# PROPOSED REGULATION ORDER

Adopt new Article 4, Subarticle 6, Methane Emissions from Municipal Solid Waste Landfills, sections 95460 to 95477, title 17, California Code of Regulations, to read as follows:

Note: The entire text below is new language proposed to be added to the California Code of Regulations (CCR).

## Subchapter 10: Climate Change
## Article 4: Regulations to Achieve Greenhouse Gas Emission Reductions
## Subarticle 6. Methane Emissions from Municipal Solid Waste Landfills

## Methane Emissions from Municipal Solid Waste Landfills

### § 95460. Purpose

The purpose of this subarticle is to reduce methane emissions from municipal solid waste (MSW) landfills pursuant to the California Global Warming Solutions Act of 2006 (Health & Safety Code, Sections 38500 et. seq.).

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

### § 95461. Applicability

This subarticle applies to all MSW landfills that received solid waste after January 1, 1977.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

### § 95462. Exemptions

(a) This subarticle does not apply to landfills that receive only hazardous waste, or are currently regulated under the Comprehensive Environmental Response, Compensation and Liability Act 42 U.S.C, Chapter 103 *(Promulgated 12/11/80; Amended 10/17/86).*

(b) This subarticle does not apply to landfills that contain only non-decomposable solid waste.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95463. Determination for Installing a Gas Collection and Control System**

(a) *Closed or Inactive MSW Landfills Less Than 450,000 Tons of Waste-in-Place:* Each owner or operator of a closed or inactive MSW landfill having less than 450,000 tons of waste-in-place must submit a Waste-in-Place Report to the Executive Officer pursuant to 95470(b)(4). Submitting a Waste-in-Place Report fulfills the requirements of this subarticle.

(b) *Active MSW Landfills Less Than 450,000 Tons of Waste-in-Place:* Each owner or operator of an active MSW landfill having less than 450,000 tons of waste-in-place must submit a Waste-in-Place Report to the Executive Officer pursuant to section 95470(b)(4).

(1) The Waste-in-Place report must be prepared for the period of January 1 through December 31 of each year. The report must be submitted to the Executive Officer by March 15 of the following year.

(2) The Waste-in-Place report in must be submitted annually until either:

(A) The MSW landfill reaches a size greater than or equal to 450,000 tons of waste-in-place; or

(B) The owner or operator submits a Closure Notification pursuant to section 95470(b)(1).

(c) *MSW Landfills Greater Than or Equal to 450,000 Tons of Waste-in-Place:* Each owner or operator of an MSW landfill having greater than or equal to 450,000 tons of waste-in-place must calculate the landfill gas heat input capacity and submit a Landfill Gas Heat Input Capacity Report within 90 days to the Executive Officer.

(1) If the calculated landfill gas heat input capacity is less than 3.0 million British thermal units per hour (MMBtu/hr) recovered, the owner or operator must:

(A) Recalculate the landfill gas heat input capacity annually using the procedures specified in section 95471(b).

(B) Submit an annual Landfill Gas Heat Input Capacity Report to the Executive Officer until either of the following conditions is met:

1. The calculated landfill gas heat input capacity is greater than or equal to 3.0 MMBtu/hr recovered, or

2. The owner or operator of an *active* MSW landfill submits a Closure Notification pursuant to section 95470(b)(1). Submitting the Closure Notification fulfills the requirements of this subarticle. If the MSW landfill is *closed or inactive*, submittal of the Closure Notification is not required to fulfill the requirements of the subarticle.

(2) If the landfill gas heat input capacity is greater than or equal to 3.0 MMBtu/hr recovered the owner or operator must either:

(A) Comply with the requirements of sections 95464 through 95477, or

(B) Demonstrate to the satisfaction of the Executive Officer that after four consecutive quarterly monitoring periods there is no measured concentration of methane of 200 parts per million by volume (ppmv) or greater using the instantaneous surface monitoring procedures specified in sections 95471(c)(1) and 95471(c)(2). Based on the monitoring results, the owner or operator must do one of the following:

1. If there is <u>any</u> measured concentration of methane of 200 ppmv or greater from the surface of an *active, inactive, or closed MSW landfill*, comply with sections 95464 through 95477;

2. If there is <u>no</u> measured concentration of methane of 200 ppmv or greater from the surface of an *active MSW landfill*, comply with section 95463(c) and recalculate the landfill gas heat input capacity annually as required in section 95463(c) until such time the owner or operator submits a Closure Notification pursuant to section 95470(b)(1); or

3. If there is <u>no</u> measured concentration of methane of 200 ppmv from the surface of a *closed or inactive MSW landfill*, the requirements of sections 95464 through 95470 no longer apply provided that the following information is submitted to and approved by the Executive Officer:

a. A Waste-in-Place Report pursuant to section 95470(b)(4);

b. All instantaneous surface monitoring records.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95464. Gas Collection and Control System Requirements**

(a) *Design Plan and Installation.*

(1) *Design Plan*: If a gas collection and control system which meets the requirements of either sections 95464(b)(1), 95464(b)(2) or 95464(b)(3) has not been installed, the owner or operator of a MSW landfill must submit a Design Plan to the Executive Officer within one year after the effective date of this subarticle, or within one year of detecting any leak on the landfill surface exceeding a methane concentration of 200 ppmv pursuant to section 95463(c)(2)(B). The Executive Officer must review and either approve or disapprove the Design Plan within 120 days. The Executive Officer may request that additional information be submitted as part of the review of the Design Plan. At a minimum, the Design Plan must meet the following requirements:

(A) The Design Plan must be prepared and certified by a professional engineer.

(B) The Design Plan must provide for the control of the collected gas through the use of a gas collection and control system meeting the requirements of either sections 95464(b)(1), 95464(b(2) or 95464(b)(3).

(D) The Design Plan must include any proposed alternatives to the requirements, test methods, procedures, compliance measures, monitoring, and recordkeeping or reporting requirements pursuant to section 95468.

(E) A description of potential mitigation measures to be used to prevent the release of methane or other pollutants into the atmosphere during the installation or preparation of wells, piping, or other equipment; during repairs or the temporary shutdown of gas collection system components; or, when solid waste is to be excavated and moved.

(F) For active MSW landfills, the design plan must identify areas of the landfill that are closed or inactive.

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(G) As operating experience is gained and as site conditions change, the Design Plan may be revised, subject to the approval of the Executive Officer.

(2) Any owner or operator of an active MSW landfill must install and operate a gas collection and control system within 18 months after approval of the Design Plan.

(3) Any owner or operator of a closed or inactive MSW landfill must install and operate a gas collection and control system within 30 months after approval of the Design Plan.

(4) If an owner or operator is modifying an existing gas collection and control system to meet the requirements of this subarticle, the existing Design Plan must be amended to include any necessary updates or addenda, and must be certified by a professional engineer.

(b) *Gas Collection and Control System Requirements.*

(1) *General Requirements.* The owner or operator must satisfy the following requirements when operating a gas collection and control system:

(A) Route the collected gas to a gas control device or devices, and operate the gas collection and control system continuously except as provided in sections 95464(d) and 95464(e).

(B) Operate the gas collection and control system so that there is no landfill gas leak that exceeds 500 ppmv, measured as methane, at any component under positive pressure.

(C) Design the gas collection and control system to handle the expected gas generation flow rate from the entire area of the MSW landfill and to collect gas at an extraction rate to comply with the surface methane emission limits in section 95465 and component leak standard in section 95464(b)(1)(B). The expected gas generation flow rate from the MSW landfill must be calculated pursuant to section 95471(e).

1. Any areas of the landfill that contain asbestos-containing waste or non-decomposable solid waste may be excluded from collection provided that the owner or operator submits documentation to the Executive Officer containing the nature, date of deposition, location and amount of asbestos or non-decomposable solid waste deposited in the area. This documentation may be included as part of the Design Plan.

(D) The gas collection system must be designed and operated to draw gas toward the gas control device or devices

(2) *Requirements for Flares.* An MSW landfill owner or operator who operates a flare must satisfy the following requirements:

(A) Route the collected gas to an enclosed flare that meets the following requirements:

1. Achieves a methane destruction efficiency of at least 99 percent by weight.

2. Enclosed flares must be equipped with automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors.

3. During restart or startup there must be a sufficient flow of propane or commercial natural gas to the burners to prevent unburned collected methane from being emitted to the atmosphere.

4. The gas control device must be operated within the parameter ranges established during the initial or most recent source test.

(B) Route the collected gas to an open flare that meets the requirements of 40 CFR 60.18 (as last amended 65 Fed.Reg. 61752 (October 17, 2000), which is incorporated by reference herein. The operation of an open flare is not allowed except under the following conditions:

1. An open flare installed and operating prior to August 1, 2008, may operate until January 1, 2018.

2. Operation of an open flare on or after January 1, 2018, may be allowed if the owner or operator can demonstrate to the satisfaction of the Executive Officer that the landfill gas heat input capacity is less than 3.0 MMBtu/hr pursuant to section 95471(b) and is insufficient to support the continuous operation of an enclosed flare or other gas control device.

3. The owner or operator is seeking to temporarily operate an open flare during the repair or maintenance of the gas control system, or while awaiting the installation of an enclosed flare, or to remedy a situation where there is an

imminent, life endangering threat to humans requiring immediate action.

a. Any owner seeking to temporarily operate an open flare must submit a written request to the Executive Officer pursuant to section 95468.

(3) *Requirements for Gas Control Devices other than Flares.* An MSW landfill owner or operator who operates a gas control device other than a flare must satisfy one of the following requirements:

(A) Route the collected gas to an energy recovery device, or series of devices that meets the following requirements:

1. Achieves a methane destruction efficiency of at least 99 percent by weight. Lean burn internal combustion engines must reduce the outlet methane concentration to less than 3,000 ppmv, dry basis, corrected to 15 percent oxygen.

2. If a boiler or a process heater is used as the gas control device, the landfill gas stream must be introduced into the flame zone. Where the landfill gas is the primary fuel for the boiler or process heater, introduction of the landfill gas stream into the flame zone is not required.

3. The gas control device must be operated within the parameter ranges established during the initial or most recent source test.

(B) Route the collected gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions vented to the atmosphere from the gas treatment system are subject to the requirements of sections 95464(b)(2).

(4) *Source Test Requirements:* The owner or operator must conduct an annual source test for any gas control device(s) subject to the requirements of sections 95464(b)(2) or 95464(b)(3)(A) using the test methods identified in 95471(f). An initial source test must be conducted within 180 days of initial start up of the gas collection and control system. Each succeeding complete annual source test must be conducted no later than 45 days after the anniversary date of the initial source test.

(c) *Wellhead Gauge Pressure Requirement:* Each wellhead must be operated under a vacuum (negative pressure), except as provided in sections 95464(d) and 95464(e), or under any of the following conditions:

(1) Use of a geomembrane or synthetic cover. The owner or operator must develop acceptable pressure limits for the wellheads and include them in the Design Plan; or

(2) A decommissioned well.

(d) *Well Raising:* The requirements of sections 95464(b)(1)(A), 95464(b)(1)(B), and 95464(c), do not apply to individual wells involved in well raising provided the following conditions are met:

(1) New fill is being added or compacted in the immediate vicinity around the well.

(2) Once installed, a gas collection well extension is sealed or capped until the raised well is reconnected to a vacuum source.

(e) *Repairs and Temporary Shutdown of Gas Collection System Components:* The requirements of sections 95464(b)(1)(A), 95464(b)(1)(B), and 95464(c), do not apply to individual landfill gas collection system components that must be temporarily shut down in order to repair the components, due to catastrophic events such as earthquakes, to connect new landfill gas collection system components to the existing system, to extinguish landfill fires, or to perform construction activities pursuant to section 95466, provided the following requirements are met:

(1) Any new gas collection system components required to maintain compliance with this subarticle must be included in the most recent Design Plan pursuant to section 95464(a)(4).

(2) Methane emissions are minimized during shutdown pursuant to section 95464(a)(1)(E).

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95465. Surface Methane Emission Limits**

(a) Except as provided in sections 95464(d), 95464(e), and 95466, beginning January 1, 2011, no location on the MSW landfill surface may exceed either of the following methane concentration limits:

(1) 500 ppmv, other than non-repeatable, momentary readings, as determined by instantaneous surface emissions monitoring.

(2) An average methane concentration limit of 25 ppmv as determined by integrated surface emissions monitoring.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95466. Construction Activities**

(a) The requirements of section 95465 do not apply to the working face of the landfill or to areas of the landfill surface where the landfill cover material has been removed and refuse has been exposed for the purpose of installing, expanding, replacing, or repairing components of the landfill gas, leachate, or gas condensate collection and removal system, or for law enforcement activities requiring excavation.

(b) Any new gas collection system components, or modifications to the existing system, must be included in the Design Plan pursuant to section 95464(a).

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95467. Permanent Shutdown and Removal of the Gas Collection and Control System**

(a) The gas collection and control system at a closed MSW landfill can be capped or removed provided the following requirements are met:

(1) The gas collection and control system was in operation for at least 15 years, unless the owner or operator can demonstrate to the satisfaction of the Executive Officer that due to declining methane rates the MSW landfill will be unable to operate the gas collection and control system for a 15-year period.

(2) Surface methane concentration measurements do not exceed the limits specified in section 95465.

(3) The owner or operator submits an Equipment Removal Report to the Executive Officer pursuant to section 95470(b)(2).

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

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## § 95468. Alternative Compliance Options

(a) The owner or operator may request alternatives to compliance measures, monitoring requirements, test methods and procedures of sections 95464, 95469, and 95471. Any alternatives requested by the owner or operator must be submitted in writing to the Executive Officer. Alternative compliance option requests may include, but are not limited to, the following:

(1) Semi-continuous operation of the gas collection and control system due to insufficient landfill gas flow rates.

(2) Additional time allowance for leak repairs for landfills having consistent issues related to the procurement and delivery of necessary parts to complete the repair.

(3) Alternative wind speed requirements for landfills consistently having winds in excess of the limits specified in this subarticle.

(b) Criteria that the Executive Officer may use to evaluate alternative compliance option requests include, but are not limited to: compliance history; documentation containing the landfill gas flow rate and measured methane concentrations for individual gas collection wells or components; permits; component testing and surface monitoring results; gas collection and control system operation, maintenance, and inspection records; and historical meteorological data.

(c) The Executive Officer will review the requested alternatives and either approve or disapprove the alternatives within 120 days. The Executive Officer may request that additional information be submitted as part of the review of the requested alternatives.

(1) If a request for an alternative compliance option is denied, the Executive Officer will provide written reasons for the denial.

(2) The Executive Officer must deny the approval of any alternatives not providing equivalent levels of enforceability or methane emission control.

(3) The decision of the Executive Officer is final.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

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## § 95469. Monitoring Requirements

(a) *Surface Emissions Monitoring Requirements:* Any owner or operator of a MSW landfill with a gas collection and control system must conduct instantaneous and integrated surface monitoring of the landfill surface quarterly using the procedures specified in section 95471(c).

(1) *Instantaneous Surface Monitoring:* Any reading exceeding the limit specified in section 95465(a)(1) must be recorded as an exceedance and the following actions must be taken:

(A) The owner or operator must record the date, location, and value of each exceedance, along with re-test dates and results. The location of each exceedance must be clearly marked and identified on a topographic map of the MSW landfill, drawn to scale with the location of both the grids and the gas collection system clearly identified.

(B) The owner or operator must initiate corrective action, such as, but not limited to, cover maintenance or repair, or well vacuum adjustments, within five calendar days of a measured exceedance.

(C) The location of the exceedance must be re-monitored within 10 calendar days of the date that the exceedance was measured.

1. If the re-monitoring of the location shows a second exceedance, additional corrective action must be taken and the location must be re-monitored again no later than 10 calendar days after the second exceedance.

2. If the re-monitoring shows a third exceedance, the owner or owner or operator must install a new or replacement well as determined to achieve compliance no later than 120 calendar days after detecting the third exceedance.

(D) Any closed or inactive MSW landfill, or any closed or inactive areas on an active MSW landfill that has no monitored exceedances of the limit specified in section 95465(a)(1) after four consecutive quarterly monitoring periods may monitor annually. Any exceedances of the limits specified in section 95465(a)(1) detected during the annual monitoring that can not be remediated within 10 calendar days will result in a return to quarterly monitoring of the affected grids.

(E) Any exceedances of the limit specified in section 95465(a)(1) detected during any compliance inspections by the Air Resources



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Board will result in a return to quarterly monitoring of the affected grids.

(2) *Integrated Surface Monitoring:* Any reading exceeding the limit specified in section 95465(a)(2) must be recorded as an exceedance and the following actions must be taken:

(A) The owner or operator must record the average surface concentration measured as methane for each grid along with re-test dates and results. The location of the grids and the gas collection system must be clearly marked and identified on a topographic map of the MSW landfill drawn to scale.

(B) The owner or operator must initiate corrective action, such as, but not limited to, cover maintenance or repair, or well vacuum adjustments, within five calendar days of a measured exceedance.

(C) The grid exceeding the limit specified in section 95465(a)(2) must be re-monitored within 10 calendar days of the date that the exceedance was first measured.

1. If the re-monitoring of the grid shows a second exceedance, additional corrective action must be taken and the location must be re-monitored again no later than 10 calendar days after the second exceedance.

2. If the re-monitoring shows a third exceedance, the owner or operator must install a new or replacement well as determined to achieve compliance no later than 120 calendar days after detecting the third exceedance.

(D) Any closed or inactive MSW landfill, or any closed or inactive areas on an active MSW landfill that has no monitored exceedances of the limit specified in section 95465(a)(2) after 4 consecutive quarterly monitoring periods may monitor annually. Any exceedances of the limits specified in section 95465(a)(2) detected during the annual monitoring that can not be remediated within 10 calendar days will result in a return to quarterly monitoring of the affected grids.

(E) Any exceedances of the limits specified in section 95465(a)(2) detected during any compliance inspections by the Air Resources Board will result in a return to quarterly monitoring of the affected grids.

(b) *Gas Control System Equipment Monitoring:* The owner or operator must monitor the gas control system using the following procedures:

(1) For enclosed combustors the following equipment must be installed, calibrated, maintained, and operated according to the manufacturer's specifications:

(A) A temperature monitoring device equipped with a continuous recorder which has an accuracy of plus or minus (±) 1 percent of the temperature being measured expressed in degrees Celsius or Fahrenheit. A temperature monitoring device is not required for boilers or process heaters with design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater.

(B) At least one gas flow rate measuring device which must record the flow to the control device(s) at least every 15 minutes.

(2) For a gas control device other than an enclosed combustor, demonstrate compliance by providing information describing the operation of the gas control device, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. Alternatives to this section must be submitted as specified in section 95468. The Executive Officer may specify additional monitoring procedures.

(3) Components containing landfill gas and under positive pressure must be monitored quarterly for leaks. Any component leak must be tagged and repaired within 10 calendar days.

(A) Component leak testing at MSW landfills having landfill gas-to-energy facilities may be conducted prior to scheduled maintenance or during planned outage periods.

(c) *Wellhead Monitoring:* The owner or operator must monitor each individual wellhead monthly to determine the gauge pressure. If there is any positive pressure reading other than as provided in sections 95464(d) and 95464(e), the owner or operator must take the following actions:

(1) Initiate corrective action within five calendar days of the positive pressure measurement.

(2) If the problem cannot be corrected within 15 days of the date the positive pressure was first measured, the owner or operator must initiate further action, including, but not limited to, any necessary expansion of the gas collection system, to mitigate any positive pressure readings.

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(3) Any expansion of the gas collection system must be completed and all new wells must be operating within 120 days of the date the positive pressure was first measured.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95470. Recordkeeping and Reporting Requirements.**

(a) *Recordkeeping Requirements.*

(1) An owner or operator must maintain the following records for at least five years:

(A) All gas collection system downtime exceeding five calendar days, including individual well shutdown and disconnection times, and the reason for the downtime.

(B) All gas control system downtime in excess of one hour, the reason for the downtime, and the length of time the gas control system was shutdown.

(C) Expected gas generation flow rate calculated pursuant to section 95471(e).

(D) Records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring, and the re-monitored concentration in ppmv, wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion.

(E) Records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken.

(F) Annual solid waste acceptance rate and the current amount of waste-in-place.

(G) Records of the nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system.

(H) Results of any source tests conducted pursuant to section 95464(b)(4).

(I) Records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere when solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; during repairs or the temporary shutdown of gas collection system components; or, when solid waste was excavated and moved.

(J) Records of any construction activities pursuant to section 95466. The records must contain the following information:

1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions.

2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components.

3. A description of the mitigation measures taken to minimize methane and other potential air quality impacts.

(K) Records of the equipment operating parameters specified to be monitored under sections 95469(b)(1) and 95469(b)(2) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information:

1. For enclosed combustors, except for boilers and process heaters with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater, all 3-hour periods of operation during which the average temperature was more than 28 degrees Celsius (82 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) and 95464(b)(3)(A) was determined.

2. For boilers or process heaters, whenever there is a change in the location at which the vent stream is introduced into the flame zone pursuant to section 95464(b)(3)(A)2.

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3. For any owner or operator who uses a boiler or process heater with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater to comply with section 95464(b)(3), all periods of operation of the boiler or process heater (e.g., steam use, fuel use, or monitoring data collected pursuant to other Federal, State, local, or Tribal regulatory requirements).

(2) The owner or operator must maintain the following records for the life of each gas control device, as measured during the initial source test or compliance determination:

(A) The control device vendor specifications.

(B) The expected gas generation flow rate as calculated pursuant to section 95471(e).

(C) For enclosed combustors, except for boilers and process heaters with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater:

1. The average temperature measured at least every 15 minutes and averaged over the same time period of the performance test.

2. The percent reduction of methane achieved by the control device determined pursuant to section 95471(f).

(D) For a boiler or process heater, the description of the location at which the collected gas vent stream is introduced into the boiler or process heater over the same time period of the performance test.

(E) For an open flare: the flare type (i.e., steam-assisted, air-assisted, or non-assisted); all visible emission readings, heat content determination, flow rate or bypass flow rate measurements, and exit velocity determinations made during the performance test as specified in CFR 40 60.18 (Promulgated 1/21/86); and records of the flare pilot flame or flare flame monitoring and records of all periods of operations during which the pilot flame or the flare flame is absent.

(3) *Record Storage:* The owner or operator must maintain copies of the records and reports required by this subarticle and provide them to the Executive Officer within five business days upon request. Records and reports must be kept at a location within the State of California.

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(b) *Reporting Requirements.*

(1) *Closure Notification:* Any owner or operator of a MSW landfill which has ceased accepting waste must submit a Closure Notification to the Executive Officer within 30 days of waste acceptance cessation.

(A) The Closure Notification must include the last day solid waste was accepted, the closure date of the MSW landfill, and the estimated waste-in-place.

(B) The Executive Officer may request additional information as necessary to verify that permanent closure has taken place in accordance with the requirements of any applicable Federal, State, local, or Tribal statues, regulations, and ordinances in effect at the time of closure.

(2) *Equipment Removal Report:* A gas collection and control system Equipment Removal Report must be submitted to the Executive Officer 30 days prior to well capping, removal or cessation of operation of the gas collection, treatment, or control system equipment. The report must contain all of the following information:

(A) A copy of the Closure Notification submitted pursuant to section 95470(b)(1).

(B) A copy of the initial source test report or other documentation demonstrating that the gas collection and control system has been installed and operated for a minimum of 15 years, unless the owner or operator can demonstrate to the satisfaction of the Executive Officer that due to declining methane rates the landfill is unable to operate the gas collection and control system for a 15-year period.

(C) Surface emissions monitoring results needed to verify that landfill surface methane concentration measurements do not exceed the limits specified in section 95465.

(3) *Annual Report:* Any owner or operator subject to the requirements of this subarticle, except section 95463, must prepare an annual report for the period of January 1 through December 31 of each year. Each subsequent annual report must be submitted to the Executive Officer by March 15 of the following year. The annual report must contain the following information:

(A) MSW landfill name, owner and operator, address, and solid waste information system (SWIS) identification number.

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(B) Total volume of landfill gas collected (reported in standard cubic feet).

(C) Average composition of the landfill gas collected over the reporting period (reported in percent methane and percent carbon dioxide by volume).

(D) Gas control device type, year of installation, rating, fuel type, and total amount of landfill gas combusted in each control device.

(E) The date that the gas collection and control system was installed and in full operation.

(F) The percent methane destruction efficiency of each gas control device(s).

(G) Type and amount of supplemental fuels burned with the landfill gas in each device.

(H) Total volume of landfill gas shipped off-site, the composition of the landfill gas collected (reported in percent methane and percent carbon dioxide by volume), and the recipient of the gas.

(I) Most recent topographic map of the site showing the areas with final cover and a geomembrane and the areas with final cover without a geomembrane with corresponding percentages over the landfill surface.

(J) The information required by sections 95470(a)(1)(A), 95470(a)(1)(C), 95470(a)(1)(D), 95470(a)(1)(E), and 95470(a)(1)(F).

(4) *Waste-in-Place Report*: Any owner or operator subject to the requirements of sections 95463(a), 95463(b), or 95643(c)(2)(B) must report the following information to the Executive Officer within 90 days of the effective date of this subarticle:

(A) MSW landfill name, owner and operator, address, and solid waste information system (SWIS) identification number.

(B) The landfill's status (active, closed, or inactive) and the estimated waste-in-place, in tons.

(C) Most recent topographic map of the site showing the areas with final cover and a geomembrane and the areas with final cover

without a geomembrane with corresponding percentages over the landfill surface.

(5) *Landfill Gas Heat Input Capacity Report:* Any owner or operator subject to the requirements of section 95463(c) must calculate the landfill gas heat input capacity using the calculation procedures specified in section 95471(b) and report the results to the Executive Officer. The calculation, along with relevant parameters, must be provided as part of the report.

(6) Any report, or information submitted pursuant to this subarticle must contain certification by a responsible official of truth, accuracy, and completeness. This certification, and any other certification required under this subarticle, must state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95471. Test Methods and Procedures**

(a) *Hydrocarbon Detector Specifications*: Any instrument used for the measurement of methane must be a gas detector or other equivalent instrument approved by the Executive Officer that meets the calibration, specifications, and performance criteria of EPA Reference Method 21, Determination of Volatile Organic Compound Leaks, 40 CFR Part 60, Appendix A (as last amended 65 Fed.Reg. 61744 (October 17, 2000)), which is incorporated by reference herein, except for the following:

(1) “Methane” replaces all references to volatile organic compounds (VOC).

(2) The calibration gas shall be methane.

(b) *Determination of Landfill Gas Heat Input Capacity:* The landfill gas heat input capacity must be determined pursuant to sections 95471(b)(1), 95471(b)(2), or 95471(b)(3), as applicable:

(1) *MSW Landfills without Carbon Adsorption or Passive Venting Systems:* The heat input capacity must be calculated using the procedure as specified in Appendix I. The Executive Officer may request additional information as may be necessary to verify the heat input capacity from the MSW landfill. Site-specific data may be substituted when available.

(2) *MSW Landfills with Carbon Adsorption Systems:* The landfill gas heat capacity must be determined by measuring the actual total landfill gas flow rate, in standard cubic feet per minute (scfm), using a flow meter or other flow measuring device such as a standard pitot tube and methane concentration (percent by volume) using a hydrocarbon detector meeting the requirements of 95471(a). The total landfill gas flow rate must be multiplied by the methane concentration and then multiplied by the gross heating value (GHV) of methane of 1,012 Btu/scf to determine the landfill gas heat input capacity.

(3) *MSW Landfills with Passive Venting Systems:* The landfill gas heat input capacity must be determined pursuant to both of the following and is the higher of those determined values:

(A) Section 95471(b)(1); and

(B) The owner or operator must measure actual landfill gas flow rates (in units of scfm) by using a flow measuring device such as a standard pitot tube and methane concentration (percent by volume) using a hydrocarbon detector meeting the requirements of 95471(a) from each venting pipe that is within the waste mass. Each gas flow rate must then be multiplied by its corresponding methane concentration to obtain the individual methane flow rate. The individual methane flow rates must be added together and then multiplied by the GHV of methane of 1,012 Btu/scf to determine the landfill gas heat input capacity.

(c) *Surface Emissions Monitoring Procedures:* The owner or operator must measure the landfill surface concentration of methane using a hydrocarbon detector meeting the requirements of section 95471(a). The landfill surface must be inspected using the following procedures:

(1) *Monitoring Area:* The entire landfill surface must be divided into individually identified 50,000 square foot grids. The grids must be used for both instantaneous and integrated surface emissions monitoring.

(A) Testing must be performed by holding the hydrocarbon detector's probe within 3 inches of the landfill surface while traversing the grid.

(B) The walking pattern must be no more than a 25-foot spacing interval and must traverse each monitoring grid.

1. If the owner or operator has no exceedances of the limits specified in section 95465 after four consecutive quarterly monitoring periods, the walking pattern spacing may be increased to 100-foot intervals. The owner or operator must

return to a 25-foot spacing interval upon any exceedances of the limits specified in section 95465 that cannot be remediated within 10 calendar days or upon any exceedances detected during a compliance inspection by the Air Resources Board.

(C) Portions of slopes that are 30 degrees and greater, wet or icy surfaces, construction areas, and other dangerous areas may be excluded from landfill surface inspection.

(D) Surface testing must be terminated when the average wind speed exceeds five miles per hour or the instantaneous wind speed exceeds 10 miles per hour. The Executive Officer may approve alternatives to this wind speed surface testing termination for MSW landfills consistently having measured winds in excess of these specified limits. Average wind speed must be determined on a 15-minute average using an on-site anemometer with a continuous recorder for the entire duration of the monitoring event.

(E) Surface emissions testing must be conducted only when there has been no measurable precipitation in the preceding 72 hours.

(2) *Instantaneous Surface Emissions Monitoring Procedures.*

*(A)* The owner or operator must record any instantaneous surface readings of methane 200 ppmv or greater.

(B) Surface areas of the MSW landfill that exceed a methane concentration limit of 500 ppmv must be marked and remediated pursuant to section 95469(a)(1).

(C) The wind speed must be recorded during the sampling period.

(D) The landfill surface areas with cover penetrations, distressed vegetation, cracks or seeps must also be inspected visually and with a hydrocarbon detector.

(3) *Integrated Surface Emissions Monitoring Procedures.*

(A) The integrated surface sample must be taken while walking a course of approximately 2,600 linear feet over a 25-minute period.

(B) Integrated surface readings must be recorded and then averaged for each grid.

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(B) Individual monitoring grids that exceed an average methane concentration of 25 ppmv must be identified and remediated pursuant to section 95469(a)(2).

(C) The wind speed must be recorded during the sampling period.

(d) *Gas Collection and Control System Leak Inspection Procedures.* Leaks must be measured using a hydrocarbon detector meeting the requirements of 95471(a).

(e) *Determination of Expected Gas Generation Flow Rate.* The expected gas generation flow rate must be determined as prescribed in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Chapter 3, which is incorporated by reference herein, using a recovery rate of 75 percent.

(f) *Control Device Destruction Efficiency Determination*. U.S. EPA Reference Method 18, Measurement of Gaseous Organic Compound Emissions By Gas Chromatography (40 CFR, Part 60, Appendix A, as last amended 65 Fed.Reg. 61744 (October 17, 2000)), which is incorporated by reference herein, must be used to determine the efficiency of the control device in reducing methane by at least 99 percent, or in reducing the outlet methane concentration to less than 3,000 ppmv, dry basis, corrected to 15 percent oxygen for lean burn engines. The following equation must be used to calculate destruction efficiency:

$$Destruction\ Efficiency = \left[1 - \left(\frac{Mass\ of\ Methane - Outlet}{Mass\ of\ Methane - Inlet}\right)\right] \times 100\%$$

(g) *Determination of Gauge Pressure.* Gauge pressure must be determined using a hand-held manometer, magnahelic gauge, or other pressure measuring device approved by the Executive Officer. The device must be calibrated and operated in accordance with the manufacture's specifications.

(h) *Alternative Test Methods*. Alternative test methods may be used provided that they are approved in writing by the Executive Officer.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95472. Penalties**

Any violation of this Subarticle may be punished pursuant to Health and Safety Code section 38580 and may be enjoined pursuant to Health and Safety Code section 41513.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95473. Right of Entry**

For purposes of inspecting MSW landfills covered in this subarticle, and inspecting or auditing the records required by this regulation or obtaining samples, an employee of the Air Resources Board or its designee, upon presentation of proper credentials, has the right to enter any facility (with any necessary safety clearances) where the landfill is located or records are kept.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95474. Fees**

An owner or operator of a MSW landfill must pay any fees assessed by a District for the purpose of recovering the District's cost of implementing and assisting with enforcing the requirements of this subarticle.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95475. Applicability of Other Rules and Regulations**

Compliance with this regulation does not exempt a person from complying with other federal, State, or local law, including but not limited to, California Health and Safety Code Section 41700; rules pertaining to visible emissions, nuisance, or fugitive dust, or from permitting requirements of a District, the Regional Water Quality Control Board, local enforcement agencies, the Integrated Waste Management Board, and other local, state, and federal agencies.

**§ 95476. Definitions**

(a) For purposes of this subarticle, the following definitions apply:

(1) "Active MSW Landfill" means a MSW landfill that is accepting solid waste for disposal.

(2) "Component Leak" means the concentration of methane measured one half of an inch or less from a component source that exceeds 500 parts per million by volume (ppmv), other than non-repeatable, momentary

readings. Measurements from any vault must be taken within 3 inches above the surface of the vault exposed to the atmosphere.

(3) "Component" means any equipment that is part of the gas collection and control system and that contains landfill gas including, but not limited to, wells, pipes, flanges, fittings, valves, flame arrestors, knock-out drums, sampling ports, blowers, compressors, or connectors. Vaults containing gas collection system equipment, where the top of the vault is located at or near the surface of the landfill, are also considered as components.

(4) "Continuous Operation" means that the gas collection and control system is operated continuously, the existing gas collection wells are operating under vacuum while maintaining landfill gas flow, and the collected landfill gas is processed by a gas control system 24 hours per day.

(5) "Closed MSW Landfill" means that a MSW landfill is no longer accepting solid waste for disposal and has documentation that the closure was conducted in accordance with the applicable statutes, regulations, and local ordinances in effect at the time of closure, or can document that the landfill is no longer receiving solid waste.

(6) "District" means any air quality management district or air pollution control district in the State of California.

(7) "Destruction Efficiency" means a measure of the ability of a gas control device to combust, transform, or otherwise prevent emissions of methane from entering the atmosphere.

(8) "Enclosed Combustor" means an enclosed flare, steam generating boiler, internal combustion engine, or gas turbine.

(9) "Energy Recovery Device" means any combustion device which uses landfill gas to recover energy in the form of steam or electricity, including, but not limited to, gas turbines, internal combustion engines, boilers, and boiler-to-steam turbine systems.

(10) "Exceedance" means the concentration of methane measured within 3 inches above the landfill surface that exceeds 500 ppmv, other than non-repeatable, momentary readings, as determined by instantaneous surface emissions monitoring; or the average methane concentration measurements exceed 25 ppmv, as determined by integrated surface emissions monitoring.

(11) "Executive Officer" means the Executive Officer of the Air Resources Board, or his or her delegate.

(12) "Facility Boundary" means the boundary surrounding the entire area on which MSW landfill activities occur and are permitted.

(13) "Gas Control Device" means any device used to dispose of or treat collected landfill gas, including, but not limited to, enclosed flares, internal combustion engines, boilers and boiler-to-steam turbine systems, fuel cells, and gas turbines.

(14) "Gas Collection System" means any system which employs various gas collection wells and connected piping, and mechanical blowers, fans, pumps, or compressors to create a pressure gradient and actively extract landfill gas.

(15) "Gas Control System" means any system which disposes of or treats collected landfill gas by one or more of the following means: combustion, gas treatment for subsequent sale, or sale for processing offsite, including for transportation fuel and injection into the natural gas pipeline.

(16) "Inactive MSW Landfill" means a MSW landfill that is no longer accepting solid waste for disposal.

(17) "Landfill Gas" means any untreated, raw gas derived through a natural process from the decomposition of organic waste deposited in a MSW landfill, from the evolution of volatile species in the waste, or from chemical reactions of substances in the waste.

(18) "Landfill Surface" means the area of the landfill under which decomposable solid waste has been placed, excluding the working face.

(19) "Municipal Solid Waste Landfill" or "MSW Landfill" means an entire disposal facility in a contiguous geographical space where solid waste is placed in or on land.

(20) "Non-decomposable Solid Waste" means materials which do not degrade biologically to form landfill gas. Examples include, but are not limited to, earth, rock, concrete asphalt paving fragments, clay products, inert slag, asbestos-containing waste, and demolition materials containing minor amounts (less than 10 percent by volume) of wood and metals. Materials that do not meet this definition are considered decomposable solid waste.

(21) "Non-repeatable, Momentary Readings" means indications of the presence of methane, which persist for less than five seconds and do not recur when the sampling probe of a portable gas detector is placed in the same location.

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(22) "Operator" means any person or entity, including but not limited to any government entity, corporation, partnership, trustee, other legal entity, or individual that:

(A) Operates the MSW landfill;

(B) Is responsible for complying with any federal, state, or local requirements relating to methane emissions from real property used for MSW landfill purposes and subject to this subarticle;

(C) Operates any stationary equipment for the collection of landfill gas;

(D) Purchases the landfill gas from an owner or operator of a MSW landfill and operates any stationary equipment for the treatment of landfill gas; or

(E) Purchases untreated landfill gas from an owner or operator of a MSW landfill and operates any stationary equipment for the combustion of landfill gas.

(23) "Owner" means any person or entity, including but not limited to any government entity, corporation, partnership, trustee, other legal entity, or individual that:

(A) Holds title to the real property on which the MSW landfill is located, including but not limited to title held by joint tenancy, tenancy in common, community property, life estate, estate for years, lease, sublease, or assignment, except title held solely as security for a debt such as mortgage;

(B) Is responsible for complying with any federal, state, or local requirements relating to methane emissions from real property used for MSW landfill purposes and subject to this subarticle.

(C) Owns any stationary equipment for the collection of landfill gas;

(D) Purchases the landfill gas from an owner or operator of a MSW landfill and owns any stationary equipment for the treatment of landfill gas; or

(E) Purchases untreated landfill gas from an owner or operator of a MSW landfill and owns any stationary equipment for the combustion of landfill gas.

(24) "Perimeter" means along the MSW landfill's permitted facility boundary.

(25) "Professional Engineer" means an engineer holding a valid certificate issued by the State of California Board of Registration for Professional Engineers and Land Surveyors or a state offering reciprocity with California.

(26) "Solid Waste" means all decomposable and non-decomposable solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial waste, manure, vegetable or animal solid and semisolid wastes, sludge, and other discarded solid and semisolid wastes. Solid waste also includes any material meeting the definition of Solid Waste in 40 CFR 60.751 (as last amended 64 Fed.Reg 9262, Feb 24, 1999).

(27) "Subsurface Gas Migration" means underground landfill gases that are detected at any point on the perimeter pursuant to California Code of Regulations Title 27, section 20921.

(28) "Vault" means any structure located at or near the surface of a MSW landfill that houses any part of the landfill gas collection system.

(29) "Waste-in-Place" means the total amount of solid waste placed in the MSW landfill estimated in tons. The refuse density is assumed to be 1,300 pounds per cubic yard and the decomposable fraction is assumed to be 70 percent by weight unless other site-specific factors are submitted to and approved by the Executive Officer.

(30) "Well Raising" means a MSW landfill activity where an existing gas collection well is temporarily disconnected from a vacuum source, and the non-perforated pipe attached to the well is extended vertically to allow the addition of a new layer of solid waste or the final cover; or is extended horizontally to allow the horizontal extension of an existing layer of solid waste or cover material. The extended pipe (well extension) is then re-connected in order to continue collecting gas from that well.

(31) "Working Face" means the open area where solid waste is deposited daily and compacted with landfill equipment.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

**§ 95477. Severability**

Each part of this subarticle is deemed severable, and in the event that any part of this subarticle is held to be invalid, the remainder of this subarticle continues in full force and effect.

Note: Authority cited: Sections 38501, 38510, 38560, 38560.5, 38580, 39600, and 39601, Health and Safety Code. Reference: Sections 38501, 38505, 38510, 38550, 38551, 38560, 38560.5, 39003, 39500, 39600, and 39601, Health and Safety Code.

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### *1.0 Calculate Heat Input Capacity*

Heat Input Capacity (MMBtu/hr) = Methane Gas Generation (scfm) x 60 minutes/1 hour x Collection Efficiency x GHV x 1 MMBtu/1,000,000 Btu

Where:

Collection Efficiency = the landfill gas collection efficiency in percent (%), which is 75 percent.

GHV (Gross Heating Value) = Gross heating value of methane, which is 1,012 in units of British thermal units per standard cubic feet, or Btu/scf; source: http://epa.gov/lmop/res/converter.htm).

***2.0 Methane Gas Generation:*** $CH_4$ Generation is calculated using the following equation:

$$CH_4 \text{ Generation (Mg of } CH_4) = \{ANDOC_{year\text{-}start} \times [1-e^{-[k]}] - ANDOC_{deposited\text{-}last\ year} \times [1/k \times (e^{-[k \times (1-M/12)]} - e^{-[k]}) - (M/12) \times e^{-[k]}] + ANDOC_{deposited\text{-}same\ year} \times [1-((1/k) \times (1-e^{-[k \times (1-M/12)]} + (M/12))]\} \times FCH_4$$

Where:

$CH_4$ Generation = $CH_4$ generated in the inventory year in question (Mg of $CH_4$) using the Mathematically Exact First-Order Decay Model provided in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Chapter 3 (Source: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf).

$FCH_4$ = Fraction of decomposing carbon converted into $CH_4$ (Default = 0.5)

$ANDOC_{year\text{-}start}$ = ANDOC in place at the beginning of the inventory year in question

$ANDOC_{deposited\text{-}last\ year}$ = ANDOC deposited during the previous inventory year

$ANDOC_{deposited\text{-}same\ year}$ = ANDOC deposited during the inventory year in question

### *3.0 To Convert Methane Generated from Mg of $CH_4$ to SCFM*

*$CH_4$ Gas Generated (scfm) = $CH_4$ Generation (Mg/year) x 1 year/ 525,600 minutes x 1,000,000 g/Mg x 1 mole $CH_4$/16.04246 g $CH_4$ x 0.83662 SCF/mole landfill gas*

### *4.0 Define ANDOC%*

$ANDOC\% = \Sigma WIPFRAC_i \times TDOC_i \times DANF_i$

Where:

WIPFRACi = Fraction of the $i^{th}$ component in the waste-in-place

TDOCi = Total Degradable Organic Carbon fraction of the ith waste component (Mg of that component/Mg of Total waste-in-place

DANFi = Decomposable Anaerobic Fraction of the $i^{th}$ waste component, that fraction capable of decomposition in anaerobic conditions (Mg of decomposable carbon for that component/Mg TDOCi for that component)

### *5.0 Define ANDOC*

*ANDOC = WIP (Tons) x 0.9072 (Mg/Ton) x ANDOC%*

Where:

ANDOC = Anaerobically Degradable Organic Carbon, carbon that is capable of decomposition in an anaerobic environment (Mg of carbon)

WIP = Waste-in-Place estimate of all the landfilled waste (wet weight) as reported to the CIWMB (tons)

### *6.0 Calculate $ANDOC_{year\text{-}end}$*

$ANDOC_{year\text{-}end} = ANDOC_{year\text{-}start} \times e^{-[k]} + ANDOC_{deposited\text{-}last\ year} \times [1/k \times (e^{-[k \times (1-M/12)]} - e^{-[k]}) - (M/12) \times e^{-[k]}] + ANDOC_{deposited\text{-}same\ year} \times [(1/k) \times (1-e^{-[k \times (1-M/12)]} + (M/12)]$

Where:

$ANDOC_{year\text{-}end}$ = ANDOC remaining undecomposed at the end of the inventory year in question

$ANDOC_{year\text{-}start}$ = ANDOC in place at the beginning of the inventory year in question

$ANDOC_{deposited\text{-}last\ year}$ = ANDOC deposited during the previous inventory year

$ANDOC_{deposited\text{-}same\ year}$ = ANDOC deposited during the inventory year in question

M = Assumed delay before newly deposited waste begins to undergo anaerobic decomposition (Months, Default = 6)

k = Assumed rate constant for anaerobic decomposition; k = ln2/half-life (years); half-life is the number of years required for half of the original mass of carbon to degrade

The following values for the assumed rate constant for anaerobic decomposition (or "k") must be used:

| Average Rainfall (Inches/Year) | k Value |
|---|---|
| <20 | 0.020 |
| 20-40 | 0.038 |
| >40 | 0.057 |

Source: U.S. EPA http//ww.ncgc.nrcs.usda.gov/products/datasets/climate/data/precipitation-state/ca.html.

The following waste characterization default values shown in Tables 1A, 1B, 2 and 3 in addition to the model equations must be used in estimating the methane generation potential for a MSW landfill:

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| **Table 1A** | **Waste Type (%) by Year** | | | | |
|---|---|---|---|---|---|
| **Waste Type** | **Up to 1964** | **1965-1974** | **1975-1984** | **1985-1992** | **1993-1995** |
| Newspaper | 6.4% | 6.4% | 5.9% | 4.8% | 3.9% |
| Office Paper | 10.7% | 11.3% | 12.0% | 13.1% | 15.0% |
| Corrugated Boxes | 10.8% | 13.5% | 11.5% | 10.5% | 10.3% |
| Coated Paper | 2.2% | 2.0% | 2.4% | 2.1% | 1.8% |
| Food | 14.8% | 11.3% | 9.5% | 12.1% | 13.4% |
| Grass | 12.1% | 10.3% | 10.1% | 9.0% | 6.6% |
| Leaves | 6.1% | 5.1% | 5.0% | 4.5% | 3.3% |
| Branches | 6.1% | 5.1% | 5.0% | 4.5% | 3.3% |
| Lumber | 3.7% | 3.3% | 5.1% | 7.0% | 7.3% |
| Textiles | 2.1% | 1.8% | 1.7% | 3.3% | 4.5% |
| Diapers | 0.1% | 0.3% | 1.4% | 1.6% | 1.9% |
| Construction/Demolition | 2.6% | 2.5% | 3.5% | 3.9% | 4.5% |
| Medical Waste | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Sludge/Manure | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Source: US EPA Municipal Solid Waste publication: http://www.epa.gov/msw/pubs/03data.pdf. | | | | | |

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| **Table 1B** | **Waste Type (%) by Year** | |
|---|---|---|
| **Waste Type** | **1996-2002[1]** | **2003-present[2]** |
| Newspaper | 4.3% | 2.2% |
| Office Paper | 4.4% | 2.0% |
| Corrugated Boxes | 4.6% | 5.7% |
| Coated Paper | 16.9% | 11.1% |
| Food | 15.7% | 14.6% |
| Grass | 5.3% | 2.8% |
| Leaves | 2.6% | 1.4% |
| Branches | 2.4% | 2.6% |
| Lumber | 4.9% | 9.6% |
| Textiles | 2.1% | 4.4% |
| Diapers | 6.9% | 4.4% |
| Construction/Demolition | 6.7% | 12.1% |
| Medical Waste | 0.0% | 0.0% |
| Sludge/Manure | 0.1% | 0.1% |

Source:
[1]CIWMB Statewide Waste Characterization Study (1999).
[2]CIWMB Statewide Waste Characterization Study (2004).

| **Table 2** | | |
|---|---|---|
| **Waste Type** | **TDOC** | **Source** |
| Newspaper | 46.5% | EPA |
| Office Paper | 39.8% | EPA |
| Corrugated Boxes | 40.5% | EPA |
| Coated Paper | 40.5% | EPA |
| Food | 11.7% | EPA |
| Grass | 19.2% | EPA |
| Leaves | 47.8% | EPA |
| Branches | 27.9% | EPA |
| Lumber | 43.0% | IPCC |
| Textiles | 24.0% | IPCC |
| Diapers | 24.0% | IPCC |
| Construction/Demolition | 4.0% | IPCC |
| Medical Waste | 15.0% | IPCC |
| Sludge/Manure | 5.0% | IPCC |

Sources
EPA *Solid Waste Management and Greenhouse Gasses: A Life-Cycle Assessment of Emissions and Sinks,* Exhibits 7-2, 7-3 (May 2002).
IPCC *Guidelines for National Greenhouse Gas Inventories*, Chapter 2, Table 2.4, 2.5 and 2.6 (2006).

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| **Table 3** | | |
|---|---|---|
| **Waste Type** | **DANF** | **Source** |
| Newspaper | 16.1% | EPA |
| Office Paper | 87.4% | EPA |
| Corrugated Boxes | 38.3% | EPA |
| Coated Paper | 21.0% | EPA |
| Food | 82.8% | EPA |
| Grass | 32.2% | EPA |
| Leaves | 10.0% | EPA |
| Branches | 17.6% | EPA |
| Lumber | 23.3% | CEC |
| Textiles | 50.0% | IPCC |
| Diapers | 50.0% | IPCC |
| Construction/Demolition | 50.0% | IPCC |
| Medical Waste | 50.0% | IPCC |
| Sludge/Manure | 50.0% | IPCC |
| Sources:<br>EPA *Solid Waste Management and Greenhouse Gasses: A Life-Cycle Assessment of Emissions and Sinks* Exhibits 7-2, 7-3 (May 2002).<br>CEC *Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004* (December 2006).<br>IPCC *Guidelines for National Greenhouse Gas Inventories*, Chapter 3, 3.13 (2006). | | |

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