California Environmental Protection Agency

AIR RESOURCES BOARD

IMPLEMENTATION GUIDANCE DOCUMENT
FOR THE REGULATION TO REDUCE METHANE EMISSIONS FROM MUNICIPAL SOLID WASTE LANDFILLS

Stationary Source Division
Emissions Assessment Branch

July 2011

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State of California
AIR RESOURCES BOARD

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Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

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ACRONYMS

AB 32	Assembly Bill 32, California Global Warming Solutions Act 2006
ARB or Board	Air Resources Board
CFR	Code of Federal Regulations
EG	Emission Guidelines
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
MMBtu/hr	Million British Thermal Units per hour
MOU	Memorandum of Understanding
MSW	Municipal Solid Waste
NESHAP	National Emission Standards for Hazardous Air Pollutants

ACRONYMS (Cont.)

NMOC	Non-Methane Organic Compounds
NSPS	New Source Performance Standards
ppmv	Parts Per Million by Volume
SWIS	Solid Waste Information System
U.S. EPA	United States Environmental Protection Agency
WIP	Waste-in-Place

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Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

I. INTRODUCTION

A. Purpose of this Document

The purpose of this document is to assist owners and operators of municipal solid waste (MSW) landfills in complying with the requirements of California Code of Regulations, title 17, subchapter 10, article 4, subarticle 6, sections 95460 to 95476, Methane Emissions from Municipal Solid Waste Landfills ("regulation"). This document may also benefit local air districts who entered into an agreement with ARB to implement and enforce the requirements of the regulation. The regulation was developed to reduce methane emissions from MSW landfills. Methane is a potent greenhouse gas (GHG) having a high global warming potential of about 21 times that of carbon dioxide. The Air Resources Board (ARB or Board) approved the regulation for adoption at its June 25, 2009, public hearing. The regulation is a discrete early action GHG reduction measure, as described in the California Global Warming Solutions Act of 2006 (Assembly Bill 32) and became effective on, June 17, 2010.

This document provides an overview of what the regulation requires, compares the regulation to existing requirements for reducing emissions from MSW landfills, explains the process used to determine if a gas collection and control system is required to be installed or if modifications are required to comply with the regulation, and discusses the monitoring, recordkeeping and reporting requirements, and compliance schedule. In addition, the document addresses various topics of concern raised by stakeholders and local air district staff concerning the implementation and enforcement of the regulatory requirements. The document also includes example reporting forms to assist owners and operators in meeting the reporting requirements, and provides an overview of ARB's Landfill Gas Tool, which was developed to assist landfill owners and operators in estimating their landfill's gas heat input capacities and methane emissions. This document is dynamic and will be revised as necessary.

B. Background

1. What does the regulation require?

The regulation requires the installation and proper operation of gas collection and control systems at active, inactive, and closed MSW landfills having 450,000 tons of waste-in-place or greater that received waste after January 1, 1977; unless exemption conditions have been met. The regulation contains performance standards for the gas

collection and control system, and specifies monitoring requirements to ensure that the system is being maintained and operated in a manner to minimize methane emissions. The regulation includes a leak standard for gas collection and control system components, a monitoring requirement for wellheads, methane destruction efficiency requirements for most control devices, surface methane emission standards, and reporting requirements. The structure of the regulation is provided in Table I-1.

Table I-1. Organization of the Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

Title 17, Subchapter 10, Article 4, Subarticle 6	
§95460	Purpose
§95461	Applicability
§95462	Exemptions
§95463	Determination for Installing a Gas Collection and Control System
§95464	Gas Collection and Control System Requirements
§95465	Surface Methane Emissions Standards
§95466	Construction Activities
§95467	Permanent Shutdown and Removal of Gas Collection and Control System
§95468	Alternative Compliance Options
§95469	Monitoring Requirements
§95470	Recordkeeping and Reporting Requirements
§95471	Test Methods and Procedures
§95472	Penalties
§95473	Implementation, Enforcement, and Related Fees
§95474	Applicability of Other Rules and Regulations
§95475	Definitions
§95476	Severability

2. How does the regulation differ from existing requirements for municipal solid waste landfills?

The regulation differs from federal requirements and local air district rules in that the focus is generally on methane and not non-methane organic compounds (NMOCs), it applies to smaller landfills (in addition to larger landfills); and has more stringent requirements for methane collection and control, and component leak testing and surface emissions monitoring. The major differences between existing requirements for MSW landfills and the regulation are provided in Table I-2.

Table I-2. Comparison of the Major Provisions of the Federal Requirements and Landfill Methane Control Measure

		NSPS/EG[1]	Landfill Methane Control Measure
Applicability to Municipal Solid Waste (MSW) Landfills	**Landfill Maximum Design Capacity Or Size Threshold**	*"New"* landfills constructed, reconstructed, modified, or began accepting MSW after 5/30/91. "Existing" landfills constructed, reconstructed, modified, or began accepting MSW after 5/30/91.	Applies to all MSW landfills that received waste after 1/1/77; unless exemption conditions are met.
	< 2.5 million Mg (2.75 million tons)	Must report design capacity. No further requirements.	No requirements for MSW having < 450,000 tons waste-in-place (WIP).
	≥ 2.5 million Mg (2.75 million tons)	Must comply with the requirements of the NSPS/EG.	MSW having ≥ 450,000 tons WIP must comply with Measure requirements, unless all exemption requirements are met.
Exempt from Controls	MSW landfills with design capacity < 2.5 million Mg (2.75 million tons) or NMOC[2] emissions < 50 Mg/yr (55 tons/yr).		Hazardous waste landfills, landfills regulated under CERCLA[3], C&D[4] landfills, and MSW landfills having < 450,000 tons WIP.
Disposal Areas Requiring Control	Active areas where the first refuse deposited in the area has reached an age of five years or more, or areas closed or at final grade where the first refuse deposited in the area has reached an age of two years or more.		Any area where solid waste has been buried; the landfill methane surface concentration must not exceed the 500 ppmv instantaneous or 25 ppmv (averaged) integrated surface methane emission standards, excluding the working face.

1. New Source Performance Standards and Emission Guidelines (40 Code of Federal Regulations, Part 60, Subparts WWW and Cc)
2. Non-Methane Organic Compound
3. Comprehensive Environmental Response, Compensation and Liability Act
4. Construction and Demolition

Table I-2. Comparison of the Major Provisions of the Federal Requirements and Landfill Methane Control Measure (Cont.)

	NSPS/EG	Landfill Methane Control Measure
Surface Monitoring	• Quarterly monitoring for surface concentrations not to exceed 500 parts per million by volume (ppmv) measured as methane. • Annual monitoring if in compliance after three consecutive monitoring periods. • Walking pattern spacing of 30 meters (or about 100 feet).	• Quarterly monitoring for instantaneous and integrated surface concentrations not to exceed 500 ppmv (instantaneous) or an averaged methane concentration limit of 25 ppmv (integrated) measured as methane. • Annual monitoring if conditions in §95469(a)(1)(C) or §95469(a)(2)(C) are met. • Initial walking pattern spacing of 25 feet, then 100 feet if in compliance.
Emission Control Requirements	• Within 30 months after determining a landfill has a NMOC emission rate of ≥ 50 Mg/yr or 55 tons/yr must install a gas collection/control system that achieves a 98 percent reduction of collected NMOC emissions.	• Within 18 months after approval of the Design Plan for active MSW landfills. • Within 30 months after approval of the Design Plan for closed or inactive MSW landfills. • 99 percent reduction of methane for most control devices; lean-burn engines must reduce outlet methane concentration to < 3,000 ppmv, dry basis, corrected to 15 percent oxygen.
Implementation and Compliance Schedule	• Capacity and Emission Reports within 90 days of the March 12, 1996 (NSPS) effective date or 90 days of the U.S. EPA approved State Plan (EG) effective date. • Design Plan within one year of the NMOC Emission Report.	• Waste-in-Place Report by December 31, 2010 if landfill is less than 450,000 tons of WIP. • Landfill Gas Heat Capacity Report by December 31, 2010 or upon reaching 450,000 tons of WIP.

Table I-2. Comparison of the Major Provisions of the Federal Requirements and Landfill Methane Control Measure (Cont.)

	NSPS/EG	Landfill Methane Control Measure
Implementation and Compliance Schedule (Cont.)	• Start-Up within 18 months of Design Plan submittal (NSPS). • Start-Up within 30 months of State Plan approval by U.S. EPA (EG). [5] • Initial Performance Test of control system within 180 days from initial start up (Initial Test)	• Surface Methane Demonstration Test (optional) if landfill gas heat input capacity is ≥ 3.0 MMBtu/hr. <u>*Design Plan*</u>*:* • By June 17, 2011; or • Within one year after determining landfill gas heat input capacity is ≥ 3.0 MMBtu/hr; or • Within one year of measuring a leak on the landfill surface ≥ 200 ppmv pursuant to the Surface Methane Demonstration Test. • Initial Performance Test of control system within 180 days from initial start up (Initial Test)
Flexibility	Is allowed for in the EG (with adequate justification to the U.S. EPA).	Is allowed for in the regulation (with adequate justification to the Implementing Agency).

5. In California most of the local air districts implement and enforce the federal Emission Guideline requirements.

New Source Performance Standards and Emission Guidelines

MSW landfills are regulated under local air district rules that implement the federal requirements of the New Source Performance Standards (NSPS) and Emission Guidelines (EG), 40 Code of Federal Regulations Part 60 Subparts WWW and Cc, for MSW landfills. The NSPS applies to “new” MSW landfills that commenced construction, modification, or reconstruction on, or after May 30, 1991. The EG applies to “existing” MSW landfills that commenced construction, modification, or reconstruction before May 30, 1991, and that have accepted waste at any time since November 8, 1987, or have additional capacity for future waste deposition. The NSPS and EG require the installation of a landfill gas collection and control system when a MSW landfill reaches a design capacity of 2.75 million tons or greater and has a NMOC emission rate of 55 tons per year, or greater.

ARB and the local air districts were required to develop and submit a “State Plan” to United States Environmental Protection Agency (U.S. EPA) for implementing and enforcing the requirements of the EG. Local air districts that elected not to adopt rules as part of the State Plan to implement the EG were placed under a Federal Plan, which is directly enforced by U.S. EPA. In general, the larger air districts adopted rules whereas several smaller districts are subject to the Federal Plan. U.S. EPA promulgated the NSPS and EG on March 12, 1996.

National Emission Standards for Hazardous Air Pollutants

U.S. EPA promulgated the National Emission Standards for Hazardous Air Pollutants (NESHAP) for MSW landfills (40 Code of Federal Regulations Part 63 Subpart AAAA) on January 16, 2003. The NESHAP has the same requirements as the NSPS but also contains provisions for start-up, shut-down, and additional recordkeeping and reporting requirements. The regulation differs from federal NSPS and NESHAP requirements in that it applies to smaller landfills (450,000 versus 2,750,000 tons of waste-in-place) and has more stringent requirements for methane collection and control, component leak testing and surface emissions monitoring, and compliance schedules. The more stringent requirements in the regulation are needed to maximize GHG emission reductions. Since the requirements of the regulation are more stringent, they do not conflict with or impede compliance with the existing federal requirements.

Local Air District Rules

Local air districts have adopted rules to implement the federal requirements for MSW landfills. However, the focus of these rules is to reduce volatile organic compounds and NMOC emissions from MSW landfills, not methane.

C. Organization of this Document

This document is organized into three chapters and six appendices. Chapter I states the purpose for developing this document, provides an overview of the regulation and discusses existing requirements for MSW landfills. Chapter II provides a summary of the key requirements of the regulation through a series of topics of concern. Chapter III discusses how ARB expects the regulation to be implemented and provides a schedule of compliance and provides a brief discussion of the penalties associated with noncompliance. Each chapter addresses regulatory topics of concern that were presented by stakeholders and are summarized in Appendix A. A copy of the regulation is provided in Appendix B. Appendix C contains a regulatory flow chart for determining control requirements. Example report forms to assist owners and operators in meeting their reporting requirements are provided in Appendix E. Finally, Appendix F provides an overview of the Landfill Gas Tool developed by ARB staff to assist landfill owners and operators in determining their landfill’s gas heat input capacities and methane generation rates.

II. REGULATORY REQUIREMENTS

This chapter summarizes the major requirements of the regulation under a series of topics, which include: applicability and exemptions, regulatory standards, alternative compliance options, and demonstrating compliance. It should be noted that this document is for guidance purposes only, is not a regulation, supplement or revision thereof, and is not enforceable. The term "implementing agency" is used in the sections that follow to indicate that the implementation and enforcement of the regulation may be done by either the local air districts (or "districts") if they have signed a Memorandum of Understanding with ARB to implement and enforce the regulation, or ARB. A copy of the regulation is provided in Appendix B.

A. Applicability and Exemptions

1. To which landfills does the regulation apply?

The regulation applies to all landfills that received solid waste after January 1, 1977. MSW landfills having 450,000 tons of waste-in-place or greater would be required to install active gas collection and control systems and comply with the requirements of the regulation unless the landfill: 1) receives only hazardous waste, or is currently regulated under the Comprehensive Environmental Response, Compensation and Liability Act 42 U.S.C., Chapter 103; 2) receives only construction and demolition wastes, inert waste, or non-decomposable wastes; or 3) is closed or inactive with less than 450,000 tons of waste-in-place (§ 95462).

2. Which landfills are exempt?

Landfills that are exempt from the requirements of the regulation include:

- hazardous waste landfills;
- landfills containing only construction and demolition waste or non-decomposable solid waste;
- closed and inactive MSW landfills having less than 450,000 tons of waste-in-place, and
- MSW landfills that did not receive solid waste after January 1, 1977.

The implementing agency may request that the owner or operator demonstrate that their landfill is exempt and does not meet the applicability criteria specified in the regulation. Such demonstration must be submitted to the implementing agency within 90 days of a written request received from the implementing agency. Appendix C presents a flow chart showing the steps for determining whether the landfill must be controlled.

3. Are active landfills having less than 450,000 tons of waste-in-place and existing gas collection and control systems exempt from the regulation?

Active MSW landfills having less than 450,000 tons of waste-in-place and existing gas collection and control systems are not exempt from the regulation. Landfills in this category must comply with the requirements of the regulation.

4. If a landfill has an existing gas collection and control system, can the landfill gas heat input analysis or the 200 ppmv surface demonstration be used for determining exemption from all or parts of the regulation?

The landfill gas heat input analysis and 200 ppmv surface demonstration do not apply to MSW landfills with existing gas collection and control systems. However, owners and operators may use these methods to demonstrate the need for an alternative compliance option pursuant to § 95468. The implementing agency may allow these methods to be used along with other appropriate criteria to address site-specific concerns and to evaluate alternative compliance option requests, such as semi-continuous operation of a gas collection and control system due to insufficient landfill gas flow rates, additional time allowance for repairs, alternative wind speed requirements, and others.

B. Determination for Installing a Gas Collection and Control System

1. What is an "uncontrolled" landfill?

A landfill is considered "uncontrolled" if it has a passive venting system, carbon adsorption system, partial gas collection system, or no controls of any kind. Passive and carbon adsorption systems allow the methane to escape untreated into the atmosphere. A partial gas collection system may collect and control methane in one area of the landfill; however, other areas of the landfill are typically uncontrolled.

2. Does the topographical map requirement apply only to active landfills having less than 450,000 tons of waste-in-place?

No, the topographical map requirement also applies to closed and inactive MSW landfills as indicated in § 95463(b)(2)(B)3.a. The Annual Report has a similar requirement in § 95470(b)(3)(I) which applies to active, closed, or inactive landfills that are subject to the requirements of § 95464 through § 95472.

3. If a landfill does not have any final cover, is a topographical map required to be included with the waste-in-place report?

No, in this situation a topographical map would not be required. However, for clarity, ARB staff recommends this information be provided to the implementing agency along with the Waste-in-Place report.

4. If a landfill is active but has undergone partial final closure of an area, should this information be included in a topographical report?

Yes, if an area of a landfill is undergoing partial final closure this information should be provided in the topographical map and submitted as part of the Waste-in-Place report. Areas of a landfill that are undergoing partial final closure are not expected to be reopened and will eventually reach final closure.

5. Which landfills are required to calculate their landfill gas heat input capacity?

Unless exempted by the regulation (see A2), owners or operators of all uncontrolled MSW landfills (i.e., landfills with) having 450,000 tons of waste-in-place or greater, must calculate their landfill's gas heat input capacity pursuant to § 95463(b).

6. Can site-specific data be used for determining the landfill's gas heat input capacity?

Yes, § 95471(b)(1) allows available site-specific data such as gas flow and methane concentration data to be used to estimate the landfill's gas heat input capacity.

7. Can the landfill gas tool developed by ARB staff be used to determine the landfill gas heat input capacity?

Yes, the landfill gas tool developed by ARB staff is an acceptable method to use to calculate the heat value. The tool can be accessed on ARB's landfill website at: http://www.arb.ca.gov/cc/landfills/landfills.htm. Site-specific data using actual gas recovery data (i.e., gas flow and methane concentration data) can be used with the tool.

8. Can other landfill gas emission tools be used to estimate emissions?

The regulation requires the use of the 2006 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories, Chapter 3 (or IPCC emissions model) to determine the expected gas generation flow rate (or landfill gas heat input capacity). ARB's Landfill Gas Tool meets the regulation's requirement to use IPCC 2006. The tool is also similar to the tool being used by the Local Government Operations Protocol for creating a greenhouse gas accounting and reporting standard for local government operations across the United States. Other tools which meet the regulation's requirement to use IPCC 2006 may also be used; however, it is recommended that use of other tools be discussed with the implementing agency in advance.

9. Does the regulation provide any flexibility to use alternate rate constants for anaerobic decomposition (or "k" values)?

The regulation requires the use of the same average rainfall and k values that are listed by the United States Environmental Protection Agency (see Appendix I, Section 6.0 of the regulation). However, to address site-specific concerns the regulation contains provisions for alternative compliance options [§ 95468, § 95471(b)(1) and § 95471(h)].

10. When is the heat input capacity report required to be submitted?

The heat input capacity reports are required to be submitted to the implementing agency within 90 days of the effective date of the regulation (September 17, 2010). However, due to the delayed approval date of the regulation, ARB delayed enforcement of the compliance date until December 31, 2010.

11. Is the surface emissions demonstration only required if the landfill gas heat input capacity is equal to or greater than 3.0 million British thermal units per hour?

If the landfill gas heat input capacity is equal to or greater than 3.0 MMBtu/hr, the surface emissions demonstration is an option that can be used by landfill owners and operators of uncontrolled landfills to show that their landfills are not expected to generate sufficient amounts of landfill gas to support a control device operating on a continuous basis without the use of supplemental fuel. If the landfill is active and there is no measured surface concentration of methane exceeding 200 ppmv, the owner or operator must recalculate the landfill gas heat input capacity annually until either the MSW landfill requires a gas collection and control system or closes and ceases to accept waste [§ 95463(b)(2)(B)(2) and § 95463(b)(2)(B)(3)].

12. When would the surface emissions demonstration in § 95463 need to begin and be completed?

If a landfill is uncontrolled and the owner or operator decides to do the surface emissions demonstration, the implementing agency should be notified and the surface demonstration testing must begin as soon as possible after determining that the landfill gas heat input capacity is equal to or greater than 3.0 MMBtu/hr. The surface emissions demonstration should be completed within one year after determining that the landfill gas heat input capacity is equal to or greater than 3.0 MMBtu/hr.

13. Under what conditions is an owner or operator of a landfill required to install a gas collection and control system?

If a MSW landfill has 450,000 tons of waste-in-place or greater and has a gas heat input capacity threshold of 3.0 MMBtu/hr or greater, the owner or operator is required to install a gas collection and control system, unless exemption conditions are met.

Table II-1 lists the conditions for determining whether or not a gas collection and control system must be installed.

Table II-1. Determination for Installing a Gas Collection and Control System at Uncontrolled Landfills[1]

Landfill Status	Waste-in-Place ≥ 450,000 (tons)?	Landfill Gas Heat Input Capacity Report Required?	Waste-in-Place Report Required?	Landfill Gas Heat Input Capacity ≥ 3.0 (MMBtu/hr)	Controls Required?
Closed or Inactive	No	N/A	N/A	N/A	Exempt
Active	No	No	Yes	N/A	No[2]
Active	Yes	Yes	No	No	No[3]
Closed or Inactive	Yes	Yes	No	No	No
Active	Yes	Yes	No	Yes	Yes[4]
Closed or Inactive	Yes	Yes	No	Yes	Yes[5]

1. Includes landfills with passive venting, carbon adsorption, partial gas collection systems, or no gas collection and control system of any kind.
2. Waste-in-place (WIP) report must be submitted annually until the landfill reaches 450,000 tons of WIP or the landfill closes.
3. Recalculate the landfill gas heat input capacity annually until the landfill gas heat input capacity is ≥3.0 MMBtu/hr or the landfill closes.
4. Install gas collection and control system (GCCS) if surface demonstration was not successful pursuant to § 95463(b)(2)(B).
5. Install GCCS if surface demonstration was not successful pursuant to § 95463(b)(2)(B). If surface demonstration was successful, must comply with limited reporting requirements and regulation no longer applies.

14. At what point is an uncontrolled landfill no longer subject to the requirements of the regulation?

Table II-2 lists the conditions that must be met for an uncontrolled landfill to be no longer subject to the regulation.

Table II-2. Conditions for Uncontrolled Landfills to be No Longer Subject to the Regulation

Landfill Status	Waste-in-Place ≥ 450,000 (tons)?	Closure Notification Submitted?	Waste-in-Place Report Submitted?	Landfill Gas Heat Input Capacity ≥ 3.0 (MMBtu/hr)	Passed Surface Demonstration?
Active	No	Yes	Yes	N/A	N/A
Active	Yes	Yes	N/A	No	N/A
Closed or Inactive	Yes	N/A	N/A	No	N/A
Active	Yes	Yes	No	Yes	Yes
Closed or Inactive	Yes	N/A	Yes	Yes	Yes

15. At what point is a landfill with an existing gas collection and control system no longer subject to the requirements of the regulation?

Landfills with existing gas collection and control systems are no longer subject to the requirements of the regulation when the following conditions have been met: a Closure Notification and an Equipment Removal Report has been submitted pursuant to [§ 95470(b)(1) and § 95470(b)(2)], there is documentation that the gas collection and control system was operated for a least 15 years, and the landfill is in compliance with the surface methane emission standards. This requirement does not apply to gas control systems that were installed on a temporary basis to address offsite gas migration issues. Closed or inactive landfills (controlled or uncontrolled) having less than 450,000 tons of waste-in-place are exempt from the regulation.

C. Gas Collection and Control System Performance, Design, and Operation Requirements

1. What are landfills required to do now if they have existing gas collection and control systems?

The regulation states that by January 1, 2011, landfills are required to be in compliance with the surface methane emissions standards. However, due to the delay in the effective date of the regulation, enforcement of the compliance deadline commencing surface methane emissions monitoring is being delayed until July 1, 2011. Landfill owners and operators should use this time to make the necessary system adjustments and improvements, establish monitoring protocols and procedures, purchase monitoring equipment, train staff, and develop recordkeeping and reporting systems. The delay applies to all landfills that are subject to the regulation, including those with existing gas collection and control systems. However, landfills that are required to install new gas collection and control systems are required to meet these standards upon commencing system operation. In addition, landfills that are currently subject to local or federal landfill rules will need to continue to ensure compliance with the 500 ppmv instantaneous standard commonly found in those rules.

Again, due to the delayed effective date of the regulation, owners and operators must comply with all other aspects of the regulation (e.g., component leak checking, well head monitoring, etc.) beginning December 31, 2010, instead of June 17, 2010 (effective date). The data collection period for the first annual report should cover from January 1, 2011 to December 31, 2011, instead of June 17, 2010 to December 31, 2010. This first annual report is due on March 15, 2012. All subsequent annual reports must cover the period from January 1st to December 31st of each year.

2. Can a valid permit or compliance plan issued by a local air district substitute for the required design plan?

Yes, a valid Permit to Construct, Permit to Operate, or Compliance Plan issued by a local air district can substitute for the required Design Plan if the implementing agency

has determined that these documents satisfy the requirements of the Design Plan. The location of components in these documents that satisfy the requirements of the regulation must be clearly identified. No Design Plan is initially needed if the landfill has an existing gas collection and control system installed. An amended Design Plan may be needed if major modifications have been made to an existing gas collection and control system.

3. Are landfill owners or operators with existing gas collection and control systems required to submit new design plans?

No, landfill owners or operators with existing gas collection and control systems are not required to submit new design plans. A new design plan is only required to be submitted if a gas collection and control system must be installed because the landfill is currently uncontrolled and the landfill gas heat input capacity is greater than 3.0 MMBtu/hr, or the surface demonstration option was not successful [§ 95464(a)(1)]. An amended design plan is required if the existing gas collection and control system is insufficient and must be modified to meet the requirements of the regulation [§ 95464(a)(4)].

4. How does the regulation apply to active landfills that develop new areas to receive waste?

The regulation establishes a 500 ppmv instantaneous surface monitoring standard and a 25 ppmv integrated surface monitoring standard to ensure that methane emissions are being adequately controlled (§ 95465). Any new areas on an active landfill that receive solid waste that are not considered to be the working face or other areas meeting § 95471(c)(1)(C) would have to meet these standards. Any exceedance of the standards would initiate re-monitoring and corrective action within 120 days to resolve the problem (§ 95469).

5. How does the regulation apply to landfill modules (or separate waste management units) that are an expansion of an existing landfill?

As previously mentioned, the regulation establishes a 500 ppmv instantaneous surface monitoring standard and a 25 ppmv integrated surface monitoring standard. Any landfill modules or separate waste management units that are an expansion of an existing landfill and are not considered to be the working face would have to comply with the regulation.

6. Are new waste receiving modules (with no collection system in place) considered separate from the main landfill or considered part of the main landfill?

New waste receiving modules would be considered as part of the main landfill and would have to meet both the 500 ppmv instantaneous surface monitoring standard 25 ppmv integrated surface monitoring standards.

7. What are some examples of modifications to a gas collection and control system that would require a Design Plan to be amended?

Examples of modifications to a gas collection and control system that would require a Design Plan to be amended or updated include, but are not limited to, the following: changes made from what was contained in the originally-approved Design Plan by the implementing agency; changes in the density of wells (i.e., number of wells per acre); installation of a blower; or replacement of a control device (e.g., flare) due to insufficient size capacity. Regular maintenance or well replacement would not require an amended Design Plan.

8. What regulatory requirements would not apply during the period a gas collection and control system is being modified?

Requirements that would not apply during the period the gas collection and control system is being modified are:

- The surface methane emission standards and the associated surface monitoring, recordkeeping and reporting requirements of sections 95469 and 95470 for portions of the landfill where the modifications are occurring; and

- The continuous operation of the gas collection and control system, component leak standard, and well gauge pressure requirements for individual landfill gas wells involved in well raising, or for individual landfill gas components that must be temporarily shut down for repair or to connect new components to existing systems [see sections 95464(d) and 95464(e)].

In accordance with section 95464(a)(2) landfill owners and operators are allowed 18 months after the approval of the Design Plan modification to install and operate the gas collection and control system and achieve compliance with the regulation.

9. Is the 99 percent destruction removal efficiency for methane applied to both new and existing control devices or to new control devices only?

The 99 percent destruction removal efficiency for methane applies to both new and existing control devices. It does not, however, apply to lean burn internal combustion engines, which must reduce the outlet methane concentration to less than 3,000 ppmv, dry basis, corrected to 15 percent oxygen (§ 95464)(b)(3)(A)1.).

10. Does the combustion temperature have to be monitored continuously for enclosed flares?

Yes, combustion temperature is to be continuously monitored for enclosed flares to ensure that the temperature is being adequately maintained. For enclosed flares, records must be kept of all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit)

below the average combustion temperature during the most recent source test [§ 95470(a)(K)1.]. The “most recent source test” is the most recent source test that demonstrated compliance with the 99 percent efficiency standard. For enclosed flares, it is recommended that the average combustion temperature be recorded at least every 15 minutes and averaged over the source test duration.

11. How can compliance be demonstrated for a gas control device other than an enclosed flare?

Compliance can be demonstrated by providing information describing the operation of the gas control device, the operating parameters (e.g., but not limited to manufactures’ specifications) that would indicate proper performance, and appropriate monitoring procedures [§95469(b)(2)].

12. Does there need to be a sufficient flow of propane or commercial natural gas to the burners of a gas control device?

Yes, during restart or startup there must be a sufficient flow of propane or commercial natural gas to the pilot light to prevent unburned collected methane from being emitted to the atmosphere [§95464(b)(2)(A)3.].

13. Can individual gas collection system components be temporarily shut down in order to prevent a fire?

Yes, individual gas collection system components can be temporarily shut down in order to prevent fires. In this situation, the requirements for continuous operation of the control device, component leak standard compliance, and operating a well under a vacuum (negative pressure) would not apply during this time period. However, methane emissions must be minimized during any shutdown of the gas collection system. Methods used to minimize these emissions are at the discretion of the landfill owner or operator.

14. What is the compliance schedule for installing controls?

As specified in § 95464(a)(1), if a gas collection and control system meeting the requirements of the regulation has not been installed, a Design Plan must be submitted by the landfill owner or operator either:

- By June 17, 2011; or
- Within one year after the determining that the landfill gas heat input capacity is greater than 3.0 MMBtu/hr; or
- Within one year of measuring a concentration of methane on the landfill surface that exceeds 200 ppmv pursuant to the surface methane demonstration test specified in § 95463(b)(2)(B)1.

Any owner or operator of an active landfill must install an active gas collection and control system within 18 months after approval of the Design Plan [§ 95464(a)(2)]. This allows sufficient time to obtain the necessary permits, and to procure and install the system. Closed or inactive MSW landfills are provided an additional 12 months for installation (for a total of 30 months) in order to obtain the necessary funds to comply [§ 95464(a)(3)]. The regulation also includes a provision for amending an existing Design Plan to respond to changes in site conditions [§ 95464(a)(5)]. An amended Design Plan must be submitted to the implementing agency within 90 days of any event that requires a change to the Design Plan (see Question 7 on page II-8). Owners and operators of existing gas collection and control systems are not required to submit Design Plans (or Design Plan equivalent document) if previously provided to the implementing agency and their systems are in compliance with the regulation. General milestones for installing a gas collection and control system for an example landfill are provided in Table II-3.

Table II-3. Sample Schedule for Installing a Gas Collection and Control System

Milestone	Example Achievement Date	Compliance Schedule
Waste-in-Place Report (Active Landfills < 450,000 tons WIP)	December 31, 2010[1]	• Within 90 days after the effective date (June 17, 2010) of the regulation
Landfill Gas Heat Capacity Report (Landfills ≥ 450,000 tons WIP)	December 31, 2010[1]	• Within 90 days after the effective date (June 17, 2010) of the regulation.
Gas Collection and Control System Design Plan	June 17, 2011	• Within 1 year after effective date or; • Within 1 year after determining landfill gas heat input capacity is • ≥ 3.0 MMBtu/hr; or • Within 1 year of measuring a concentration of methane on landfill surface ≥ 200 ppmv pursuant to the surface methane demonstration test specified in §95463(b)(2)(B)1.

1. Original date was September 17, 2010, however was delayed until December 31, 2010.

Table II-3. Sample Schedule for Installing a Gas Collection and Control System (Cont.)

Installation of Collection and Control System	December 2012 (Active Landfills) December 2013 (Closed or Inactive Landfills)	• Within 18 months of approval by the implementing agency (Active Landfill) • Within 30 months of approval by the implementing agency (Inactive Landfill)
Initial Performance Test of Control System	June 2013 (Active Landfills) June 2014 (Closed or Inactive Landfills)	• Within 180 days from initial startup (Initial Test)

15. When can a gas collection and control system be removed?

The regulation allows the capping or removal of the gas collection and control system at a closed MSW landfill provided the following requirements are met (§ 95467):

- 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 implementing agency 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;

- Surface methane concentration measurements do not exceed the surface methane emission limits (§ 95465); and

- The owner or operator submits an Equipment Removal Report to the implementing agency [§ 95470(b)(2)].

D. Alternative Compliance Options

Landfills are dynamic sources and there are a number of site-specific factors involved in the design and operation of gas collection and control systems. Accordingly, there may be some cases where alternatives to test methods, monitoring requirements, and operational requirements may warrant consideration. Therefore, § 95468 of the regulation allows owners and operators to request such alternatives, subject to agency approval. Owners and operators will need to demonstrate why consideration of an alternative is necessary in order to comply with the regulation.

1. **What are some examples of situations that may warrant alternative compliance options?**

The following topics are some examples of situations that may warrant alternative compliance options:

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

- Additional time allowance for component leak repairs for landfills having consistent issues related to the procurement and delivery of necessary parts to complete the repair, or adverse weather conditions that impede repair work.

- Alternative wind speed requirements for landfills consistently having winds in excess of the limits specified in the regulation.

- Alternative walking patterns to address potential safety and other issues, such as: steep or slippery slopes, monitoring instrument obstructions, and physical obstructions.

- Exclusion of construction areas and other dangerous areas from landfill surface inspection.

- Quarterly submittal of surface methane emission monitoring results, instead of annually.

- Exclusion of paved roads that do not have any cracks, pot holes, or other penetrations from landfill surface inspection.

- Modification of the 50,000 square foot grid dimensions to meet specific landfill topography and safety needs.

- Consideration of an alternate window period for conducting surface monitoring for the wetter regions of the state.

- The use of hand held anemometers to determine wind speed while conducting surface monitoring.

- Flexibility for mitigation and remediation during winter and wetter months.

2. **What criteria might the implementing agency use to evaluate alternative compliance option requests?**

Criteria that the implementing agency 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 § 95468(b). Landfill owners or operators requesting alternatives are encouraged to first contact the implementing agency to discuss their plans and to determine what documents may need to be submitted.

The implementing agency will review the requested alternatives and either approve or disapprove the alternatives within 120 days. The implementing agency may request that additional information be submitted as part of their review of the requested alternatives § 95468(c). If a request for an alternative compliance option is denied, the implementing agency will provide written reasons for the denial.

E. Monitoring Requirements and Test Procedures

A summary of the monitoring requirements for the gas collection and control system is provided in Table II-4 on page II-14.

1. When is the deadline for compliance with the surface methane emissions standards?

Due to the unexpected delay of the effective date of the regulation, ARB is delaying enforcement of the compliance deadline for implementing the surface monitoring requirements (January 1, 2011) until July 1, 2011. This is discussed in ARB's December 2010 municipal solid waste landfill regulatory advisory located at: http://www.arb.ca.gov/cc/landfills/docs/status1210.pdf.

2. If an ARB inspector finds an exceedance during a compliance inspection, is it a violation?

Yes, if an ARB inspector determines during a compliance inspection that the concentration of methane measured within 3 inches above the landfill surface exceeds 500 ppmv, other than non-repeatable, momentary readings, as determined by instantaneous surface emissions monitoring; or the average methane concentration measurements exceeds 25 ppmv, as determined by integrated surface emissins monitoring, it is a violation. Any exceedance discovered by an ARB inspector during a compliance inspection of the landfill would also result in a return to quarterly surface monitoring, instead of annual surface monitoring [§ 95469(a)(1)(D) and § 95469(a)(2)(D)], and 25-foot spacing intervals instead of 100-foot intervals [§ 95471(c)(1)(B)2.].

3. How does the surface demonstration option overlap with other surface emissions monitoring requirements?

If a landfill is uncontrolled, and has a gas heat input capacity equal to or greater than 3.0 MMBtu/hr a gas, the surface demonstration can be used to delay the installation of a gas collection and control system. However, the landfill owner or operator must show

that after four consecutive quarterly monitoring periods (using instantaneous monitoring) that there is no measured concentration of methane of 200 ppmv on the landfill surface, other than non-repeatable measurements. If selected as an option by the landfill owner or operator, the surface demonstration must begin immediately after determining that the landfill gas heat input capacity is equal to or greater than 3.0 MMBtu/hr and must be completed within one year. This process is repeated until such time a gas collection and control system is required to me installed.

Surface methane emissions monitoring is required for all landfills that are subject to the regulation and must be conducted on a quarterly basis (for most landfills). Landfill owners and operators must meet a 500 ppmv instantaneous and 25 ppmv integrated surface methane emission standard.

Table II-4. Summary of Monitoring Requirements for Municipal Solid Waste Landfills

Operation	Monitoring Action	Schedule	Reference
Gas Collection System	Monitor instantaneous surface methane concentrations and record values >200 ppmv. Monitor integrated surface methane concentrations and record values >25 ppmv. Instantaneous and integrated methane values of < 500 ppmv and < 25 ppmv, respectively indicate well extraction rates are sufficient to minimize the amount of methane seeping out of the landfill.	Quarterly Quarterly or Annual[1]	§ 95471(c)(2)(A) § 95469(a)(2)
	Monitor landfill gas components that are under positive pressure. Surface methane concentrations that exceed 500 ppmv must be repaired.	Quarterly	§ 95469(b)(3)
	Monitor gauge pressure within each gas extraction well. A negative value indicates a well is operating with a sufficient rate.	Monthly	§ 95469(c)

1. Grids can be monitored annually if the conditions in § 95469(a)(1)(C) or 95469(a)(2)(C) are met.

Table II-4. Summary of Monitoring Requirements for Municipal Solid Waste Landfills (Cont.)

Gas Control System Equipment	Record gas flow from the collection system to the enclosed combustion device. Monitor the combustion temperature of the enclosed combustion device with a temperature monitoring device equipped with a continuous recorder (temperature monitoring is not required for a boiler or process heater >44 megawatts). This requirement identifies operational and performance status of the control device.	Recording every 15 minutes	§ 95469(b)(1)(B)
	Monitor the continuous presence of a pilot flame or the flare flame for an open flare. This requirement confirms the operational status of the control device		CFR 60.18
	For an alternative compliance device, the owner or operator must submit appropriate monitoring requirements to the implementing agency for approval.	To be determined.	§95468

4. Were controlled landfills required to start surface monitoring during the first quarter of 2010?

No, due to the delayed approval date of the regulation, enforcement of the regulation's integrated and instantaneous surface emissions monitoring and spacing requirements have been delayed until July 1, 2011. Landfill owners and operators should use this time to make the necessary system adjustments and improvements, establish monitoring protocols and procedures, purchase monitoring equipment, train staff, and develop recordkeeping and reporting systems.

5. How should the 50,000 square foot grids be designed?

The regulation does not specify the specific design of the 50,000 square foot grid. An example grid design is provided on page D-5 in Appendix D.

6. Can the landfill owner or operator conduct integrated and instantaneous monitoring simultaneously?

Yes, if the monitoring instrument is equipped with a data logger, it is possible to conduct instantaneous and integrated surface monitoring procedures simultaneously. The data logger keeps a database of methane readings given a user-set frequency (e.g., every 5 seconds). For equipment without data-logging capability, taking manual readings while performing the monitoring procedures is an option. Recommended procedures for

conducting both integrated and instantaneous surface monitoring simultaneously is provided in Appendix D.

7. Does the regulation provide an incentive for decreased monitoring frequencies and increased walking patterns?

Yes, the regulation provides incentives for decreased monitoring frequencies and increased walking patterns by establishing a history of compliance with the 25 ppmv integrated and 500 ppmv instantaneous surface emission standards. Owners or operators of closed or inactive landfills, or closed or inactive areas on active landfills that have no exceedances of the surface methane emission standards after four consecutive quarterly monitoring periods, can increase their sampling period from quarterly to annually.

The regulation also provides flexibility for increasing the walking pattern from 25-foot to 100-foot intervals at active, inactive and closed landfills that have no exceedances of the surface methane emission standards after four consecutive quarterly monitoring periods [§ 95469(a)(1)(C) and § 95469(a)(2)(C)].

8. Does the regulation provide flexibility for an increased walking pattern for landfills that have historical data showing no exceedances of the surface methane emission standards?

Yes, the regulation provides flexibility for an increased walking pattern from 25-foot to 100-foot intervals at active, inactive and closed landfills that can demonstrate in the past three years before the effective date of the regulation (June 17, 2010) there has been no measured exceedance of the instantaneous surface methane emission standard of 500 ppmv [§ 95471(c)(1)(B)1.].

9. If a site has only a partial landfill gas extraction system do the surface methane emissions standards and monitoring spacing requirements apply?

Yes, the surface methane emissions standards and monitoring spacing requirements would apply if the landfill is not exempt from the requirements of the regulation. Owners or operators of landfills that are 450,000 tons of WIP or greater with passive venting, carbon adsorption, or partial landfill gas extraction systems would have to determine if they are required to install an active gas collection and control system (§95463). Landfills exempt from the regulation include: hazardous waste landfills, landfills containing only construction and demolition waste or non-decomposable solid waste, closed and inactive MSW landfills having less than 450,000 tons of waste-in-place, and MSW landfills that did not receive solid waste after January 1, 1977 (§ 95462).

10. How will cover vegetation affect surface monitoring?

Surface monitoring must be performed by holding the hydrocarbon detector probe within 3 inches of the landfill surface (where reasonable), focusing on areas with distressed vegetation, penetration points, cracks, or fissures. In some cases, cover vegetation may impede the landfill technician's ability to adequately test the surface of the landfill. The regulation contains a provision for alternative compliance options to address site-specific concerns such as tall vegetation or other monitoring obstructions (§ 95468) that are persistent problems.

11. Are areas of a landfill with structures on top of them (e.g., material recovery facilities, maintenance facilities, offices, composting operations, or asphalt parking, etc.) exempt from the surface monitoring requirements?

Landfill surface emissions monitoring is only required in areas where solid waste has been buried. The working face, material recovery facilities, maintenance facilities, offices, composting operations, portions of slopes that are 30 degrees and greater, wet or icy surfaces, construction areas, and other dangerous areas may be excluded from surface monitoring. Paved roads that do not have any cracks, pot holes, or other penetrations may also be excluded [§ 95468(a)(4) through § 95468(a)(6)].

12. Which portions of a landfill are subject to surface monitoring requirements of the regulation?

Areas of the landfill under which decomposable solid waste has been placed, excluding the working face, would be subject to the surface monitoring requirements [§ 95475(a)(20)]. The working face is the open area where solid waste is deposited daily and compacted with landfill equipment [§ 95475(a)(32)]. Areas of the landfill where material recovery facilities, maintenance facilities, offices, or composting operations are located are also excluded from surface monitoring requirements.

F. Recordkeeping and Reporting Requirements

1. What kinds of records must be kept?

The records can be maintained in paper, electronic, or other format approved by the implementing agency (§ 95470). The owner or operator must maintain copies of the records and reports required by the regulation and provide them to the implementing agency within five business days upon request. Records and reports must be kept at a location within the State of California.

The recordkeeping requirements can be categorized into four major categories:

- Landfill and gas collection and control system design;
- Gas collection and control system monitoring data;

- Performance test data of the gas collection and control system; and
- Emissions related data

The recordkeeping requirements for each of the four categories are summarized in Table II-5.

Table II-5. Summary of Recordkeeping Requirements for Municipal Solid Waste Landfills

Operation	Recordkeeping Item	Reference
Landfill and Gas Collection and Control System Design	Annual solid waste acceptance rate and current waste-in-place.	§ 95470(a)(1)(F)
	Nature, location, amount, and date of deposition of non-degradable waste for any landfill areas excluded from the collection system.	§ 95470(a)(1)(G)
	Addition of any new components to the gas collection system to maintain compliance with the regulation.	§ 95464(a)(4)
Gas Collection and Control System Monitoring Data	Gas collection and control equipment downtime.	§ 95470(a)(1)(A) § 95470(a)(1)(B)
	Expected gas flow rates to the gas control device.	§ 95470(a)(1)(C)
	All instantaneous surface monitoring measurements of 200 ppmv or greater and instantaneous and integrating surfacing sampling; all exceedances of the limits in § 95464(b)(1)(B) or § 95465, including the location of the exceedance (or affected grid), exceedance concentration in ppmv, date and time of measurement, the action taken to repair the exceedance, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion.	§ 95470(a)(1)(D)
	Well head gauge pressure measurements.	§ 95470(a)(1)(E)
	Any source tests.	§ 95470(a)(1)(H)
	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; or during repairs or the temporary shutdown of gas collection system components; or when solid waste was excavated and moved.	§ 95470(a)(1)(I)
	Records of any construction activities.	§ 95470(a)(1)(J)

Table II-5. Summary of Recordkeeping Requirements for Municipal Solid Waste Landfills (Cont.)

Operation	Recordkeeping Item	Reference
Gas Collection and Control System Monitoring Data (Cont.)	Records of the equipment operating parameters specified to be monitored under § 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.	§ 95470(a)(1)(K)
Performance Test Data	Gas control equipment operating parameters as well as records for operational periods during which parameter boundaries established during the most recent compliant source test(s) were exceeded.	§ 95470(a)(1)(K)
	For enclosed flares, records of all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test.	§ 95470(a)(1)(K)1
	A record of whenever there is a change in the location at which the landfill gas stream is introduced into the flame zone (for any size boiler or process heater used).	§ 95470(a)(1)(K)2
	Records of all periods of operation of the boiler or process heater, such as: steam use, fuel use, or monitoring data collected pursuant to other federal, State, local, or tribal regulatory requirements if a boiler or process heater with a design heat input capacity of 44 megawatts (150 MMBtu/hr) or greater is used to comply with § 95464(b)(3).	§ 95470(a)(1)(K)3
	Vendor specifications for the control device.	§ 95470(a)(2)(A)
	The calculated expected gas generation flow rate (or measured if site-specific data is available)	§ 95470(a)(2)(B) § 95471(e)
	The percent reduction of methane achieved by the control device	§ 95470(a)(2)(C)
	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	§ 95470(a)(2)(D)

Table II-5. Summary of Recordkeeping Requirements for Municipal Solid Waste Landfills (Cont.)

Operation	Recordkeeping Item	Reference
Performance Test Data (Cont.)	For an open flare: 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; 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	40 CFR § 60.18 § 95470(a)(2)(E)
Emissions Related Data	MSW landfill name, owner and operator, address, and solid waste information system (SWIS) identification number	§ 95470(b)(3)(A)
	Total volume of landfill gas collected (reported in standard cubic feet)	§ 95470(b)(3)(B)
	Average composition of the landfill gas collected over the reporting period (reported in percent methane and percent carbon dioxide by volume)	§ 95470(b)(3)(C)
	Gas control device type, year of installation, rating, fuel type, and total amount of landfill gas combusted in each control device	§ 95470(b)(3)(D)
	The date that the gas collection and control system was installed and in full operation.	§ 95470(b)(3)(E)
	The percent methane destruction efficiency of each gas control device(s).	§ 95470(b)(3)(F)
	Type and amount of supplemental fuels burned with the landfill gas in each device.	§ 95470(b)(3)(G)
	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.	§ 95470(b)(3)(H)
	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.	§ 95470(b)(3)(I)

2. What information must be reported?

The landfill owner or operator must submit a series of reports to the implementing agency to demonstrate compliance with the regulation [§ 95470]. These reports include, but are not limited to: an initial performance test report for the control device, an annual report that would include information for emissions inventory purposes, equipment shutdown times exceeding five calendar days, exceedances of any equipment operating parameters, and exceedances of the component leak standard and surface methane emission standards; closure notification report and an equipment removal report. Also, all instantaneous surface monitoring measurements of 200 ppmv or greater must be reported.

Additionally, there are some specific reports that need to be submitted under specific conditions, such as a Waste-in-Place Report for landfills having less than 450,000 tons of waste-in-place or a Closure Notification Report for landfills that are ceasing waste acceptance and closing. Finally, an Equipment Removal Report is required when a landfill is seeking to decommission the gas collection and control system.

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

3. Is there anything that needs to be reported within 90 days of the effective date of the regulation?

By September 17, 2010, owners and operators of active MSW landfills having less than 450,000 tons of waste-in-place were required to submit a Waste-in-Place Report to the implementing agency. The report must be submitted annually until the landfill reaches a size greater than or equal to 450,000 tons of waste-in-place. However, due to the delayed approval date of the regulation ARB has delayed enforcement of the September 17, 2010, compliance date until December 31, 2010.

To determine if a gas collection and control system is required to be installed, owners or operators of MSW landfills having 450,000 tons of waste-in-place or greater were required to determine their landfill's gas heat input capacity and submit a report to ARB by September 17, 2010. ARB's Landfill Gas Tool is an acceptable method to use for this purpose. Again, ARB delayed enforcement of the September 17, 2010 compliance date until December 31, 2010, due to the delayed approval date of the regulation.

4. Can the results of the quarterly surface monitoring be reported quarterly instead of annually to the implementing agency?

Yes, the results of the required quarterly monitoring can be reported to the implementing agency on a quarterly basis. However, this should be coordinated with the implementing agency.

5. What format and submittal pathway should be used for reports?

Reports can be submitted either in paper copy or electronic formats to the attention of the appropriate district that has signed an MOU with ARB. If a district has not signed an MOU with ARB, the reports can be submitted to:

Mr. Renaldo Crooks
California Air Resources Board
P.O. Box 2815
Sacramento, California 95812

Table II-6 provides a list of the required reports and their submittal schedules.

TABLE II-6. Summary of Reporting Requirements for Municipal Solid Waste Landfills

Report	Schedule	Reference
Waste-in-Place Report	Active MSW landfills having < 450,000 tons waste-in-place submit report by December 31, 2010. Waste-in-Place Report must be submitted by March 15th annually until the landfill is ≥ 450,000 tons of waste-in-place or a Closure Notification is submitted.	§ 95463(a) § 95470(b)(4)
Landfill Gas Heat Input Capacity Report	Report results by December 31, 2010 or upon reaching or exceeding ≥ 450,000 tons WIP.	§ 95470(b)(5), § 95463(b), § 95471(b)
Design Plan	By June 17, 2011; or within 1 year after determining landfill gas heat input capacity is ≥ 3.0 MMBtu/hr; or within one year of detecting any exceedance on the landfill surface exceeding a methane concentration of 200 ppmv.	§ 95464(a)(1)
Amended Design Plan	Within 90 days of any event that requires a change to the Design Plan.	§ 95464(a)(5)
Closure Notification	When landfill is no longer accepting refuse and the landfill is considered closed. Submit within 30 days of refuse acceptance cessation.	§ 95470(b)(1)
Equipment Removal	Submit report within 30 days prior to removal or cessation of control system operations	§ 95470(b)(2)
Annual Report	Submit report by March 15 annually	§ 95470(b)(3)

6. Will existing source test frequencies established by local air districts for landfill gas control devices satisfy the requirements of the regulation?

Maybe, but each case would have to be examined separately. The regulation allows owners and operators to request alternative compliance options, subject to approval. Owners and operators will need to demonstrate why consideration of an alternative is necessary in order to comply with the regulation (§ 95468). The landfill owner or operator may also have to demonstrate a history of compliance for the gas control device based on the existing source testing frequency established and approved by the local air district.

7. Due to the delayed effective date of the regulation, what is the data collection periods for the annual report?

The period for data collection (except for surface methane emissions monitoring) should cover from January 1, 2011, to December 31, 2011, with the first report being due on March 15, 2012. The second annual report should cover from January 1, 2011, to December 31, 2011, and should include both the surface emissions monitoring and all other required data, with the report being due on March 15, 2012. All subsequent annual reports must cover the period from January 1st to December 31st of each year and be submitted by March 15th of the following year.

8. Can the reporting required by the regulation be incorporated with the district's semi-annual reports to ARB?

The regulation requires landfill owners and operators to submit an Annual Report to the implementing agency. If a district entered into an agreement (MOU) with the ARB to implement and enforce the requirements of the regulation, the district's semi-annual reports may be used by landfill owners and operators to incorporate the reporting requirements. For districts without a MOU, landfill owners and operators must submit their Annual Reports to the ARB.

III. IMPLEMENTATION AND COMPLIANCE

A. Agreements with Local Air Districts

The districts have been implementing and enforcing federal and local requirements for municipal solid waste landfills since the early 1980's. However, the subject regulation was developed pursuant to Assembly Bill 32, which did not directly provide a mechanism for the local air districts to implement and enforce greenhouse gas regulations. Therefore, the regulation reflects ARB's role as primary monitor and enforcer of the regulation.

ARB staff has developed a memorandum of understanding (MOU) between the ARB and local air districts to enable local air districts to participate as partners in implementing and enforcing the regulation. We believe that the districts' participation in implementing and enforcing the regulation is critical to the successful implementation of the regulation.

The MOU is intended to enable local air districts to implement and enforce the regulation. There are three possible district statuses with respect to the MOU:

1) Districts not adopting a new or amended landfill regulation that is as or more stringent than ARB's, and that do not want to implement or enforce these statewide regulations;

2) Districts not adopting their own new or amended landfill regulation that is as or more stringent than ARB's, but that do want to implement or enforce these statewide regulations; and

3) Districts adopting a new or amended landfill regulation that is as or more stringent than ARB's and intend to implement and enforce their own, local regulations.

Districts in Category 1) will not be entering into an MOU; the ARB will implement and enforce the regulation in these districts. Districts in Categories 2) and 3) will be entering into an MOU.

1. How will the delay of the regulation's effective date affect landfill owners and operators compliance with the regulation?

The regulation was approved by the Office of Administrative Law on June 17, 2010, and became effective on the same day. The implementation and enforcement of the regulation begins as of the effective date of the regulation. However, due to the delayed approval date of the regulation, ARB delayed enforcement of the September 17, 2010, Waste-in-Place Report and Landfill Gas Heat Input Capacity Reports until December 31, 2010. The enforcement of the integrated and instantaneous surface

emissions monitoring requirements have been delayed until July 1, 2011. A summary of the delayed compliance dates are shown in Table III-1.

Table III-1. Summary of Delayed Compliance Dates

Milestone	Compliance Schedule
Waste-in-Place Report (Active Landfills < 450,000 tons WIP[1])	• By December 31, 2010[1]
Landfill Gas Heat Capacity Report (Landfills ≥ 450,000 tons WIP[1])	• By December 31, 2010[1]
Surface Emissions Monitoring Requirements	• By July 1, 2011

1. The original date was September 17, 2010, however was delayed until December 31, 2010.

2. Will the local air districts be able to adopt landfill rules that are more stringent than the regulation?

Yes, local air districts may adopt landfill rules that are more stringent than the regulation.

3. Will the MOU address requirements in district landfill rules that may be more stringent than those in the regulation such as surface monitoring heights?

Districts have the authority under State law to include more stringent requirements in their local rules even if they have entered into an MOU.

B. Implementation, Enforcement and Related Fees

The regulation was developed pursuant to AB 32, which did not directly provide a mechanism for the local air districts to implement and enforce regulations developed under AB 32. A landfill MOU template has been developed to enable local air districts to implement and enforce the regulation. It is expected that many of the larger local air districts will chose to implement and enforce the regulation. ARB will enforce and implement the regulation for some smaller districts that may have insufficient staff and resources. In both cases, ARB will retain its oversight authority.

1. Will districts that enter into an MOU with ARB to monitor compliance with and enforce the regulation be able to recover their costs?

Yes, the regulation provides a provision that allows local air districts to assess fees upon landfills to recover the costs associated with implementing and enforcing the regulation (Section 95473).

C. Penalties

1. Are there consequences including penalties for landfills that are noncompliant?

Yes, noncompliant landfills are subject to penalties and other consequences. The implementing agency may assess penalties for any violation of this regulation pursuant to Health and Safety Code (H&SC) § 38580. Each day during any portion of which a violation occurs is a separate offense. Any violation of the regulation may be enjoined pursuant to H&SC § 41513. Each day or portion thereof that any report, plan, or document required by this regulation remains unsubmitted, is submitted late, or contains incomplete or inaccurate information, shall constitute a single, separate violation of this regulation. Penalties are addressed in § 95472 of the regulation.

2. Is a document available that explains how ARB resolves violations and determines penalties?

Senate Bill 1402, which became law on September 28, 2010, directs ARB to publish by March 1, 2011, a penalty policy that takes certain circumstances into account when assessing penalties. On February 25, 2011, ARB staff released a proposed Enforcement Penalties: Background and Policy located at: http://www.arb.ca.gov/enf/sb1402/policy.pdf for public comment. The document provides context and background for the penalty policy, the proposed penalty policy itself, along with related California Environmental Protection Agency guidance documents. These materials and others related to ARB's efforts under SB 1402 are available at http://www.arb.ca.gov/enf/sb1402/sb1402.htm.

Appendix A

Index to Regulatory Topics of Concern

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Appendix B

Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

FINAL REGULATION ORDER

Methane Emissions from Municipal Solid Waste Landfills

Subchapter 10. Climate Change
Article 4. Regulations to Achieve Greenhouse Gas Emission Reductions
Subarticle 6. 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 receive only construction and demolition wastes, inert waste, or non-decomposable wastes.

(c) This subarticle does not apply to closed or inactive MSW landfills with less than 450,000 tons of waste-in-place.

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) *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), within 90 days of the effective date of this subarticle.

(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 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).

(b) *MSW Landfills Greater Than or Equal to 450,000 Tons of Waste-in-Place:* Within 90 days of the effective date of this subarticle or upon reaching 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 pursuant to section 95471(b) and must submit a Landfill Gas Heat Input Capacity Report 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. If the MSW landfill is active, the owner or operator 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 95476, 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 any 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 95476;

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

3. If there is no measured concentration of methane of 200 ppmv or greater 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 within 90 days:

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

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(b)(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).

(C) 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.

(D) 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.

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

(F) 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 only asbestos-containing waste, inert 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.

(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.

(5) An amended Design Plan must be submitted to the Executive Officer within 90 days of any event that requires a change to the Design Plan.

(6) The gas collection system must be operated, maintained, and expanded in accordance with the procedures and schedules in the approved Design Plan.

(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) The gas collection system must be designed and operated to draw all the 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. Is 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 73 Fed.Reg. 78209 (December 22, 2008), 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 address offsite gas migration issues.

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 not 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)(A) 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.

(A) If a gas control device remains in compliance after three consecutive source tests the owner or operator may conduct the source test every three years. If a subsequent source test shows the gas collection and control system is out of compliance the source testing frequency will return to annual.

(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)(D).

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 Standards

(a) Except as provided in sections 95464(d), 95464(e), and 95466, beginning January 1, 2011, or upon commencing operation of a newly installed gas collection and control system or modification of an existing gas collection and control system pursuant to 95464(a)(1), whichever is later, 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.

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.

§ 95468. Alternative Compliance Options

(a) The owner or operator may request alternatives to the 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, or adverse weather conditions that impede repair work.

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

(4) Alternative walking patterns to address potential safety and other issues, such as: steep or slippery slopes, monitoring instrument obstructions, and physical obstructions.

(5) Exclusion of construction areas and other dangerous areas from landfill surface inspection.

(6) Exclusion of paved roads that do not have any cracks, pot holes, or other penetrations from landfill surface inspection.

(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.

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.

§ 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) Corrective action must be taken by the owner or operator such as, but not limited to, cover maintenance or repair, or well vacuum adjustments and the location must be

remonitored within ten calendar days of a measured exceedance.

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, or it is a violation of this subarticle.

(C) 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 limit 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 landfill.

(D) Any exceedances of the limit specified in section 95465(a)(1) detected during any compliance inspections will result in a return to quarterly monitoring of the landfill.

(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) Within 10 calendar days of a measured exceedance, corrective action must be taken by the owner or operator such as, but not limited to, cover maintenance or repair, or well vacuum adjustments and the grid must be re-monitored.

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 in section 95469(a)(2)(B)1. 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, or it is a violation of this subarticle.

(C) 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 landfill.

(D) Any exceedances of the limits specified in section 95465(a)(2) detected during any compliance inspections will result in a return to quarterly monitoring of the landfill.

(3) An owner or operator of a closed or inactive MSW landfill, or any closed or inactive areas on an active MSW landfill that can demonstrate that in the three years before the effective date of this subarticle that there were no measured exceedances of the limits specified in section 95465 by annual or quarterly monitoring may monitor annually. Any exceedances of the limits specified in section 95465 detected during the annual monitoring that can not be remediated within 10 calendar days will result in a return to quarterly monitoring of the landfill.

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

(1) For enclosed flares 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.

(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 flare, 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, or it is a violation of this subarticle.

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

(3) Corrective actions, including any expansion of the gas collection and control system, must be completed and any new wells must be operating within 120 days of the date the positive pressure was first measured, or it is a violation 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.

§ 95470. Recordkeeping and Reporting Requirements.

(a) *Recordkeeping Requirements.*

(1) An owner or operator must maintain the following records, whether in paper, electronic, or other format, 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, and 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:

1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment;

2. During repairs or the temporary shutdown of gas collection system components; or,

3. 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 emissions 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 flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 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.

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, whether in paper, electronic, or other format, 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) 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 40 CFR § 60.18 (as last amended 73 Fed.Reg. 78209 (December 22, 2008), which is incorporated by reference herein; 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.

(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 anticipated 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 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.

(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)(B), 95470(a)(1)(C), 95470(a)(1)(D), 95470(a)(1)(E), and 95470(a)(1)(F), 95470(a)(1)(H), and 95470(a)(1)(K).

(4) *Waste-in-Place Report*: Any owner or operator subject to the requirements of sections 95463(a), or 95643(b)(2)(B)3. must report the following information to the Executive Officer:

(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(b) 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 within 90 days of the effective date of this subarticle or upon reaching 450,000 tons of waste-in-place. 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 any 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.

2. If an owner or operator of a MSW landfill can demonstrate that in the past three years before the effective date of this subarticle that there were no measured exceedances of the limit specified in section 95465(a)(1) by annual or quarterly monitoring, the owner or operator may increase the walking pattern spacing 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.

(C) 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.

(D) 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, other than non-repeatable, momentary readings.

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

(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*. The following methods of analysis must be used to determine the efficiency of the control device in reducing methane:

(1) *Enclosed Combustors:* One of the following test methods, all of which are incorporated by reference herein (and all as promulgated in 40 CFR, Part 60, Appendix A, as last amended

65 Fed.Reg. 61744 (October 17, 2000) at the pages cited below 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 for lean burn engines to less than 3,000 ppmv, dry basis, corrected to 15 percent oxygen:

U.S. EPA Reference Method 18, Measurement of Gaseous Organic Compound Emissions By Gas Chromatography (65 Fed.Reg. at 62007);

U.S. EPA Reference Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer (65 Fed.Reg. at 62062); or

The following equation must be used to calculate destruction efficiency:

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

(2) *Open Flares:* Open flares must meet the requirements of 40 CFR § 60.18 (as last amended 73 Fed.Reg. 78209 (December 22, 2008).

(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

(a) Penalties may be assessed for any violation of this subarticle pursuant to Health and Safety Code section 38580. Each day during any portion of which a violation occurs is a separate offense.

(b) Any violation of this subarticle may be enjoined pursuant to Health and Safety Code section 41513.

(c) Each day or portion thereof that any report, plan, or document required by this subarticle remains unsubmitted, is submitted late, or contains incomplete or inaccurate information, shall constitute a single, separate violation 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.

§ 95473. Implementation, Enforcement, and Related Fees

(a) The Executive Officer, at his or her discretion, may enter into an agreement with a District to implement and enforce this subarticle. Pursuant to this agreement, 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 enforcing the requirements of this subarticle. Implementation and enforcement of other law as described in Section 95474 cannot result in a standard, requirement, or prohibition less stringent than provided in this subarticle, as determined by the Executive Officer.

(b) The Executive Officer may request any owner or operator to demonstrate that a landfill does not meet the applicability criteria specified in this subarticle. Such demonstration must be submitted to the Executive Officer within 90 days of a written request received from 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, 39601, and 40001(a), Health and Safety Code.

§ 95474. 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.

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, 39601, and 40001(a), Health and Safety Code.

§ 95475. 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.

(4) "Construction and Demolition Wastes" means waste building materials, packaging and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings and other structures.

(5) "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.

(6) "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.

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

(8) “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.

(9) “Enclosed Combustor” means an enclosed flare, steam generating boiler, internal combustion engine, or gas turbine.

(10) “Energy Recovery Device” means any combustion device that 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.

(11) “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 that exceed 25 ppmv, as determined by integrated surface emissions monitoring.

(12) “Executive Officer” means the Executive Officer of the Air Resources Board, or his or her delegate.

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

(14) “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.

(15) “Gas Collection System” means any system that 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.

(16) “Gas Control System” means any system that 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.

(17) “Inactive MSW Landfill” means a MSW landfill that is no longer accepting solid waste for disposal, or can document that the landfill is no longer receiving solid waste.

(18) “Inert Waste” means any material meeting the definition of “Inert Waste” as defined in Title 27, California Code of Regulations, Division 2, Subdivision 1, Chapter 3, Subchapter 2, Article 2, Section 20230(a) (effective July 18, 1997).

(19) “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.

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

(21) “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.

(22) “Non-decomposable Solid Waste” means materials that do not degrade biologically to form landfill gas. Examples include, but are not limited to, earth, rock, concrete asphalt paving fragments, uncontaminated concrete (including fiberglass or steel reinforcing rods embedded in the concrete), brick, glass, ceramics, 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.

(23) “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.

(24) “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 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.

(25) “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.

(26) “Perimeter” means along the MSW landfill’s permitted facility boundary.

(27) “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 an engineer holding a valid certificate issued by a state offering reciprocity with California.

(28) “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) as incorporated by reference herein.

(29) "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.

(30) "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.

(31) "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.

(32) "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.

§ 95476. 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.

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%

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

Where:

WIPFRACi = Fraction of the ith 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 ith 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:

Table 1. Average Rainfall and k Values

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

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

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:

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.					

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).

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:
EPA *Solid Waste Management and Greenhouse Gasses: A Life-Cycle Assessment of Emissions and Sinks* Exhibits 7-2, 7-3 (May 2002).
CEC *Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004* (December 2006).
IPCC *Guidelines for National Greenhouse Gas Inventories*, Chapter 3, 3.13 (2006).

Appendix C

Flowchart for Determining Control Requirements

Figure 1. Flow Chart for Determining Control Requirements

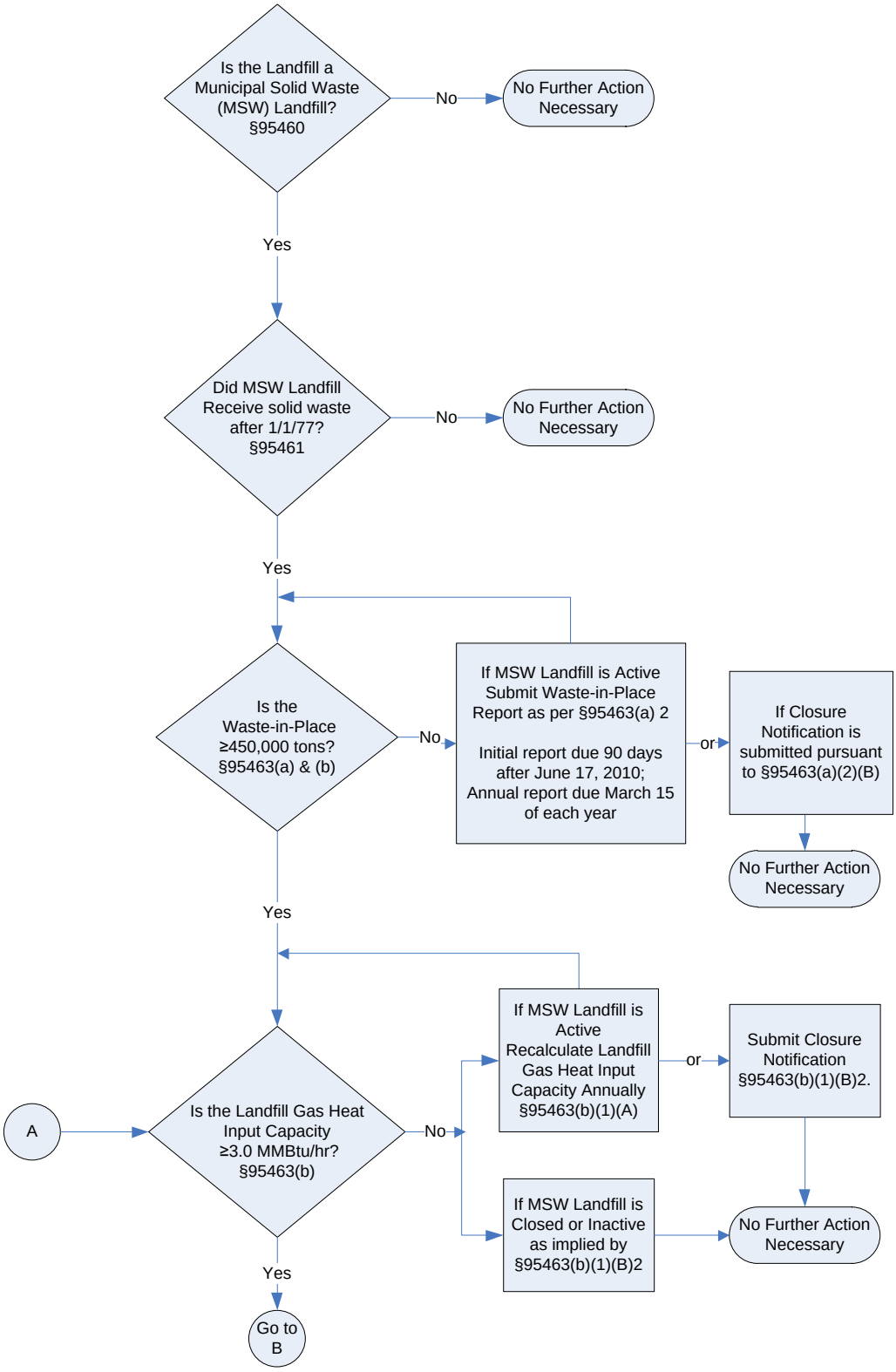
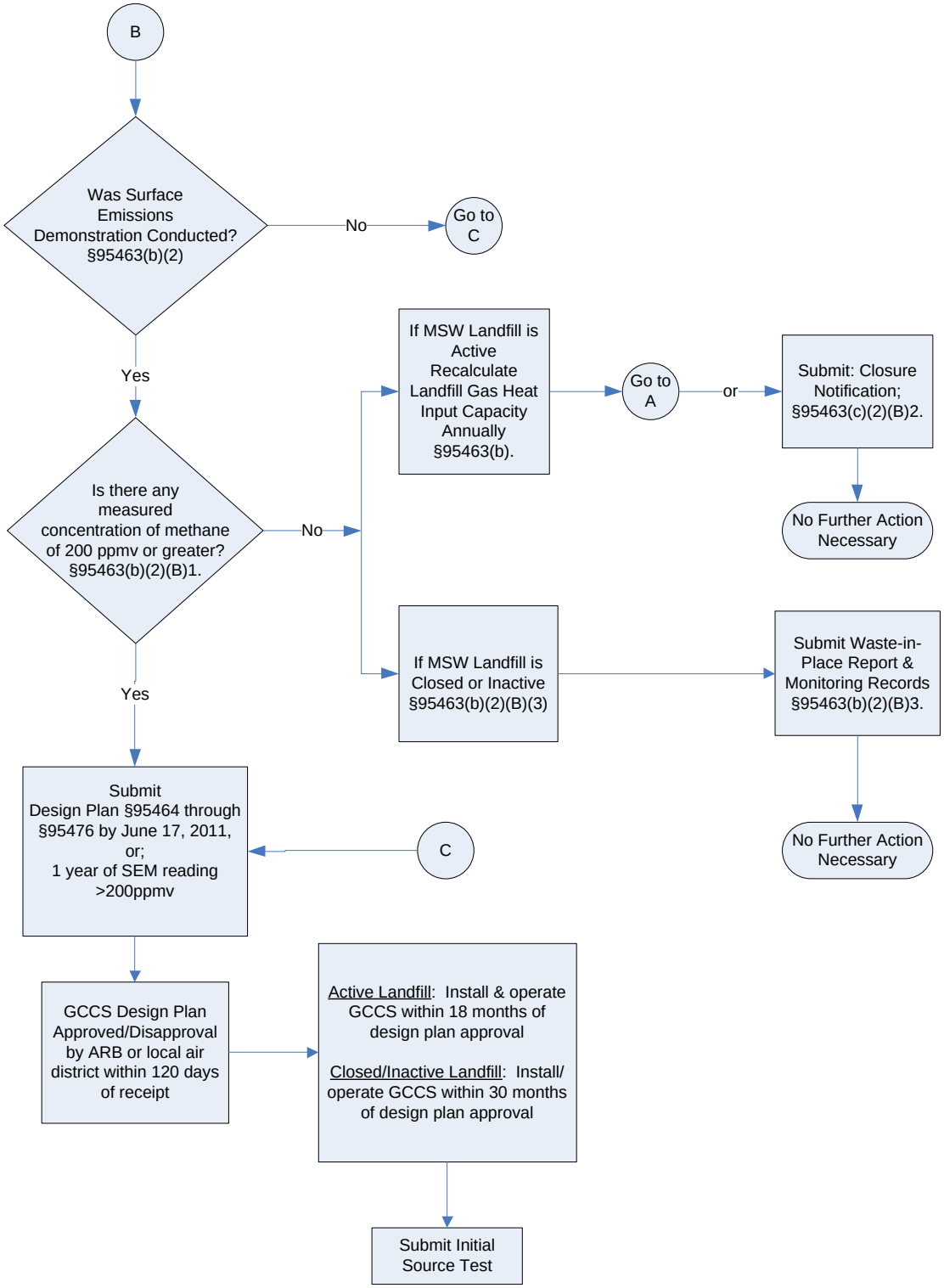


Figure 1. Flow Chart for Determining Control Requirements (Cont.)



Appendix D

Example Procedure for Conducting Integrated and Instantaneous Surface Monitoring Simultaneously

Example Procedure for Conducting Integrated and Instantaneous Surface Monitoring Simultaneously

The purpose of this document is to provide an example procedure for conducting integrated and instantaneous surface monitoring simultaneously. Conducting instantaneous and integrated surface monitoring simultaneously would satisfy the requirements of the regulation while saving landfill owners and operators both time and resources.

This document presents an example procedure that was based on the Los Angeles County Sanitation District's (LACSD) monitoring procedures manual. LACSD has been conducting both integrated and instantaneous surface monitoring as required under the South Coast Air Quality Management District's Rule 1150.1 for several years. The example procedure has been revised to address requirements that are specific to the regulation. The specifications in the example procedure are optional, unless described as required. Mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use.

Overview of Surface Monitoring Procedures

Surface monitoring is conducted by continuously recording methane levels while traversing the landfill area in a systematic pattern § 95471(c). Samples are collected from within three inches of the landfill surface using a portable hydrocarbon detector [§ 95471(a) and § 95471(c)(1)(A)].

Re-monitoring is required when emission levels exceed a threshold and is based on the type of monitoring for which the exceedance occurred (i.e., integrated surface monitoring is performed for an integrated exceedance, and instantaneous surface monitoring is performed for a point source exceedance).

The major requirements for integrated and instantaneous surface monitoring are presented in Table 1 and summarized below:

1. The landfill disposal area is divided into 50,000 square feet (ft^2) grids as required in § 95471(c)(1). Current maps of the landfill should be maintained on-site. Due to the geometry of the disposal area, not all grids will measure 50,000 ft^2. All grids on the landfill surface must be sampled for methane at least quarterly, unless: 1) determined to be inaccessible and excluded from monitoring (see Table 4), or 2) the grids are in compliance with § 95469(a)(1)(C) or 95469(a)(2)(C) and can be monitored annually.

2. For integrated surface monitoring, methane level must be less than 25 ppmv for each grid [§ 95465(a)(2)].

3. For instantaneous surface monitoring, the methane level must be less than 500 ppmv at any point on the landfill surface [§ 95465(a)(1)]. All instantaneous surface monitoring measurements of 200 ppmv or greater must be recorded and reported [§ 95465(c)(2)(A) and § 95470(b)(3)(J)].

4. For any grid or area within a grid exceeding the integrated or instantaneous surface emission limit, remediation and re-monitoring of the grid or grid area must be conducted within the timelines specified in § 95469(a).

Table 1. Summary of Requirements for Integrated and Instantaneous Surface Monitoring

Requirement	Limit/Specification
Monitor all accessible grids	Monitor once quarterly[1]
Integrated surface monitoring of all grids	< 25 ppmv average methane
Instantaneous surface monitoring of all grids	<500 ppm maximum methane[2]
Remediate and re-monitor any area that exceeds the emission limits	Timetables are specified in site-specific Compliance Plans[3]

1. Grids can be monitored annually if the conditions in § 95469(a)(1)(C) or 95469(a)(2)(C) are met.
2. Instantaneous surface methane readings of 200 ppmv or greater must be recorded pursuant to § 95471(c)(2)(A).
3. Timetables in Compliance Plans approved by the local air districts must also meet the requirements of the regulation.

Planning and Preparation

This section describes activities that should be considered to prepare for integrated and instantaneous surface monitoring. Table 2 provides a list of each activity, and further detail is included in the subsections that follow. Many of the activities described may require that results be recorded on data sheets. A sample data sheet is provided in Figure 2.

Table 2. List of Recommended Preparation Activities for Instantaneous and Integrated Surface Monitoring

TASK	TIMING	COMMENTS
Obtain grid map	Daily	Print out or obtain grid map; use drawings from previous quarter if available.
Select grids and monitoring routes	Daily	A walking pattern with a 25-foot spacing interval in a 50,000-ft^2 grid[1]. A route of approximately 2,450 linear ft in a 50,000 ft^2 grid to be walked in 20 minutes is recommended.
Identify excluded areas	Quarterly	Sample all grids that can be monitored safely.
Inspect grid for accessibility	Prior to monitoring	Identify any items requiring attention before monitoring. As necessary, arrange to have brush or weeds removed from monitoring path.
Ensure area will be dry	3-5 days ahead of test	As necessary and to the extent possible, have irrigation shut off several days before testing.
Confirm weather conditions	Day of test	No rain in previous 72 hours (based on site rain gauge or local newspaper) [§ 95471(c)(1)(D)]; wind speed less than 5 mph for 15-min average or 10 mph instantaneous (based on hand held anemometer) [§ 95471(c)(1)(C)].
Prepare and calibrate equipment	Day of test	Prepare according to standard operating procedures.
Confirm safe conditions	Day of test	Confirm conditions are safe for monitoring. Use additional safety precautions as necessary so that all required areas are monitored.

1. Unless increased to a 100-foot spacing interval pursuant to § 95471(c)(1)(B)1. or § 95471(c)(1)(B)2.

Scheduling

Key factors to consider when scheduling surface grid monitoring are as follows:

1. Monitoring should always be started as early as possible in a quarter to assure that all monitoring is completed before the end of the quarter.

2. Grids to be monitored are selected daily and selection often depends on weather conditions, keeping in mind wind speed and rain requirements.

3. Re-monitoring and remediation activities should be incorporated into the quarterly schedule and typically take priority over routine monitoring.

Route Selection

This section describes methods for selecting sampling routes when excluding full or partial grids from monitoring. The entire landfill surface (except for exempt areas) must be monitored each quarter.

Ideal grid example. The monitoring path for an ideal grid (a 50,000 ft^2 rectangle) may resemble that shown in Figure 1 (next page). Figure 1 is an illustrative example for landfill owners and operators to refer to in the development of appropriate walking

patterns to comply with the regulation. Because of the variability of landscapes and operational practices it is not expected for landfill owners or operators to follow the exact walking pattern depicted in Figure 1.

The regulation requires that the walking pattern must be no more than a 25-foot spacing interval and must traverse each grid [§ 95471(c)(1)(A) and § 95471(c)(1)(B)]; unless the spacing interval is increased to a 100-foot spacing interval pursuant to § 95471(c)(1)(B)1. or § 95471(c)(1)(B)2. The sampling path resembles a "serpentine" pattern. A route of approximately 2,450 feet long in a 50,000 ft^2 grid to be walked in about 20 minutes while using a 4-second sampling frequency is recommended. The walking pace should be approximately 100 feet per minute, except when limited by terrain or vegetation. This would yield about 300 data points per 50,000 ft^2 grid.

Irregular grid example. Different routes need to be used for grids with excluded areas or irregular shapes. Guidelines for selecting routes and sampling times for irregular grids are presented in Table 3. In these cases both the length of the traverse and the time taken to complete the traverse should be prorated to the percent of the total grid that can be sampled. For example, if only 70% (35,000 ft^2) of the area is sampled, the traverse length and sampling time are calculated as shown below:

Adjusted route length = 0.7 x 2,450 ft = 1,715 ft
Adjusted sample time = 0.7 x 20 minutes = 14 minutes

Note that since the proportion reduces both the distance and sample time, the speed at which the route is walked will remain the constant.

Grids with excluded areas. Grids with excluded areas will have less than 50,000 ft^2 of area available for traversing. In these cases both the length of the traverse and the time taken to complete the traverse should be applied to the percent of the total grid that can be sampled. Areas that are not required to be monitored do not need to be split into 50,000 ft^2 grids.

Figure 1. Typical 50,000 Square Foot Grid and Walk Pattern

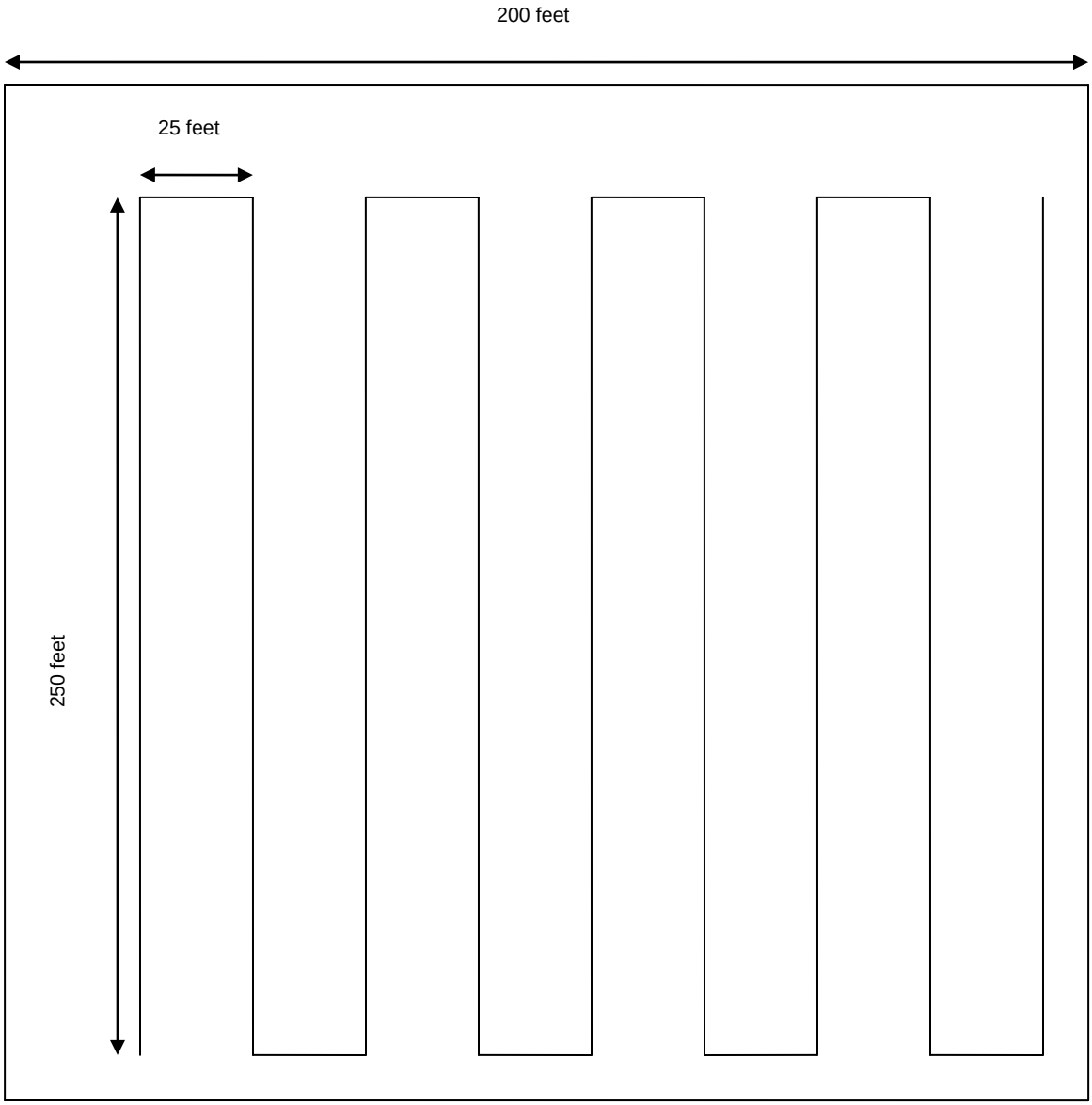


Figure 1: Landfill Walk Pattern for an Ideal 50,000 Square Foot Grid

Table 3. Guidelines for Route Selection on Irregular Grids

ISSUE	RECOMMENDED ACTION
Grid has excluded area	1. Choose a representative route over remaining area. 2. Prorate length of route to fraction of grid sampled. 3. Prorate sampling time to fraction of grid sampled.
Grid has irregular shape and/or terrain	Adjust shape of route to provide complete, safe coverage.

Grids with irregular shapes or terrain. Some grids will have irregular shapes or terrain that will make walking a standard serpentine route impossible. In these cases, an alternate route should be developed that provides representative coverage of the grid.

Excluded areas. Table 4 presents reasons for excluding the following types of surfaces from monitoring as provide in § 95468 of the regulation:

- Steep or slippery slopes, construction areas or other dangerous areas.
- Paved areas (note that separations or cracks in paving must be monitored).
- Monitoring instrument obstruction and physical obstruction areas.
- The active working face.

Also, areas can be excluded if it can be demonstrated to the implementing agency that they are unsafe or inaccessible. If an area is inaccessible due to temporary conditions, such as construction or a wet surface, it should be checked again later in the quarter and monitored if it is accessible. Documentation of excluded areas meeting the criteria listed above should be noted on grid maps maintained on-site. Table 4 presents guidelines for determining if an area can or should be excluded from monitoring.

Although an area or a grid may not be routinely monitored, it is not exempt from compliance with the surface monitoring requirements of the regulation. Therefore, if there are signs of gas emission, such as distressed vegetation, cracks, odors, etc. the area must be monitored and repaired as necessary.

Grid Preparation

It is necessary to ensure ahead of time that the grid surface will be dry and accessible for monitoring. Steps taken to satisfy this requirement include:

- *Irrigation*. Make arrangements to shut off the irrigation a few days before monitoring if normal irrigation would render the grid unsafe to monitor. Monitoring should be planned around the irrigation schedule.

- *Vegetation*. Some types of vegetation are either unsafe to walk on or impractical to walk through. As necessary, and within the limits of the regulation or other restrictions, modifications to the landscape and vegetation should be considered to allow for safe monitoring of the grid. These modifications may include removal of vegetation or construction of a path to reach areas that are difficult to access.

Table 4. Guidelines for Excluding Areas from Monitoring[1]

Reason for Exclusion	Reference	Comments
Steep or slippery slopes	§ 95468	
Paved areas	§ 95468	Must monitor cracks in pavement
Active working face	§ 95475(a)(20)	"Landfill surface" excludes the active working face
Thick or slippery vegetation	§ 95468	Cut vegetation or construct path as necessary, test when safe
Wet/muddy surface	§ 95468	Adjust irrigation; test when dry and safe. Monitoring takes precedence over irrigation
Uncorrectable unsafe conditions	§ 95468	Written submission and implementing agency approval required.

1. Areas excluded from monitoring must continue to comply with the regulation's methane emission limits. Repairs should be made if there are signs of emissions (distressed vegetation, cracks, odors, etc.).

Weather Conditions

The regulation includes several weather restrictions to ensure representative monitoring. These restrictions are:

1. Average wind speed less than 5 mph, based on a 15-minute average [§ 95471(c)(1)(C)].

2. Instantaneous wind speed less than 10 mph [§ 95471(c)(1)(C)].

3. No measurable precipitation within the past 72 hours [§ 95471(c)(1)(D)].

Weather checks are performed as part of monitoring as follows:

1. At the beginning and end of each day, check and record wind speed and wind direction using the site weather station or other instrumentation. Relative humidity and barometric pressure can also be recorded.

2. Before and after monitoring each grid, measure and record wind speed using a hand held anemometer.

Sampling Equipment Preparation

A portable hydrocarbon detector meeting the specifications noted in the regulation must be used for sampling methane levels [§ 95471(a)]. The instrument used in this example procedure document for conducting both integrated and instantaneous surface monitoring simultaneously is the TVA 1000B (other instruments meeting the requirements of § 95471(a) may also be used).

The TVA 1000B has data-logging capability which enables integrated and instantaneous surface monitoring to be performed simultaneously by recording methane readings at a short interval (e.g., every four to six seconds) along a path and averaging the results. In effect, the instrument provides the integrated surface methane measurement required by the regulation. The continuous sampling and data logging of emission results over the short time interval allows instantaneous surface monitoring to be completed during the process.

The monitoring instrument should be maintained and serviced as specified in the operator's manual. Daily equipment preparation includes the following steps:

1. Fill hydrogen tank.

2. Turn on equipment and allow to warm up.

3. Calibrate.

4. Input grid numbers into instrument.

Calibration. Details on equipment operation and calibration are included in the manufacturer's equipment manual. The regulation requires the instrument used to meet the calibration procedures, specifications, and performance requirements of U.S. EPA Method 21. The calibration gas to be used is methane. Recommended calibration parameters are listed in Table 5. If the analyzer does not meet calibration specifications, then it should be recalibrated, repaired, or replaced, as necessary.

Table 5. Recommended Calibration Parameters for Surface Monitoring[1]

PARAMETER	SPECIFICATION	COMMENTS
Span calibration gas concentration	Not less than 25 ppm; or more than 500 ppm	When a single calibration gas is used, 250 ppm and below is the preferred range
Calibration precision	≤ 3 percent of the calibration gas value	
Instrument response on span gas	Gas value ± 3 percent	

1. Some local air district landfill gas rules may require multiple calibration gases.

Integrated Surface Monitoring

This section outlines suggested steps to be taken during integrated surface monitoring. Instantaneous surface monitoring, which is conducted during integrated surface monitoring, is discussed later. It should be noted that proactive action is necessary during integrated surface monitoring to evaluate possible exceedances of the instantaneous concentration limit. Table 6 presents an example checklist for integrated surface monitoring.

Table 6. Example Checklist for Integrated Surface Monitoring

ITEM	COMMENTS
Confirm surface is dry.	If wet, reschedule monitoring.
Check wind speed with hand held anemometer.	$\leq$ 5 mph average and $\leq$ 10 mph instantaneous required. Record on data sheet.
Visually assess grid to plan traverse.	If not done previously, draw inaccessible areas on grid map.
Confirm instrument settings and operation.	Record instrument number on data sheet.
Start monitoring.	Note start time to cover grid.
Ensure proper monitoring technique.	Hold probe within 3" of the landfill surface.
During monitoring, listen for alarm and look for signs of emissions or point sources. [1]	If alarm goes off or potential point sources are seen, suspend integrated surface monitoring and conduct instantaneous surface monitoring. Clearly mark or flag location and return within 10-calendar days to remediate and re-monitor area.
Finish monitoring and record data	Note stop time on data sheet. Record the average surface concentration measured as methane for each grid, post-monitoring wind speed, exceedances and any unusual conditions.
Remediation and re-monitoring	Take corrective action to remediate the exceedance[2] and re-monitor within 10-calendar days.

1. For the purpose of this document, a point source is any specific location within a grid where there is a surface leak.
2. Average methane concentration measurements exceeding 25 ppmv, as determined by integrated surface emissions monitoring; or exceeding 500 ppmv, as determined by instantaneous surface emissions monitoring.

Data Sheet. A typical data sheet for recording surface monitoring (for both integrated and instantaneous) data may include the following fields: date, grid number, instrument number, start time, wind speed start, stop time, wind speed end, methane concentration (ppmv), and general comments.

Confirm surface is dry. If the surface is wet from irrigation, arrange to monitor when the surface is dry enough to safely walk the slopes.

Check wind speed. Using the hand held anemometer, measure and record the local wind speed. Site regional wind speeds are to be measured at a weather station situated at the landfill. The 15-minute average wind speed must be below 5 mph and the instantaneous wind speed is not to exceed 10 mph. If the wind speed exceeds specifications, monitoring for that grid will need to be rescheduled. One approach to minimizing wind problems is to schedule monitoring according to the time of day based on local weather patterns. For example, perform grid monitoring on calm days or in the morning in areas of the landfill that tend to have higher afternoon wind speeds.

Assess grid to plan traverse. Review the grid visually to plan the traverse. Identify all corners, boundaries, and inaccessible areas. If there is uncertainty about the steepness of a slope, it should be measured with an inclinometer. Previous grid drawings may show inaccessible areas. If a drawing does not exist, then one should be prepared. The percentage of the grid that is accessible should be estimated each quarter and noted on the drawing.

Confirm instrument settings and operation. Confirm that the proper grid number is entered, and that the instrument is operating properly.

Start monitoring. Note and record start time, and plan to monitor for about 20 minutes. If a portion of the grid is not accessible, multiply 20 minutes by the fraction of the grid that is accessible to determine the target sample time. Record the average surface concentration measured as methane for each grid.

Ensure proper monitoring technique. Proper monitoring technique includes the following:

- *Probe height*. Should be held within 3 inches of the landfill surface [§ 95471(c)(1)(A)].

- *Horizontal coverage*. While walking, the probe should be slowly moved from side to side to cover a path about 4-6 feet wide (or about 2-3 feet on each side).

- *Walking pace*. A recommended constant walking pace of approximately 100 feet per minute should be maintained, except when limited by terrain or vegetation. If the pace is interrupted for more than 10-15 seconds for any reason, data logging should be paused.

Listen for alarm and look for signs of emissions. The alarm set point on the TVA should be set to comply with the integrated surface methane limit. When the alarm sounds, discontinue integrated surface monitoring, indicate the location where integrated monitoring was halted, switch the grid name in the instrument from the integrated grid name to the instantaneous grid name then begin instantaneous surface monitoring.

Every effort should be made to identify the source of elevated emissions, so that the necessary corrections can be planned and executed with the time limits specified in the

regulation. While conducting surface monitoring, the technician should look for signs of gas emissions such as surface cracks, distressed vegetation, and odors. If any of these signs are observed, then surface monitoring should focus on these areas. Once the instance of instantaneous surface monitoring is completed, return to the location where integrated surface monitoring was halted and resume integrated surface monitoring.

Finish monitoring and record data. Record the average surface concentrations measured as methane for each grid, post-monitoring wind speed, and note any relevant comments on data sheet (e.g., exceedances or other unusual conditions).

Remediation and re-monitoring. For integrated surface monitoring, the average methane concentration measurements must not exceed 25 ppmv for each grid [§ 95465(a)(2)]. For any grid or area within a grid exceeding the integrated surface emission limit, remediation and re-monitoring of the grid or grid area must be conducted within the timelines specified in § 95469(a).

Instantaneous Surface Monitoring

To monitor more efficiently, it is recommended to perform instantaneous and integrated surface monitoring together. Like integrated surface monitoring, instantaneous surface monitoring uses the same grids and requires that each grid be monitored using a 25-foot spacing interval; unless the spacing interval is increased to a 100-foot spacing interval pursuant to § 95471(c)(1)(B)1. or § 95471(c)(1)(B)2. A data sheet should be used to record instantaneous surface monitoring data and the proper monitoring technique followed (see discussions on these topics on pages D-9 and D-10, respectively).

Data collected from instantaneous surface monitoring requires the recording of methane concentration measurements of 200 ppmv and above and remediation of any “exceedance” within the gird. For instantaneous surface monitoring, an exceedance is any specific location within a grid where the methane concentration exceeds 500 ppmv. During instantaneous surface monitoring, multiple point sources within a grid may be detected. A checklist for instantaneous surface monitoring is presented in Table 7. Discussions of the checklist items immediately follow the table. Note that for this discussion, the term “point source monitoring” refers to activities that are separate from integrated surface monitoring and are focused on identifying, locating, and quantifying surface leaks.

Table 7. Checklist for Instantaneous Surface Monitoring

ITEM	COMMENTS
Triggers for instantaneous surface monitoring	a. Instrument alarm sounds. b. Odor of landfill gas detected. c. Evidence of leakage seen, such as cracks or distressed vegetation. d. Retest of remediated area with prior exceedance.
Clearly mark or flag location if methane > 500 ppm	
Record data	(see Data Sheet discussion on Page D-9)

While conducting integrated and instantaneous surface monitoring simultaneously, various triggers are used to initiate a more detailed instantaneous surface monitoring, such as:

- The instrument alarm sounds during integrated surface monitoring, signaling a concentration greater than the alarm set point.
- The odor of landfill gas is detected.
- Evidence of leakage is seen, such as cracks or distressed vegetation.

If alarm goes off or potential point sources are seen, suspend integrated surface monitoring and conduct instantaneous surface monitoring. Clearly mark or flag location and return within 10-calendar days to remediate and re-monitor area.

Record Data. Record all instantaneous surface methane concentration measurements of 200 ppmv or greater. If there is an exceedance, show the area of the exceedance on a grid map. Note any relevant comments or unusual conditions on the data sheet.

Data Reporting and Record Keeping

The development of specific procedures for data reporting and record keeping is to be determined by the landfill owner or operator.

Appendix E

Example Report Forms

James Ryden
Chief of the Enforcement Division
California Air Resources Board
1001 “I” Street
P.O. Box 2815
Sacramento, California 95812

MM/DD/YYYY

RE: Closure Report as Required by the Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

Dear Mr. Ryden:

Landfill A is regulated under California Code of Regulations, title 17, subchapter 10, article 4, subarticle 6, sections 95460 to 95476, Methane Emissions from Municipal Solid Waste Landfills (“regulation”). Under the requirements of the regulation, Landfill A must submit a closure report within 30 days of waste acceptance cessation. The last day of waste acceptance was MM/DD/YYYY, and the landfill was closed on MM/DD/YYY. The closure is intended to be permanent.

The current estimated waste-in-place of Landfill A is XXXX tons as of MM/DD/YYYY. A copy of the data is enclosed.

Sincerely,

Landfill A Name
Owner or operator
Address
SWIS Number

cc: Renaldo Crooks
Air Pollution Specialist
Stationary Source Division
Process Evaluation Section
P.O. Box 2815
Sacramento, California 95812

James Ryden
Chief of the Enforcement Division
California Air Resources Board
1001 “I” Street
P.O. Box 2815
Sacramento, California 95812

MM/DD/YYYY

RE: Equipment Removal Report as required by the Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

Dear Mr. Ryden:

Landfill A is regulated under California Code of Regulations, title 17, subchapter 10, article 4, subarticle 6, sections 95460 to 95476, Methane Emissions from Municipal Solid Waste Landfills (“regulation”). Under the requirements of the regulation, Landfill A must submit an equipment removal report 30 days prior to ceasing to operate and removal of landfill gas collection and control equipment. Operation of the collection and control system is scheduled to cease on MM/DD/YYYY.

The control system has been in operation since MM/DD/YYYY. Therefore the minimum 15 year operating requirement has been fulfilled. As required by this regulation, a dated copy of the initial performance test report is enclosed to document the system initial installation date. Also enclosed are dated copies of the three most recent landfill surface methane monitoring reports demonstrating that the landfill is in compliance with the surface methane emissions standards pursuant to section 95465 after closure.

Sincerely,

Landfill A Name
Owner or operator
Address
SWIS Number

cc: Renaldo Crooks
Air Pollution Specialist
Stationary Source Division
Process Evaluation Section
P.O. Box 2815
Sacramento, California 95812

James Ryden
Chief of the Enforcement Division
California Air Resources Board
1001 “I” Street
P.O. Box 2815
Sacramento, California 95812

MM/DD/YYYY

RE: Waste-in-Place Report as required by the Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills

Dear Mr. Ryden:

Landfill A is regulated under California Code of Regulations, title 17, subchapter 10, article 4, subarticle 6, sections 95460 to 95476, Methane Emissions from Municipal Solid Waste Landfills (“regulation”). Under the requirements of the regulation, Landfill A must submit a waste-in-place report when the 450,000 ton waste-in-place threshold is exceeded or when the landfill closes.

The status of Landfill A is (active/closed/inactive). The current estimated waste-in-place is XXXX tons as of MM/DD/YYYY. A copy of the data is enclosed.

Sincerely,

Landfill A Name
Owner or operator
Address
SWIS Number

cc: Renaldo Crooks
Air Pollution Specialist
Stationary Source Division
Process Evaluation Section
P.O. Box 2815
Sacramento, California 95812

SAMPLE WASTE-IN-PLACE LETTER

James Ryden
Chief of the Enforcement Division
California Air Resources Board
1001 “I” Street
P.O. Box 2815
Sacramento, California 95812

RE: Waste-in-Place Report

Attached is the Waste-in-Place report as required to be submitted pursuant to Sections 95463(a) or 95463(b)(2)(B)3.a.

Date of submittal of this report: _____

The waste in place for this landfill is:

- ☐ less than 450,000 tons
- ☐ greater than or equal to 450,000 tons
- ☐ greater than or equal to 450,000 tons and there is no measured concentration of methane of 200 ppmv or greater from the surface of a closed or inactive MSW landfill

MSW landfill name: _____ SWIS Number: _____

	Owner	Operator
Name:		
Address: Street City, State Zip		

Landfill’s status: Active _____ Controlled _____
Closed _____ Uncontrolled _____
Inactive _____

Estimated waste-in-place (tons): _____

Date of estimated waste-in-place _____

- ☐ No topographic map is required since the facility has less than 450,000 tons waste in place and there are no areas with final cover or geomembrane installed.

- Attached is the 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.

Please contact me if you have any questions.

Sincerely,

cc: Renaldo Crooks
Air Pollution Specialist
Stationary Source Division
Process Evaluation Section
P.O. Box 2815
Sacramento, California 95812

Appendix F

Landfill Gas Tool

Appendix F

Landfill Gas Tool

Overview

ARB staff has developed a Landfill Gas Tool to assist owners and operators in complying with the landfill regulation. The tool is based on the mathematically exact first-order decay model from the 2006 IPCC guidelines and is designed to estimate the fugitive emissions from a landfill that does not have a landfill gas collection system. It also includes an estimate of the landfill's captured gas heating value (in MMBtu/hr). The values used in the tool are consistent with those used in ARB's landfill emissions inventory methodology. If you have comments or questions about this tool please contact Larry Hunsaker, Staff Air Pollution Specialist (e-mail: lhunsake@arb.ca.gov).

California Air Resources Board's Implementation of IPCC's Mathematically Exact First-Order Decay Model

Release date: June 3, 2010

This tool is designed to estimate greenhouse gas emissions from a landfill in support of the Local Government Operations Protocol.

Please follow these steps to estimate emissions:

1) Read the ***Methodology*** page to become familiar with the equations and the assumptions underlying the calculations.

2) Enter the landfill specific data on the ***Landfill Model Inputs*** page. **This is the only page where data needs to be added or modified.**

Data Type	Field or Column Name	Description
Landfill Specific Data	k Value	Decay factor (see ***Methodology*** page).
	State/Country	State or country where the landfill is located. Will determine the waste characterization data used.
Waste Deposit Data	Year	Year of the data entry values.
	Waste Deposited (Tons)	Amount of waste deposited in that year.
	Waste Deposited (% ANDOC)	Percent of the waste that is degradable, based on waste characterization data.
	Greenwaste & Compost - Daily Cover (Tons)	Amount of daily cover materials of the given type used in that year.
	Greenwaste & Compost - Daily Cover (% ANDOC)	Percent of the daily cover that is degradable, based on waste characterization data.
	Sludge - Daily Cover (Tons)	Amount of daily cover materials of the given type used in that year.
	Sludge - Daily Cover (% ANDOC)	Percent of the daily cover that is degradable, based on waste characterization data.
Note: Required data fields on the **Landfill Model Inputs** page are highlighted in rose		

The rose colored field names indicate which fields require data entry, all others have defaults that will be used in the calculations.

3) If you wish to overwrite the default % ANDOC value with your own value, you can use the calculator on the ***Landfill Specific ANDOC Values*** page (the last page in this tool) and then type your calculated landfill specific value over the default ANDOC% value.

4) Estimates of the emissions reflecting the current inputs are listed on the ***Landfill Emissions Output*** page and estimates of captured gas heat are available on the ***Landfill Gas Heat Output*** page.

Landfill Methane Emissions Estimation Methodology

The calculations made by this tool are based on:

1) The following equations from IPCC's Mathematically Exact First-Order Decay Model, see section 3A1.6.3 of the 2006 IPCC Guidelines available online at:
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

ANDOC% = Σ *WIPFRAC*$_i$ x *TDOC*$_i$ x *DANF*$_i$	
ANDOC%	Percent of the waste that is degradable
WIPFRAC$_i$	Fraction of the ith component in the Waste-in-Place (WIP)
TDOC$_i$	Total Degradable Organic Carbon fraction of the ith waste component (Mg of that component/Mg of Total WIP)
DANF$_i$	Decomposable Anaerobic Fraction of the ith waste component. That is, the fraction capable of decomposition in anaerobic conditions (Mg of decomposable carbon for that component/Mg TDOCi for that component)
ANDOC = WIP (Tons) x 0.9072 (Mg/Ton) x **ANDOC%**	
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)
$\mathbf{ANDOC_{year\text{-}end}} = \mathbf{ANDOC_{year\text{-}start}} \times e^{-[k]}$ $+ \mathbf{ANDOC_{deposited\text{-}last\ year}} \times [1/k \times (e^{-[k \times (1-M/12)]} - e^{-[k]}) - (M/12) \times e^{-[k]}]$ $+ \mathbf{ANDOC_{deposited\text{-}same\ year}} \times [(1/k) \times (1-e^{-[k \times (1-M/12)]}) + (M/12)]$	
$ANDOC_{year\text{-}end}$	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
$\mathbf{CH_4\ Generation} = \{\mathbf{ANDOC_{year\text{-}start}} \times [1-e^{-[k]}]$ $- \mathbf{ANDOC_{deposited\text{-}last\ year}} \times [1/k \times (e^{-[k \times (1-M/12)]} - e^{-[k]}) - (M/12) \times e^{-[k]}]$ $+ \mathbf{ANDOC_{deposited\text{-}same\ year}} \times [1-((1/k) \times (1-e^{-[k \times (1-M/12)]}) + (M/12))]\} \times \mathbf{FCH_4} \times 16/12$	
CH_4 Generation	CH_4 generated in the inventory year in question (Mg of CH_4)
FCH_4	Fraction of decomposing carbon converted into CH_4 (Default = 0.5)
CH_4 Emitted = CH_4 Generation x (1-**OX**)	
CH_4 Emitted	CH_4 emitted to the atmosphere in the inventory year in question (Mg of CH_4)
OX	Fraction of escaping CH_4 that is oxidized to CO_2 in the cover soil (Default = 0.1)

2) Using an iterative approach (where the $ANDOC_{year\text{-}start}$ for the next inventory year equals the the $ANDOC_{year\text{-}end}$ of the previous inventory year), starting with the landfill's opening year and working through each subsequent years to arrive at the year for which an estimate is desired.

3) Choosing the rate of anaerobic decomposition (k). For the US and Mexico, select one of the following k values from EPA depending on the local average rainfall:

Average Rainfall (Inches/Year)		
<20	**20-40**	**>40**
k = 0.02	k = 0.038	k = 0.057

Where to input k values

For Canada, select the k value that corresponds to the province/territory :

Province/Territories	k
Alberta	0.012
British Columbia	0.082
Manitoba	0.019
New Brunswick	0.062
Newfoundland & Labrador	0.078
Nova Scotia	0.077
Northwest Territories	0.005
Nunavut	0.005
Ontario	0.045
Prince Edward Island	0.060
Quebec	0.056
Sakatchewan	0.010
Yukon	0.001

4) Using IPCC default value for the percent of methane oxidized while passing through the landfill to atmosphere:

Percent oxidation: 10%

Note: *Items 5 & 6 below only pertain when using this tool to assist in compliance with the Early Action Landfill Rule, and only affect the results shown in the Landfill Gas Heat Output page.*

5) Using EPA default value for the percent of methane captured by a landfill gas collection system:

Percent collection: 75%

6) Using EPA value for heat content of methane:

Methane heat content: 1,012 btu/scf

Percent of Anaerobically Degradable Carbon (ANDOC%): Default Values Used for California

For documentation on these values, see the ARB's Local Government Operations Protocol, available online at:
http://www.arb.ca.gov/cc/protocols/localgov/pubs/pubs.htm

Table 1: EPA 1960 Waste Characterization Study (Applies for waste deposited up to 1964)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	6.40%	47.04%	14.97%	0.45%
Office Paper	10.70%	39.59%	87.37%	3.70%
Corrugated Boxes	10.80%	44.86%	44.27%	2.15%
Coated Paper	2.20%	33.03%	24.30%	0.18%
Food	14.80%	14.85%	86.53%	1.90%
Grass	12.10%	13.33%	32.49%	0.52%
Leaves	6.05%	29.11%	27.87%	0.49%
Branches	6.05%	44.25%	23.16%	0.62%
Lumber	3.70%	43.00%	23.26%	0.37%
Textiles	2.10%	24.00%	50.00%	0.25%
Diapers	0.05%	24.00%	50.00%	0.01%
Construction/Demolition	2.60%	4.00%	50.00%	0.05%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.69%**

Table 2: EPA 1970 Waste Characterization Study (Applies for waste deposited from 1965 to 1974)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	6.40%	47.04%	14.97%	0.45%
Office Paper	11.30%	39.59%	87.37%	3.91%
Corrugated Boxes	13.50%	44.86%	44.27%	2.68%
Coated Paper	2.00%	33.03%	24.30%	0.16%
Food	11.30%	14.85%	86.53%	1.45%
Grass	10.25%	13.33%	32.49%	0.44%
Leaves	5.13%	29.11%	27.87%	0.42%
Branches	5.13%	44.25%	23.16%	0.53%
Lumber	3.30%	43.00%	23.26%	0.33%
Textiles	1.80%	24.00%	50.00%	0.22%
Diapers	0.30%	24.00%	50.00%	0.04%
Construction/Demolition	2.50%	4.00%	50.00%	0.05%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.67%**

Table 3: **EPA 1980 Waste Characterization Study (Applies for waste deposited from 1975 to 1984)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	5.90%	47.04%	14.97%	0.42%
Office Paper	12.00%	39.59%	87.37%	4.15%
Corrugated Boxes	11.50%	44.86%	44.27%	2.28%
Coated Paper	2.40%	33.03%	24.30%	0.19%
Food	9.50%	14.85%	86.53%	1.22%
Grass	10.05%	13.33%	32.49%	0.44%
Leaves	5.03%	29.11%	27.87%	0.41%
Branches	5.03%	44.25%	23.16%	0.51%
Lumber	5.10%	43.00%	23.26%	0.51%
Textiles	1.70%	24.00%	50.00%	0.20%
Diapers	1.40%	24.00%	50.00%	0.17%
Construction/Demolition	3.50%	4.00%	50.00%	0.07%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.57%**

Table 4: **EPA 1990 Waste Characterization Study (Applies for waste deposited from 1985 to 1992)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	4.80%	47.04%	14.97%	0.34%
Office Paper	13.10%	39.59%	87.37%	4.53%
Corrugated Boxes	10.50%	44.86%	44.27%	2.09%
Coated Paper	2.10%	33.03%	24.30%	0.17%
Food	12.10%	14.85%	86.53%	1.55%
Grass	8.95%	13.33%	32.49%	0.39%
Leaves	4.48%	29.11%	27.87%	0.36%
Branches	4.48%	44.25%	23.16%	0.46%
Lumber	7.00%	43.00%	23.26%	0.70%
Textiles	3.30%	24.00%	50.00%	0.40%
Diapers	1.60%	24.00%	50.00%	0.19%
Construction/Demolition	3.90%	4.00%	50.00%	0.08%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.25%**

Table 5: **EPA 1995 Waste Characterization Study (Applies for waste deposited from 1993 to 1995)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	3.90%	47.04%	14.97%	0.27%
Office Paper	15.00%	39.59%	87.37%	5.19%
Corrugated Boxes	10.30%	44.86%	44.27%	2.05%
Coated Paper	1.80%	33.03%	24.30%	0.14%
Food	13.40%	14.85%	86.53%	1.72%
Grass	6.55%	13.33%	32.49%	0.28%
Leaves	3.28%	29.11%	27.87%	0.27%
Branches	3.28%	44.25%	23.16%	0.34%
Lumber	7.30%	43.00%	23.26%	0.73%
Textiles	4.50%	24.00%	50.00%	0.54%
Diapers	1.90%	24.00%	50.00%	0.23%
Construction/Demolition	4.50%	4.00%	50.00%	0.09%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.85%**

Table 6: CIWMB 1999 Waste Characterization Study (Applies for waste deposited from 1996 to 2002)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	4.28%	47.04%	14.97%	0.30%
Office Paper	4.44%	39.59%	87.37%	1.54%
Corrugated Boxes	4.59%	44.86%	44.27%	0.91%
Coated Paper	16.92%	33.03%	24.30%	1.36%
Food	15.72%	14.85%	86.53%	2.02%
Grass	5.27%	13.33%	32.49%	0.23%
Leaves	2.63%	29.11%	27.87%	0.21%
Branches	2.37%	44.25%	23.16%	0.24%
Lumber	4.91%	43.00%	23.26%	0.49%
Textiles	2.11%	24.00%	50.00%	0.25%
Diapers	6.91%	24.00%	50.00%	0.83%
Construction/Demolition	6.65%	4.00%	50.00%	0.13%
Medical Waste	0.02%	15.00%	50.00%	0.00%
Sludge/Manure	0.14%	5.00%	50.00%	0.00%
MSW Total				**8.52%**

Table 7: CIWMB 2004 Waste Characterization Study (Applies for waste deposited from 2003 to 2006)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	2.20%	47.04%	14.97%	0.16%
Office Paper	1.95%	39.59%	87.37%	0.67%
Corrugated Boxes	5.75%	44.86%	44.27%	1.14%
Coated Paper	11.09%	33.03%	24.30%	0.89%
Food	14.55%	14.85%	86.53%	1.87%
Grass	2.81%	13.33%	32.49%	0.12%
Leaves	1.41%	29.11%	27.87%	0.11%
Branches	2.59%	44.25%	23.16%	0.26%
Lumber	9.65%	43.00%	23.26%	0.96%
Textiles	4.44%	24.00%	50.00%	0.53%
Diapers	4.36%	24.00%	50.00%	0.52%
Construction/Demolition	12.06%	4.00%	50.00%	0.24%
Medical Waste	0.04%	15.00%	50.00%	0.00%
Sludge/Manure	0.09%	5.00%	50.00%	0.00%
MSW Total				**7.50%**

Table 8: CIWMB 2008 Waste Characterization Study (Applies for waste deposited from 2007 to the present)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	1.65%	47.04%	14.97%	0.12%
Office Paper	1.84%	39.59%	87.37%	0.64%
Corrugated Boxes	4.80%	44.86%	44.27%	0.95%
Coated Paper	8.98%	33.03%	24.30%	0.72%
Food	15.50%	14.85%	86.53%	1.99%
Grass	1.90%	13.33%	32.49%	0.08%
Leaves	3.24%	29.11%	27.87%	0.26%
Branches	1.95%	44.25%	23.16%	0.20%
Lumber	14.51%	43.00%	23.26%	1.45%
Textiles	5.47%	24.00%	50.00%	0.66%
Diapers	4.33%	24.00%	50.00%	0.52%
Construction/Demolition	5.48%	4.00%	50.00%	0.11%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.05%	5.00%	50.00%	0.00%
MSW Total				**7.70%**

Percent of Anaerobically Degradable Carbon (ANDOC%): Default Values Used for Canada and Mexico

For documentation on these values, see the ARB's Local Government Operations Protocol, available online at:
http://www.arb.ca.gov/cc/protocols/localgov/pubs/pubs.htm

Table 18: IPCC 2006 Waste Characterization Defaults - Central America (Applies for all years of waste deposited)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	1.64%	47.04%	14.97%	0.12%
Office Paper	6.30%	39.59%	87.37%	2.18%
Corrugated Boxes	4.93%	44.86%	44.27%	0.98%
Coated Paper	0.82%	33.03%	24.30%	0.07%
Food	43.80%	14.85%	86.53%	5.63%
Grass	0.00%	13.33%	32.49%	0.00%
Leaves	0.00%	29.11%	27.87%	0.00%
Branches	0.00%	44.25%	23.16%	0.00%
Lumber	13.50%	43.00%	23.26%	1.35%
Textiles	4.40%	24.00%	50.00%	0.53%
Diapers	0.00%	24.00%	50.00%	0.00%
Construction/Demolition	0.00%	4.00%	50.00%	0.00%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.85%**

Table 19: IPCC 2006 Waste Characterization Defaults - North America (Applies for all years of waste deposited)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	2.78%	47.04%	14.97%	0.20%
Office Paper	10.67%	39.59%	87.37%	3.69%
Corrugated Boxes	8.35%	44.86%	44.27%	1.66%
Coated Paper	1.39%	33.03%	24.30%	0.11%
Food	33.90%	14.85%	86.53%	4.36%
Grass	0.00%	13.33%	32.49%	0.00%
Leaves	0.00%	29.11%	27.87%	0.00%
Branches	0.00%	44.25%	23.16%	0.00%
Lumber	6.20%	43.00%	23.26%	0.62%
Textiles	5.30%	24.00%	50.00%	0.64%
Diapers	0.00%	24.00%	50.00%	0.00%
Construction/Demolition	0.00%	4.00%	50.00%	0.00%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.27%**

Percent of Anaerobically Degradable Carbon (ANDOC%): Default Values Used for United States (other than California)

For documentation on these values, see the ARB's Local Government Operations Protocol, available online at:
http://www.arb.ca.gov/cc/protocols/localgov/pubs/pubs.htm

Table 1: EPA 1960 Waste Characterization Study (Applies for waste deposited up to 1964)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	6.40%	47.04%	14.97%	0.45%
Office Paper	10.70%	39.59%	87.37%	3.70%
Corrugated Boxes	10.80%	44.86%	44.27%	2.15%
Coated Paper	2.20%	33.03%	24.30%	0.18%
Food	14.80%	14.85%	86.53%	1.90%
Grass	12.10%	13.33%	32.49%	0.52%
Leaves	6.05%	29.11%	27.87%	0.49%
Branches	6.05%	44.25%	23.16%	0.62%
Lumber	3.70%	43.00%	23.26%	0.37%
Textiles	2.10%	24.00%	50.00%	0.25%
Diapers	0.05%	24.00%	50.00%	0.01%
Construction/Demolition	2.60%	4.00%	50.00%	0.05%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.69%**

Table 2: EPA 1970 Waste Characterization Study (Applies for waste deposited from 1965 to 1974)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	6.40%	47.04%	14.97%	0.45%
Office Paper	11.30%	39.59%	87.37%	3.91%
Corrugated Boxes	13.50%	44.86%	44.27%	2.68%
Coated Paper	2.00%	33.03%	24.30%	0.16%
Food	11.30%	14.85%	86.53%	1.45%
Grass	10.25%	13.33%	32.49%	0.44%
Leaves	5.13%	29.11%	27.87%	0.42%
Branches	5.13%	44.25%	23.16%	0.53%
Lumber	3.30%	43.00%	23.26%	0.33%
Textiles	1.80%	24.00%	50.00%	0.22%
Diapers	0.30%	24.00%	50.00%	0.04%
Construction/Demolition	2.50%	4.00%	50.00%	0.05%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.67%**

Table 3: **EPA 1980 Waste Characterization Study (Applies for waste deposited from 1975 to 1984)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	5.90%	47.04%	14.97%	0.42%
Office Paper	12.00%	39.59%	87.37%	4.15%
Corrugated Boxes	11.50%	44.86%	44.27%	2.28%
Coated Paper	2.40%	33.03%	24.30%	0.19%
Food	9.50%	14.85%	86.53%	1.22%
Grass	10.05%	13.33%	32.49%	0.44%
Leaves	5.03%	29.11%	27.87%	0.41%
Branches	5.03%	44.25%	23.16%	0.51%
Lumber	5.10%	43.00%	23.26%	0.51%
Textiles	1.70%	24.00%	50.00%	0.20%
Diapers	1.40%	24.00%	50.00%	0.17%
Construction/Demolition	3.50%	4.00%	50.00%	0.07%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.57%**

Table 4: **EPA 1990 Waste Characterization Study (Applies for waste deposited from 1985 to 1992)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	4.80%	47.04%	14.97%	0.34%
Office Paper	13.10%	39.59%	87.37%	4.53%
Corrugated Boxes	10.50%	44.86%	44.27%	2.09%
Coated Paper	2.10%	33.03%	24.30%	0.17%
Food	12.10%	14.85%	86.53%	1.55%
Grass	8.95%	13.33%	32.49%	0.39%
Leaves	4.48%	29.11%	27.87%	0.36%
Branches	4.48%	44.25%	23.16%	0.46%
Lumber	7.00%	43.00%	23.26%	0.70%
Textiles	3.30%	24.00%	50.00%	0.40%
Diapers	1.60%	24.00%	50.00%	0.19%
Construction/Demolition	3.90%	4.00%	50.00%	0.08%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.25%**

Table 5: **EPA 1995 Waste Characterization Study (Applies for waste deposited from 1993 to 1997)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	3.90%	47.04%	14.97%	0.27%
Office Paper	15.00%	39.59%	87.37%	5.19%
Corrugated Boxes	10.30%	44.86%	44.27%	2.05%
Coated Paper	1.80%	33.03%	24.30%	0.14%
Food	13.40%	14.85%	86.53%	1.72%
Grass	6.55%	13.33%	32.49%	0.28%
Leaves	3.28%	29.11%	27.87%	0.27%
Branches	3.28%	44.25%	23.16%	0.34%
Lumber	7.30%	43.00%	23.26%	0.73%
Textiles	4.50%	24.00%	50.00%	0.54%
Diapers	1.90%	24.00%	50.00%	0.23%
Construction/Demolition	4.50%	4.00%	50.00%	0.09%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.85%**

Table 9: **EPA 2000 Waste Characterization Study (Applies for waste deposited from 1998 to 2000)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	3.60%	47.04%	14.97%	0.25%
Office Paper	14.50%	39.59%	87.37%	5.01%
Corrugated Boxes	10.00%	44.86%	44.27%	1.99%
Coated Paper	1.50%	33.03%	24.30%	0.12%
Food	15.40%	14.85%	86.53%	1.98%
Grass	4.35%	13.33%	32.49%	0.19%
Leaves	2.18%	29.11%	27.87%	0.18%
Branches	2.18%	44.25%	23.16%	0.22%
Lumber	7.00%	43.00%	23.26%	0.70%
Textiles	5.20%	24.00%	50.00%	0.62%
Diapers	1.90%	24.00%	50.00%	0.23%
Construction/Demolition	4.70%	4.00%	50.00%	0.09%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.59%**

Table 10: **EPA 2001 Waste Characterization Study (Applies for waste deposited in 2001)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	2.10%	47.04%	14.97%	0.15%
Office Paper	14.50%	39.59%	87.37%	5.01%
Corrugated Boxes	9.80%	44.86%	44.27%	1.95%
Coated Paper	1.30%	33.03%	24.30%	0.10%
Food	16.20%	14.85%	86.53%	2.08%
Grass	3.75%	13.33%	32.49%	0.16%
Leaves	1.88%	29.11%	27.87%	0.15%
Branches	1.88%	44.25%	23.16%	0.19%
Lumber	7.40%	43.00%	23.26%	0.74%
Textiles	5.60%	24.00%	50.00%	0.67%
Diapers	2.10%	24.00%	50.00%	0.25%
Construction/Demolition	5.00%	4.00%	50.00%	0.10%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.57%**

Table 11: **EPA 2002 Waste Characterization Study (Applies for waste deposited in 2002)**

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	1.90%	47.04%	14.97%	0.13%
Office Paper	14.70%	39.59%	87.37%	5.08%
Corrugated Boxes	9.80%	44.86%	44.27%	1.95%
Coated Paper	1.20%	33.03%	24.30%	0.10%
Food	16.10%	14.85%	86.53%	2.07%
Grass	3.75%	13.33%	32.49%	0.16%
Leaves	1.88%	29.11%	27.87%	0.15%
Branches	1.88%	44.25%	23.16%	0.19%
Lumber	7.40%	43.00%	23.26%	0.74%
Textiles	5.70%	24.00%	50.00%	0.68%
Diapers	2.10%	24.00%	50.00%	0.25%
Construction/Demolition	5.10%	4.00%	50.00%	0.10%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.61%**

Table 12: EPA 2003 Waste Characterization Study (Applies for waste deposited in 2003)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	1.90%	47.04%	14.97%	0.13%
Office Paper	13.60%	39.59%	87.37%	4.70%
Corrugated Boxes	9.20%	44.86%	44.27%	1.83%
Coated Paper	1.40%	33.03%	24.30%	0.11%
Food	16.60%	14.85%	86.53%	2.13%
Grass	3.90%	13.33%	32.49%	0.17%
Leaves	1.95%	29.11%	27.87%	0.16%
Branches	1.95%	44.25%	23.16%	0.20%
Lumber	7.40%	43.00%	23.26%	0.74%
Textiles	5.90%	24.00%	50.00%	0.71%
Diapers	2.00%	24.00%	50.00%	0.24%
Construction/Demolition	5.00%	4.00%	50.00%	0.10%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.22%**

Table 13: EPA 2004 Waste Characterization Study (Applies for waste deposited in 2004)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	2.50%	47.04%	14.97%	0.18%
Office Paper	13.00%	39.59%	87.37%	4.50%
Corrugated Boxes	9.60%	44.86%	44.27%	1.91%
Coated Paper	1.50%	33.03%	24.30%	0.12%
Food	16.70%	14.85%	86.53%	2.15%
Grass	3.50%	13.33%	32.49%	0.15%
Leaves	1.75%	29.11%	27.87%	0.14%
Branches	1.75%	44.25%	23.16%	0.18%
Lumber	7.30%	43.00%	23.26%	0.73%
Textiles	5.90%	24.00%	50.00%	0.71%
Diapers	2.00%	24.00%	50.00%	0.24%
Construction/Demolition	5.00%	4.00%	50.00%	0.10%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**11.10%**

Table 14: EPA 2005 Waste Characterization Study (Applies for waste deposited in 2005)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	2.00%	47.04%	14.97%	0.14%
Office Paper	12.80%	39.59%	87.37%	4.43%
Corrugated Boxes	8.80%	44.86%	44.27%	1.75%
Coated Paper	1.50%	33.03%	24.30%	0.12%
Food	17.30%	14.85%	86.53%	2.22%
Grass	3.60%	13.33%	32.49%	0.16%
Leaves	1.80%	29.11%	27.87%	0.15%
Branches	1.80%	44.25%	23.16%	0.18%
Lumber	7.50%	43.00%	23.26%	0.75%
Textiles	6.10%	24.00%	50.00%	0.73%
Diapers	2.00%	24.00%	50.00%	0.24%
Construction/Demolition	5.20%	4.00%	50.00%	0.10%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.97%**

Table 15: EPA 2006 Waste Characterization Study (Applies for waste deposited in 2006)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	1.80%	47.04%	14.97%	0.13%
Office Paper	12.10%	39.59%	87.37%	4.18%
Corrugated Boxes	8.70%	44.86%	44.27%	1.73%
Coated Paper	1.50%	33.03%	24.30%	0.12%
Food	17.60%	14.85%	86.53%	2.26%
Grass	3.60%	13.33%	32.49%	0.16%
Leaves	1.80%	29.11%	27.87%	0.15%
Branches	1.80%	44.25%	23.16%	0.18%
Lumber	7.40%	43.00%	23.26%	0.74%
Textiles	6.30%	24.00%	50.00%	0.76%
Diapers	2.10%	24.00%	50.00%	0.25%
Construction/Demolition	5.30%	4.00%	50.00%	0.11%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.76%**

Table 16: EPA 2007 Waste Characterization Study (Applies for waste deposited in 2007)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	1.30%	47.04%	14.97%	0.09%
Office Paper	11.20%	39.59%	87.37%	3.87%
Corrugated Boxes	8.20%	44.86%	44.27%	1.63%
Coated Paper	1.40%	33.03%	24.30%	0.11%
Food	18.10%	14.85%	86.53%	2.33%
Grass	3.45%	13.33%	32.49%	0.15%
Leaves	1.73%	29.11%	27.87%	0.14%
Branches	1.73%	44.25%	23.16%	0.18%
Lumber	8.50%	43.00%	23.26%	0.85%
Textiles	6.40%	24.00%	50.00%	0.77%
Diapers	2.20%	24.00%	50.00%	0.26%
Construction/Demolition	5.50%	4.00%	50.00%	0.11%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.49%**

Table 17: EPA 2008 Waste Characterization Study (Applies for waste deposited from 2008 to the present)

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	0.60%	47.04%	14.97%	0.04%
Office Paper	11.50%	39.59%	87.37%	3.98%
Corrugated Boxes	7.40%	44.86%	44.27%	1.47%
Coated Paper	1.30%	33.03%	24.30%	0.10%
Food	18.60%	14.85%	86.53%	2.39%
Grass	3.50%	13.33%	32.49%	0.15%
Leaves	1.75%	29.11%	27.87%	0.14%
Branches	1.75%	44.25%	23.16%	0.18%
Lumber	8.90%	43.00%	23.26%	0.89%
Textiles	6.90%	24.00%	50.00%	0.83%
Diapers	2.30%	24.00%	50.00%	0.28%
Construction/Demolition	5.80%	4.00%	50.00%	0.12%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.57%**

Landfill Specific Value Calculator
for the Percent of Anaerobically Degradable Carbon (ANDOC%)

Landfill specific Waste Characterization Data

Waste Type	WIPFRAC	TDOC	DANF	%ANDOC
Newspaper	6.40%	47.04%	14.97%	0.45%
Office Paper	10.70%	39.59%	87.37%	3.70%
Corrugated Boxes	10.80%	44.86%	44.27%	2.15%
Coated Paper	2.20%	33.03%	24.30%	0.18%
Food	14.80%	14.85%	86.53%	1.90%
Grass	12.10%	13.33%	32.49%	0.52%
Leaves	6.05%	29.11%	27.87%	0.49%
Branches	6.05%	44.25%	23.16%	0.62%
Lumber	3.70%	43.00%	23.26%	0.37%
Textiles	2.10%	24.00%	50.00%	0.25%
Diapers	0.05%	24.00%	50.00%	0.01%
Construction/Demolition	2.60%	4.00%	50.00%	0.05%
Medical Waste	0.00%	15.00%	50.00%	0.00%
Sludge/Manure	0.00%	5.00%	50.00%	0.00%
MSW Total				**10.69%**

1) Enter your landfill specific waste characterization data (WIPFRAC).
2) Copy the result of the calculation (MSW total) and overwrite the default %ANDOC value for the particular year on the ***Landfill Model Inputs*** page.
Note: Only the data for the Fraction of the Waste in Place (WIPFRAC) should be altered. If you wish to modify the TDOC or DANF values, please contact ARB staff.

Model Output: Landfill Characteristics

Landfill Name:		**Year Opened:**			
State:	CA	**If Closed, Year:**		**k Value:**	0.020
City/County:				**M Value:**	6

Model Output: Methane and Carbon Dioxide Emissions (metric tonnes of CO_2 equivalent)

Year	CH_4	CO_2
1999		
2000		
2001		
2002		
2003		
2004		
2005		
2006		
2007		
2008		
2009		

Model Output: Landfill Characteristics

Landfill Name:		**Year Opened:**			
State:	CA	**If Closed, Year:**		**k Value:**	0.020
City/County:				**M Value:**	6

Model Output: Landfill Gas Captured and Captured Gas Heat (graph values in MMbtu/hr)

Year	Landfill Gas Captured (scf/min)	Captured Gas Heat (MMbtu/hr)
1999		
2000		
2001		
2002		
2003		
2004		
2005		
2006		
2007		
2008		
2009		