typical sensor deployment height of approximately 2 meters — the meteorological scope EPA accepts for this monitoring class — together with internally measured temperature used for sensor quality assurance rather than for the concentration measurement. Replace the incorporation of the EPA 10-metre siting handbook with a compact CARB siting guidance document for wind sensors, and assign the storage duty to the EDS. Where a dynamic alert threshold that uses atmospheric stability class is employed (Comment 3), permit the option of a three-dimensional (acoustic) anemometer to determine stability class in real time.

Basis

The statute directs that the EDS be sited “consistent with local meteorology” (PRC § 3283(a)(2)(A)) and refers to a meteorological measurement capability; it does not require a full ambient-grade weather station recording barometric pressure and relative humidity. The Discussion Draft appears to interpret the statutory reference to a “meteorological station” as though it required a “weather station” in the general sense — an instrument suite additionally recording barometric pressure and relative humidity. That interpretation is not supported by how California air-quality agencies themselves define a meteorological station for dispersion and monitoring purposes, nor by the operational function of an EDS.

An air district defines the meteorological station by its wind and temperature measurements, not by pressure or humidity. The Bay Area Air Quality Management District’s Meteorological Monitoring Guidance (Manual of Procedures, Volume VI: Air Monitoring Procedures; adopted July 20, 1994; latest revision March 21, 2006) — the district guidance governing meteorological data used for dispersion modeling, health-risk assessments, and ground-level-monitoring analyses — states that “Standard surface meteorological measurements for air quality purposes usually include the following variables: Wind Speed, Wind Direction, Sigma Theta, Temperature,” with Delta-T listed as optional. Sigma Theta is a derived value out of wind data. Humidity and barometric pressure are not among the standard variables at all. The point is reinforced by the operative section of the same Manual of Procedures: Volume VI, Section 1.2, requires the responsible party to provide “at least one meteorological station to record wind

speed, wind direction, and ... 1-minute shelter temperature measurements” — defining the air-district meteorological station by wind speed, wind direction, and temperature, with no barometric-pressure or relative-humidity requirement. San Joaquin Valley Air Pollution Control District Rule 4460 (Petroleum Refinery Fence-line Air Monitoring), Section 5.2.3, is to the same effect, requiring equipment “to measure and continuously record wind speed and wind direction data” at the refinery, with no pressure or humidity instrument. This is the precedent for reading the “meteorological station” of § 93504(i) as a wind-and-temperature instrument, and for concluding that CARB’s five-parameter, pressure-and-humidity “weather station” reading is broader than either the statute or established California air-district practice requires.

Stability class is determined from wind statistics and sensible heat flux, not from barometric pressure. The same district guidance confirms that atmospheric stability “is not measured directly, but is derived from standard surface measurements.” It identifies the recognized schemes — the sigma-theta (standard deviation of horizontal wind direction) method, and the solar-radiation/delta-T (SRDT) method that combines surface wind speed with solar radiation by day and a vertical temperature difference at night — none of which uses a barometric-pressure measurement. This is consistent with EPA’s Meteorological Monitoring Guidance for Regulatory Modeling Applications and its implementation in AERMET. Accordingly, where an EDS uses stability class for a dynamic threshold, real-time determination is fully supported by a three-dimensional (acoustic) anemometer — which yields wind and turbulence statistics, including vertical sensible heat flux — without any pressure sensor. The regulation should state which stability-class scheme applies when stability class is used.

Effect

- **Protection:** Equal or better. No EDS threshold computation consumes the removed parameters; wind, the operationally necessary input, is retained and better sited relative to the equipment, and stability class — where used — is determined from wind and turbulence, consistent with established air-district and EPA practice.
- **Cost:** Reduction. A single integrated wind sensor replaces a regulatory-grade weather station across the covered population.

Proposed regulatory language

§ 93504(i) Meteorological measurement. Each site shall include a meteorological station consisting of a wind sensor that measures wind speed and wind direction and a temperature measurement. The wind sensor shall be installed at a height and location representative of wind transport between monitored sources, EDS sensors, and sensitive receptors, in accordance with wind-sensor siting guidance incorporated by reference. A wind-sensor height of approximately two (2) meters may be used where potential sources vary in height. Temperature measured for sensor quality-assurance purposes satisfies the temperature-measurement requirement. Barometric-pressure and relative-humidity measurements are not required by this subsection. Wind and temperature data shall be recorded continuously at one-minute resolution and time-synchronized with the EDS.

(1) Meteorological sensor quality, siting, and quality assurance shall adhere to CARB wind-sensor siting guidance incorporated by reference in this subchapter.

(2) Wind and temperature data shall be retained in the system of record under subsection (k).

(3) If a dynamic alert threshold uses atmospheric stability class, a three-dimensional anemometer may be used to determine stability in real time. The LDRP shall identify the stability-class scheme, calculation method, data-quality criteria, and relationship to the threshold algorithm.

Full clean and redline text: Appendix A.

Comment 9 — Response chain and leak identification

Issue

The statute requires an alarm system that “effectively, immediately, and reliably alerts the operator when triggered” (PRC § 3283(a)(2)(B)) and an alarm-response protocol providing for “immediate action to rapidly identify and fix the leak,” with a 48-hour community-notification clause running from “the leak being identified” (PRC § 3283(b)). The draft uses “alert thresholds” and “automated alerting functionality” and does not define leak identification or map its terms to the statute. The draft uses open-ended language such as “technically feasible” without regard to potentially open-ended cost implications.

Deficiency

Every response deadline in the program depends on terms the draft does not define, so the moment the statutory 48-hour clock starts — the most consequential timestamp in the program — would be interpreted independently in each plan.

The identification step is undefined. This is expected to be a crucial step, as maintenance events or compressor startups are expected to create frequent events that need to be assessed. The requirement to transmit an alert within at most 15 minutes (or as fast as “technically feasible”) is highly ambiguous and would drive very significant additional costs for custom-designed solutions specifically for SB 1137, for no substantial environmental benefit, if interpreted strictly. Almost all commercially available EDS implementations operate as follows: each individual sensor measures data at predefined intervals (every one to five minutes) and automatically transmits them to a cloud solution. Transmission is by wireless means such as 4G LTE cellular network or LoRaWAN — either directly or by local mesh network and base station. Transmission is typically near-instantaneous, but speed is never guaranteed; for example, in cases of cellular-network congestion, transmission may occasionally be delayed beyond 15 minutes. Local data buffering prevents data loss. The aggregation of individual measurements into longer-duration averages, and the determination of whether an alert is present, is then conducted in the cloud solution by mathematical calculation that takes account of data from all sensors for dynamic background subtraction (already a standard feature for many vendors). This calculation is near-instantaneous. Transmission of the alert to an operator is almost always over the internet and therefore has very short latency, assuming the internet is working normally.

In addition, the notification mechanics are undefined; a per-message operator-acknowledgment default would produce habituation and a compliance record that measures acknowledgment speed rather than response.

Recommended alternative

Adopt the statute’s own vocabulary and define the sequence: a threshold exceedance is a machine determination on the background-subtracted increment (typically conducted in a cloud solution); the alarm system alerts the operator automatically within 15 minutes, by defined channels, and transmits an updated exceedance value at least hourly during a continuing event, with transmission logging instead of a per-message acknowledgment. The statutory duty of “immediate action to rapidly identify” takes the form of a defined leak-identification period of 24 hours (72 hours where the alarm is intermittent), during which the operator confirms the signal is sustained or recurs, applies documented operational-event flags (SCADA or timestamped operation-and-maintenance logs), evaluates off-site contribution using wind-resolved data, and

checks for instrument malfunction. Completion of that procedure is the point the leak is “identified,” starting the statutory 48-hour clock. Exceedances during an open identification period or an open 48-hour window join the existing event. CARB should require the LDRP to carry a named Alarm Response Plan stating every step, role, and clock, and integrate the statutory leak-event compositional sampling duty (PRC § 3283(b)) with a defined trigger and ten-year retention (PRC § 3283(f)). EDS sensors that are designed and operated to attempt transmission of data to the system gathering all sensor data at a site (usually a cloud solution) at least every 15 minutes are deemed compliant with the alerting-latency requirement (addressing the case of network congestion).

Basis

Each element of the proposed sequence maps directly to statutory text (PRC § 3283(a)(2), (b), and (f)), so the alarm, the identification step, and the compositional-sampling duty are given operational definitions rather than left to per-plan interpretation. The two-stage structure — a fast, automated alert followed by a bounded, largely desk-based identification period before the statutory 48-hour clock begins — is drawn from established leak-response practice for facilities of comparable or greater hazard.

Staged confirmation before escalation. The practice of confirming that a signal is sustained (or recurs) before treating it as an identified leak, and of aggregating related exceedances within a defined window rather than opening parallel events for one physical leak, follows the staged-confirmation approach used in the Aliso Canyon continuous-monitoring regime, where a defined sustained-signal criterion, a malfunction check, and speciated confirmation precede escalation. Aliso Canyon is the California facility class with the most catastrophic demonstrated release potential; a confirmation step proportionate for that setting is a fortiori proportionate here.

Paired short- and long-window action levels. The use of a short identification window for continuous signals and a longer window for intermittent signals mirrors the paired short- and long-window action-level structure of EPA’s 2024 super-emitter response provisions, and reflects the observation that a substantial fraction of production-site sources appear intermittently rather than continuously, so recurrence — not only continuity — must be able to confirm a leak.

Transmission logging rather than acknowledgment. Substituting transmission-logging for a per-message operator acknowledgment follows recognized alarm-management practice (ANSI/ISA-18.2 and IEC 62682), which treats operator-acknowledgment flooding as a documented cause of alarm habituation and instead relies on logged delivery and rationalized alarm handling.

Effect

- **Protection:** Equal. The response clocks become enforceable and uniformly interpreted, and cases of intermittency are addressed.
- **Cost:** Reduction. A defined, desk-capable identification step directs field mobilization only to signals that survive scrutiny, and transmission logging removes acknowledgment overhead.

Proposed regulatory language

§ 93504(j)(1) A threshold exceedance occurs when the EDS determines that the background-subtracted increment exceeds the applicable alert threshold. The alarm system shall automatically transmit notice to the operator through the channels identified in the Alarm Response Plan within fifteen (15) minutes after the threshold exceedance is determined and shall transmit an updated

exceedance value at least hourly while the exceedance continues. Transmission shall be logged. Per-message operator acknowledgment is not required. An EDS satisfies the transmission-latency requirement if its sensors are designed and operated to attempt transmission to the site data system at least every fifteen (15) minutes, notwithstanding an occasional network delay, provided the data are time-stamped and locally buffered against loss and the notification is transmitted promptly when connectivity is restored.

(2) The operator shall begin leak identification immediately after notification. The leak-identification period is twenty-four (24) hours, or seventy-two (72) hours if the signal is intermittent. During the identification period, the operator shall evaluate persistence or recurrence, documented operational-event flags, wind-resolved evidence of off-site contribution, instrument or system malfunction, emission magnitude, and source or source group.

(3) Completion of the documented identification procedure constitutes identification of the leak for purposes of Public Resources Code section 3283(b) and starts the applicable forty-eight-hour period. Related exceedances occurring during an open identification period or open forty-eight-hour period shall be associated with the existing event unless evidence demonstrates a separate source or event.

(4) The LDRP shall include a named Alarm Response Plan identifying each step, responsible role, decision criterion, notification channel, clock, escalation condition, and required record. The plan shall specify the trigger and procedure for compositional sampling required by Public Resources Code section 3283(b), and the resulting records shall be retained for ten years under Public Resources Code section 3283(f).

(5) The EDS shall be programmed to send a notification to the operator in the event of a sensor or monitor failure.

Full clean and redline text: Appendix A.

Comment 10 — Corrective action and disposition of non-leak exceedances

Issue

In the January 5, 2026 Discussion Draft, § 93504(e) ends at paragraph (e)(3); there is no (e)(4) or (e)(5). The corrective-action and disposition provisions below are therefore proposed as new paragraphs. The Discussion Draft does not define correction of a leak by an objectively verifiable result, establish a complete disposition framework for exceedances that are not leaks, or provide a repeatable method for recurring off-site contributions.

Deficiency

The absence of a result-based definition creates uncertainty about when corrective action is complete. A threshold exceedance may cease after a remote operational adjustment, such as a SCADA setpoint change, a process shutdown, or confirmation that a hatch or valve has reseated. If the regulation is read to require a field visit in every case, an operator would have to mobilize personnel even where the continuously operating EDS already demonstrates that the emission ended. Conversely, a remote action should not be treated as sufficient merely because it was taken; the result must be verified against the same monitoring record that produced the alert.

The draft also lacks a complete disposition framework for events that do not represent an uncontrolled on-site leak. Expected categories include permitted or documented operational events, maintenance-related emissions, compressor startup or shutdown, pipeline pigging, combustion or compressor methane slip, off-site contributions not fully removed by background correction, and EDS or meteorological-system malfunction. Without defined categories and minimum supporting evidence, equivalent events will be characterized differently among operators, plan reviewers, auditors, and annual reports. The resulting data will not be comparable, and operators with broader monitoring coverage may appear to have worse performance simply because they record more non-leak events.

Recurring off-site sources require separate treatment. Once an off-site source pattern has been demonstrated using wind-resolved monitoring data and supporting records, requiring a complete new demonstration for every recurrence adds cost without improving attribution. At the same time, a standing correction cannot be open-ended: it should identify the off-site source or source area, the meteorological conditions under which the correction applies, the calculation method, quality-control conditions, and a review trigger when conditions materially change.

Recommended alternative

Define corrective action by its verified outcome. A leak should be considered corrected when the operator documents the action taken and the background-subtracted on-site increment remains below the applicable alert threshold for 24 consecutive valid hours for which there is coverage of the source by the EDS. Remote action should be permitted where the EDS verifies the result; a field visit should be required where remote action does not reduce the measured increment, where the source cannot be identified with sufficient confidence, or where equipment condition cannot be evaluated remotely.

Require every exceedance to receive a documented disposition. At minimum, the categories should include: identified leak; permitted or documented operational event; off-site source; EDS or meteorological-system malfunction; invalid data; and background excursion or indeterminate event. Each disposition should be supported by defined evidence, such as the concentration and wind record, operational logs, equipment status, field observations, or instrument

diagnostics. Annual reporting should distinguish these categories rather than combining all threshold exceedances into a single alarm count.

Permit an Executive-Officer-approved standing off-site attribution method for recurring sources. Approval should apply to a documented method and defined operating conditions, not to a blanket exclusion. The method should be reviewed when the source environment, sensor layout, background method, or relevant meteorology changes materially.

Basis

Continuous verification links the end of corrective action to measured performance rather than to the physical location of the person taking the action. This preserves protection because a remote intervention is not accepted unless the monitoring record confirms that the event has ended. Defined disposition categories improve the evidentiary record and align the operational response with the distinction, already central to the draft, between a threshold exceedance and a confirmed leak; the disposition categories correspond to the exceedance classes described in the response-chain analysis of Comment 9. A standing off-site attribution method is consistent with the concept of a site-specific background correction in EPA refinery fenceline monitoring provisions (40 CFR § 63.658), and with the contemporaneous-background approach of Comment 4, while preserving agency review of the method and its boundaries.

Effect

- **Protection:** Equal. Correction is demonstrated through the continuous monitoring outcome; events that cannot be resolved remotely still require further investigation. Defined categories and supporting evidence make non-leak determinations auditable.
- **Cost:** Substantial reduction. Verified remote correction avoids unnecessary mobilization after an emission has ended. Standard disposition categories reduce repeated technical disputes, and a standing off-site attribution method avoids re-performing the same analysis for recurring conditions.

Proposed regulatory language

§ 93504(e)(4) Corrective action. Corrective action shall be evaluated by its verified result. A leak is corrected when the operator documents the action taken and valid EDS data demonstrate that the background-subtracted on-site increment remains below the applicable alert threshold for twenty-four (24) consecutive hours during which the affected source is covered by the EDS under subparagraph 93504(e)(2)(A)2. Corrective action may be performed remotely or on site. An on-site inspection is required if remote action does not reduce the increment below the applicable threshold, the source cannot be identified with sufficient confidence, or equipment condition cannot otherwise be verified. A continuous methane monitoring camera may be used in lieu of an on-site visit.

(5) Disposition. Each threshold-exceedance event shall receive a documented disposition supported by the monitoring record and other relevant evidence. Dispositions shall include, as applicable: identified leak; permitted or documented operational event; off-site source; EDS or meteorological-system malfunction; invalid data; background excursion; and indeterminate event. The disposition, evidentiary basis, and any corrective action shall be retained in the event log and reported by category.

(6) Recurring off-site contribution. The Executive Officer may approve a standing attribution method for a recurring off-site source or source area under specified meteorological and quality-control conditions. The approved method shall identify the source or source area, calculation method, evidence, applicability limits, and conditions requiring reevaluation, including a material change in the source environment, sensor layout, background method, or relevant meteorology.

Full clean and redline text: Appendix A.

Comment 11 — Continuous data storage and network availability

Issue

The draft requires retention of EDS and meteorological data but does not define the authoritative system of record, minimum event-log content, acceptable storage architecture, or a network-level approach to availability. Downtime is framed at the individual-sensor level even though protection is delivered by the operating network and its coverage of sensitive receptors.

Deficiency

A retention period alone does not define a usable compliance record. A complete record must connect raw and processed measurements to the thresholds in effect, alerts transmitted, operator review, leak-identification decisions, dispositions, corrective actions, verification, calibration and maintenance activity, data-quality flags, and system failures. If these items are maintained in separate systems or reconstructed after the fact, an auditor cannot efficiently reproduce what the EDS determined or why an operator reached a particular conclusion.

The regulation should therefore distinguish the data archive from the event log. The archive preserves the underlying measurements and metadata at the required resolution. The event log is the structured, human-readable and machine-readable sequence of regulatory events and decisions. Both may reside in a secure cloud, on-premises, or hybrid architecture, provided integrity, retention, access control, export, backup, and time-synchronization requirements are met. The regulation should not prescribe a commercial hosting model where equivalent controls can be demonstrated.

Individual-sensor downtime is also an unsuitable proxy for protection. In a redundant network, failure of one sensor may not reduce modeled coverage of any sensitive receptor. Counting the failed sensor as complete EDS downtime penalizes redundancy and can cause a larger network to accumulate more downtime than a smaller, less protective network at the same component reliability. The relevant performance question is whether the remaining network continues to satisfy the approved coverage criterion and whether the failed element is repaired within the applicable response period.

Meteorological data require a similarly bounded continuity rule. A brief failure of the site wind sensor should not invalidate all EDS data if a qualified substitute data source can support the limited functions for which it is used. Substitution should be time-limited, documented, quality-checked, and prohibited where the substitute is not representative enough to support source attribution or a dynamic threshold.

Recommended alternative

Recognize a secure cloud, on-premises, or hybrid system as an acceptable system of record if it preserves data integrity, traceability, access control, backup, time synchronization, and export capability. Require a structured event log that links each threshold exceedance to the applicable threshold, data-quality status, notification record, investigation, identification decision, disposition, corrective action, and verification.

Assess operational availability at the network and receptor-coverage level. Failure of an individual sensor should not constitute EDS downtime where the remaining valid sensors continue to demonstrate the approved coverage of sensitive receptors. Where coverage is reduced, downtime should begin when the reduction occurs and end when coverage is restored through repair, replacement, temporary instrumentation, or another approved measure.

Permit temporary substitution of representative wind data from an approved public station or modeled dataset for a defined period, subject to documentation and quality criteria. Substituted data should not be used for functions that cannot be supported at the required spatial and temporal representativeness.

Basis

The proposed approach preserves the raw data required for independent review while adding the event-level record needed to reproduce regulatory decisions. It also aligns availability with the outcome the network is designed to deliver, so redundancy is credited only when it actually preserves receptor coverage — the availability construction relied on in Comment 12's System Failure Plan. Continuous-monitoring practice commonly distinguishes automatic diagnostic checks from periodic manual checks; an unavailable manual check should not be treated as continuous system failure where automated diagnostics and valid measurement data remain available. The event-log record supports the public-access collaboration contemplated by PRC § 3283(c) and supplies the structured source for the annual reporting of Comment 13.

Effect

- **Protection:** Equal or greater. The event log improves traceability and auditability. Availability is measured against continued sensitive-receptor coverage rather than component count, and substitute meteorological data are limited to circumstances in which they remain technically representative.
- **Cost:** Reduction. One authoritative system of record avoids parallel archives and manual reconstruction. Network-level availability does not penalize protective redundancy, and bounded meteorological substitution avoids unnecessary invalidation of otherwise usable monitoring data.

Proposed regulatory language

§ 93504(k)(1) System of record. EDS data and records, including at least five (5) years of continuous instrument data and the ability to generate hourly, daily, weekly, monthly, and annual reports, may be maintained in a secure cloud, on-premises, or hybrid system that provides data integrity, access control, time synchronization, backup, retention, traceability, and export in a documented machine-readable format.

(2) Event log. The operator shall maintain a system-generated event log linking each threshold exceedance to the applicable alert threshold and input conditions; data-quality flags; notification transmission; investigation steps; leak-identification decision; disposition; corrective action; and verification. The event log and underlying measurements constitute the reproducible compliance record.

(3) Network availability. Failure of an individual sensor or supporting component does not constitute EDS downtime while valid data from the remaining system continue to demonstrate the approved sensitive-receptor coverage under subparagraph 93504(e)(2)(A)2. If approved coverage is reduced, downtime begins when the reduction occurs and ends when coverage is restored through repair, replacement, temporary instrumentation, or another approved measure. Operational downtime under subparagraph 93504(c)(2) is assessed on this network and receptor-coverage basis.

(4) Temporary meteorological substitution. During temporary failure of the site wind sensor, representative data from an approved public station or approved modeled dataset may be substituted for not more than seven (7) consecutive days if the source, time period, quality review, and limitations are documented. Substituted data shall not support a dynamic threshold or source-attribution decision unless representativeness for that use is demonstrated.

Full clean and redline text: Appendix A.

Comment 12 — Quality assurance and independent audits

Issue

Section 93504(m)(8) lists elements of a Quality Assurance Project Plan and a System Failure Plan, while § 93504(n) requires independent audits. The draft does not provide a standardized QAPP structure, complete data-validation framework, quantitative acceptance criteria, a defined system-failure architecture, or a sufficiently specific audit protocol.

Deficiency

A QAPP should allow a reviewer to determine whether data are fit for their intended regulatory use. The present list addresses several operational topics but does not fully connect measurement objectives, data-quality indicators, acceptance criteria, validation rules, corrective action, and final usability determinations. Without that connection, operators may submit substantially different documents under the same title, and auditors may evaluate equivalent systems against different expectations.

Three elements require explicit treatment. First, data validation and usability must establish how flagged, substituted, corrected, incomplete, or out-of-envelope data are evaluated and whether they may support alerting, attribution, coverage, or reporting. Second, assessment and response must identify how deviations are detected, classified, corrected, and closed. Third, document and configuration control must preserve the versions of algorithms, thresholds, sensor maps, calibration records, and procedures that were in effect for each event.

The System Failure Plan should be a defined operational component rather than an undefined sub-item. It should classify failures by functional effect: loss of one sensor without loss of receptor coverage; partial loss of coverage; loss of meteorological input; loss of communications with local buffering intact; loss of alerting; and loss of the system of record. For each class, the plan should state detection method, response time, permissible interim measure (including the wind-data substitution of Comment 11), escalation threshold, restoration criterion, and documentation requirement.

Independent audits also require a common scope to be provided by CARB or CalGEM.

Recommended alternative

CARB should publish a model QAPP and validation template that operators may adopt, with site-specific appendices for sensor layout, thresholds, meteorology, and local procedures. One operator-level QAPP should be permitted to cover multiple sites where the technology, algorithms, quality systems, and operating procedures are common, provided each site appendix identifies local departures and inputs.

Each data-quality indicator should have a quantitative or objectively testable acceptance criterion tied to the applicable performance requirement, including the § 93504(d) performance floor of Comment 7. The QAPP should specify validation levels, data flags, authority to approve exceptions, and the uses permitted for each data status.

CARB should define minimum System Failure Plan content and publish a common independent-audit protocol. Corrective action should be tiered by severity, with immediate response for conditions that eliminate alerting or receptor coverage and scheduled correction for documentation deficiencies that do not affect measurement validity.

Basis

EPA-approved methane alternative test methods provide a quality-management architecture designed for continuous monitoring systems used at oil and gas facilities. That architecture is a more appropriate starting point than importing a refinery-scale documentation regime without adaptation. A standardized model reduces variability without preventing site-specific controls. A defined audit protocol also improves protection because it tests data and calculations, not merely the presence of narrative sections.

Effect

- **Protection:** Equal or greater. Data validity, usability, configuration control, failure response, and audit sampling become explicit and testable. Quantitative acceptance criteria allow an auditor to identify a deficient system consistently.
- **Cost:** Substantial reduction. A model QAPP and operator-level common core avoid repeated preparation and review of identical material. A defined audit scope reduces duplicative interpretation and allows qualification requirements to focus on competence and independence.

Proposed regulatory language

§ 93504(m)(8) Quality Assurance Project Plan. The existing subparagraphs (A) through (L), including subparagraph (I) quality-assurance procedures, are retained. The QAPP chapeau is amended to add that the QAPP shall define measurement objectives; data-quality indicators and objectively testable acceptance criteria; calibration and verification; data review, validation, and usability; assessment and corrective response; document and configuration control; record retention; and management responsibility. The acceptance criteria shall incorporate the applicable performance requirements of subsection (d). CARB shall publish a model QAPP and data-validation template. An operator may use one common QAPP for multiple sites where common technology, algorithms, quality systems, and procedures apply, with site-specific appendices identifying local inputs, configurations, and departures.

(H) System Failure Plan. The plan shall classify failures by their effect on measurement, notification, meteorological input, communications and buffering, data retention, and sensitive-receptor coverage. For each class, it shall specify the detection method, response time, permissible interim measures, escalation criteria, restoration criteria, and required records.

§ 93504(n) Independent audit. The existing audit schedule in subparagraphs 93504(n)(1) through (3) is retained. An independent audit shall follow a CARB-published protocol that includes document and configuration review; a defined sample of event records and underlying data; verification of selected calculations; review of calibration, verification, and maintenance records; and site inspection where necessary to confirm physical configuration. Auditor qualification shall be based on demonstrated technical competence, financial and outcome independence, and disclosure of conflicts. Corrective-action requirements and completion periods shall be tiered according to the effect of the finding on data validity, alerting, or sensitive-receptor coverage.

Full clean and redline text: Appendix A.

Comment 13 — Plan updates and annual reporting

Issue

The draft requires periodic plan updates and annual reporting and uses “material modification” to trigger additional duties, but does not define the term, distinguish changed from unchanged plan elements, establish a predictable review process for updates, or define the metrics required for comparable annual reporting.

Deficiency

An undefined modification threshold creates uncertainty for equipment replacement, software updates, sensor relocation, changes in source composition, changes in nearby receptors, and changes to algorithms or thresholds. If every change requires a complete plan revision, source testing, remodeling, and audit, routine maintenance and incremental improvement become disproportionately expensive. If operators decide independently which changes are material, equivalent modifications will receive different treatment and audit findings.

The update mechanism should focus review on information that can affect monitored sources, health-protective performance, or reproducibility. Examples include addition or removal of an equipment class; a process or composition change that may alter the toxic-of-highest-concern determination or methane-to-toxic ratio; a receptor change that alters the modeled protection boundary; a sensor-layout change that can reduce coverage; and an algorithm or threshold-policy change that can alter alerting. Like-for-like replacement, contact updates, and other administrative changes should be logged and reported without reopening the full plan.

The same principle applies to the five-year update. Unchanged model inputs, qualifications, standard procedures, and common QAPP elements should be incorporated by reference under a current attestation. Repeat source testing should be linked to a composition-relevant change or to an established representativeness limit, rather than performed solely because time has elapsed.

Annual reporting also requires defined denominators and event states. “Alert,” “validated alarm,” “identified leak,” “corrected leak,” and “repair interval” should not be used interchangeably. Raw alert counts without operating time, valid-data completeness, receptor coverage, and disposition categories can produce misleading comparisons. An operator that monitors more completely can record more exceedances even while delivering better protection.

Recommended alternative

Define material modification categorically and create a lower-burden log-and-report path for nonmaterial changes. Scope plan updates to the elements affected by the change, allow unchanged elements to be incorporated by reference under attestation, and require repeat source testing or remodeling only where the underlying composition, equipment class, receptor set, source geometry, or threshold policy changes materially.

Establish a defined review period for plan updates, including an itemized deficiency notice and a cure process. An update should not remain pending indefinitely where the unchanged approved system continues to operate.

Consolidate annual reporting into one structured electronic submission that satisfies overlapping QAPP, event-reporting, and PRC § 3286 requirements. Define core metrics, including total valid monitoring hours; data completeness; time and receptor coverage; threshold exceedances by disposition; identified leaks; time from exceedance to operator notification; time from notification

to identification; time from identification to verified correction; and unresolved events at year-end.

Basis

The categorical approach is analogous to regulatory programs that distinguish significant from minor permit modifications, but it is adapted here to EDS performance, directing agency review to changes capable of altering protection or compliance. Structured reporting aligns with the event sequence proposed in Comments 9 and 10 and the event log proposed in Comment 11, allowing annual metrics to be generated from the same record rather than re-created manually.

Effect

- **Protection:** Equal or greater. Material changes that can affect health-protective performance receive targeted review; unchanged elements remain subject to attestation and audit. Defined metrics yield comparable results with transparent denominators.
- **Cost:** Reduction. Operators avoid repeating unaffected analyses and duplicative reports. Agencies review the changed technical elements rather than complete plans, and machine-readable reporting reduces manual re-entry and reconciliation.

Proposed regulatory language

§ 93503(f) Plan updates. “Material modification” means a change reasonably capable of significantly altering source characterization, the toxic-of-highest-concern determination, modeled receptor impact, sensor coverage, alert-threshold policy, data validity, or response performance. Material modifications include addition or removal of an equipment class; a composition-relevant process change; a receptor change that alters the modeled protection boundary; or a sensor-layout change that may reduce coverage below the ninety-percent requirement of subparagraph 93504(e)(2)(A)2. Other changes shall be recorded in an annual change log. A plan update shall address only the elements affected by the modification. Unchanged elements may be incorporated by reference under a current attestation. Repeat source testing or modeling is required only if the modification affects the inputs to, or conclusions of, that testing or modeling. Existing § 93503(d) (five-year review and update) is retained unchanged.

§ 93504(p) Annual report. The operator shall submit one structured electronic annual report containing: total valid monitoring hours; data completeness; approved and achieved sensitive-receptor coverage; threshold exceedances by disposition; identified leaks; elapsed time from exceedance to operator notification, notification to identification, and identification to verified correction; system downtime that affected coverage; and unresolved events at year-end. CARB shall publish a reporting schema defining each metric, denominator, event state, and calculation rule.

Full clean and redline text: Appendix A.

Comment 14 — Plan format, portfolio plans, and review process

Issue

The draft allows free-form LDRPs, does not define a structured submission schema or binding completeness criteria, and provides insufficiently specific review and cure procedures. Each site may therefore become a separate original document even where the operator, technology, quality system, and response procedures are identical.

Deficiency

Free-form plans make both preparation and review unnecessarily variable. Sensor identifiers, coordinates, source groups, receptors, thresholds, modeled coverage, calibration status, data flags, and response clocks are data fields. When submitted only as prose or bespoke tables, they cannot be checked systematically or transferred reliably into annual reporting and public-access systems. A narrative should explain site-specific reasoning, but it should not substitute for structured data.

The draft also does not distinguish operator-level common material from site-specific material. Technology specifications, manufacturer qualification, data architecture, cybersecurity controls, common algorithms, training, QAPP procedures, maintenance systems, and standard alarm-response steps may apply across an operator's portfolio. Repeating them in every site plan increases document volume and creates version-control risk. A portfolio structure would preserve site-specific review while allowing the common core to be reviewed once.

Completeness must be objective and separate from technical approval. A published checklist should identify every required field, attachment, certification, and file format. A completeness determination should answer whether the submission contains the required material; technical review should address whether that material demonstrates compliance. Combining the two permits serial deficiency notices and makes planning deadlines unpredictable.

The consequences of delay are unusually significant because implementation depends on approval and the statute ultimately links the absence of an implemented approved plan to suspension of operations. The review process therefore needs a defined agency response period, consolidated deficiency notice, cure cycle, and clear treatment of a timely and complete submission while agency review remains pending. Joint CARB and CalGEM review should produce one coordinated record rather than inconsistent sequential requests.

Recommended alternative

Publish a model LDRP with a binding digital submission schema that specifies fields, units, coordinate conventions, data formats, attachments, and validation rules. Permit a portfolio LDRP consisting of an operator-level common core and site-specific appendices. The common core should be incorporated by reference, with version control and a process for propagating approved updates.

Publish a completeness checklist and require a single itemized deficiency notice within a defined review period. Provide a cure cycle in which the operator responds to identified deficiencies without reopening unrelated approved elements. CARB and CalGEM should coordinate their technical comments and identify the agency responsible for each determination.

Use staggered submission windows or another workload-management approach that does not reduce statutory protection. The final rule or associated enforcement policy should state how

timely, complete, good-faith submissions are treated where final agency action is delayed for reasons not attributable to the operator.

Basis

A structured plan makes required information machine-checkable and supports the reporting system proposed in Comment 12. Portfolio plans reduce duplication without reducing site-specific analysis because each appendix still contains the source inventory, receptor set, meteorological basis, sensor layout, thresholds, coverage demonstration, and local contacts. A defined completeness and cure process improves both administrative efficiency and the likelihood that technically adequate systems are implemented on schedule. California refinery experience under BAAQMD Regulation 12-15, in which all five refinery plans were initially disapproved with several years of lead time, illustrates the review-capacity risk when many complex plans are reviewed against under-specified criteria; that risk is far greater for the thousands of plans expected here on a statutory deadline.

Effect

- **Protection:** Equal or greater. Site-specific protection remains fully demonstrated, while common procedures are controlled consistently. Complete, machine-checkable submissions reduce omission risk and make review more reproducible.
- **Cost:** Substantial reduction. Common material is prepared and reviewed once, data are not re-keyed across documents, and itemized coordinated review reduces serial resubmission. The recommendation also reduces delay-related implementation risk for both agencies and operators.

Proposed regulatory language

§ 93504(m)(12) Plan format. CARB and CalGEM shall publish a model LDRP, a completeness checklist, and a structured electronic submission schema specifying required fields, units, coordinate conventions, formats, attachments, and validation rules. An operator may submit a portfolio LDRP consisting of an operator-level common core and site-specific appendices. The common core may include technology specifications, manufacturer qualification, common algorithms, data architecture, cybersecurity controls, QAPP procedures, maintenance systems, training, and standard response procedures. Each site appendix shall contain the site-specific source inventory; receptor information; modeling inputs and outputs; sensor layout; thresholds; coverage demonstration; meteorological configuration; and response contacts. The common core shall be version-controlled, and an approved revision may be incorporated by reference into each affected site appendix.

§ 93504(o) Review. The Executive Officer shall notify CalGEM in writing whether the EDS described in the submitted LDRP is complete and acceptable. In addition, within ninety (90) days after receipt of a complete submission, the reviewing agencies shall issue either a determination or one consolidated, itemized deficiency notice identifying each applicable requirement and the information required for correction, consistent with the CalGEM approval timeline in § 93503(b). The operator may submit a focused cure addressing the identified items without reopening unrelated approved elements. CARB and CalGEM shall coordinate comments and identify the agency responsible for each determination. CARB and CalGEM shall publish the treatment of a timely, complete, good-faith submission if final agency action is delayed for reasons not attributable to the operator.

Full clean and redline text: Appendix A.

Comment 15 — Scope, coverage, and definitions

Issue

Several provisions use “production equipment,” “production facility,” “site,” and related terms without a stable distinction. Applicability boundaries for wells, flowlines, pipelines, and related facilities are not mapped comprehensively; plan aggregation remains insufficiently explicit; minimum-configuration provisions alternate between component- and facility-level duties; and the no-detection and compositional-reporting cases are incomplete.

Deficiency

Section 93502(a)(28) treats “production equipment” and “production facility” as interchangeable even though the remainder of the draft assigns duties at different levels. Sampling and equipment-specific ratios concern components or source groups. Sensor siting, receptor coverage, meteorology, downtime, and the LDRP concern a facility or site. Using one term for both creates ambiguity in nearly every downstream requirement.

Applicability also requires a complete boundary. The regulation should state how it treats active and idle wells, associated flowlines, above- and below-ground pipelines, produced-water equipment, injection equipment, gathering equipment, gas-processing equipment, and facilities subject to the State Fire Marshal or underground-gas-storage exclusions. The purpose is not to expand or contract statutory coverage through guidance, but to make the agency’s interpretation visible and consistently reviewable. A mapping from CalGEM status flags to covered, excluded, or case-specific treatment would allow operators and agencies to apply the same rule to the same records.

The plan unit should also be explicit. Based on CARB’s prior clarification, an operator may aggregate contiguous or proximate operations into a site. The final rule should state this directly and identify the criteria relevant to aggregation, such as common operational control, shared equipment, common receptor set, and a technically coherent meteorological and modeling domain. Aggregation should not permit a well-covered area to mask a poorly covered area; each source-receptor combination must still satisfy the coverage requirement of Comment 5.

The individual-well branch remains vague. A single well commonly includes associated flowlines or other equipment that affects source geometry and sensor placement. Additional requirements triggered solely by the label “individual well” can increase cost without improving protection. The same modeling, background, threshold, coverage, and performance principles should apply, with the configuration determined from the actual sources and receptors.

Two technical edge cases should be resolved in the text. First, where no Table 1 compound is detected above the applicable reporting limit, the rule should specify the resulting toxic-of-highest-concern determination or default. Second, composition data are commonly reported on a mole basis while Equation 1 uses pollutant mass percentage. The regulation should require a consistent basis, show the conversion, and prevent an unstated unit choice from changing the compound ranking.

Recommended alternative

Define “production facility” separately by reference to PRC § 3010 and define “production equipment” as the equipment or monitored source items within that facility. Use “site” only as an approved aggregation of one or more production facilities or wells for LDRP administration and monitoring design.

Adopt or publish an applicability table covering relevant equipment and facility classes, with the statutory or regulatory basis for each treatment, and publish a crosswalk of CalGEM status flags. State expressly the criteria under which contiguous or proximate operations may be aggregated, while preserving source- and receptor-specific coverage demonstrations.

Clarify that the individual-well branch does not impose additional technology or sensor-count requirements merely because a site contains one well. Require the approved configuration to follow the same performance analysis applicable to other sites.

Add a no-detection default and require composition calculations to state whether values are on a mole or mass basis, to convert consistently to the basis required by Equation 1, and to show the conversion.

Basis

PRC § 3010 provides an existing statutory definition of production facility. Separating the facility from its constituent equipment allows the draft's component-level and site-level duties to be applied coherently. An applicability table and status crosswalk reduce case-by-case interpretation without replacing the governing statute. Explicit aggregation criteria preserve flexibility while preventing inconsistent plan boundaries. Requiring a transparent mole-to-mass conversion addresses a calculation ambiguity that can affect selection of the toxic of highest concern.

Effect

- **Protection:** Equal or greater. The same sources and receptors are evaluated under definitions that can be applied consistently. Source-receptor coverage remains the controlling protection test, and the toxic-of-highest-concern calculation becomes reproducible.
- **Cost:** Reduction. Settled definitions, an applicability crosswalk, and explicit aggregation rules avoid repeated plan-level disputes. The individual-well clarification avoids prescriptive configurations unrelated to actual risk, while the no-detection and unit rules prevent reanalysis during review.

Proposed regulatory language

§ 93501(b) Applicability table. CARB shall publish an applicability table identifying the treatment of relevant well, flowline, pipeline, produced-water, injection, gathering, gas-processing, and other equipment and facility classes, and the statutory or regulatory basis for each treatment, together with a crosswalk of CalGEM status flags. The table shall identify covered, excluded, and case-specific categories and shall not alter statutory coverage.

§ 93502(a)(28) "Production facility" means a production facility as defined in Public Resources Code section 3010. "Production equipment" means equipment or a monitored source item located within or associated with a production facility, including, but not limited to, tanks, flowlines, headers, gathering lines, wellheads, heater treaters, pumps, valves, compressors, injection equipment, production safety systems, separators, manifolds, and pipelines that are not under the jurisdiction of the State Fire Marshal pursuant to section 51010 of the Government Code, excluding fire suppression equipment.

§ 93502(a) (new definition, inserted in alphabetical order) "Site" means one or more contiguous or proximate production facilities or wells included in a single LDRP under common operational control and approved aggregation criteria, including shared equipment, a common receptor set, and a technically coherent meteorological and modeling domain.

§ 93504(a)(4) No-detection case. If no Table 1 compound is detected above the applicable reporting limit in any valid sample, the operator shall apply the default toxic-of-highest-concern determination specified by CARB and shall document the reporting limits supporting that determination.

§ 93504(b)(2)(A) Compositional source measurements for each production process category shall be averaged by calculating the arithmetic mean species mass percentage of each compound present in the source test measurements. Composition results shall identify whether each value is reported on a mole or mass basis. Calculations under Equation 1 shall use a consistent basis and shall show the mole-to-mass conversion and molecular weights used.

§ 93504(e)(2)(C) Individual-well configuration. A site containing an individual well is subject to the same performance-based modeling, background, threshold, coverage, and sensor-performance requirements applicable to other sites. No additional minimum sensor configuration applies solely because the site contains one well. Aggregation does not relieve any source-and-receptor combination from the coverage requirement of subparagraph 93504(e)(2)(A)2.

Full clean and redline text: Appendix A.

Appendix A — Proposed Regulatory Text (Clean and Redline)

Baseline. This appendix redlines the CARB Discussion Draft Performance Standards for Continuously Operating Emissions Detection Systems, proposed 17 CCR §§ 93500–93506, dated January 5, 2026 (Discussion-Draft-Reg-Text_V6_ADA.pdf).

Length convention. To reduce length, only provisions changed by Comments 1–15 (including Comment 2A) are reproduced. Sections and subsections with no change are omitted and marked with a short note. Numbering follows the quality-control reconciliation: additions to § 93504(h) are placed at (5)–(8); the “material modification” definition is placed at § 93503(f); the annual report at § 93504(p); plan format at § 93504(m)(12); and no existing provision is silently deleted.

Legend: ~~strike-through red~~ = deletion underline blue = insertion plain = unchanged context.

A.1 — Clean Text of Amended and New Provisions

The following reproduces the final text of only those provisions changed by the comments. All other sections and subsections of the Discussion Draft are unchanged and are omitted here.

▫ § 93500 (Scope and Purpose), § 93505, and § 93506 — no change from Discussion Draft.

§ 93501. Applicability

▫ (a) — no change from Discussion Draft.

(b) Applicability table. CARB shall publish an applicability table identifying the treatment of relevant well, flowline, pipeline, produced-water, injection, gathering, gas-processing, and other equipment and facility classes, and the statutory or regulatory basis for each treatment, together with a crosswalk of CalGEM status flags. The table shall identify covered, excluded, and case-specific categories and shall not alter statutory coverage.

§ 93502. Definitions

▫ (a)(1)–(27), (29)–(46) — no change.

(a)(28) “Production facility” means a production facility as defined in Public Resources Code section 3010. “Production equipment” means equipment or a monitored source item located within or associated with a production facility, including, but not limited to, tanks, flowlines, headers, gathering lines, wellheads, heater treaters, pumps, valves, compressors, injection equipment, production safety systems, separators, manifolds, and pipelines that are not under the jurisdiction of the State Fire Marshal pursuant to section 51010 of the Government Code, excluding fire suppression equipment.

(a) new definition “Site” (inserted in alphabetical order). “Site” means one or more contiguous or proximate production facilities or wells included in a single LDRP under common operational control and approved aggregation criteria, including shared equipment, a common receptor set, and a technically coherent meteorological and modeling domain.

§ 93503. Requirements Specified by PRC § 3283(a)

▫ (a)–(e), including the five-year update rule in (d) — no change; retained.

(f) Plan updates. “Material modification” means a change reasonably capable of significantly altering source characterization, the toxic-of-highest-concern determination, modeled receptor impact, sensor coverage, alert-threshold policy, data validity, or response performance. Material modifications include addition or removal of an equipment class; a composition-relevant process change; a receptor change that alters the modeled protection boundary; or a sensor-layout change that may reduce coverage below the ninety-percent requirement of subparagraph 93504(e)(2)(A)2. Other changes shall be recorded in an annual change log. A plan update shall address only the elements affected by the modification. Unchanged elements may be incorporated by reference under a current

attestation. Repeat source testing or modeling is required only if the modification affects the inputs to, or conclusions of, that testing or modeling.

§ 93504(a). Toxics of highest concern

▫ (a) intro, Table 1, and (1)–(3) — no change.

(a)(4) No-detection case. If no Table 1 compound is detected above the applicable reporting limit in any valid sample, the operator shall apply the default toxic-of-highest-concern determination specified by CARB and shall document the reporting limits supporting that determination.

§ 93504(b). Composition methodology

▫ (b) intro, (1), (2) *chapeau*, (2)(B)–(E), (3), (4) — no change.

(b)(2)(A) Compositional source measurements for each production process category shall be averaged by calculating the arithmetic mean species mass percentage of each compound present in the source test measurements. Composition results shall identify whether each value is reported on a mole or mass basis. Calculations under Equation 1 shall use a consistent basis and shall show the mole-to-mass conversion and molecular weights used.

§ 93504(c). Continuous operation

(c)(1) Irrespective of monitoring technology, the EDS shall collect measurements at intervals not exceeding five (5) minutes. The alert-threshold comparison shall be based on an average of one (1) hour or less under paragraph 93504(e)(3).

(c)(1)(A) A valid hour shall contain valid measurements representing at least forty-five (45) minutes of the hour and, for a system operating at a five-minute collection interval, not fewer than nine (9) valid measurements. Only valid hours shall count as sensor-provided coverage under subparagraph 93504(e)(2)(A)2.

▫ (c)(2)(A)–(E) *rolling-downtime framework* — retained; operational downtime is assessed on the network / receptor-coverage basis of § 93504(k)(3).

§ 93504(d). Sensor performance

▫ (d) intro and (1)–(3) — no change (*numerical floor retained*).

(d)(4) The manufacturer-documented accuracy and precision specifications shall identify the confidence level, methane concentration points, environmental operating envelope, production-equivalent test population, and production-batch basis used to demonstrate compliance. The precision required by this subsection shall be expressed at a three-standard-deviation confidence level across the tested device population. Compliance shall be demonstrated using not fewer than thirty (30) production-equivalent devices from not fewer than three (3) production batches, at not fewer than three (3) methane concentration points that bracket the alert threshold and lower concentrations relevant to detection, across the declared environmental operating envelope. The distribution of results shall be reported.

(d)(5) Quarterly field verification is the default compliance pathway. The sensor type shall be demonstrated to maintain the applicable accuracy and precision requirements throughout each three-month verification interval.

(d)(6) The Executive Officer may approve a field-verification interval longer than three months where field data, accelerated lifetime testing, or both demonstrate maintained compliance over the proposed interval. Accelerated testing shall follow a recognized reliability-qualification standard, including JEDEC JESD22, JEDEC JEP122, the ZVEI Handbook for Robustness Validation, AEC-Q100, or an equivalent documented standard, and shall justify the relationship between applied stress and the claimed interval using an accepted acceleration model. The interval shall not exceed the demonstrated stability period or five (5) years, whichever is shorter.

(d)(7) If the reported concentration uses automatic baseline correction or other ambient-data-based drift compensation, the manufacturer shall document the method, input-selection criteria, update timescale, maximum correction, and suspension conditions, and shall demonstrate that persistent methane enhancement, low-wind accumulation, and elevated off-site background do not cause systematic under-reporting. Baseline correction alone does not satisfy paragraph (5) or (6).

(d)(8) The EDS shall have documented cross-sensitivity specifications for relevant co-present gases and environmental interferents. Positive and negative interference shall be quantified separately. Any interference that reduces reported methane concentration shall be incorporated into the demonstration that the applicable alert threshold can be detected.

(d)(9) The manufacturer shall declare the temperature, humidity, and pressure envelope over which the detection-limit, accuracy, precision, and response specifications are valid. Compliance shall be demonstrated across that envelope, and data collected outside it shall be flagged.

(d)(10) The EDS shall have documented rise and recovery characteristics under a defined dynamic challenge. If response is asymmetric, the manufacturer shall demonstrate that the asymmetry does not materially bias the concentration average used for alerting under fluctuating-plume conditions.

§ 93504(e). Sensitivity, siting, thresholds

▫ *(e) intro, (1), (2)(A) chapeau, (2)(B), (3)(A)–(F) — no change.*

(e)(2)(A)1 For EDS that scan or image leaks (e.g., fixed OGI cameras, fixed LiDAR cameras), the EDS shall scan or image all production equipment monitored by the EDS and report measurements at a minimum frequency of five (5) minutes. Such a system shall not serve as the sole basis for alerting unless it completes a valid measurement or image cycle for the relevant monitored area at least once every five (5) minutes.

(e)(2)(A)2 A plume-detecting EDS shall achieve at least ninety (90) percent sensitive-receptor coverage for each monitored source and each sensitive receptor within the health protection zone. Coverage shall be calculated using subsection (h), including the five-year meteorological dataset, the within-hour variability method, and the alert-threshold policy proposed in the LDRP. For each modeled hour and each source-and-receptor combination, determine the leak rate that would produce a concentration equal to the acute REL of the toxic of highest concern at the sensitive receptor. The hour is covered if either: (a) the modeled meteorology would not transport the leak toward the sensitive receptor; or (b) the leak would cause at least one valid EDS sensor to reach the alert threshold applicable for that hour. Coverage is the number of covered hours divided by the total number of modeled hours for the source-and-receptor combination. The same model configuration and treatment of source characterization, terrain, meteorology, within-hour variability, and alert thresholds shall be used for sensor siting, coverage, and threshold-setting. Sensor measurement performance at the applicable threshold shall be demonstrated separately under subsection (d).

(e)(2)(C) Individual-well configuration. A site containing an individual well is subject to the same performance-based modeling, background, threshold, coverage, and sensor-performance requirements applicable to other sites. No additional minimum sensor configuration applies solely because the site contains one well. Aggregation does not relieve any source-and-receptor combination from the coverage requirement of subparagraph 93504(e)(2)(A)2.

(e)(3)(B)3. Set a dynamic alert threshold, evaluated at an averaging time of one hour or less, that is adjusted using one or more of the following: atmospheric stability class; wind direction measured under subsection (i); and demonstrated source attribution or source exclusion. The threshold shall be calculated under subsection (h).

(e)(3)(G) A dynamic alert threshold shall not suppress an alert during an averaging interval unless the meteorological data recorded under subsection (i) demonstrate that a REL-level leak from the

associated source or source group would not be transported toward any sensitive receptor during that interval.

(e)(3)(H) Alert thresholds may be established by equipment group where the EDS demonstrates sufficient attribution accuracy to the group of origin or reliably excludes a source type demonstrated to lack REL-level leak potential. If a compliant fenceline threshold is infeasible because of site geometry, a near-proximity source-based configuration may be used for the affected equipment group, subject to subsection (g), the source-localization demonstration, and the near-source modeling limitation in subparagraph 93504(h)(7).

(e)(3)(I) An operator using a dynamic alert threshold shall document in the LDRP the algorithm and inputs; the source groups to which it applies; any stability-class scheme; source-attribution and exclusion criteria; data-quality requirements; and quality-assurance procedures sufficient to reproduce the threshold applicable to any averaging interval. The threshold policy used in operation shall be the same policy used in the coverage demonstration under subparagraph 93504(e)(2)(A)2.

(e)(4) Corrective action. Corrective action shall be evaluated by its verified result. A leak is corrected when the operator documents the action taken and valid EDS data demonstrate that the background-subtracted on-site increment remains below the applicable alert threshold for twenty-four (24) consecutive hours during which the affected source is covered by the EDS under subparagraph 93504(e)(2)(A)2. Corrective action may be performed remotely or on site. An on-site inspection is required if remote action does not reduce the increment below the applicable threshold, the source cannot be identified with sufficient confidence, or equipment condition cannot otherwise be verified. A continuous methane monitoring camera may be used in lieu of an on-site visit.

(e)(5) Disposition. Each threshold-exceedance event shall receive a documented disposition supported by the monitoring record and other relevant evidence. Dispositions shall include, as applicable: identified leak; permitted or documented operational event; off-site source; EDS or meteorological-system malfunction; invalid data; background excursion; and indeterminate event. The disposition, evidentiary basis, and any corrective action shall be retained in the event log and reported by category.

(e)(6) Recurring off-site contribution. The Executive Officer may approve a standing attribution method for a recurring off-site source or source area under specified meteorological and quality-control conditions. The approved method shall identify the source or source area, calculation method, evidence, applicability limits, and conditions requiring reevaluation, including a material change in the source environment, sensor layout, background method, or relevant meteorology.

§ 93504(f). Siting/threshold analysis

▫ No change from Discussion Draft.

§ 93504(g). Baseline / background

(g)(1) For a plume-detecting EDS, the alert threshold shall be applied to the background-subtracted methane increment determined under paragraphs (4) and (6). No baseline-accumulation period is required, and subparagraphs 93504(g)(1)(A) and (B) do not apply to a plume-detecting EDS.

▫ (g)(1)(A)–(B) — *deleted (not applicable to a plume-detecting EDS).*

(g)(2) The interim monthly baseline requirement does not apply to a plume-detecting EDS.

▫ (g)(3) *same averaging time — retained.*

(g)(4) For each averaging interval, the background-subtracted methane increment equals the concentration at the alerting monitor minus the contemporaneous background concentration. If a valid monitor is located within the approved upwind wind cone of the alerting monitor, the contemporaneous background concentration shall be the concentration measured by that monitor during the same averaging interval. The upwind wind cone shall be determined from the wind

direction and within-hour wind-direction variability measured for that interval. An upwind monitor is valid only if applicable meteorological, completeness, and quality-assurance requirements are met and the monitor is not within the influence of an on-site emission source under the measured conditions.

(g)(5) The methodology used to establish the background-subtracted increment shall be documented in the LDRP.

(g)(6) If no valid upwind monitor is available for an averaging interval, the contemporaneous background concentration shall be a representative regional atmospheric background methane concentration published or approved by the Executive Officer. The substituted background value, the reason for substitution, and the applicable quality status shall be recorded in the system event log.

§ 93504(h). Air dispersion modeling

(h) chapeau Air dispersion modeling of potential leaks from production equipment monitored by the EDS to identify REL-level leak rates shall conform to the air dispersion modeling guidance provided in the OEHHA Air Toxics Hot Spots Program Guidance Manual, which is defined in paragraph 93502(a) of this subchapter, read together with a modeling protocol incorporated by reference in this subchapter. The Executive Officer shall publish the modeling protocol, standard templates, and acceptance criteria sufficiently in advance of required LDRP preparation to permit consistent implementation and review.

(h)(1) AERMOD shall be used in accordance with a modeling protocol incorporated by reference in this subchapter. The protocol shall specify the model version and options; source-characterization methods, including methods for wells, equipment, pipelines, and flowlines; receptor-grid design; terrain and geospatial-data requirements; the governing concentration statistic; standard input and output formats; quality-control procedures; and acceptance criteria.

▫ *(h)(2) methane ratios, (h)(3) equipment location, (h)(4) documentation — retained unchanged.*

(h)(5) The meteorological basis for design-stage modeling shall be five consecutive years of the most recent representative data available from the nearest representative public meteorological station or an AERMOD-ready dataset supplied or approved by the Executive Officer. Site-specific meteorological data collection shall not be required for design-stage modeling. An operator may use a different historical dataset upon demonstrating that it is more representative of the site.

(h)(6) Within-hour wind-direction variability. When hourly dispersion-model results are used to establish EDS sensor siting, sensitive-receptor coverage, sensor-to-receptor concentration relationships, or alert thresholds, the analysis shall account for within-hour wind-direction variability using the method specified in the incorporated modeling protocol or another method approved by the Executive Officer. The method shall represent the angular region sampled by the plume during the hourly averaging period and shall be applied consistently to siting, coverage, and threshold calculations.

(h)(7) Near-source applicability. A modeled concentration at an EDS sensor location may be used to establish a sensor-to-receptor concentration relationship or an alert threshold only if the sensor location is separated from each associated potential emission source by at least three (3) meters. A shorter separation may be used if the operator demonstrates, in accordance with the incorporated modeling protocol, that the modeled concentration is not materially sensitive to uncertainty in leak location, release geometry or orientation, initial momentum or buoyancy, nearby equipment or wakes, or unresolved plume position. This paragraph does not prohibit use of a sensor located within three meters for qualitative leak detection, source localization, or other purposes that do not rely on the sensor location as a quantitative modeled-concentration anchor.

(h)(8) A digital siting tool implementing the published AERMOD algorithms may be used if its inputs, calculations, and outputs are reproducible under the incorporated modeling protocol. The operator

may use custom AERMOD settings where justified by site-specific conditions and documented in the LDRP.

§ 93504(i). Meteorological measurement

(i) chapeau Each site shall include a meteorological station consisting of a wind sensor that measures wind speed and wind direction and a temperature measurement. The wind sensor shall be installed at a height and location representative of wind transport between monitored sources, EDS sensors, and sensitive receptors, in accordance with wind-sensor siting guidance incorporated by reference. A wind-sensor height of approximately two (2) meters may be used where potential sources vary in height. Temperature measured for sensor quality-assurance purposes satisfies the temperature-measurement requirement. Barometric-pressure and relative-humidity measurements are not required by this subsection. Wind and temperature data shall be recorded continuously at one-minute resolution and time-synchronized with the EDS.

(i)(1) Meteorological sensor quality, siting, and quality assurance shall adhere to CARB wind-sensor siting guidance incorporated by reference in this subchapter.

(i)(2) Wind and temperature data shall be retained in the system of record under subsection (k).

(i)(3) If a dynamic alert threshold uses atmospheric stability class, a three-dimensional anemometer may be used to determine stability in real time. The LDRP shall identify the stability-class scheme, calculation method, data-quality criteria, and relationship to the threshold algorithm.

§ 93504(j). Alarm / response chain

(j)(1) A threshold exceedance occurs when the EDS determines that the background-subtracted increment exceeds the applicable alert threshold. The alarm system shall automatically transmit notice to the operator through the channels identified in the Alarm Response Plan within fifteen (15) minutes after the threshold exceedance is determined and shall transmit an updated exceedance value at least hourly while the exceedance continues. Transmission shall be logged. Per-message operator acknowledgment is not required. An EDS satisfies the transmission-latency requirement if its sensors are designed and operated to attempt transmission to the site data system at least every fifteen (15) minutes, notwithstanding an occasional network delay, provided the data are time-stamped and locally buffered against loss and the notification is transmitted promptly when connectivity is restored.

(j)(2) The operator shall begin leak identification immediately after notification. The leak-identification period is twenty-four (24) hours, or seventy-two (72) hours if the signal is intermittent. During the identification period, the operator shall evaluate persistence or recurrence, documented operational-event flags, wind-resolved evidence of off-site contribution, instrument or system malfunction, emission magnitude, and source or source group.

(j)(3) Completion of the documented identification procedure constitutes identification of the leak for purposes of Public Resources Code section 3283(b) and starts the applicable forty-eight-hour period. Related exceedances occurring during an open identification period or open forty-eight-hour period shall be associated with the existing event unless evidence demonstrates a separate source or event.

(j)(4) The LDRP shall include a named Alarm Response Plan identifying each step, responsible role, decision criterion, notification channel, clock, escalation condition, and required record. The plan shall specify the trigger and procedure for compositional sampling required by Public Resources Code section 3283(b), and the resulting records shall be retained for ten years under Public Resources Code section 3283(f).

(j)(5) The EDS shall be programmed to send a notification to the operator in the event of a sensor or monitor failure. [renumbered to (j)(5)]

§ 93504(k). Data storage / availability

(k)(1) System of record. EDS data and records, including at least five (5) years of continuous instrument data and the ability to generate hourly, daily, weekly, monthly, and annual reports, may be maintained in a secure cloud, on-premises, or hybrid system that provides data integrity, access control, time synchronization, backup, retention, traceability, and export in a documented machine-readable format.

(k)(2) Event log. The operator shall maintain a system-generated event log linking each threshold exceedance to the applicable alert threshold and input conditions; data-quality flags; notification transmission; investigation steps; leak-identification decision; disposition; corrective action; and verification. The event log and underlying measurements constitute the reproducible compliance record.

(k)(3) Network availability. Failure of an individual sensor or supporting component does not constitute EDS downtime while valid data from the remaining system continue to demonstrate the approved sensitive-receptor coverage under subparagraph 93504(e)(2)(A)2. If approved coverage is reduced, downtime begins when the reduction occurs and ends when coverage is restored through repair, replacement, temporary instrumentation, or another approved measure. Operational downtime under subparagraph 93504(c)(2) is assessed on this network and receptor-coverage basis.

(k)(4) Temporary meteorological substitution. During temporary failure of the site wind sensor, representative data from an approved public station or approved modeled dataset may be substituted for not more than seven (7) consecutive days if the source, time period, quality review, and limitations are documented. Substituted data shall not support a dynamic threshold or source-attribution decision unless representativeness for that use is demonstrated.

§ 93504(l). Qualified personnel

▫ *No change from Discussion Draft.*

§ 93504(m). LDRP submission

▫ *(m)(1)–(7), (9)–(11), and (8)(A)–(L) — retained; (8)(I) quality-assurance procedures unchanged.*

(m)(8) chapeau A quality assurance project plan (QAPP) describing the necessary quality assurance, quality control, and other technical procedures that must be implemented to ensure proper performance of the EDS. The QAPP shall define measurement objectives; data-quality indicators and objectively testable acceptance criteria; calibration and verification; data review, validation, and usability; assessment and corrective response; document and configuration control; record retention; and management responsibility. The acceptance criteria shall incorporate the applicable performance requirements of subsection (d). CARB shall publish a model QAPP and data-validation template. An operator may use one common QAPP for multiple sites where common technology, algorithms, quality systems, and procedures apply, with site-specific appendices identifying local inputs, configurations, and departures. At a minimum, these procedures shall include the following information:

(m)(8)(H) System Failure Plan. The plan shall classify failures by their effect on measurement, notification, meteorological input, communications and buffering, data retention, and sensitive-receptor coverage. For each class, it shall specify the detection method, response time, permissible interim measures, escalation criteria, restoration criteria, and required records.

(m)(12) Plan format. CARB and CalGEM shall publish a model LDRP, a completeness checklist, and a structured electronic submission schema specifying required fields, units, coordinate conventions, formats, attachments, and validation rules. An operator may submit a portfolio LDRP consisting of an operator-level common core and site-specific appendices. The common core may include technology specifications, manufacturer qualification, common algorithms, data architecture,

cybersecurity controls, QAPP procedures, maintenance systems, training, and standard response procedures. Each site appendix shall contain the site-specific source inventory; receptor information; modeling inputs and outputs; sensor layout; thresholds; coverage demonstration; meteorological configuration; and response contacts. The common core shall be version-controlled, and an approved revision may be incorporated by reference into each affected site appendix.

§ 93504(n). Independent audit

◦ *(n)(1)–(3) audit schedule and reporting — retained.*

(n) audit protocol (added) An independent audit shall follow a CARB-published protocol that includes document and configuration review; a defined sample of event records and underlying data; verification of selected calculations; review of calibration, verification, and maintenance records; and site inspection where necessary to confirm physical configuration. Auditor qualification shall be based on demonstrated technical competence, financial and outcome independence, and disclosure of conflicts. Corrective-action requirements and completion periods shall be tiered according to the effect of the finding on data validity, alerting, or sensitive-receptor coverage.

§ 93504(o). Review

(o) The Executive Officer shall notify CalGEM in writing whether the EDS described in the submitted LDRP is complete and acceptable. In addition, within ninety (90) days after receipt of a complete submission, the reviewing agencies shall issue either a determination or one consolidated, itemized deficiency notice identifying each applicable requirement and the information required for correction, consistent with the CalGEM approval timeline in § 93503(b). The operator may submit a focused cure addressing the identified items without reopening unrelated approved elements. CARB and CalGEM shall coordinate comments and identify the agency responsible for each determination. CARB and CalGEM shall publish the treatment of a timely, complete, good-faith submission if final agency action is delayed for reasons not attributable to the operator.

§ 93504(p). Annual report

(p) Annual report. The operator shall submit one structured electronic annual report containing: total valid monitoring hours; data completeness; approved and achieved sensitive-receptor coverage; threshold exceedances by disposition; identified leaks; elapsed time from exceedance to operator notification, notification to identification, and identification to verified correction; system downtime that affected coverage; and unresolved events at year-end. CARB shall publish a reporting schema defining each metric, denominator, event state, and calculation rule.

A.2 — Redline Against the January 5, 2026 Discussion Draft

Only changed provisions are shown. Deletions are struck through in red; insertions are underlined in blue. Unchanged provisions are omitted with a note.

- § 93500 (Scope and Purpose), § 93505, and § 93506 — no change; omitted.

§ 93501. Applicability

- (a) — no change from Discussion Draft.

(b) **Applicability table.** CARB shall publish an applicability table identifying the treatment of relevant well, flowline, pipeline, produced-water, injection, gathering, gas-processing, and other equipment and facility classes, and the statutory or regulatory basis for each treatment, together with a crosswalk of CalGEM status flags. The table shall identify covered, excluded, and case-specific categories and shall not alter statutory coverage.

§ 93502. Definitions

- (a)(1)–(27), (29)–(46) — no change.

(a)(28) Discussion Draft — delete:

~~“Production equipment” or “production facility” means any equipment associated with oil and gas production or injection operations including, but not limited to, tanks, flowlines, headers, gathering lines, wellheads, heater treaters, pumps, valves, compressors, injection equipment, production safety systems, separators, manifolds, and pipelines that are not under the jurisdiction of the State Fire Marshal pursuant to section 51010 of the Government Code, excluding fire suppression equipment. “Production equipment” and “production facility” are used interchangeably.~~

Proposed — insert: “Production facility” means a production facility as defined in Public Resources Code section 3010. “Production equipment” means equipment or a monitored source item located within or associated with a production facility, including, but not limited to, tanks, flowlines, headers, gathering lines, wellheads, heater treaters, pumps, valves, compressors, injection equipment, production safety systems, separators, manifolds, and pipelines that are not under the jurisdiction of the State Fire Marshal pursuant to section 51010 of the Government Code, excluding fire suppression equipment.

(a) new definition “Site” (inserted in alphabetical order). “Site” means one or more contiguous or proximate production facilities or wells included in a single LDRP under common operational control and approved aggregation criteria, including shared equipment, a common receptor set, and a technically coherent meteorological and modeling domain.

§ 93503. Requirements Specified by PRC § 3283(a)

- (a)–(e), including the five-year update rule in (d) — no change; retained.

(f) **Plan updates.** “Material modification” means a change reasonably capable of significantly altering source characterization, the toxic-of-highest-concern determination, modeled receptor impact, sensor coverage, alert-threshold policy, data validity, or response performance. Material modifications include addition or removal of an equipment class; a composition-relevant process change; a receptor change that alters the modeled protection boundary; or a sensor-layout change that may reduce coverage below the ninety-percent requirement of subparagraph 93504(e)(2)(A)2. Other changes shall be recorded in an annual change log. A plan update shall address only the elements affected by the modification. Unchanged elements may be incorporated by reference under a current attestation. Repeat source testing or modeling is required only if the modification affects the inputs to, or conclusions of, that testing or modeling.

§ 93504(a). Toxics of highest concern

- (a) intro, Table 1, and (1)–(3) — no change.

(a)(4) No-detection case. If no Table 1 compound is detected above the applicable reporting limit in any valid sample, the operator shall apply the default toxic-of-highest-concern determination specified by CARB and shall document the reporting limits supporting that determination.

§ 93504(b). Composition methodology

◦ (b) intro, (1), (2) chapeau, (2)(B)–(E), (3), (4) — no change.

(b)(2)(A) Discussion Draft — delete:

~~Compositional source measurements for each production process category shall be averaged by calculating the arithmetic mean species mass percentage of each compound present in the source test measurements.~~

Proposed — insert: Compositional source measurements for each production process category shall be averaged by calculating the arithmetic mean species mass percentage of each compound present in the source test measurements. Composition results shall identify whether each value is reported on a mole or mass basis. Calculations under Equation 1 shall use a consistent basis and shall show the mole-to-mass conversion and molecular weights used.

§ 93504(c). Continuous operation

(c)(1) Discussion Draft — delete:

~~The EDS shall be capable of providing time-resolved measurement data at intervals of one (1) hour or less.~~

Proposed — insert: Irrespective of monitoring technology, the EDS shall collect measurements at intervals not exceeding five (5) minutes. The alert-threshold comparison shall be based on an average of one (1) hour or less under paragraph 93504(e)(3).

(c)(1)(A) A valid hour shall contain valid measurements representing at least forty-five (45) minutes of the hour and, for a system operating at a five-minute collection interval, not fewer than nine (9) valid measurements. Only valid hours shall count as sensor-provided coverage under subparagraph 93504(e)(2)(A)2.

◦ (c)(2)(A)–(E) rolling-downtime framework — retained; operational downtime is assessed on the network / receptor-coverage basis of § 93504(k)(3).

§ 93504(d). Sensor performance

◦ (d) intro and (1)–(3) — no change (numerical floor retained).

(d)(4) The manufacturer-documented accuracy and precision specifications shall identify the confidence level, methane concentration points, environmental operating envelope, production-equivalent test population, and production-batch basis used to demonstrate compliance. The precision required by this subsection shall be expressed at a three-standard-deviation confidence level across the tested device population. Compliance shall be demonstrated using not fewer than thirty (30) production-equivalent devices from not fewer than three (3) production batches, at not fewer than three (3) methane concentration points that bracket the alert threshold and lower concentrations relevant to detection, across the declared environmental operating envelope. The distribution of results shall be reported.

(d)(5) Quarterly field verification is the default compliance pathway. The sensor type shall be demonstrated to maintain the applicable accuracy and precision requirements throughout each three-month verification interval.

(d)(6) The Executive Officer may approve a field-verification interval longer than three months where field data, accelerated lifetime testing, or both demonstrate maintained compliance over the proposed interval. Accelerated testing shall follow a recognized reliability-qualification standard, including JEDEC JESD22, JEDEC JEP122, the ZVEI Handbook for Robustness Validation, AEC-Q100, or an equivalent documented standard, and shall justify the relationship between applied

stress and the claimed interval using an accepted acceleration model. The interval shall not exceed the demonstrated stability period or five (5) years, whichever is shorter.

(d)(7) If the reported concentration uses automatic baseline correction or other ambient-data-based drift compensation, the manufacturer shall document the method, input-selection criteria, update timescale, maximum correction, and suspension conditions, and shall demonstrate that persistent methane enhancement, low-wind accumulation, and elevated off-site background do not cause systematic under-reporting. Baseline correction alone does not satisfy paragraph (5) or (6).

(d)(8) The EDS shall have documented cross-sensitivity specifications for relevant co-present gases and environmental interferents. Positive and negative interference shall be quantified separately. Any interference that reduces reported methane concentration shall be incorporated into the demonstration that the applicable alert threshold can be detected.

(d)(9) The manufacturer shall declare the temperature, humidity, and pressure envelope over which the detection-limit, accuracy, precision, and response specifications are valid. Compliance shall be demonstrated across that envelope, and data collected outside it shall be flagged.

(d)(10) The EDS shall have documented rise and recovery characteristics under a defined dynamic challenge. If response is asymmetric, the manufacturer shall demonstrate that the asymmetry does not materially bias the concentration average used for alerting under fluctuating-plume conditions.

§ 93504(e). Sensitivity, siting, thresholds

▫ (e) intro, (1), (2)(A) chapeau, (2)(B), (3)(A)–(F) — no change.

(e)(2)(A)1 Discussion Draft — delete:

~~For EDS that scan or image leaks (e.g., fixed OGI cameras, fixed LiDAR cameras), the EDS shall scan or image all production equipment monitored by the EDS and report measurements at a minimum frequency of one (1) hour.~~

Proposed — insert: For EDS that scan or image leaks (e.g., fixed OGI cameras, fixed LiDAR cameras), the EDS shall scan or image all production equipment monitored by the EDS and report measurements at a minimum frequency of five (5) minutes. Such a system shall not serve as the sole basis for alerting unless it completes a valid measurement or image cycle for the relevant monitored area at least once every five (5) minutes.

(e)(2)(A)2 Discussion Draft — delete:

~~For EDS that detect leak plumes downwind of a source (e.g., point sensor network EDS, open-path EDS), the EDS shall be sited to achieve detection on an hourly basis of at least 90 percent of leaks that exceed the REL level leak rate(s) from the production equipment monitored by the EDS that are transported in the direction of sensitive receptors within the health protection zone.~~

Proposed — insert: A plume-detecting EDS shall achieve at least ninety (90) percent sensitive-receptor coverage for each monitored source and each sensitive receptor within the health protection zone. Coverage shall be calculated using subsection (h), including the five-year meteorological dataset, the within-hour variability method, and the alert-threshold policy proposed in the LDRP. For each modeled hour and each source-and-receptor combination, determine the leak rate that would produce a concentration equal to the acute REL of the toxic of highest concern at the sensitive receptor. The hour is covered if either: (a) the modeled meteorology would not transport the leak toward the sensitive receptor; or (b) the leak would cause at least one valid EDS sensor to reach the alert threshold applicable for that hour. Coverage is the number of covered hours divided by the total number of modeled hours for the source-and-receptor combination. The same model configuration and treatment of source characterization, terrain, meteorology, within-hour variability, and alert thresholds shall be used for sensor siting, coverage, and threshold-setting. Sensor measurement performance at the applicable threshold shall be demonstrated separately under subsection (d).

(e)(2)(C) Discussion Draft — delete:

~~For monitoring an individual well, EDS siting may include at minimum one (1) sensor located within 10 meters of the well, positioned predominantly downwind under prevailing wind conditions, with no obstructions to airflow between the sensor and the well.~~

Proposed — insert: Individual-well configuration. A site containing an individual well is subject to the same performance-based modeling, background, threshold, coverage, and sensor-performance requirements applicable to other sites. No additional minimum sensor configuration applies solely because the site contains one well. Aggregation does not relieve any source-and-receptor combination from the coverage requirement of subparagraph 93504(e)(2)(A)2.

(e)(3)(B)3. Set a dynamic alert threshold, evaluated at an averaging time of one hour or less, that is adjusted using one or more of the following: atmospheric stability class; wind direction measured under subsection (i); and demonstrated source attribution or source exclusion. The threshold shall be calculated under subsection (h).

(e)(3)(G) A dynamic alert threshold shall not suppress an alert during an averaging interval unless the meteorological data recorded under subsection (i) demonstrate that a REL-level leak from the associated source or source group would not be transported toward any sensitive receptor during that interval.

(e)(3)(H) Alert thresholds may be established by equipment group where the EDS demonstrates sufficient attribution accuracy to the group of origin or reliably excludes a source type demonstrated to lack REL-level leak potential. If a compliant fenceline threshold is infeasible because of site geometry, a near-proximity source-based configuration may be used for the affected equipment group, subject to subsection (g), the source-localization demonstration, and the near-source modeling limitation in subparagraph 93504(h)(7).

(e)(3)(I) An operator using a dynamic alert threshold shall document in the LDRP the algorithm and inputs; the source groups to which it applies; any stability-class scheme; source-attribution and exclusion criteria; data-quality requirements; and quality-assurance procedures sufficient to reproduce the threshold applicable to any averaging interval. The threshold policy used in operation shall be the same policy used in the coverage demonstration under subparagraph 93504(e)(2)(A)2.

(e)(4) **Corrective action.** Corrective action shall be evaluated by its verified result. A leak is corrected when the operator documents the action taken and valid EDS data demonstrate that the background-subtracted on-site increment remains below the applicable alert threshold for twenty-four (24) consecutive hours during which the affected source is covered by the EDS under subparagraph 93504(e)(2)(A)2. Corrective action may be performed remotely or on site. An on-site inspection is required if remote action does not reduce the increment below the applicable threshold, the source cannot be identified with sufficient confidence, or equipment condition cannot otherwise be verified. A continuous methane monitoring camera may be used in lieu of an on-site visit.

(e)(5) **Disposition.** Each threshold-exceedance event shall receive a documented disposition supported by the monitoring record and other relevant evidence. Dispositions shall include, as applicable: identified leak; permitted or documented operational event; off-site source; EDS or meteorological-system malfunction; invalid data; background excursion; and indeterminate event. The disposition, evidentiary basis, and any corrective action shall be retained in the event log and reported by category.

(e)(6) **Recurring off-site contribution.** The Executive Officer may approve a standing attribution method for a recurring off-site source or source area under specified meteorological and quality-control conditions. The approved method shall identify the source or source area, calculation method, evidence, applicability limits, and conditions requiring reevaluation, including a material change in the source environment, sensor layout, background method, or relevant meteorology.

§ 93504(f). Siting/threshold analysis

▫ No change from Discussion Draft.

§ 93504(g). Baseline / background

(g)(1) Discussion Draft — delete:

~~The EDS shall collect 12 months of valid hourly measurements before establishing baseline detection target concentration(s).~~

Proposed — insert: For a plume-detecting EDS, the alert threshold shall be applied to the background-subtracted methane increment determined under paragraphs (4) and (6). No baseline-accumulation period is required, and subparagraphs 93504(g)(1)(A) and (B) do not apply to a plume-detecting EDS.

~~**(g)(1)(A)** Measurements shall be representative of normal operating conditions of the production equipment monitored by the EDS. Periods when maintenance activities, malfunctions, or leaks occur from production equipment monitored by the EDS shall be excluded from baseline conditions.~~

~~**(g)(1)(B)** Days with incomplete data (five (5) or more hours of missing measurement values) shall be excluded from baseline conditions.~~

(g)(2) Discussion Draft — delete:

~~An interim baseline value shall be calculated each calendar month and include all valid hourly measurements collected to date, until baseline detection target concentrations have been established pursuant to subparagraph 93504(g)(1).~~

Proposed — insert: The interim monthly baseline requirement does not apply to a plume-detecting EDS.

▫ (g)(3) same averaging time — retained.

(g)(4) Discussion Draft — delete:

~~Baseline detection target concentration(s) shall be calculated as the arithmetic mean of baseline measurements made pursuant to subparagraph 93504(g)(1).~~

Proposed — insert: For each averaging interval, the background-subtracted methane increment equals the concentration at the alerting monitor minus the contemporaneous background concentration. If a valid monitor is located within the approved upwind wind cone of the alerting monitor, the contemporaneous background concentration shall be the concentration measured by that monitor during the same averaging interval. The upwind wind cone shall be determined from the wind direction and within-hour wind-direction variability measured for that interval. An upwind monitor is valid only if applicable meteorological, completeness, and quality-assurance requirements are met and the monitor is not within the influence of an on-site emission source under the measured conditions.

(g)(5) Discussion Draft — delete:

~~The methodology used to establish baseline detection target concentration(s) shall be documented in the LDRP.~~

Proposed — insert: The methodology used to establish the background-subtracted increment shall be documented in the LDRP.

(g)(6) If no valid upwind monitor is available for an averaging interval, the contemporaneous background concentration shall be a representative regional atmospheric background methane concentration published or approved by the Executive Officer. The substituted background value, the reason for substitution, and the applicable quality status shall be recorded in the system event log.

§ 93504(h). Air dispersion modeling

(h) chapeau Discussion Draft — delete:

~~Air dispersion modeling of potential leaks from production equipment monitored by the EDS to identify REL-level leak rates shall conform to the air dispersion modeling guidance provided in the OEHHA Air Toxics Hot Spots Program Guidance Manual, which is defined in paragraph 93502(a) of this subchapter.~~

Proposed — insert: Air dispersion modeling of potential leaks from production equipment monitored by the EDS to identify REL-level leak rates shall conform to the air dispersion modeling guidance provided

in the OEHHA Air Toxics Hot Spots Program Guidance Manual, which is defined in paragraph 93502(a) of this subchapter, read together with a modeling protocol incorporated by reference in this subchapter. The Executive Officer shall publish the modeling protocol, standard templates, and acceptance criteria sufficiently in advance of required LDRP preparation to permit consistent implementation and review.

(h)(1) *Discussion Draft — delete:*

~~AERMOD shall be used for air dispersion modeling.~~

Proposed — insert: AERMOD shall be used in accordance with a modeling protocol incorporated by reference in this subchapter. The protocol shall specify the model version and options; source-characterization methods, including methods for wells, equipment, pipelines, and flowlines; receptor-grid design; terrain and geospatial-data requirements; the governing concentration statistic; standard input and output formats; quality-control procedures; and acceptance criteria.

◦ *(h)(2) methane ratios, (h)(3) equipment location, (h)(4) documentation — retained unchanged.*

(h)(5) The meteorological basis for design-stage modeling shall be five consecutive years of the most recent representative data available from the nearest representative public meteorological station or an AERMOD-ready dataset supplied or approved by the Executive Officer. Site-specific meteorological data collection shall not be required for design-stage modeling. An operator may use a different historical dataset upon demonstrating that it is more representative of the site.

(h)(6) Within-hour wind-direction variability. When hourly dispersion-model results are used to establish EDS sensor siting, sensitive-receptor coverage, sensor-to-receptor concentration relationships, or alert thresholds, the analysis shall account for within-hour wind-direction variability using the method specified in the incorporated modeling protocol or another method approved by the Executive Officer. The method shall represent the angular region sampled by the plume during the hourly averaging period and shall be applied consistently to siting, coverage, and threshold calculations.

(h)(7) Near-source applicability. A modeled concentration at an EDS sensor location may be used to establish a sensor-to-receptor concentration relationship or an alert threshold only if the sensor location is separated from each associated potential emission source by at least three (3) meters. A shorter separation may be used if the operator demonstrates, in accordance with the incorporated modeling protocol, that the modeled concentration is not materially sensitive to uncertainty in leak location, release geometry or orientation, initial momentum or buoyancy, nearby equipment or wakes, or unresolved plume position. This paragraph does not prohibit use of a sensor located within three meters for qualitative leak detection, source localization, or other purposes that do not rely on the sensor location as a quantitative modeled-concentration anchor.

(h)(8) A digital siting tool implementing the published AERMOD algorithms may be used if its inputs, calculations, and outputs are reproducible under the incorporated modeling protocol. The operator may use custom AERMOD settings where justified by site-specific conditions and documented in the LDRP.

§ 93504(i). Meteorological measurement

(i) chapeau *Discussion Draft — delete:*

~~The EDS shall include a meteorological monitoring system that shall have sufficient sensors to continuously measure representative meteorological conditions at the facility including ambient temperature, ambient pressure, relative humidity, wind speed, and wind direction, with the ability to continuously record measurements at a measurement resolution of one (1) minute or less.~~

Proposed — insert: Each site shall include a meteorological station consisting of a wind sensor that measures wind speed and wind direction and a temperature measurement. The wind sensor shall be installed at a height and location representative of wind transport between monitored sources, EDS sensors, and sensitive receptors, in accordance with wind-sensor siting guidance incorporated by reference. A wind-sensor height of approximately two (2) meters may be used where potential sources

vary in height. Temperature measured for sensor quality-assurance purposes satisfies the temperature-measurement requirement. Barometric-pressure and relative-humidity measurements are not required by this subsection. Wind and temperature data shall be recorded continuously at one-minute resolution and time-synchronized with the EDS.

(i)(1) *Discussion Draft — delete:*

~~Meteorological sensor quality, siting, and quality assurance shall, to the extent site-specific conditions allow, adhere to the specifications and guidelines that are specified in the U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements (March 24, 2008), which is incorporated herein by reference.~~

Proposed — insert: Meteorological sensor quality, siting, and quality assurance shall adhere to CARB wind-sensor siting guidance incorporated by reference in this subchapter.

(i)(2) *Discussion Draft — delete:*

~~The meteorological monitoring system shall have the ability to store at least five (5) years of continuous instrument data at a data resolution of one (1) hour or less.~~

Proposed — insert: Wind and temperature data shall be retained in the system of record under subsection (k).

(i)(3) If a dynamic alert threshold uses atmospheric stability class, a three-dimensional anemometer may be used to determine stability in real time. The LDRP shall identify the stability-class scheme, calculation method, data-quality criteria, and relationship to the threshold algorithm.

§ 93504(j). Alarm / response chain

(j)(1) *Discussion Draft — delete:*

~~The EDS shall be programmed to automatically trigger the alarm system and generate and send a notification to the operator as soon as technically feasible, but no later than 15 minutes after the detection target identified in the approved LDRP exceeds an alert threshold determined pursuant to paragraph 93504(e) and identified in the approved LDRP.~~

Proposed — insert: A threshold exceedance occurs when the EDS determines that the background-subtracted increment exceeds the applicable alert threshold. The alarm system shall automatically transmit notice to the operator through the channels identified in the Alarm Response Plan within fifteen (15) minutes after the threshold exceedance is determined and shall transmit an updated exceedance value at least hourly while the exceedance continues. Transmission shall be logged. Per-message operator acknowledgment is not required. An EDS satisfies the transmission-latency requirement if its sensors are designed and operated to attempt transmission to the site data system at least every fifteen (15) minutes, notwithstanding an occasional network delay, provided the data are time-stamped and locally buffered against loss and the notification is transmitted promptly when connectivity is restored.

(j)(2) The operator shall begin leak identification immediately after notification. The leak-identification period is twenty-four (24) hours, or seventy-two (72) hours if the signal is intermittent. During the identification period, the operator shall evaluate persistence or recurrence, documented operational-event flags, wind-resolved evidence of off-site contribution, instrument or system malfunction, emission magnitude, and source or source group.

(j)(3) Completion of the documented identification procedure constitutes identification of the leak for purposes of Public Resources Code section 3283(b) and starts the applicable forty-eight-hour period. Related exceedances occurring during an open identification period or open forty-eight-hour period shall be associated with the existing event unless evidence demonstrates a separate source or event.

(j)(4) The LDRP shall include a named Alarm Response Plan identifying each step, responsible role, decision criterion, notification channel, clock, escalation condition, and required record. The plan shall specify the trigger and procedure for compositional sampling required by Public Resources

Code section 3283(b), and the resulting records shall be retained for ten years under Public Resources Code section 3283(f).

▫ (j)(2) sensor- or monitor-failure notification — text unchanged; renumbered to (j)(5).

§ 93504(k). Data storage / availability

(k) Discussion Draft — delete:

~~The EDS shall have the ability to store at least five (5) years of continuous instrument data and the ability to generate hourly, daily, weekly, monthly, and annual reports.~~

Proposed — insert: (1) System of record. EDS data and records, including at least five (5) years of continuous instrument data and the ability to generate hourly, daily, weekly, monthly, and annual reports, may be maintained in a secure cloud, on-premises, or hybrid system that provides data integrity, access control, time synchronization, backup, retention, traceability, and export in a documented machine-readable format.

(k)(2) Event log. The operator shall maintain a system-generated event log linking each threshold exceedance to the applicable alert threshold and input conditions; data-quality flags; notification transmission; investigation steps; leak-identification decision; disposition; corrective action; and verification. The event log and underlying measurements constitute the reproducible compliance record.

(k)(3) Network availability. Failure of an individual sensor or supporting component does not constitute EDS downtime while valid data from the remaining system continue to demonstrate the approved sensitive-receptor coverage under subparagraph 93504(e)(2)(A)2. If approved coverage is reduced, downtime begins when the reduction occurs and ends when coverage is restored through repair, replacement, temporary instrumentation, or another approved measure. Operational downtime under subparagraph 93504(c)(2) is assessed on this network and receptor-coverage basis.

(k)(4) Temporary meteorological substitution. During temporary failure of the site wind sensor, representative data from an approved public station or approved modeled dataset may be substituted for not more than seven (7) consecutive days if the source, time period, quality review, and limitations are documented. Substituted data shall not support a dynamic threshold or source-attribution decision unless representativeness for that use is demonstrated.

§ 93504(l). Qualified personnel

▫ No change from Discussion Draft.

§ 93504(m). LDRP submission

▫ (m)(1)–(7), (9)–(11), and (8)(A)–(L) — retained; (8)(I) quality-assurance procedures unchanged.

(m)(8) chapeau Discussion Draft — delete:

~~A quality assurance project plan (QAPP) describing the necessary quality assurance, quality control, and other technical procedures that must be implemented to ensure proper performance of the EDS. At a minimum, these procedures shall include the following information:~~

Proposed — insert: A quality assurance project plan (QAPP) describing the necessary quality assurance, quality control, and other technical procedures that must be implemented to ensure proper performance of the EDS. The QAPP shall define measurement objectives; data-quality indicators and objectively testable acceptance criteria; calibration and verification; data review, validation, and usability; assessment and corrective response; document and configuration control; record retention; and management responsibility. The acceptance criteria shall incorporate the applicable performance requirements of subsection (d). CARB shall publish a model QAPP and data-validation template. An operator may use one common QAPP for multiple sites where common technology, algorithms, quality systems, and procedures apply, with site-specific appendices identifying local inputs, configurations, and departures. At a minimum, these procedures shall include the following information:

(m)(8)(H) *Discussion Draft — delete:*

~~System Failure Plan that describes the measurements that would be taken in the event of a system failure or during routine maintenance activities and used until the EDS is restored to normal operating conditions.~~

Proposed — insert: System Failure Plan. The plan shall classify failures by their effect on measurement, notification, meteorological input, communications and buffering, data retention, and sensitive-receptor coverage. For each class, it shall specify the detection method, response time, permissible interim measures, escalation criteria, restoration criteria, and required records.

(m)(12) Plan format. CARB and CalGEM shall publish a model LDRP, a completeness checklist, and a structured electronic submission schema specifying required fields, units, coordinate conventions, formats, attachments, and validation rules. An operator may submit a portfolio LDRP consisting of an operator-level common core and site-specific appendices. The common core may include technology specifications, manufacturer qualification, common algorithms, data architecture, cybersecurity controls, QAPP procedures, maintenance systems, training, and standard response procedures. Each site appendix shall contain the site-specific source inventory; receptor information; modeling inputs and outputs; sensor layout; thresholds; coverage demonstration; meteorological configuration; and response contacts. The common core shall be version-controlled, and an approved revision may be incorporated by reference into each affected site appendix.

§ 93504(n). Independent audit

▫ *(n)(1)–(3) audit schedule and reporting — retained.*

(n) audit protocol (added) An independent audit shall follow a CARB-published protocol that includes document and configuration review; a defined sample of event records and underlying data; verification of selected calculations; review of calibration, verification, and maintenance records; and site inspection where necessary to confirm physical configuration. Auditor qualification shall be based on demonstrated technical competence, financial and outcome independence, and disclosure of conflicts. Corrective-action requirements and completion periods shall be tiered according to the effect of the finding on data validity, alerting, or sensitive-receptor coverage.

§ 93504(o). Review

(o) *Discussion Draft — delete:*

~~The Executive Officer shall notify CalGEM in writing if the EDS described in the submitted LDRP is incomplete or deficient. If the EDS is acceptable, the Executive Officer shall notify CalGEM that the requirements for EDS performance standards are met.~~

Proposed — insert: The Executive Officer shall notify CalGEM in writing whether the EDS described in the submitted LDRP is complete and acceptable. In addition, within ninety (90) days after receipt of a complete submission, the reviewing agencies shall issue either a determination or one consolidated, itemized deficiency notice identifying each applicable requirement and the information required for correction, consistent with the CalGEM approval timeline in § 93503(b). The operator may submit a focused cure addressing the identified items without reopening unrelated approved elements. CARB and CalGEM shall coordinate comments and identify the agency responsible for each determination. CARB and CalGEM shall publish the treatment of a timely, complete, good-faith submission if final agency action is delayed for reasons not attributable to the operator.

§ 93504(p). Annual report

(p) Annual report. The operator shall submit one structured electronic annual report containing: total valid monitoring hours; data completeness; approved and achieved sensitive-receptor coverage; threshold exceedances by disposition; identified leaks; elapsed time from exceedance to operator notification, notification to identification, and identification to verified correction; system downtime that affected coverage; and unresolved events at year-end. CARB shall publish a reporting schema defining each metric, denominator, event state, and calculation rule.