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Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

[EPA–HQ–OAR–2014–0451; FRL–9949–55–OAR]

RIN 2060–AS23

Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is finalizing a new subpart that updates the Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills (Emission Guidelines). The EPA reviewed the landfills Emission Guidelines based on changes in the landfills industry since the Emission Guidelines were promulgated in 1996. The EPA's review of the Emission Guidelines for municipal solid waste (MSW) landfills considered landfills that accepted waste after November 8, 1987, and commenced construction, reconstruction, or modification on or before July 17, 2014. Based on this review, the EPA has determined that it is appropriate to revise the Emission Guidelines to reflect changes to the population of landfills and the results of an analysis of the timing and methods for reducing emissions. This action will achieve additional reductions in emissions of landfill gas and its components, including methane, by lowering the emissions threshold at which a landfill must install controls. This action also incorporates new data and information received in response to an advanced notice of proposed rulemaking and a proposed rulemaking and addresses other regulatory issues including surface emissions monitoring, wellhead monitoring, and the definition of landfill gas treatment system.

The revised Emission Guidelines, once implemented through revised state plans or a revised federal plan, will reduce emissions of landfill gas, which contains both nonmethane organic compounds and methane. Landfills are a significant source of methane, which is a potent greenhouse gas pollutant. These avoided emissions will improve air quality and reduce the potential for public health and welfare effects associated with exposure to landfill gas emissions.

DATES: This final rule is effective on October 28, 2016.

The incorporation by reference of certain publications listed in the regulations is approved by the Director of the Federal Register as of October 28, 2016.

ADDRESSES: The EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR–2014–0451. All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available electronically through *http://www.regulations.gov.*

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SUPPLEMENTARY INFORMATION:

Acronyms and Abbreviations. The following acronyms and abbreviations are used in this document.

ANPRM Advance notice of proposed rulemaking
ANSI American National Standards Institute
BMP Best management practice
Btu British thermal unit
CAA Clean Air Act
CBI Confidential business information
CDX Central Data Exchange
CEDRI Compliance and Emissions Data Reporting Interface
CFR Code of Federal Regulations
CO_2 Carbon dioxide
CO_2e Carbon dioxide equivalent
EPA Environmental Protection Agency
ERT Electronic Reporting Tool
FID Flame ionization detector
GCCS Gas collection and control system
GHG Greenhouse gas
GHGRP Greenhouse Gas Reporting Program
GWP Global warming potential
HAP Hazardous air pollutant
HOV Higher operating value
IAMS Integrated assessment models
ICR Information collection request
IPCC Intergovernmental Panel on Climate Change
IWG Interagency working group
LFG Landfill gas
LFGCost Landfill Gas Energy Cost Model
m^3 Cubic meters
Mg Megagram
Mg/yr Megagram per year
mph Miles per hour
MSW Municipal solid waste
$mtCO_2e$ Metric tons of carbon dioxide equivalent
MW Megawatt
MWh Megawatt hour
NAICS North American Industry Classification System
NESHAP National Emission Standards for Hazardous Air Pollutants
NMOC Nonmethane organic compound
NRC National Research Council
NSPS New source performance standards
NTTAA National Technology Transfer and Advancement Act
OAQPS Office of Air Quality Planning and Standards
OMB Office of Management and Budget
PM Particulate matter
$PM_{2.5}$ Fine particulate matter
ppm Parts per million
ppmvd Parts per million by dry volume
RCRA Resource Conservation and Recovery Act
RD&D Research, development, and demonstration
RFA Regulatory Flexibility Act
SBAR Small Business Advocacy Review
$SC–CH_4$ Social cost of methane
$SC–CO_2$ Social cost of carbon dioxide
SEM Surface emissions monitoring
SO_2 Sulfur dioxide
SSM Startup, shutdown, and malfunction
Tg Teragram
TIP Tribal implementation plan
TTN Technology Transfer Network
U.S. United States
USGCRP U.S. Global Change Research Program
VCS Voluntary consensus standard
VOC Volatile organic compound

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I. Executive Summary

A. Purpose of Regulatory Action

This action finalizes changes to the MSW landfills Emission Guidelines resulting from the EPA's review of the Emission Guidelines under Clean Air Act (CAA) section 111. The EPA's review identified a number of advances in technology and operating practices for reducing emissions of landfill gas (LFG) and the final changes are based on our evaluation of those advances and our understanding of LFG emissions. The resulting changes to the Emission Guidelines will achieve additional reductions in emissions of LFG and its components, including methane. This final rule is consistent with the President's 2013 Climate Action Plan,[1] which directs federal agencies to focus on "assessing current emissions data, addressing data gaps, identifying technologies and best practices for reducing emissions, and identifying existing authorities and incentive-based opportunities to reduce methane emissions." The final rule is also consistent with the President's Methane Strategy,[2] which directs the EPA's regulatory and voluntary programs to continue to pursue emission reductions through regulatory updates and to encourage LFG energy recovery through voluntary programs. These directives are discussed in detail in section III.A of this preamble. This regulatory action also resolves or clarifies several implementation issues that were previously addressed in amendments proposed on May 23, 2002 (67 FR 36475) and September 8, 2006 (71 FR 53271).

1. Need for Regulatory Action

The EPA reviewed the Emission Guidelines to determine the potential for achieving additional reductions in emissions of LFG. Significant changes have occurred in the landfill industry over time, including changes to the size and number of existing landfills, industry practices, and gas control methods and technologies. Based on the EPA's review, we are finalizing changes to the Emission Guidelines. The changes will achieve additional emission reductions of LFG and its components (including methane), which will reduce air pollution and the resulting harm to public health and welfare. Landfills are a significant source of methane, a potent greenhouse gas, for which there are cost-effective means of reduction, so this rule is an important element of the United States' work to reduce emissions that are contributing to climate change. In addition, the changes provide more effective options for demonstrating compliance, and provide clarification of several implementation issues raised during the amendments proposed in 2002 and 2006. Additional information supporting the EPA's decision to review the Emission Guidelines can be found in Section I.A. of the Emission Guidelines proposal (80 FR 52100, August 27, 2015).

2. Legal Authority

The EPA is not statutorily obligated to conduct a review of the Emission Guidelines, but has the discretion to do so when circumstances indicate that it is appropriate. The EPA determined that it was appropriate to review the Emission Guidelines based on changes in the landfill industry and changes in operation of landfills, including the size, trends in gas collection and control system installations, and age of landfills since the Emission Guidelines were promulgated in 1996. The EPA compiled new information on landfills through data collection efforts for a statutorily mandated review of the existing new source performance standards (NSPS) (40 CFR part 60, subpart WWW), public comments received on the NSPS proposal (79 FR 41796, July 17, 2014), public comments received on the Advance Notice of Proposed Rulemaking (ANPRM) (79 FR 41772, July 17, 2014), and public comments received on the Emission Guidelines proposal (80 FR 52100, August 27, 2015) for use in reviewing the Emission Guidelines. This information allowed the EPA to assess current practices, emissions, and the potential for additional emission reductions.

The EPA interprets CAA section 111(d) as providing discretionary authority to update emission guidelines, and by extension to require states to update standards of performance, in appropriate circumstances. The EPA believes this is the best, and perhaps only, permissible interpretation of the CAA. It is consistent with the gap filling nature of section 111(d), the general purposes of the CAA to protect and enhance air quality. Moreover, this is supported because Congress's grant of authority to issue regulations carries with it the authority to amend or update regulations[3] that they have issued.[4] "Regulatory agencies do not establish rules of conduct to last forever; they are supposed, within the limits of the law and of fair and prudent administration, to adapt their rules and practices to the Nation's needs in a volatile, changing economy. They are neither required nor supposed to regulate the present and the future within the inflexible limits of yesterday." [5]

To interpret the CAA otherwise would mean that Congress intended to

[1] Executive Office of the President, "The President's Climate Action Plan" June 2013. *https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.*

[2] Executive Office of the President, "Climate Action Plan Strategy to Reduce Methane, March 2014. *https://www.whitehouse.gov/sites/default/files/strategy_to_reduce_methane_emissions_2014-03-28_final.pdf.*

[3] Congress has provided the Agency with broad authority to issue regulations "as necessary to carry out [her] functions under" the Act. This broad grant of authority further supports the reasonableness of EPA's interpretation.

[4] *See Trujillo* v. *General Electric Co.,* 621 F.2d 1084, 1086 (10th Cir. 1980) ("Administrative agencies have an inherent authority to reconsider their own decisions, since the power to decide in the first instance carries with it the power to reconsider.") (citing *Albertson* v. *FCC,* 182 F.2d 397, 399 (D.C. Cir. 1950)). See 621 F.2d at 1088 ("The authority to reconsider may result in some instances, as it did here, in a totally new and different determination.").

[5] *American Trucking Ass'n* v. *Atchison, Topeka & Santa Fe Ry.,* 387 U.S. 397, 416 (1967).

allow existing sources to operate forever without any consideration of the need for updated controls simply because, at some point in the distant past, the EPA had previously required these sources to be regulated. The EPA's interpretation is consistent with the gap filling nature of section 111(d), whereas the opposite interpretation would undermine it. By its terms, section 111(d) was designed to address emissions from existing sources of non-national ambient air quality standards (NAAQS), non-CAA section 112 hazardous air pollutants.[6] A one-off approach would mean that the EPA would be unable to address the threats from these sources even as we improve our understanding of the danger presented by the pollutant at issue or new or improved control options become available. Indeed, this lack of authority would exist even in cases such as the instant one where some affected sources had not yet been required to invest in emission controls.

The overall structure of the CAA also supports EPA's interpretation. The primary goal of the CAA is: "[T]o protect and enhance the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." CAA section 101(b)(1), 42 U.S.C. 7401(b)(1). The CAA goes about this in a number of ways. Under section 111 the chosen approach is through the identification of the best system of emission reduction available to reduce emissions to the atmosphere which takes into account the cost of achieving such reductions and any nonair quality health and environmental impact and energy requirements. These systems change over time. Where such changes have the effect of substantially reducing harmful air emissions, it would be illogical that the EPA would be precluded from requiring existing sources to update their controls in recognition of those changes, particularly when those sources may continue to operate for decades. Similarly, if, after a rule was finalized, factual information were to arise revealing that the initial standards were too stringent to be met, it would be illogical that EPA would be precluded from revising the standards accordingly. Had Congress intended to preclude the EPA from updating the emission guidelines to reflect changes, it would surely have specifically said so, something it did not do.

The fact that the EPA has the authority to update the emission guidelines does not, however, mean that it is unconstrained in exercising that authority. Rather, the decision whether to update a particular set of emission guidelines must be made on a rule-specific basis after considering the same factors the EPA considered in establishing those guidelines, including the level of reductions achievable and the cost of achieving those reductions, and, as appropriate, taking into account controls sources installed to comply with the initial emission guidelines. The EPA has determined that it is appropriate to update the emission guidelines for municipal solid waste (MSW) landfills. The EPA's final rule is not a requirement to install new and different control equipment (compared to the existing rule), but rather to install the same basic controls, *i.e.,* a well-designed and well-operated landfill gas collection and control system, on an accelerated basis. While this will result in some additional cost, the EPA believes that cost is fully justified given the substantial reduction in emissions of landfill gas and its constituent components, including methane, that will result. As indicated in the final rule, lowering the threshold above which landfill owners/operators must install a gas collection and control system from 50 Mg of non-methane organic compounds (NMOC) per year to 34 Mg/year will result in an additional reduction in NMOC emissions of 1,810 Mg/yr and a concomitant reduction in methane emissions of 0.285 million Mg/yr. In these circumstances, the EPA believes that it not only has the legal authority to update the emission guidelines, but that doing so imminently reasonable.

B. Summary of Major Provisions

The final Emission Guidelines apply to landfills that accepted waste after November 8, 1987,[7] and that commenced construction, reconstruction, or modification on or before July 17, 2014 (the date of publication of proposed revisions to the landfills NSPS, 40 CFR part 60, subpart XXX). The final rule provisions are described below.

Thresholds for Installing Controls. The final Emission Guidelines retain the current design capacity thresholds of 2.5 million megagrams (Mg) and 2.5 million cubic meters (m^3), but reduce the nonmethane organic compounds (NMOC) emission threshold for the installation and removal of a gas collection and control system (GCCS) from 50 Mg/yr to 34 Mg/yr for landfills that are not closed as of September 27, 2017. (A megagram is also known as a metric ton, which is equal to 1.1 U.S. short tons or about 2,205 pounds.) An MSW landfill that exceeds the design capacity thresholds must install and start up a GCCS within 30 months after LFG emissions reach or exceed an NMOC level of 34 Mg/yr. Consistent with the existing Emission Guidelines, the owner or operator of a landfill may control the gas by routing it to a non-enclosed flare, an enclosed combustion device, or a treatment system that processes the collected gas for subsequent sale or beneficial use.

Emission Threshold Determination. The EPA is finalizing an alternative site-specific emission threshold determination methodology for when a landfill must install and operate a GCCS. This alternative methodology, referred to as "Tier 4," is based on surface emissions monitoring (SEM) and demonstrates whether or not surface emissions are below a specific threshold. The Tier 4 SEM demonstration allows landfills that exceed the threshold using modeled NMOC emission rates using Tier 1 or 2 to demonstrate that actual site-specific surface methane emissions are below a specific threshold. A landfill that can demonstrate that surface emissions are below 500 parts per million (ppm) for four consecutive quarters does not trigger the requirement to install a GCCS even if Tier 1, 2, or 3 calculations

[6] CAA subsection 111(d)(1)(A)(i), provides that regulation under CAA section 111(d) is intended to cover pollutants that are not regulated under either the criteria pollutant/NAAQS provisions or section 112 of the CAA. Thus, section 111(d) is designed to regulate pollutants from existing sources that fall in the gap not covered by the criteria pollutant provisions or the hazardous air pollutant provisions. This gap-filling purpose can be seen in the early legislative history of the CAA. As originally enacted in the 1970 CAA, the precursor to CAA section 111 (which was originally section 114) was described as covering pollutants that would not be controlled by the criteria pollutant provisions or the hazardous air pollutant provisions. See S. Committee Rep. to accompany S. 4358 (Sept. 17, 1970), 1970 CAA Legis. Hist. at 420 ("It should be noted that the emission standards for pollutants which cannot be considered hazardous (as defined in section 115 [which later became section 112]) could be established under section 114 [later, section 111]. Thus, there should be no gaps in control activities pertaining to stationary source emissions that pose any significant danger to public health or welfare."); Statement by S. Muskie, S. Debate on S. 4358 (Sept. 21, 1970), 1970 CAA Legis. Hist. at 227 ("[T]he bill [in section 114] provides the Secretary with the authority to set emission standards for selected pollutants which cannot be controlled through the ambient air quality standards and which are not hazardous substances.").

[7] This date in 1987 is the date on which permit programs were established under the Hazardous and Solid Waste Amendments of the Resource, Conservation and Recovery Act (RCRA) which amended the Solid Waste Disposal Act (SWDA), 42 U.S.C. 6901–6992k. This date was also selected as the regulatory cutoff in the Emission Guidelines for landfills no longer receiving wastes because the EPA judged states would be able to identify active facilities as of this date.

indicate that the 34 Mg/yr threshold has been exceeded. Landfills that have calculated NMOC emissions of 50 Mg/yr or greater are not eligible for the Tier 4 emission threshold determination in order to prevent conflicting requirements between subpart Cf and the landfills NESHAP (40 CFR part 63, subpart AAAA). Many landfills that are subject to subpart Cf will also be subject to the landfills NESHAP. The landfills NESHAP requires landfills that exceed the size threshold (2.5 million Mg and 2.5 million m^3) and exceed the NMOC emissions threshold (50 Mg/yr) to install and operate a GCCS.

Closed Landfill Subcategory. Because closed landfills do not produce as much LFG as an active landfill, the EPA is finalizing a separate subcategory for landfills that close on or before September 27, 2017. Landfills in this subcategory will continue to be subject to an NMOC emission threshold of 50 Mg/yr for determining when controls must be installed or can be removed.

Low LFG Producing Areas. The EPA is also finalizing criteria for determining when it is appropriate to cap or remove all or a portion of the GCCS. The final criteria for capping or removing all or a portion of the GCCS are: (1) The landfill is closed, (2) the GCCS has operated for at least 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows, and (3) the calculated NMOC emission rate at the landfill is less than 34 Mg/yr on three successive test dates. The final rule does not contain a GCCS removal criterion based on surface emissions monitoring.

Landfill Gas Treatment. In the final Emission Guidelines, the EPA has addressed two issues related to LFG treatment. First, the EPA is clarifying that the use of treated LFG is not limited to use as a fuel for a stationary combustion device but may be used for other beneficial uses such as vehicle fuel, production of high-British thermal unit (Btu) gas for pipeline injection, or use as a raw material in a chemical manufacturing process. Second, the EPA is finalizing a definition of *treated landfill gas* that applies to LFG processed in a treatment system meeting the requirements in 40 CFR part 60, subpart Cf, and defining *treatment system* as a system that filters, de-waters, and compresses LFG for sale or beneficial use. The definition of treatment system allows the level of treatment to be tailored to the type and design of the specific combustion equipment or the other beneficial use such as vehicle fuel, production of high-Btu gas for pipeline injection, or use as a raw material in a chemical manufacturing process in which the LFG is used. Owners or operators must develop a site-specific treatment system monitoring plan that includes monitoring parameters addressing all three elements of treatment (filtration, de-watering, and compression) to ensure the treatment system is operating properly for the intended end use of the treated LFG. They also must keep records that demonstrate that such parameters effectively monitor filtration, de-watering, and compression system performance necessary for the end use of the treated LFG.

Wellhead Operational Standards. The EPA is finalizing changes to certain operational standards (*i.e.,* the requirement to meet specific operating limits) for nitrogen/oxygen level at the wellheads. Landfill owners or operators are not required to take corrective action based on exceedances of specified operational standards for nitrogen/oxygen levels at wellheads, but they must continue to monitor and maintain records of nitrogen/oxygen levels on a monthly basis in order to inform any necessary adjustments to the GCCS and must maintain records of monthly readings. The operational standard, corrective action, and corresponding recordkeeping and reporting remain for temperature and maintaining negative pressure at the wellhead.

Surface Monitoring. The EPA is finalizing a requirement to monitor all surface penetrations at existing landfills. In final 40 CFR part 60, subpart Cf, landfills must conduct SEM at all cover penetrations and openings within the area of the landfill where waste has been placed and a gas collection system is required to be in place and operating according to the operational standards in final 40 CFR part 60, subpart Cf. Specifically, landfill owners or operators must conduct surface monitoring on a quarterly basis at the specified intervals and where visual observations indicate elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations.

Startup, Shutdown, and Malfunction. The EPA is finalizing a requirement that standards of performance in the Emission Guidelines apply at all times, including periods of startup, shutdown, and malfunction (SSM). The EPA is also finalizing an alternative standard during SSM events: In the event the collection or control system is not operating, the gas mover system must be shut down and all valves in the collection and control system contributing to venting of the gas to the atmosphere must be closed within 1 hour of the collection or control system not operating.

Other Clarifications. The EPA is finalizing a number of clarifications to address several issues that have been raised by landfill owners or operators during implementation of the current NSPS and Emission Guidelines. These clarifications include adding criteria for when an affected source must update its design plan and clarifying when landfill owners or operators must submit requests to extend the timeline for taking corrective action. The EPA is also updating several definitions in the Emission Guidelines. In addition, while the EPA is not mandating organics diversion, we are finalizing two specific compliance flexibilities in the Emission Guidelines to encourage wider adoption of organics diversion and GCCS best management practices (BMPs) for emission reductions at landfills. These compliance flexibilities are discussed in section V.A.1 and VI.A.1 (wellhead monitoring) and section V.B and section VI.B (Tier 4 emission threshold determination) of this preamble.

C. Costs and Benefits

The final Emission Guidelines are expected to significantly reduce emissions of LFG and its components, which include methane, volatile organic compounds (VOC), and hazardous air pollutants (HAP). Landfills are a significant source of methane emissions, and in 2014, landfills represented the third largest source of human-related methane emissions in the U.S. This rulemaking applies to existing landfills that commenced construction, modification, or reconstruction on or before July 17, 2014 and accepted waste after 1987. The EPA estimates 1,851 existing landfills that accepted waste after 1987 and opened prior to 2014.

To comply with the emission limits in the final rule, MSW landfill owners or operators are expected to install the least-cost control for collecting, and treating or combusting LFG. The annualized net cost for the final Emission Guidelines is estimated to be $54.1 million (2012$) in 2025, when using a 7 percent discount rate. The annualized costs represent the costs compared to no changes to the current Emission Guidelines (*i.e.,* baseline) and include $92.6 million to install and operate a GCCS, as well as $0.76 million to complete the corresponding testing and monitoring. These control costs are offset by $39.3 million in revenue from electricity sales, which is incorporated into the net control costs for certain landfills that are expected to generate revenue by using the LFG to produce electricity.

Installation of a GCCS to comply with the 34 Mg/yr NMOC emissions threshold at open landfills would achieve reductions of 1,810 Mg/yr NMOC and 285,000 metric tons methane (about 7.1 million metric tons of carbon dioxide equivalent ($mtCO_2e$)) beyond the baseline in year 2025. In addition, the final rule is expected to result in the net reduction of an additional 277,000 Mg CO_2, due to reduced demand for electricity from the grid as landfills generate electricity from LFG. The NMOC portion of LFG can contain a variety of air pollutants, including VOC and various organic HAP. VOC emissions are precursors to both fine particulate matter ($PM_{2.5}$) and ozone formation. These pollutants, along with methane, are associated with substantial health effects, welfare effects, and climate effects. The EPA expects that the reduced emissions will result in improvements in air quality and lessen the potential for health effects associated with exposure to air pollution related emissions, and result in climate benefits due to reductions of the methane component of LFG.

The EPA estimates that the final rule's estimated methane emission reductions and secondary CO_2 emission reductions in the year 2025 would yield global monetized climate benefits of $200 million to approximately $1.2 billion, depending on the discount rate. Using the average social cost of methane (SC–CH_4) and the average social cost of CO_2 (SC–CO_2), each at a 3-percent discount rate, results in an estimate of about $440 million in 2025 (2012$).

The SC–CH_4 and SC–CO_2 are the monetary values of impacts associated with marginal changes in methane and CO_2 emissions, respectively, in a given year. It includes a wide range of anticipated climate impacts, such as net changes in agricultural productivity, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning.

With the data available, we are not able to provide health benefit estimates for the reduction in exposure to HAP, ozone, and $PM_{2.5}$ for this rule. This is not to imply that there are no such benefits of the rule; rather, it is a reflection of the difficulties in modeling the direct and indirect impacts of the reductions in emissions for this sector with the data currently available.

Based on the monetized benefits and costs, the annual net benefits of the final guidelines are estimated to be $390 million ($2012) in 2025, based on the average SC–CH_4 at a 3 percent discount rate, average SC–CO_2 at a 3 percent discount rate, and costs at a 7 percent discount rate.

II. General Information

A. Does this action apply to me?

This final rule addresses existing MSW landfills, *i.e.*, landfills accepting waste after 1987 and on which construction was commenced on or before July 17, 2014, and associated solid waste management programs. Potentially affected categories include those listed in Table 1 of this preamble.

TABLE 1—REGULATED ENTITIES

Category	NAICS [a]	Examples of affected facilities
Industry: Air and water resource and solid waste management	924110	Solid waste landfills.
Industry: Refuse systems—solid waste landfills	562212	Solid waste landfills.
State, local, and tribal government agencies	924110	Administration of air and water resource and solid waste management programs.

[a] North American Industry Classification System.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by the new subpart. To determine whether your facility would be regulated by this action, you should carefully examine the applicability criteria in final 40 CFR 60.32f of subpart Cf. If you have any questions regarding the applicability of the final subpart to a particular entity, contact the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

B. Where can I get a copy of this document and other related information?

In addition to being available in the docket, an electronic copy of this action is available through EPA's Technology Transfer Network (TTN) Web site, a forum for information and technology exchange in various areas of air pollution control. Following signature by the EPA Administrator, the EPA will post a copy of this action at *http://www.epa.gov/ttnatw01/landfill/landflpg.html.* Following publication in the **Federal Register**, the EPA will post the **Federal Register** version of this final rule and technical documents at this same Web site.

III. Background

The Emission Guidelines for MSW landfills were promulgated on March 12, 1996, and subsequently amended on June 16, 1998, February 24, 1999, and April 10, 2000, to make technical corrections and clarifications. Amendments were proposed on May 23, 2002, and September 8, 2006, to address implementation issues, but those amendments were never finalized. On July 17, 2014, the EPA issued an ANPRM for the MSW landfills Emission Guidelines (79 FR 41772). The purpose of that action was to request public input on controls and practices that could further reduce emissions from existing MSW landfills and to evaluate that input to determine if changes to the Emission Guidelines were appropriate. On July 17, 2014, the EPA issued a concurrent proposal for revised NSPS for new MSW landfills (79 FR 41796). On August 27, 2015 (80 FR 52100), the EPA proposed a review of the Emission Guidelines to build on progress to date to (1) Achieve additional reductions in emissions of LFG and its components, (2) account for changes in the landfill industry and changes in operation of the landfills, including the size, trends in GCCS installations, and age of landfills, as reflected in new data, (3) provide new options for demonstrating compliance, and (4) to complete efforts regarding unresolved implementation issues. The EPA considered information it received in response to the ANPRM (79 FR 41772) and Notice of Proposed Rulemaking (80 FR 52100) for existing landfills in evaluating these final Emission Guidelines. We are also finalizing some of the amendments proposed on May 23, 2002, and September 8, 2006 to improve implementation of the Emission Guidelines. The respective frameworks of NSPS and Emission Guidelines have been similar since they were first promulgated in 1996 (*e.g.*, size threshold, emission threshold, monitoring requirements, etc). In response to public comments, which include implementation concerns

associated with the potential for different approaches and requirements between revised final rules, the EPA is finalizing similar requirements for the NSPS and Emission Guidelines.

A. Landfill Gas Emissions and Climate Change

In June 2013, President Obama issued a Climate Action Plan that directed federal agencies to focus on "assessing current emissions data, addressing data gaps, identifying technologies and best practices for reducing emissions, and identifying existing authorities and incentive-based opportunities to reduce methane emissions." [8] Methane is a potent greenhouse gas (GHG) that is 28–36 times greater than carbon dioxide (CO_2) and has an atmospheric life of about 12 years.[9] Because of methane's potency as a GHG and its atmospheric life, reducing methane emissions is one of the best ways to achieve near-term beneficial impact in mitigating global climate change.

The "Climate Action Plan: Strategy to Reduce Methane Emissions" [10] (the Methane Strategy) was released in March 2014. The strategy recognized the methane reductions achieved through the EPA's regulatory and voluntary programs to date. It also directed the EPA to continue to pursue emission reductions through regulatory updates and to encourage LFG energy recovery through voluntary programs.

The EPA recognized the climate benefits associated with reducing methane emissions from landfills nearly 25 years ago. The 1991 NSPS Background Information Document [11] asserted that the reduction of methane emissions from MSW landfills was one of many options available to reduce global warming. The NSPS for MSW landfills, promulgated in 1996, also recognized the climate co-benefits of controlling methane (61 FR 9917, March 12, 1996).

A recent study assessed EPA regulations and voluntary programs over the period 1993–2013 and found that they were responsible for the reduction of about 130 million metric tons of methane emissions (equal to about 18 percent of the total U.S. methane emissions over that time period), leading to a reduction in atmospheric concentrations of methane of about 28 parts per billion in 2013 [12] (compared to an observed increase in methane concentrations of about 80 ppb over those 20 years).

The review and final revision of the MSW landfills Emission Guidelines capitalizes on additional opportunities to achieve methane reductions while acknowledging historical agency perspectives and research on climate, a charge from the President's Climate Action Plan, the Methane Strategy, and improvements in the science surrounding GHG emissions.

LFG is a collection of air pollutants, including methane and NMOC. LFG is typically composed of 50-percent methane, 50-percent CO_2, and less than 1-percent NMOC by volume. The NMOC portion of LFG can contain various organic HAP and VOC. When the Emission Guidelines and NSPS were promulgated in 1996, NMOC was selected as a surrogate for MSW LFG emissions because NMOC contains the air pollutants that at that time were of most concern due to their adverse effects on public health and welfare. Today, methane's effects on climate change are also considered important. In 2014, methane emissions from MSW landfills represented 18.2 percent of total U.S. methane emissions and 1.9 percent of total U.S. GHG emissions (in carbon dioxide equivalent (CO_2e)).[13] In 2014, MSW landfills continued to be the third largest source of human-related methane emissions in the U.S., releasing an estimated 133.1 million metric tons of CO_2e. For these reasons and because additional emissions reductions can be achieved at a reasonable cost, the EPA is finalizing changes to the Emission Guidelines that are based on reducing the NMOC and methane components of LFG.

B. What are the public health and welfare effects of landfill gas emissions?

1. Public Health Effects of VOC and Various Organic HAP

VOC emissions are precursors to both $PM_{2.5}$ and ozone formation. As documented in previous analyses (U.S. EPA, 2006 [14], 2010 [15], and 2014 [16]), exposure to $PM_{2.5}$ and ozone is associated with significant public health effects. $PM_{2.5}$ is associated with health effects, including premature mortality for adults and infants, cardiovascular morbidity such as heart attacks, and respiratory morbidity such as asthma attacks, acute bronchitis, hospital admissions and emergency room visits, work loss days, restricted activity days and respiratory symptoms, as well as welfare impacts such as visibility impairment.[17] Ozone is associated with public health effects, including hospital and emergency department visits, school loss days and premature mortality, as well as ecological effects (*e.g.*, injury to vegetation and climate change).[18] Nearly 30 organic HAP have been identified in uncontrolled LFG, including benzene, toluene, ethyl benzene, and vinyl chloride.[19] Benzene is a known human carcinogen.

[8] Executive Office of the President, "The President's Climate Action Plan" June 2013. *https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.*

[9] The IPCC updates GWP estimates with each new assessment report, and in the latest assessment report, AR5, the latest estimate of the methane GWP ranged from 28–36, compared to a GWP of 25 in AR4. The impacts analysis in this final rule is based on the 100-year GWP from AR4 (25) instead of AR5 to be consistent with and comparable to key Agency emission quantification programs such as the Inventory of Greenhouse Gas Emissions and Sinks (GHG Inventory), and the GHGRP.

[10] Executive Office of the President, "Climate Action Plan Strategy to Reduce Methane, March 2014. *https://www.whitehouse.gov/sites/default/files/strategy_to_reduce_methane_emissions_2014-03-28_final.pdf.*

[11] Air Emissions from Municipal Solid Waste Landfills-Background Information for Proposed Standards and Guidelines, U.S. EPA (EPA–450/3–90–011a) (NTIS PB 91–197061) page 2–15.

[12] Melvin, A.M.; Sarofim, M.C.; Crimmins, A.R., "Climate benefits of U.S. EPA programs and policies that reduced methane emissions 1993–2013", Environmental Science & Technology, 2016, in press. *http://pubs.acs.org/doi/pdf/10.1021/acs.est.6b00367.* DOI 10.1021/acs.est.6b00367.

[13] Total U.S. methane emissions were 731 teragrams (Tg) CO_2e and total U.S. GHG emissions were 6,870.5 Tg in 2014. A teragram is equal to 1 million Mg. (A megagram is also known as a metric ton, which is equal to 1.1 U.S. short tons or about 2,205 pounds.) U.S. EPA "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014." Table ES–2. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html.*

[14] U.S. EPA. *RIA. National Ambient Air Quality Standards for Particulate Matter,* Chapter 5. Office of Air Quality Planning and Standards, Research Triangle Park, NC. October 2006. Available on the Internet at *http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205-Benefits.pdf.*

[15] U.S. EPA. *RIA. National Ambient Air Quality Standards for Ozone.* Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2010. Available on the Internet at *http://www.epa.gov/ttn/ecas/regdata/RIAs/s1-supplemental_analysis_full.pdf.*

[16] U.S. EPA. *RIA. National Ambient Air Quality Standards for Ozone.* Office of Air Quality Planning and Standards, Research Triangle Park, NC. December 2014. Available on the Internet at *http://www.epa.gov/ttnecas1/regdata/RIAs/20141125ria.pdf.*

[17] U.S. EPA. Integrated Science Assessment for Particulate Matter (Final Report). EPA–600–R–08–139F. National Center for Environmental Assessment—RTP Division. December 2009. Available at *http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546.*

[18] U.S. EPA. Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). EPA/600/R–05/004aF–cF. Washington, DC: U.S. EPA. February 2006. Available on the Internet at *http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=149923.*

[19] U.S. EPA. 1998. Office of Air and Radiation, Office of Air Quality Planning and Standards. "Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 2: Solid Waste Disposal, Section 2.4: Municipal Solid Waste Landfills". Available at: *http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s04.pdf.*

2. Climate Impacts of Methane Emissions

In addition to the improvements in air quality and resulting benefits to human health and the non-climate welfare effects discussed above, reducing emissions from landfills is expected to result in climate co-benefits due to reductions of the methane component of LFG. Methane is a potent GHG with a global warming potential (GWP) 28–36 times greater than CO_2, which accounts for methane's stronger absorption of infrared radiation per ton in the atmosphere, but also its shorter lifetime (on the order of 12 years compared to centuries or millennia for CO_2).[20 21] According to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report, methane is the second leading long-lived climate forcer after CO_2 globally.[22]

Methane is also a precursor to ground-level ozone, which can cause a number of harmful effects on public health and the environment. Additionally, ozone is a short-lived climate forcer that contributes to global warming.

In 2009, based on a large body of robust and compelling scientific evidence, the EPA Administrator issued an Endangerment Finding under CAA section 202(a)(1).[23] In the Endangerment Finding, the Administrator found that the current, elevated concentrations of GHGs in the atmosphere—already at levels unprecedented in human history—may reasonably be anticipated to endanger public health and welfare of current and future generations in the U.S. We summarize these adverse effects on public health and welfare briefly here.

3. Public Health Impacts Detailed in the 2009 Endangerment Finding

The 2009 Endangerment Finding documented that climate change caused by human emissions of GHGs threatens the health of Americans. By raising average temperatures, climate change increases the likelihood of heat waves, which are associated with increased deaths and illnesses. While climate change also increases the likelihood of reductions in cold-related mortality, evidence indicates that the increases in heat mortality will be larger than the decreases in cold mortality in the United States. Compared to a future without climate change, climate change is expected to increase ozone pollution over broad areas of the U.S., including in the largest metropolitan areas with the worst ozone problems, and thereby increase the risk of morbidity and mortality. Climate change is also expected to cause more intense hurricanes and more frequent and intense storms of other types and heavy precipitation, with impacts on other areas of public health, such as the potential for increased deaths, injuries, infectious and waterborne diseases, and stress-related disorders. Children, the elderly, and the poor are among the most vulnerable to these climate-related health effects.

4. Public Welfare Impacts Detailed in the 2009 Endangerment Finding

The 2009 Endangerment Finding documented that climate change impacts touch nearly every aspect of public welfare. Among the multiple threats caused by human emissions of GHGs, climate changes are expected to place large areas of the country at serious risk of reduced water supplies, increased water pollution, and increased occurrence of extreme events such as floods and droughts. Coastal areas are expected to face a multitude of increased risks, particularly from rising sea level and increases in the severity of storms. These communities face storm and flooding damage to property, or even loss of land due to inundation, erosion, wetland submergence and habitat loss.

Impacts of climate change on public welfare also include threats to social and ecosystem services. Climate change is expected to result in an increase in peak electricity demand. Extreme weather from climate change threatens energy, transportation, and water resource infrastructure. Climate change may also exacerbate ongoing environmental pressures in certain settlements, particularly in Alaskan indigenous communities, and is very likely to fundamentally rearrange U.S. ecosystems over the 21st century. Though some benefits may balance adverse effects on agriculture and forestry in the next few decades, the body of evidence points towards increasing risks of net adverse impacts on U.S. food production, agriculture and forest productivity as temperature continues to rise. These impacts are global and may exacerbate problems outside the U.S. that raise humanitarian, trade, and national security issues for the U.S.

5. New Scientific Assessments

In 2009, based on a large body of robust and compelling scientific evidence, the EPA Administrator issued the Endangerment Finding under CAA section 202(a)(1).[24] In the Endangerment Finding, the Administrator found that the current, elevated concentrations of GHGs in the atmosphere—already at levels unprecedented in human history—may reasonably be anticipated to endanger public health and welfare of current and future generations in the U.S. The D.C. Circuit later upheld the Endangerment Finding from all challenges. *Coalition for Responsible Regulation* v. *EPA*, 684 F. 3d 102, 116–26 (D.C. Cir. 2012).

Since the administrative record concerning the Endangerment Finding closed following the EPA's 2010 Reconsideration Denial, the climate has continued to change, with new records being set for a number of climate indicators such as global average surface temperatures, Arctic sea ice retreat, CO_2 concentrations, and sea level rise. Additionally, a number of major scientific assessments have been released that improve understanding of the climate system and strengthen the case that GHGs endanger public health and welfare both for current and future generations. These assessments, from the Intergovernmental Panel on Climate Change (IPCC), the U.S. Global Change Research Program (USGCRP), and the National Research Council (NRC), include: IPCC's 2012 Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) and the 2013–2014 Fifth Assessment Report (AR5), the USGCRP's 2014 National Climate Assessment, Climate Change Impacts in the United States (NCA3), and the NRC's 2010 Ocean Acidification: A National Strategy to Meet the Challenges of a Changing

[20] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[21] As previously noted, this rulemaking uses the AR4 100-year GWP value for methane (25), rather than AR5, for CO_2 equivalency calculations to be consistent with and comparable to key Agency emission quantification programs such as the Inventory of Greenhouse Gas Emissions and Sinks (GHG Inventory), and the GHGRP.

[22] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[23] "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 FR 66496 (Dec. 15, 2009) ("Endangerment Finding").

[24] "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 FR 66496 (Dec. 15, 2009) ("Endangerment Finding").

Ocean (Ocean Acidification), 2011 Report on Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia (Climate Stabilization Targets), 2011 National Security Implications for U.S. Naval Forces (National Security Implications), 2011 Understanding Earth's Deep Past: Lessons for Our Climate Future (Understanding Earth's Deep Past), 2012 Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, 2012 Climate and Social Stress: Implications for Security Analysis (Climate and Social Stress), and 2013 Abrupt Impacts of Climate Change (Abrupt Impacts) assessments.

The conclusions of the recent scientific assessments confirm and strengthen the science that supported the 2009 Endangerment Finding. The NCA3 indicates that climate change "threatens human health and well-being in many ways, including impacts from increased extreme weather events, wildfire, decreased air quality, threats to mental health, and illnesses transmitted by food, water, and disease-carriers such as mosquitoes and ticks." [25] Most recently, the USGCRP released a new assessment, "The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment" (also known as the USGCRP Climate and Health Assessment). This assessment finds that "climate change impacts endanger our health" and that in the United States we have "observed climate-related increases in our exposure to elevated temperatures; more frequent, severe, or longer lasting extreme events; diseases transmitted through food, water, or disease vectors such as ticks and mosquitoes; and stresses to mental health and well-being." The assessment determines that "[e]very American is vulnerable to the health impacts associated with climate change." Climate warming will also likely "make it harder for any given regulatory approach to reduce ground-level ozone pollution", and, unless offset by reductions of ozone precursors, it is likely that "climate-driven increases in ozone will cause premature deaths, hospital visits, lost school days, and acute respiratory symptoms." [26]

Assessments state that certain populations are particularly vulnerable to climate change. The USGCRP Climate and Health Assessment assesses several disproportionately vulnerable populations, including those with low income, some communities of color, immigrant groups, indigenous peoples, pregnant women, vulnerable occupational groups, persons with disabilities, and persons with preexisting or chronic medical conditions. The Climate and Health Assessment also concludes that children's unique physiology and developing bodies contribute to making them particularly vulnerable to climate change. Children also have unique behaviors and exposure pathways that could increase their exposure to environmental stressors, like contaminants in dust or extreme heat events. Impacts from climate change on children are likely from heat waves, air pollution, infectious and waterborne illnesses, disruptions in food safety and security, and mental health effects resulting from extreme weather events. For example, climate change can disrupt food safety and security by significantly reducing food quality, availability and access. Children are more susceptible to this disruption because nutrition is important during critical windows of development and growth. Older people are at much higher risk of mortality during extreme heat events and pre-existing health conditions also make older adults susceptible to cardiac and respiratory impacts of air pollution and to more severe consequences from infectious and waterborne diseases. Limited mobility among older adults can also increase health risks associated with extreme weather and floods.

The new assessments also confirm and strengthen the science that supported the 2009 Endangerment Finding. The NRC assessment Understanding Earth's Deep Past stated that "[b]y the end of this century, without a reduction in emissions, atmospheric CO2 is projected to increase to levels that Earth has not experienced for more than 30 million years." In fact, that assessment stated that "the magnitude and rate of the present GHG increase place the climate system in what could be one of the most severe increases in radiative forcing of the global climate system in Earth history." [27] Because of these unprecedented changes in atmospheric concentrations, several assessments state that we may be approaching critical, poorly understood thresholds. The NRC Abrupt Impacts report analyzed the potential for abrupt climate change in the physical climate system and abrupt impacts of ongoing changes that, when thresholds are crossed, could cause abrupt impacts for society and ecosystems. The report considered destabilization of the West Antarctic Ice Sheet (which could cause 3–4 m of potential sea level rise) as an abrupt climate impact with unknown but probably low probability of occurring this century. The report categorized a decrease in ocean oxygen content (with attendant threats to aerobic marine life); increase in intensity, frequency, and duration of heat waves; and increase in frequency and intensity of extreme precipitation events (droughts, floods, hurricanes, and major storms) as climate impacts with moderate risk of an abrupt change within this century. The NRC Abrupt Impacts report also analyzed the threat of rapid state changes in ecosystems and species extinctions as examples of an irreversible impact that is expected to be exacerbated by climate change. Species at most risk include those whose migration potential is limited, whether because they live on mountaintops or fragmented habitats with barriers to movement, or because climatic conditions are changing more rapidly than the species can move or adapt. While some of these abrupt impacts may be of low or moderate probability in this century, the probability for a significant change in many of these processes after 2100 was judged to be higher, with severe impacts likely should the abrupt change occur. Future temperature changes will be influenced by what emissions path the world follows. In its high emission scenario, the IPCC AR5 projects that global temperatures by the end of the century will likely be 2.6 °C to 4.8 °C (4.7 to 8.6 °F) warmer than today. There is very high confidence that temperatures on land and in the Arctic will warm even faster than the global average. However, according to the NCA3, significant reductions in emissions would lead to noticeably less future warming beyond mid-century, and therefore less impact to public health and welfare. According to the NCA3, regions closer to the poles are projected to receive more precipitation, while the dry subtropics expand (colloquially, this has been summarized as wet areas getting wet and dry regions getting drier), while "[t]he widespread trend of increasing heavy downpours is expected to continue, with precipitation becoming less frequent but more intense." Meanwhile, the NRC Climate Stabilization Targets assessment found that the area burned by wildfire in parts of western North America is expected to grow by 2 to 4 times for 1 °C (1.8 °F) of warming. The NCA also found that

[25] USGCRP, Third National Climate Assessment, p. 221.

[26] See also Kleeman, M.J., S.-H. Chen, and R.A. Harley. 2010. Climate change impact on air quality in California: Report to the California Air Resources Board. *http://www.arb.ca.gov/research/apr/past/04-349.pdf.*

[27] National Research Council, Understanding Earth's Deep Past, p. 138.

"[e]xtrapolation of the present observed trend suggests an essentially ice-free Arctic in summer before mid-century." Retreating snow and ice, and emissions of carbon dioxide and methane released from thawing permafrost, are very likely to amplify future warming.

Since the 2009 Endangerment Finding, the IPCC AR5, the USGCRP NCA3, and three of the new NRC assessments provide estimates of projected global average sea level rise. These estimates, while not always directly comparable as they assume different emissions scenarios and baselines, are at least 40 percent larger than, and in some cases more than twice as large as, the projected rise estimated in the IPCC AR4 assessment, which was referred to in the 2009 Endangerment Finding. The NRC Sea Level Rise assessment projects a global average sea level rise of 0.5 to 1.4 meters by 2100. The NRC National Security Implications assessment suggests that "the Department of the Navy should expect roughly 0.4 to 2 meters global average sea-level rise by 2100." The NRC Climate Stabilization Targets assessment states that a global average temperature increase of 3 °C will lead to a global average sea level rise of 0.5 to 1 meter by 2100. These NRC and IPCC assessments continue to recognize and characterize the uncertainty inherent in accounting for melting ice sheets in sea level rise projections.

In addition to future impacts, the NCA3 emphasizes that climate change driven by human emissions of GHGs is already happening now and it is happening in the U.S. According to the IPCC AR5 and the NCA3, there are a number of climate-related changes that have been observed recently, and these changes are projected to accelerate in the future:

- The planet warmed about 0.85 °C (1.5 °F) from 1880 to 2012. It is extremely likely (>95 percent probability) that human influence was the dominant cause of the observed warming since the mid-20th century, and likely (>66 percent probability) that human influence has more than doubled the probability of occurrence of heat waves in some locations. In the Northern Hemisphere, the last 30 years were likely the warmest 30 year period of the last 1400 years.
- Global sea levels rose 0.19 m (7.5 inches) from 1901 to 2010. Contributing to this rise was the warming of the oceans and melting of land ice. It is likely that 275 gigatons per year of ice melted from land glaciers (not including ice sheets) since 1993, and that the rate of loss of ice from the Greenland and Antarctic ice sheets increased substantially in recent years, to 215 gigatons per year and 147 gigatons per year respectively since 2002. For context, 360 gigatons of ice melt is sufficient to cause global sea levels to rise 1 mm.
- Annual mean Arctic sea ice has been declining at 3.5 to 4.1 percent per decade, and Northern Hemisphere snow cover extent has decreased at about 1.6 percent per decade for March and 11.7 percent per decade for June.
- Permafrost temperatures have increased in most regions since the 1980s, by up to 3 °C (5.4 °F) in parts of Northern Alaska.
- Winter storm frequency and intensity have both increased in the Northern Hemisphere. The NCA3 states that the increases in the severity or frequency of some types of extreme weather and climate events in recent decades can affect energy production and delivery, causing supply disruptions, and compromise other essential infrastructure such as water and transportation systems.

In addition to the changes documented in the assessment literature, there have been other climate milestones of note. According to the National Oceanic and Atmospheric Administration (NOAA), methane concentrations in 2014 were about 1,823 parts per billion, 150 percent higher than concentrations were in 1750. After a few years of nearly stable concentrations from 1999 to 2006, methane concentrations have resumed increasing at about 5 parts per billion per year.[28] Concentrations today are likely higher than they have been for at least the past 800,000 years.[29] Arctic sea ice has continued to decline, with September of 2012 marking the record low in terms of Arctic sea ice extent, 40 percent below the 1979–2000 median. Sea level has continued to rise at a rate of 3.2 mm per year (1.3 inches/decade) since satellite observations started in 1993, more than twice the average rate of rise in the 20th century prior to 1993.[30] And 2015 was the warmest year globally in the modern global surface temperature record, going back to 1880, breaking the record previously held by 2014; this now means that the last 15 years have been 15 of the 16 warmest years on record.[31]

These assessments and observed changes raise concerns that reducing emissions of GHGs across the globe is necessary in order to avoid the worst impacts of climate change, and underscore the urgency of reducing emissions now. In 2011 the NRC Committee on America's Climate Choices listed a number of reasons "why it is imprudent to delay actions that at least begin the process of substantially reducing emissions."[32] For example, they stated:

- The faster emissions are reduced, the lower the risks posed by climate change. Delays in reducing emissions could commit the planet to a wide range of adverse impacts, especially if the sensitivity of the climate to GHGs is on the higher end of the estimated range.
- Waiting for unacceptable impacts to occur before taking action is imprudent because the effects of GHG emissions do not fully manifest themselves for decades and, once manifested, many of these changes will persist for hundreds or even thousands of years.
- In the committee's judgment, the risks associated with maintaining business as usual are a much greater concern than the risks associated with engaging in strong response efforts.

Overview of Climate Change Impacts in the United States

The NCA3 assessed the climate impacts in eight regions of the U.S., noting that changes in physical climate parameters such as temperatures, precipitation, and sea ice retreat were already having impacts on forests, water supplies, ecosystems, flooding, heat waves, and air quality. The U.S. average temperatures have similarly increased by 1.3 to 1.9 degrees F since 1895, with most of that increase occurring since 1970, and the most recent decade was the U.S.'s hottest as well as the world's hottest. Moreover, the NCA3 found that future warming is projected to be much larger than recent observed variations in temperature, with 2 to 4 degrees F warming expected in most areas of the U.S. over the next few decades, and up to 10 degrees F possible by the end of the century assuming continued increases in emissions. Extreme heat events will continue to become more common, and extreme cold less common. Additionally, precipitation is considered likely to increase in the northern states, decrease in the southern states, and with the heaviest precipitation events projected to increase everywhere.

[28] Ed Dlugokencky, NOAA/ESRL (*www.esrl.noaa.gov/gmd/ccgg/trends_ch4/*).

[29] U.S. Environmental Protection Agency. 2014. Climate change indicators in the United States, 2014. Third edition. EPA 430–R–14–004. *www.epa.gov/climatechange/indicators.*

[30] Blunden, J., and D. S. Arndt, Eds., 2015: State of the Climate in 2014. Bull. Amer. Meteor. Soc., 96 (7), S1–S267.

[31] *http://www.ncdc.noaa.gov/sotc/global/201513.*

[32] NRC, 2011: America's Climate Choices, The National Academies Press, p. 2.

In the Northeast, temperatures increased almost 2 °F from 1895 to 2011, precipitation increased by about 5 inches (10 percent), and sea level rise of about a foot has led to an increase in coastal flooding. In the future, if emissions continue to increase, the Northeast is projected to experience 4.5 to 10 °F of warming by the 2080s. This is expected to lead to more heat waves, coastal and river flooding, and intense precipitation events. Sea levels in the Northeast are expected to increase faster than the global average because of subsidence, and models suggest changing ocean currents may further increase the rate of sea level rise.

In the Southeast, average annual temperature during the last century cycled between warm and cool periods. A warm peak occurred during the 1930s and 1940s followed by a cool period and temperatures then increased again from 1970 to the present by an average of 2 °F. Louisiana has already lost 1,880 square miles of land in the last 80 years due to sea level rise and other contributing factors. The Southeast is exceptionally vulnerable to sea level rise, extreme heat events, hurricanes, and decreased water availability. Major risks of further warming include significant increases in the number of hot days (95 °F or above) and decreases in freezing events, as well as exacerbated ground level ozone in urban areas. Projections suggest that there may be fewer hurricanes in the Atlantic in the future, but they will be more intense, with more Category 4 and 5 storms. The NCA identified New Orleans, Miami, Tampa, Charleston, and Virginia Beach as cities at particular risk of flooding.

In the Northwest, temperatures increased by about 1.3 °F between 1895 and 2011. Snowpack in the Northwest is an important freshwater source for the region. More precipitation falling as rain instead of snow has reduced the snowpack, and warmer springs have corresponded to earlier snowpack melting and reduced stream flows during summer months. Drier conditions have increased the extent of wildfires in the region. Average annual temperatures are projected to increase by 3.3 °F to 9.7 °F by the end of the century (depending on future global GHG emissions), with the greatest warming is expected during the summer. Continued increases in global GHG emissions are projected to result in up to a 30 percent decrease in summer precipitation. Warmer waters are expected to increase disease and mortality in important fish species, including Chinook and sockeye salmon.

In Alaska, temperatures have changed faster than anywhere else in the U.S. Annual temperatures increased by about 3 °F in the past 60 years. Warming in the winter has been even greater, rising by an average of 6 °F. Glaciers in Alaska are melting at some of the fastest rates on Earth. Permafrost soils are also warming and beginning to thaw. Drier conditions had already contributed to more large wildfires in the 10 years prior to the NCA3 than in any previous decade since the 1940s, when recordkeeping began, and subsequent years have seen even more wildfires. By the end of this century, continued increases in GHG emissions are expected to increase temperatures by 10 to 12 °F in the northernmost parts of Alaska, by 8 to 10 °F in the interior, and by 6 to 8 °F across the rest of the state. These increases will exacerbate ongoing arctic sea ice loss, glacial melt, permafrost thaw and increased wildfire, and threaten humans, ecosystems, and infrastructure.

In the Southwest, temperatures are now about 2 °F higher than the past century, and are already the warmest that region has experienced in at least 600 years. The NCA notes that there is evidence that climate-change induced warming on top of recent drought has influenced tree mortality, wildfire frequency and area, and forest insect outbreaks. At the time of publication of the NCA, even before the last 2 years of extreme drought in California, tree ring data was already indicating that the region might be experiencing its driest period in 800 years. The Southwest is projected to warm an additional 5.5 to 9.5 °F over the next century if emissions continue to increase. Winter snowpack in the Southwest is projected to decline (consistent with recent record lows), reducing the reliability of surface water supplies for cities, agriculture, cooling for power plants, and ecosystems. Sea level rise along the California coast is projected to worsen coastal erosion, increase flooding risk for coastal highways, bridges, and low-lying airports, and pose a threat to groundwater supplies in coastal cities. Also, ''[t]he combination of a longer frost-free season, less frequent cold air outbreaks, and more frequent heat waves accelerates crop ripening and maturity, reduces yields of corn, tree fruit, and wine grapes, stresses livestock, and increases agricultural water consumption.'' Increased drought, higher temperatures, and bark beetle outbreaks are likely to contribute to continued increases in wildfires.

The rate of warming in the Midwest has markedly accelerated over the past few decades. Temperatures rose by more than 1.5 °F from 1900 to 2010, but between 1980 and 2010 the rate of warming was three times faster than from 1900 through 2010. Precipitation generally increased over the last century, with much of the increase driven by intensification of the heaviest rainfalls. Several types of extreme weather events in the Midwest (*e.g.*, heat waves and flooding) have already increased in frequency and/or intensity due to climate change. In the future, if emissions continue increasing, the Midwest is expected to experience 5.6 to 8.5 °F of warming by the 2080s, leading to more heat waves. Specific vulnerabilities highlighted by the NCA include long-term decreases in agricultural productivity, changes in the composition of the region's forests, increased public health threats from heat waves and degraded air and water quality, negative impacts on transportation and other infrastructure associated with extreme rainfall events and flooding, and risks to the Great Lakes including shifts in invasive species, increases in harmful algal blooms, and declining beach health.

High temperatures (more than 100 °F in the Southern Plains and more than 95 °F in the Northern Plains) are projected to occur much more frequently by mid-century. Increases in extreme heat will increase heat stress for residents, energy demand for air conditioning, and water losses. In Hawaii, other Pacific islands, and the Caribbean, rising air and ocean temperatures, shifting rainfall patterns, changing frequencies and intensities of storms and drought, decreasing base flow in streams, rising sea levels, and changing ocean chemistry will affect ecosystems on land and in the oceans, as well as local communities, livelihoods, and cultures. Low islands are particularly at risk.

In Hawaii and the Pacific islands, ''[w]armer oceans are leading to increased coral bleaching events and disease outbreaks in coral reefs, as well as changed distribution patterns of tuna fisheries. Ocean acidification will reduce coral growth and health. Warming and acidification, combined with existing stresses, will strongly affect coral reef fish communities.'' For Hawaii and the Pacific islands, future sea surface temperatures are projected to increase 2.3 °F by 2055 and 4.7 °F by 2090 under a scenario that assumes continued increases in emissions.

Methane Specific Impacts. Methane is also a precursor to ground-level ozone, which can cause a number of harmful effects on health and the environment. Additionally, ozone is a short-lived climate forcer that contributes to global

warming. In remote areas, methane is an important precursor to tropospheric ozone formation.[33] Almost half of the global annual mean ozone increase since preindustrial times is believed to be due to anthropogenic methane.[34] Projections of future emissions also indicate that methane is likely to be a key contributor to ozone concentrations in the future.[35] Unlike nitrogen oxide (NO_X) and VOC, which affect ozone concentrations regionally and at hourly time scales, methane emissions affect ozone concentrations globally and on decadal time scales given methane's relatively long atmospheric lifetime compared to these other ozone precursors.[36] Reducing methane emissions, therefore, may contribute to efforts to reduce global background ozone concentrations that contribute to the incidence of ozone-related health effects.[37 38 39] These benefits are global and occur in both urban and rural areas.

C. What is the EPA's authority for reviewing the Emission Guidelines?

The EPA is not statutorily obligated to conduct a review of the Emission Guidelines, but has the discretionary authority to do so when circumstances indicate that it is appropriate. The EPA has determined that it is appropriate to conduct a review of and finalize certain changes to the Emission Guidelines due to changes in the landfill industry and changes in operation of the landfills, including the size, trends in GCCS installations (such as the types of MSW landfills that have installed gas collection systems), and age of landfills since the Emission Guidelines were promulgated in 1996 and the opportunities for significant reductions in methane and other pollutants at reasonable cost. The EPA compiled new information on MSW landfills through data collection efforts for a statutorily mandated review of the NSPS, public comments received on the NSPS proposal, and public comments received on an ANPRM, as well as a proposed rulemaking for a review of the Emission Guidelines. This information allowed the EPA to conduct an assessment of current practices, emissions and potential for additional emission reductions.

D. What is the purpose and scope of this action?

The purpose of this action is to (1) Present the results of the EPA's review of the Emission Guidelines, (2) finalize revisions to the Emission Guidelines based on that review, and (3) resolve or provide clarification regarding several implementation issues that were addressed in prior proposed amendments published on May 23, 2002 (67 FR 36475) and September 8, 2006 (71 FR 53271) as they apply to existing sources. The final revisions appear in 40 CFR part 60, subpart Cf.[40] Although the EPA is not required to respond to comments received on the July 17, 2014, ANPRM (79 FR 41772) for the MSW landfills Emission Guidelines or comments it received on the concurrent proposal for revised NSPS for new MSW landfills in this document, the EPA is summarizing several comments it received to provide a framework and support the rationale for the final revisions to the Emission Guidelines.

E. How would the changes in applicability affect sources currently subject to subparts Cc and WWW?

Landfills currently subject to 40 CFR part 60, subparts Cc and WWW, are considered "existing" with the promulgation of this new subpart Cf and are ultimately affected by any changes to the Emission Guidelines resulting from this review. Each MSW landfill for which construction, modification, or reconstruction commenced on or before July 17, 2014, the date of proposal of the standard for new landfills under subpart XXX, is an existing source as of the effective date of this rule. Under CAA section 111, a source is either new, *i.e.*, construction, modification, or reconstruction commenced after a proposed NSPS is published in the **Federal Register** (CAA section 111(a)(1)) or existing, *i.e.*, any source other than a new source (CAA section 111(a)(6)). Because the revised Emission Guidelines apply to existing sources, any source that is not subject to subpart XXX will be subject to the revised Emission Guidelines. Any existing MSW landfill that modifies or reconstructs after July 17, 2014 would become a new source subject to the NSPS subpart XXX.

Consistent with the general approach evinced by CAA section 111, sources currently subject to subpart WWW would need to continue to comply with the requirements in that rule until they become subject to more stringent requirements in the revised Emission Guidelines as implemented through a revised state or federal plan. The current Emission Guidelines, subpart Cc, refer to subpart WWW for their substantive requirements. That is, the requirements regarding the installation and operation of a well-designed and well-operated GCCS and compliance with the specified emission limits are the same in both rules. Thus, because the EPA is finalizing its proposal to revise the Emission Guidelines to increase their stringency, a landfill currently subject to 40 CFR part 60, subpart WWW, would need to comply with the more stringent requirements in a revised state plan or federal plan implementing the revised Emission Guidelines (40 CFR part 60, subpart Cf). States with designated facilities must develop (or revise) and submit a state plan to the EPA within 9 months of promulgation of any revisions to the Emission Guidelines (40 CFR 60.23). Any revisions to an existing state plan and any newly adopted state plan must be established following the requirements of 40 CFR part 60, subpart B. To assist regulatory agencies in preparing state plans, the EPA developed the document "Municipal Solid Waste Landfills, Volume 2: Summary of Requirements for Section 111(d) State Plans for Implementing the Municipal Solid Waste Landfill Emission Guidelines." This volume describes the elements of a state plan and explains the state plan development and review process. The requirements include making the state plan publically available and providing the opportunity for public discussion. MSW Landfills, Volume 2 is available on the TTN Web site at *https://www3.epa.gov/ttn/atw/landfill/landflpg.html*. Note that MSW Landfills, Volume 2 was written for implementing the 1996 Emission Guidelines and contains a schedule corresponding to the 1996 Emission Guidelines. For these 2016 Emission Guidelines, state plans are due May 30, 2017.

Once the EPA receives a complete state plan or plan revision, and completes its review of that plan or plan revision, the EPA will propose the plan or plan revision for approval or disapproval. The EPA will approve or disapprove the plan or plan revision

[33] U.S. EPA. 2013. "Integrated Science Assessment for Ozone and Related Photochemical Oxidants (Final Report)." EPA–600–R–10–076F. National Center for Environmental Assessment—RTP Division. Available at *www.epa.gov/ncea/isa/*.

[34] *Ibid.*

[35] *Ibid.*

[36] *Ibid.*

[37] West, J.J., Fiore, A.M. 2005. "Management of tropospheric ozone by reducing methane emissions." *Environ. Sci. Technol.* 39:4685–4691.

[38] Anenberg, S.C., et al. 2009. "Intercontinental impacts of ozone pollution on human mortality," *Environ. Sci. & Technol.* 43: 6482–6487.

[39] Sarofim, M.C., Waldhoff, S.T., Anenberg, S.C. 2015. "Valuing the Ozone-Related Health Benefits of Methane Emission Controls," *Environ. Resource Econ.* DOI 10.1007/s10640–015–9937–6.

[40] Rather than merely updating 40 CFR part 60, subpart Cc, the existing emissions guidelines, the EPA has determined that the most appropriate way to proceed is to establish a new subpart that includes both the verbatim restatement of certain provisions in the existing Emission Guidelines and revisions to, or the addition of, other provisions.

according to the schedule in 40 CFR part 60, subpart B. The EPA will publish notice of state plan approvals or disapprovals in the **Federal Register** and will include an explanation of its decision. The EPA also intends to revise the existing federal plan (40 CFR part 62, subpart GGG) to incorporate the changes and other requirements adopted in this final action revising the Emission Guidelines. The revised federal plan will apply in states that have either never submitted a state plan or not received approval of any necessary revised state plan until such time as an initial state plan or revised state plan is approved. Fifteen states and territories implement the original Emission Guidelines promulgated at subpart Cc under the Federal Plan (40 CFR part 62, subpart GGG) The revised federal plan would also apply in Indian country unless and until replaced by a tribal implementation plan (TIP).[41]

Because many of the landfills currently subject to 40 CFR part 60, subparts Cc and WWW, are closed, the EPA is finalizing provisions to minimize the burden on these closed landfills while continuing to protect air quality, as discussed in sections V.C and VI.C of this preamble.

IV. Summary of the Final Emission Guidelines

A. What are the control requirements?

1. Design Capacity and Emissions Thresholds

The revised Emission Guidelines retain the current design capacity thresholds of 2.5 million Mg and 2.5 million m^3, but reduce the NMOC emission threshold for the installation and removal of a GCCS from 50 Mg/yr to 34 Mg/yr for landfills that are not closed as of September 27, 2017. An MSW landfill that exceeds the design capacity thresholds must install and start up a GCCS within 30 months after reporting that LFG emissions reach or exceed a NMOC level of 34 Mg/yr NMOC. The owner or operator of a landfill may control the gas by routing it to a non-enclosed flare, an enclosed combustion device, or a treatment system that processes the collected gas for subsequent sale or beneficial use.

[41] Indian tribes may, but are not required to, seek approval for treatment in a manner similar to a state for purposes of developing a tribal implementation plan implementing the Emission guidelines. If a tribe obtains such approval and submits a proposed TIP, the EPA will use the same criteria and follow the same procedure in approving that plan as it does with state plans. The federal plan will apply to all affected facilities located in Indian country unless and until EPA approves an applicable TIP.

2. Tier 4

The current Emission Guidelines (40 CFR part 60, subpart Cc) provide that owners or operators determine whether the landfill has exceeded the NMOC emissions threshold using one of three available modeling procedures, known as Tiers 1, 2, and 3. The EPA is finalizing in subpart Cf an additional optional methodology based on site-specific surface methane emissions to determine when a landfill must install and operate a GCCS. This alternative emission threshold methodology, referred to as "Tier 4," is based on SEM and demonstrates that surface methane emissions are below a specific threshold. The Tier 4 SEM demonstration allows certain landfills that exceed modeled NMOC emission rates using Tier 1 or 2 to demonstrate that site-specific surface methane emissions are below a surface concentration threshold (a landfill need not model emissions under Tier 3 before using Tier 4). A landfill that can demonstrate that surface emissions are below 500 ppm for four consecutive quarters does not trigger the requirement to install a GCCS even if Tier 1, 2, or 3 calculations indicate that the 34 Mg/yr threshold has been exceeded. Owners or operators continue to keep detailed records of each quarterly monitoring demonstration and must submit a Tier 4 surface emissions report annually. If a landfill measures a surface emissions reading of greater than 500 ppm methane, the landfill must submit a GCCS design plan and install and operate a GCCS.

Tier 4 is based on the results of quarterly site-specific methane emissions monitoring of the perimeter of the landfill and entire surface of the landfill along a pattern that traverses the landfill at 30-meter (98-ft) intervals, in addition to monitoring areas where visual observations may indicate elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations. If the landfill opts to use Tier 4 for its emission threshold determination and there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill, the owner or operator must install a GCCS, and the landfill cannot go back to using Tiers 1, 2, or 3 modeling to demonstrate that emissions are below the NMOC threshold.

Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr, but less than 50 Mg/yr using Tier 1 or Tier 2. If both Tier 1 and Tier 2 indicate NMOC emissions of 50 Mg/yr or greater, Tier 4 cannot be used. In addition, a wind barrier must be used for Tier 4 when the average wind speed exceeds 4 miles per hour (mph)(or 2 meters per second), or gusts are above 10 mph. Tier 4 measurements cannot be conducted if the average wind speed exceeds 25 mph. Wind speed must be measured with an on-site anemometer with a continuous recorder and data logger for the entire duration of the monitoring event. The average wind speed must be determined at 5-minute intervals. The gust must be determined at 3-second intervals. Further, when conducting Tier 4 monitoring, the sampling probe must be held no more than 5 centimeters above the landfill (*e.g.,* using a mechanical device such as a wheel on a pole). Tier 4 measurements cannot be conducted if the average wind speed exceeds 25 mph

In addition, landfills with a non-regulatory GCCS are allowed to operate the GCCS during the Tier 4 SEM demonstration, however, the GCCS must have operated at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration.

3. Subcategory of Closed Landfills

Because many landfills are closed and do not produce as much LFG, the EPA is finalizing the proposed subcategory for landfills that close on or before September 27, 2017. Landfills in this subcategory will continue to be subject to an NMOC emission threshold of 50 Mg/yr for determining when controls must be installed or can be removed, consistent with the NMOC thresholds in subparts Cc and WWW of 40 CFR part 60. These closed landfills would also be exempt from initial reporting requirements (*i.e.,* initial design capacity, initial NMOC emission rate, GCCS design plan, initial annual report, closure report, equipment removal report, and initial performance test report), provided that the landfill already met these requirements under subparts Cc or WWW of 40 CFR part 60.

4. Criteria for Removing GCCS

Landfill emissions increase as waste is added to a landfill, but decline over time; as waste decays, a landfill produces less and less methane and other pollutants. In the proposed Emission Guidelines (80 FR 52112), the EPA recognized that many open landfills subject to the Emission Guidelines contain inactive areas that have experienced declining LFG flows. Therefore, the EPA is finalizing criteria for determining when it is appropriate to cap, remove, or decommission a portion of the GCCS. The criteria for capping, removing, or decommissioning

the GCCS are: (1) The landfill is closed, (2) the GCCS has operated for at least 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows, and (3) the calculated NMOC emission rate at the landfill is less than 34 Mg/yr on three successive test dates. For landfills in the closed subcategory, the NMOC emission rate threshold for removing controls is 50 Mg/yr.

5. Excluding Non-Productive Areas From Control

The EPA is finalizing a provision that allows the use of actual flow data when estimating NMOC emissions for the purposes of excluding low- or non-producing areas of the landfill from control. Owners or operators of landfills with physically separated, closed areas may either model NMOC emission rates, or may determine the flow rate of LFG using actual measurements, to determine NMOC emissions. Using actual flow measurements yields a more precise measurement of NMOC emissions for purposes of demonstrating the closed area represents less than 1 percent of the landfills total NMOC emissions. The Emission Guidelines historically allowed owners or operators to exclude from control areas that are non-productive. In this final action, the retained the 1 percent criteria level, rather than raising it, to prevent landfills from excluding areas from control unless emissions were very low. But, to help owners or operators demonstrate that a non-productive area may be excluded from control, the final rule allow the owner or operator to use site-specific flow measurements to determine NMOC emissions.

6. Landfill Gas Treatment

The EPA is finalizing two provisions related to LFG treatment. First, the EPA is clarifying that the use of treated LFG is not limited to use as a fuel for a stationary combustion device but also allows other beneficial uses such as vehicle fuel, production of high-Btu gas for pipeline injection, and use as a raw material in a chemical manufacturing process. Second, the EPA is defining ''treated landfill gas'' as LFG processed in a treatment system meeting the requirements in 40 CFR part 60, subpart Cf, and defining ''treatment system'' as a system that filters, de-waters, and compresses LFG for sale or beneficial use. Owners or operators must develop a site-specific treatment system monitoring plan that includes monitoring parameters addressing all three elements of treatment (filtration, de-watering, and compression) to ensure the treatment system is operating properly for each intended end use of the treated LFG. They also must keep records that demonstrate that such parameters effectively monitor filtration, de-watering, and compression system performance necessary for each end use of the treated LFG. The treatment system monitoring plan must be submitted as part of the landfill's title V permit application. The permitting authority will review the permit application, including the treatment system monitoring plan, as part of the general permitting process. The treatment system monitoring parameters would be included in the permit as applicable requirements and thus become enforceable conditions (*i.e.,* the landfill monitors the treatment system monitoring parameters and maintains them in the specified range).

B. What are the monitoring, recordkeeping, and reporting requirements?

1. Wellhead Monitoring

The operational standard, corrective action, and corresponding recordkeeping and reporting remain for temperature and maintaining negative pressure at the wellhead. The EPA is removing the operational standards for nitrogen/oxygen levels at wellheads. Thus, the EPA is removing the corresponding requirement to take corrective action for exceedances of nitrogen/oxygen at wellheads. These adjustments to the wellhead monitoring parameters apply to all landfills. Although landfill owners or operators are not required to take corrective action based on exceedances of nitrogen/oxygen levels at wellheads, they are required to monitor nitrogen/oxygen levels at wellheads on a monthly basis to inform any necessary adjustments to the GCCS and must maintain records of all monthly readings. The landfill owner or operator must make these records available to the Administrator upon request.

2. Surface Monitoring

The EPA is finalizing the proposed requirement to monitor all surface penetrations. Landfills must conduct SEM at all cover penetrations and openings within the area of the landfill where waste has been placed and a GCCS is required to be in place and operating according to the operational standards in 40 CFR part 60, subpart Cf. Specifically, landfill owners or operators must conduct surface monitoring on a quarterly basis around the perimeter of the collection area and along a pattern that traverses the landfill at no more than 30 meter intervals, at all cover penetrations, and where visual observations may indicate the presence of elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover. Cover penetrations include wellheads, but do not include items such as survey stakes, fencing or litter fencing, flags, signs, trees, and utility poles.

3. Corrective Action

The owner or operator must measure the LFG temperature at the wellhead and gauge pressure in the gas collection header applied to each individual well on a monthly basis. If there is an exceedance (*i.e.,* LFG temperature of 55 degrees Celsius (131 degrees Fahrenheit) or positive pressure), the owner or operator must initiate corrective action within 5 days. If the temperature exceedance or positive pressure cannot be resolved within 15 days, then the owner or operator must determine the appropriate corrective action by conducting a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after the first measurement of the temperature exceedance or positive pressure. For corrective action that takes longer than 60 days to fully implement, the owner or operator must also conduct a corrective action analysis and develop an implementation schedule for the corrective action that does not exceed 120 days. The owner or operator must also notify the Administrator of any corrective action exceeding 60 days within 75 days and also include a description of the root cause analysis, corrective action analysis and implementation schedule in the annual report. If corrective action is expected to take longer than 120 days after the initial exceedance, the owner or operator must submit the corrective action plan and corresponding implementation timeline to the Administrator for approval within 75 days of the first measurement of positive pressure. Owners or operators must keep records of corrective action analyses. Owners or operators must include corrective action records in the annual compliance report for corrective actions that take more than 60 days to implement.

4. Update and Approval of Design Plan

The EPA is reaffirming some requirements and revising others to address design plans. Design plans must continue to be prepared and approved by a professional engineer. The landfill owner or operator must then notify the Administrator that the plan is completed and provide a copy of the

plan's signature page. The Administrator will now have 90 days to make a decision about whether the plan should be submitted for review. If the Administrator chooses to review, the approval process continues at outlined in this section. However, if the Administrator indicates that submission is not required or doesn't respond within 90 days, the landfill owner or operator can continue to implement the plan with the recognition that they are proceeding at their own risk. In the event that the design plan is required to be modified to obtain approval, the owner/operator must take any steps necessary to conform any prior actions to the approved design plan and any failure to do so could result in an enforcement action.

The EPA is also finalizing two criteria for when an affected source must update its design plan and submit it to the Administrator for approval. A revised design plan must be submitted on the following timeline: (1) Within 90 days of expanding operations to an area not covered by the previously approved design plan; and (2) prior to installing or expanding the gas collection system in a manner other than the one described in the previous design plan. The final rule continues to require landfill owners or operators to prepare both an initial and revised design plan.

5. Electronic Reporting

The EPA is requiring owners or operators of existing MSW Landfills to submit electronic copies of certain required performance test reports, NMOC emission rate reports, annual reports, Tier 4 emission rate reports, and wet landfilling practices through the EPA's Central Data Exchange (CDX) using the Compliance and Emissions Data Reporting Interface (CEDRI). Owners or operators are allowed to maintain electronic copies of the records in lieu of hardcopies to satisfy federal recordkeeping requirements.

The requirement to submit performance test data electronically to the EPA applies only to those performance tests conducted using test methods that are supported by the Electronic Reporting Tool (ERT). A listing of the pollutants and test methods supported by the ERT is available at: *www3.epa.gov/ttn/chief/ert/ert_info.html.* When the EPA adds new methods to the ERT, a notice will be sent out through the Clearinghouse for Inventories and Emissions Factors (CHIEF) Listserv (*www.epa.gov/air-emissions-inventories/emissions-inventory-listservs*) and a notice of availability will be added to the ERT Web site. You are encouraged to check the ERT Web site regularly for up-to-date information on methods supported by the ERT.

The EPA believes that the electronic submittal of the reports addressed in this rulemaking will increase the usefulness of the data contained in those reports, is in keeping with current trends in data availability, will further assist in the protection of public health and the environment and will ultimately result in less burden on the regulated community. Electronic reporting can also eliminate paper-based, manual processes, thereby saving time and resources, simplifying data entry, eliminating redundancies, minimizing data reporting errors and providing data quickly and accurately to the affected facilities, air agencies, the EPA and the public.

The EPA Web site that stores the submitted electronic data, WebFIRE, will be easily accessible to everyone and will provide a user-friendly interface that any stakeholder could access. By making the records, data, and reports addressed in this rulemaking readily available, the EPA, the regulated community, and the public will benefit when the EPA conducts its CAA-required reviews. As a result of having reports readily accessible, our ability to carry out comprehensive reviews will be increased and achieved within a shorter period of time.

We anticipate fewer or less substantial information collection requests (ICRs) in conjunction with prospective CAA-required reviews may be needed. Under an electronic reporting system, the EPA would have air emissions and performance test data in hand; we would not have to collect these data from the regulated industry. The data would provide useful information on actual emissions, types of controls in place, locations of facilities, and other data that the EPA uses in conducting required reviews or future assessments. We expect this to result in a decrease in time spent by industry to respond to data collection requests. We also expect the ICRs to contain less extensive stack testing provisions, as we will already have stack test data electronically. Reduced testing requirements would be a cost savings to industry. The EPA should also be able to conduct these required reviews more quickly. While the regulated community may benefit from a reduced burden of ICRs, the general public benefits from the agency's ability to provide these required reviews more quickly, resulting in increased public health and environmental protection.

Air agencies could benefit from more streamlined and automated review of the electronically submitted data. Having reports and associated data in electronic format will facilitate review through the use of software "search" options, as well as the downloading and analyzing of data in spreadsheet format. The ability to access and review air emission report information electronically will assist air agencies to more quickly and accurately determine compliance with the applicable regulations, potentially allowing a faster response to violations which could minimize harmful air emissions. This benefits both air agencies and the general public.

For a more thorough discussion of electronic reporting required by this rule, see the discussion in the proposed NSPS (79 FR 41818) and the 2015 proposed Emission Guidelines (80 FR 52127). In summary, in addition to supporting regulation development, control strategy development, and other air pollution control activities, having an electronic database populated with performance test data will save industry, air agencies, and the EPA significant time, money, and effort while improving the quality of emission inventories and air quality regulations and enhancing the public's access to this important information.

6. Landfills Recirculating Leachate or Adding Other Liquids

In the ANPRM and proposed Emission Guidelines, the EPA solicited input on whether additional action should be taken to address emissions from wet landfills. As discussed in section VI.A.3 of this preamble, there were a wide variety of perspectives provided in the public comments, and while many commenters supported separate thresholds for wet landfills, the EPA did not receive sufficient data to support a separate subcategory for landfills adding leachate or other liquids. In addition, the EPA has several other pending regulatory actions that could affect wet landfills. Accordingly, the EPA believes it is appropriate to further assess emissions from wet landfills prior to taking additional action. Therefore, the EPA is finalizing electronic reporting of additional data elements, as discussed in Section V.A.3 of this preamble, to inform potential action on wet landfills in the future.

C. Startup, Shutdown, and Malfunction Provisions

The standards in 40 CFR part 60, subpart Cf, apply at all times, including periods of startup or shutdown, and periods of malfunction. The EPA is reaffirming the work practice standard applicable during SSM events wherein

the landfill owner or operator is required to shut down the gas mover system and close all valves in the collection and control system potentially contributing to the venting of the gas to the atmosphere within 1 hour of the collection or control system not operating. The landfill owner or operator must also keep records and submit reports of all periods when the collection and control device is not operating.

V. Summary of Significant Changes Since Proposal

A. Changes to Monitoring, Recordkeeping, and Reporting

1. Wellhead Monitoring

Although the EPA is finalizing the proposed removal of wellhead operational standards for nitrogen/oxygen, the EPA has decided to retain the operational standards for temperature. The temperature standards were considered to be an essential indicator for fires, as discussed in Section VI.A.1 of this preamble.

2. Corrective Action

We are revising the procedural requirements for correcting positive pressure and temperature by allowing owners or operators 60 days to correct exceedances. If the owner or operator cannot achieve negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) by 60 days after the initial exceedance, owners or operators must conduct a root cause analysis to identify the most appropriate corrective action, which can include, but is not limited to, expanding the GCCS. For corrective action that takes longer than 60 days, owners or operators must develop an implementation schedule to complete the corrective action as soon as practicable, but no more than 120 days following the initial positive pressure or temperature reading. Additionally, owners or operators must keep records of the corrective action analysis. Owners or operators must submit the corrective action and corresponding implementation timeline to the Administrator for approval when implementation of the corrective action is expected to take longer than 120 days after the initial exceedance.

This change provides flexibility to owners or operators in determining the appropriate remedy, as well as the timeline for implementing the remedy.

3. Landfills Recirculating Leachate or Adding Other Liquids

The EPA is adding additional electronic reporting requirements for wet areas of landfills. The additional reporting applies to areas of the landfill that have recirculated leachate within the last 10 years and to areas where other liquids were added within the last 10 years.

The EPA is requiring these landfills to annually report quantities of liquids added and/or leachate recirculated. The first report will contain historical quantities, where those data are available in on-site records. The EPA is also requiring the landfill to report the surface area over which the liquids are added or the leachate is recirculated during each reporting year. The EPA is also requiring the landfill to report the total waste disposed in the area with recirculated leachate or added liquids as well as the annual waste acceptance rates in those same areas. As discussed in Section VI.A.3 of this preamble, this additional electronic reporting for wet landfills will inform potential future action on wet landfills.

4. Portable Gas Analyzers

We are allowing the use of portable gas composition analyzers in conjunction with Method 3A to monitor the oxygen level at a wellhead. A portable analyzer may be used to monitor the oxygen level at a wellhead provided that it is calibrated and meets all QA/QC requirements according to Method 3A. ASTM D6522–11 may be used as an alternative to Method 3A for wellhead monitoring as long as all the quality assurance is conducted as required by ASTM D6522–11. To use ASTM D6552–11, the sample location must be prior to combustion.

This change allows owners or operators to employ devices that are commonly used in practice to measure wellhead parameters. This change also eliminates the need for the landfill owner or operator to request portable analyzers as an alternative, as well as the need for agency review or approval of such requests. In addition to providing reliable results when used properly, portable analyzers have a number of benefits, including common use, the ability to provide additional information on gas composition, and the ability to download data to a spreadsheet for easy access and analysis.

5. More Precise Location Data

The EPA is finalizing a requirement for landfills to report the latitude and longitude coordinates of each surface emissions exceedance (500 ppm methane or greater), as proposed, except the instrument accuracy must be at least 4 meters instead of 3 meters. This change will provide a more robust and long-term record of GCCS performance. Landfill owners or operators and regulators can use locational data to gain perspective on how the LFG collection system is functioning over time and owners or operators will be able to track trends in GCCS performance and cover practices to ensure a well operating system and minimize emissions.

B. Tier 4

The EPA is finalizing the use of Tier 4 SEM as an alternative way of determining when a landfill must install a GCCS; however, in the final rule, the final Tier 4 emissions threshold determination can be used only at landfills that have modeled NMOC emissions using Tier 1 or Tier 2 of greater than or equal to 34 Mg/yr but less than 50 Mg/yr because the landfills NESHAP (40 CFR part 63, subpart AAAA) requires landfills that have modeled NMOC emissions of 50 Mg/yr or greater to install and operate a GCCS irrespective of surface emissions. If both Tier 1 and Tier 2 indicate NMOC emissions of 50 Mg/yr or greater, Tier 4 cannot be used (a landfill need not model emissions under Tier 3 before using Tier 4). In order to verify that the landfill is eligible for Tier 4, the EPA is finalizing a provision to require landfill owners or operators that choose to use Tier 4 to continue to conduct Tier 1 and Tier 2 NMOC emission rate calculations and report results in the annual report.

The EPA is also limiting the use of Tier 4 at landfills with a GCCS installed. In order for a landfill with an operational GCCS to qualify for Tier 4, the GCCS must have operated for at least 75 percent of the 12 months prior to initiating Tier 4 testing. The EPA is finalizing reporting and recordkeeping requirements for the annual operating hours of destruction devices in order to verify that a landfill with a GCCS installed and opting for Tier 4 meets the GCCS criteria for having operated the system.

In addition, the EPA is finalizing specific requirements for the use of Tier 4 for emission threshold determinations related to wind speed. Since accurate measurements can be compromised in even moderately windy conditions, the EPA is requiring the owner or operator to use a wind barrier, similar to a funnel or other device, to minimize surface air turbulence when onsite wind speed exceeds the limits in the rule. Thus, when a wind barrier is used, the final rule allows the Tier 4 surface emissions demonstration to proceed when the average on-site wind speed exceeds 4 mph, or gusts exceed 10 mph. Tier 4 measurements cannot be conducted if the average wind speed exceeds 25

mph. Although we are aware of the use of wind barriers in the field, the EPA intends to provide additional guidance on their use. In addition, the owner or operator must take digital photographs of the instrument setup, including the wind barrier. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration. The owner or operator must maintain those photographs per the recordkeeping requirements. Wind speed must be measured with an on-site anemometer with a continuous recorder and data logger for the entire duration of the monitoring event. The average wind speed must be determined at 5-minute intervals. The gust must be determined at 3-second intervals. Further, when taking surface measurements, the sampling probe must be held no more than 5 centimeters above the landfill surface (*e.g.,* using a mechanical device such as a wheel on a pole).

The EPA is also finalizing reporting and recordkeeping requirements to ensure that a GCCS is installed in a timely manner and to improve the transparency of SEM testing. To ensure that a GCCS is installed in a timely manner, the EPA is requiring a GCCS to be installed and operated within 30 months of the most recent NMOC emission rate report in which the calculated NMOC emission rate equals or exceeds 34 Mg/yr according to Tier 2, once there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill. To improve the transparency of SEM testing, landfill owners or operators must notify the delegated authority 30 days prior to conducting Tier 4 tests and maintain records of all SEM monitoring data and calibrations. In addition, landfill owners or operators must take and store digital photographs of the instrument setup. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration.

C. Changes To Address Closed or Non-Productive Areas

1. Closed Landfill Subcategory

The closed landfill subcategory is expanded to include those landfills that close on or before September 27, 2017 which is 13 months after publication of the final Emission Guidelines. This change gives landfills that closed or are planning to close time to complete the steps to reach closure.

2. Criteria for Removing or Decommissioning GCCS

The GCCS can be capped or removed when a landfill owner or operator demonstrates that (1) the landfill is closed, (2) the GCCS has operated for at least 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows, and (3) the calculated NMOC emission rate at the landfill is less than 34 Mg/yr on three consecutive test dates (50 Mg/yr for the closed landfill subcategory). The final rule does not contain a GCCS removal criterion based on SEM.

D. Startup, Shutdown, and Malfunction Provisions

In the 2015 Emission Guidelines proposal (80 FR 52103), the EPA clarified that standards apply at all times, including periods of SSM. The EPA also added requirements to estimate emissions during SSM events. Consistent with *Sierra Club* v. *EPA,* 551 F.3d 1019 (D.C. Cir. 2008), the EPA is clarifying that the standards in the Emission Guidelines, once implemented through an EPA-approved state plan or a promulgated federal plan, apply at all times. In recognition of the unique nature of landfill emissions, and consistent with the need for standards to apply at all times, including during periods of SSM, the EPA is reaffirming a work practice standard that applies during SSM events. During such events, owners or operators must shut down the gas mover system and close within 1 hour all valves in the collection and control system contributing to the potential venting of the gas to the atmosphere. The landfill owner or operator must also keep records and submit reports of all periods when the collection and control device is not operating.

E. Other Corrections and Clarifications

The use of EPA Method 25A and Method 18 (on a limited basis, *e.g.,* specific compounds like methane) are included in the final rule. Method 25A in conjunction with Method 18 (for methane) or Method 3C can be used to determine NMOC for the outlet concentrations less than 50 ppm NMOC as carbon.

VI. Rationale for Significant Changes Since Proposal

After considering public comments and further analyzing the available data, the EPA made several changes in this final rule relative to what we proposed. A complete list of public comments received on the proposed rule and the responses to them can be viewed in the document ''Responses to Public Comments on EPA's Standards of Performance for Municipal Solid Waste Landfills and Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills: Proposed Rules'' (hereafter ''Response to Comments document''), which is available in Docket EPA–HQ–OAR–2014–0451. This section of the preamble summarizes comments and presents responses to those comments for only those provisions that have changed since the 2015 proposed Emission Guidelines.

A. Changes to Monitoring, Recordkeeping, and Reporting

1. Wellhead Monitoring

In the 2014 proposed NSPS, the EPA requested comment on alternative wellhead monitoring requirements, including potential exclusion from the temperature and nitrogen/oxygen monitoring requirements, or a reduction in the frequency of this monitoring. For example, the EPA indicated that it could reduce the frequency of wellhead monitoring for these three parameters (temperature and nitrogen/oxygen) from monthly to a quarterly or semi-annual schedule. The EPA requested comments on whether the potential exclusion should apply to a subset of landfills or landfill areas based on beneficial use of LFG.

In the 2015 proposed Emission Guidelines, the EPA proposed to remove the operational standards (*i.e.,* the requirement to meet operating limits) for temperature and nitrogen/oxygen at the wellheads, thus removing the corresponding requirement to take corrective action for exceedances of these parameters. This approach was taken to eliminate the need for owners or operators to request higher operating values (HOVs) for these parameters, submit alternative timelines for corrective action, or expand the GCCS to address exceeding these wellhead standards. The EPA proposed to maintain the requirement to monitor nitrogen/oxygen and temperature on a monthly basis, but to remove the requirement to report exceedances from fluctuations or variations in these parameters in the annual reports. Instead of annual reporting, the EPA proposed that landfill owners or operators maintain the records of this monthly monitoring on site to inform any necessary adjustments to the GCCS and make these records available to the Administrator upon request. The EPA proposed to maintain the requirement to

operate the GCCS at negative pressure and in a manner that collects the most LFG and minimizes losses of LFG through the surface of the landfill. The EPA also requested comments on whether it should add a requirement to monitor wellhead flow rate, or any other wellhead monitoring parameters, that would help to ensure a well-operated GCCS (80 FR 52138).

Comment: Several commenters want the EPA to maintain the wellhead operational standards, including states, industry consultants, and environmental organizations, with one environmental organization stating that these wellhead parameters are the only warning signal for potential fire hazards. One state stated that the removal of the operational standards could lead to some landfill owners or operators not operating the GCCS in an effective manner, thus creating a potential for increased LFG emissions through the landfill surface.

Many other commenters supported removing the nitrogen/oxygen and temperature operational standards, including industry, some states), and the Small Business Association. Several commenters indicated that a lack of response to or approval of HOV requests or alternative timelines for corrective action, despite appropriate justification, is a significant administrative barrier in the current Emission Guidelines. These commenters stated that a lack of response to or approval of HOVs results in owners or operators having to install new wells to correct for temperature or oxygen exceedances even though such expansion of the GCCS does not correct the exceedance and may be contrary to a well-operated GCCS. One commenter stated that removing the operational standards would alleviate one of the most significant barriers to installing interim gas collection measures and would alleviate the corresponding administrative burden of requesting HOVs. Other commenters stated that removing the operational standards would not only reduce administrative burden, but would also facilitate early installation of GCCS and the use of appropriate best management practices to maximize gas collection. Two commenters from state agencies agreed with removing the operational standards, and agreed with retaining monthly monitoring of temperature and nitrogen/oxygen and retaining the corresponding monitoring data.

Several commenters suggested that certain monitoring data should be reported on a semi-annual basis so that agencies can identify or prevent fires. For example, state agency commenters suggested that the EPA require semi-annual reporting of wellhead readings above 5 percent oxygen and 130 degrees Fahrenheit, which was supported by supplemental comments received from the industry and industry trade organizations. One commenter also suggested reporting of any subsurface fire. One regional agency wanted the results to be reported if temperature exceeds 150 °F and also suggested reporting any methane to carbon dioxide ratio less than 1.

Commenters that supported removal of the operational standards for temperature and nitrogen/oxygen also contended that the nitrogen/oxygen and temperature wellheads parameters are poor indicators of landfill fires or inhibited decomposition and that landfill owners or operators already have their own incentive to prevent landfill fires. Commenters added that expanding the LFG collection system by drilling new wells may introduce more air into the landfill, which can exacerbate a fire and actually increase oxygen content. Commenters (0451–0178, 0451–0167, 0215–0191, 0215–0121) that favored retaining the operational standards for temperature and nitrogen/oxygen contend that temperature and nitrogen/oxygen data are essential to inform regulators of the presence of the potential for a landfill fire.

Response: After carefully considering public comments and available data, the EPA is removing the operational standards (*i.e.,* the requirement to meet operating limits) for nitrogen/oxygen, but not temperature. Landfill owners or operators must continue to monitor nitrogen/oxygen on a monthly basis, however, to ensure that the GCCS is well maintained and operated, collects the most LFG, and minimizes losses of LFG through the surface of the landfill. Landfill owners or operators must maintain records of this monthly monitoring and make these records available to the Administrator upon request. The EPA is requiring monthly monitoring and recordkeeping for these wellhead monitoring parameters (*i.e.,* oxygen, nitrogen, temperature, and pressure), since these are key indicators that are already being monitored by landfill owner or operators to determine how well the landfill is being operated, including the capturing and destroying landfill gas, promoting efficient anaerobic decomposition and/or preventing landfill fires.

Because of concerns regarding fire hazards, the EPA is retaining the operational standard for temperature. Landfill owners or operators must electronically submit, as part of their annual report, all readings that show LFG temperatures greater than 55 degrees Celsius (131 degrees Fahrenheit), and document the root cause and corrective action taken to correct for this exceedance, as discussed in section VI.A.2 of this preamble. While several commenters supported removing the temperature parameter, other commenters were concerned with fire risks if the parameter was removed. In addition, given the EPA experience with consent decrees and other enforcement actions involving elevated temperature values, the EPA has decided to retain temperature as an operating standard in the final rule. This overall approach will reduce the number of requests for higher operating values and alternative timeliness for nitrogen/oxygen parameters. In addition, note that regulatory agencies can request data records of oxygen, nitrogen, or temperature monitoring, as measured on a monthly basis, at any time.

Landfills are subject to 40 CFR part 60, subpart A. These provisions require landfill owners or operators, to the extent practicable, to maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Due to the extreme environmental consequences of a subsurface landfill fire, these provisions obligate landfill owners or operators to take all practical steps necessary to avoid landfill fires. While this action removes requirements to meet operational standards for nitrogen/oxygen at wellheads and to make corrective actions, landfill owners or operators must continue all due diligence to ensure that the GCCS is not overdrawn, thereby creating a flammable subsurface environment.

Because the corrective action requirements for certain parameters have been retained, the EPA is reaffirming its provisions for HOVs. The HOV provisions were originally enacted to address variations in temperature between landfills and between wells. With a sufficient demonstration (*i.e.,* supporting data showing the elevated parameter does not cause fires or significantly inhibit anaerobic decomposition by killing methanogens), an HOV may be established for temperature, nitrogen, or oxygen at a particular well. The EPA encourages regulatory authorities review requests for HOVs in a timely manner and to make use of these mechanisms where

appropriate.[42] States may also consider HOVs when developing state plans.

2. Corrective Action

In a 1998 **Federal Register** notice (63 FR 32748, June 16, 1998), the EPA amended the wellhead monitoring provisions of 40 CFR part 60, subpart WWW, to allow an alternative timeline for correcting wellhead exceedances to be submitted to the Administrator for approval. The rule change made the wellhead monitoring provisions consistent with the SEM provisions, which allow an alternative remedy and corresponding timeline for correcting an exceedance to be submitted to the Administrator for approval. The EPA noted in the 1998 preamble that any timeline extending more than 120 days must be approved by the regulating agency. Since 1998, questions have been raised about the timing of correcting wellhead exceedances and whether a landfill needs agency approval for corrective action timelines that exceed 15 calendar days but are less than the 120 days allowed for expanding the GCCS.

In the 2015 Emission Guidelines proposal, the EPA clarified its intent and outlined a corresponding timeline for correcting positive pressure at a wellhead. The EPA proposed that a landfill must submit an alternative corrective action timeline request to the Administrator for approval if the landfill cannot restore negative pressure within 15 calendar days of the initial failure to maintain negative pressure and the landfill is unable to (or does not plan to) expand the gas collection system within 120 days of the initial exceedance. The EPA explained in the preamble that it did not specify a schedule in the proposed rule language by when a landfill would need to submit alternative timeline requests because the EPA determined that investigating and determining the appropriate corrective action, as well as the schedule for implementing corrective action, would be site specific and depend on the reason for the exceedance (80 FR 52126). In addition, the EPA requested comment (80 FR 52126) on an alternative timeline that extends the requirement for notification from 15 days to as soon as practicable, but no later than 60 days from when an exceedance is identified. In the 2014 ANPRM, the EPA had requested comment on the same approach, as well as whether 60 days is the appropriate time to make necessary repairs.

Comment: The EPA received comments on the proposed changes, including the time allowed for corrective action and for submitting alternative timeline requests for approval by the Administrator. Regarding the timeframe for submitting a request, several state agencies recommended extending the 15-day timeline for a request to be submitted and indicated that 15 days is not sufficient time to evaluate the problem and plan for corrective action, which may often involve construction activities. There were varied opinions from the state agencies on what length of time beyond 15 days is appropriate. Two agencies supported an extension to as soon as practicable but no later than 60 days, other agencies specified that the request should be submitted within 30 days from the initial exceedance.

Industry representatives from private and publicly owned landfills as well as waste industry consultants opposed the requirement to submit a request for an alternative corrective action timeline within 15 days. The commenters were concerned that 15 days is not enough time to assess the appropriate solution across miles of interconnected piping. In addition, the commenters were concerned that a 15-day time period would increase the paperwork for both the landfill and the reviewing regulatory agency. One commenter indicated that while many repairs can be completed within 60 days, some repairs, especially in cold weather climates, may take longer. One industry commenter suggested that a timeframe of 90 days to complete any adjustments or repairs is appropriate. If the corrections could not be made within 90 days, the commenter stated that the landfill would be prepared to have the system expanded within 120 days.

Industry commenters raised the issue that the timeline for corrective action for surface exceedances in the current subpart WWW regulations, 40 CFR 60.755(c)(4)(v), allows 120 days to install a new well or other collection device or submit an alternative timeline for another corrective action. These commenters also indicated that the 1998 NSPS amendments modified the corrective action for wellhead parameter exceedances to be consistent with the timeframe allowed for correcting surface exceedances (63 FR 32748, June 16, 1998). The commenters also noted that the 1998 amendments recognized that installation of a new well may not always be the appropriate corrective action for remedying a wellhead exceedance.

Despite the 1998 rule amendments, several of these industry commenters note that interpretation and implementation of the 1998 amendments to 40 CFR 60.755(a)(3) have been inconsistent, with some agencies only requiring the landfill owner or operator to submit requests if the corrective action will take longer than 120 days. Other states have taken the position that any exceedances that cannot be resolved within 15 days must automatically result in a requirement to expand the GCCS. One commenter referenced determinations that required landfills to submit an alternative timeline request within 15 days. One commenter indicated that the original rule never anticipated notification and a request for an alternative compliance timeline within 15 days, while another commenter indicated that the state of Texas requires landfills to submit alternative timelines only if the corrective action requires more than 120 days to complete.

In consideration of the 1998 final rule notice, industry commenters recommended that EPA require landfill owners or operators to submit an alternative timeline request for approval as soon as practicable and only in circumstances in which a system expansion or alternative corrective action will require more than 120 days to complete. One of the commenters (Republic 0451–0176) suggested that this approach was consistent with the Petroleum Refineries NSPS (40 CFR part 60, subpart Ja). The commenter noted that while the Landfills NSPS requires special approval to avoid the default corrective action of expanding the GCCS, the Refineries NSPS requires a root cause analysis to identify the appropriate corrective action, without specifying a default approach. The Refineries NSPS requires a root cause analysis and a corrective action analysis for exceedances and requires the facility to implement the corrective action within 45 days. If the corrective action cannot be completed in 45 days, the refinery must document and record all corrective actions completed to date. For actions not fully completed by day 45, they must develop an implementation schedule, as soon as practicable, for beginning and completing all corrective action.

One commenter provided some ideas for landfills to demonstrate good faith effort to comply with the 120-day corrective action schedule. They suggested the rules clarify that the landfill owner or operator is required to submit a notification to the agency that

[42] The EPA asserts the importance of case specific HOV requests and approvals. However, to address concerns from HOV request reviewers and those submitting requests, an example of regulatory guidance for HOV demonstrations can be found at *http://www.epa.ohio.gov/portals/34/document/guidance/gd_1002.pdf.*

identifies and describes the diagnosis performed, the results of the diagnosis, identifies the corrective measure or alternative remedy to be implemented and reason(s) why system expansion is not appropriate to correct the exceedance. Under such an approach, corrective measures other than expansion that take 0–60 days to complete from the initial exceedance would not require any notification or approval but they would be documented in the annual compliance report. For corrective actions other than expansion that take longer than 60 days but less than 120 days to complete, the landfill owner or operator would notify the regulatory agency by day 75 from the date of the initial exceedance. This would allow 45 days for the agency to review and comment, and such notification would not require agency approval so as not to delay the site from proceeding with and completing the corrective action, as long as the corrective actions are completed within the 120-day timeframe.

Industry commenters indicated that the timeline for corrective action is affected by other regulations. Two of these commenters noted that any corrective action that involves disturbing the final landfill cover could delay diagnosing the problem. All of these commenters also noted that a 60-day timeframe is problematic for landfills affected by the Asbestos NESHAP (40 CFR part 61, subpart M), which requires a 45-day notification prior to disturbing areas that may have asbestos containing material.

Response: The EPA is retaining the corrective action requirements for temperature in addition to negative pressure. The EPA recognizes the importance of temperature as a critical indicator of landfill fires and its effect on methanogens. Further removal of the corrective action requirements for temperature could have the unintended consequence of improper operation of a GCCS which could lead to a subsurface fire. Due to the importance of this parameter, e-reporting requirements for excessive temperature have also been established to better assess landfill fires.[43]

After carefully considering the comments received and evaluating the available data, the EPA is finalizing corrective action requirements that generally give owners or operators 60 days to investigate and determine the appropriate corrective action and then implement that action. The EPA has retained the requirements for temperature and positive pressure, in that if positive pressure or temperature exceedances exist, action must be initiated to correct the exceedances within 5 calendar days. This requirement has been retained to ensure the landfill takes prompt action to ensure the GCCS remains well-operated. The EPA recognizes, however, that the appropriate corrective action, as well as a schedule to implement it, is site-specific and depends on the reason for the exceedance. Therefore, for corrective action that takes longer than 60 days after the initial exceedance to implement, the EPA is providing flexibility for the landfill to determine the appropriate course of action based on a root cause analysis. Specifically, if the owner or operator cannot achieve negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) at the GCCS wellhead within 15 days, then the owner or operator must conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after positive pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) was first measured. An implementation schedule is required for exceedances that will take longer than 60 days to correct. A root cause analysis is an assessment conducted through a process of investigation to determine the primary cause, and any other contributing cause(s), of positive pressure at a wellhead or temperature above 55 degrees Celsius (131 degrees Fahrenheit). The root cause analysis and documentation of the corrective action taken to restore negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) must be kept on site as a record, but they do not have to be submitted or approved.

If negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) cannot be achieved within 60 days, then the owner or operator must develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the positive pressure or temperature reading. The owner or operator must also notify the Administrator within 75 days. The implementation schedule, root cause analysis, and documentation of the corrective action taken to restore negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) must be submitted in the facility's next annual report, but these items do not have to be approved.

If the exceedance cannot be corrected (or is not expected to be corrected) within 120 days, then the owner or operator must submit the root cause analysis, plan for corrective action to restore negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit), and the corresponding implementation timeline to the Administrator. The Administrator must approve the plan for corrective action and the corresponding timeline. The owner or operator must submit the proposed corrective action and timeline to the Administrator for approval as soon as practicable but no later than 75 days after the initial exceedance. Requiring approval by the Administrator for corrective action timelines that extend beyond 120 days is consistent with the corrective action timeline for surface emissions in 40 CFR 60.36f(c)(4)(v). This approach also prevents the landfill owner or operator from delaying submittals for corrective action requests until day 120. Once the negative pressure has been restored, the facility must document the corrective actions taken in the facility's next annual report.

For corrective action required to address positive pressure or temperature, the owner or operator must keep a record of the root cause analysis conducted, including a description of the recommended corrective action(s); the date for corrective action(s) already completed following the positive pressure reading and; and for action(s) not already completed within 60 days of the initial positive pressure reading, a schedule for implementation, including proposed commencement and completion dates. For corrective actions taking longer than 60 days to correct the exceedance, the owner or operator would also include in the annual report the root cause analysis, recommended corrective action(s), date corrective actions were completed, and schedule for implementing corrective actions. The owner or operator must also notify the Administrator within 75 days. For corrective actions taking longer than 120 days to correct the exceedance, the owner or operator would include, in a separate notification submitted to the Administrator for approval as soon as practicable, but no later than 75 days after the initial positive pressure or elevated temperature reading, the root cause analysis, recommended corrective action(s), date corrective actions taken to date were completed, and proposed schedule for implementing corrective actions.

[43] The need to rely on temperature in addition to pressure is also illustrated in the report titled Subsurface Heating Events at Solid Waste and Construction and Demolition Debris Landfills: Best Management Practices at *http://www.epa.state.oh.us/Portals/34/document/guidance/gd_1009.pdf*.

3. Landfills Recirculating Leachate or Adding Other Liquids

In the ANPRM and proposed Emission Guidelines, the EPA solicited input on whether additional action should be taken to address emissions from wet landfills (*i.e.,* landfills that recirculate leachate or add liquids). Commenters differed on whether the EPA should require separate thresholds or different lag times for landfills that recirculate leachate or add liquids. (The lag time is the time period between when the landfill exceeds the emission rate threshold and when controls are required to be installed and started up.)

Comments: Commenters supported more environmentally protective requirements for wet landfills and asserted that wet landfills produce more methane but actually collect less. Commenters said that the EPA should shorten the lag time for installing controls for these landfills. Other commenters opposed separate requirements for wet landfills and contended that additional requirements for wet landfills would achieve minimal emission reductions and would result in a significant additional burden for landfills that recirculate leachate. One commenter said that the EPA should focus on potential emission reductions at landfills that recirculate leachate.

Commenters also differed on what methane generation rate (k-value) should be used in the landfill Emission Guidelines for wet landfills. One commenter indicated that they have previously provided several studies on k-values for wet landfills to EPA and urged the EPA to update the emission factors for wet landfills based on this literature prior to adjusting the control requirements at landfills recirculating leachate or adding other liquids. Another commenter asked the EPA to use higher, more representative k-values, or perhaps a sensitivity analysis for a range of k-values to estimate the impacts of controlling emissions from wet landfills in the landfills Emission Guidelines.

Response: Based on the diverse nature of the feedback provided and several other outstanding EPA actions affecting the control requirements and emission factors for wet landfills, the EPA is not creating separate emission threshold or lag time requirements for wet landfills in this action. Instead, the EPA believes it is appropriate to further assess emissions from wet landfills prior to taking additional action on control requirements or changes to the k-values. As a result, the EPA is finalizing additional electronic reporting requirements for wet landfills with a design capacity of 2.5 million Mg or greater to inform potential future action on wet landfills. The final rule is limiting reporting of these additional data to wet landfills that meet the current size threshold of 2.5 million Mg of design capacity to be consistent with the universe of landfills that are affected by the rule.

Specifically, the final Emission Guidelines require annual electronic reporting of the volume of leachate recirculated (gallons per year) and the volume of other liquids added (gallons per year), as well as the surface area over which the leachate is recirculated (or sprayed), and the surface area (acres) over which any liquids are applied. The quantity of leachate recirculated or liquids added should be based on company records or engineering estimates. The initial report will collect historical data for the 10 years preceding the initial annual reporting year, to the extent the data are available in on-site records, along with data corresponding to the initial reporting year. After the initial report, the other annual electronic reports will include only the quantities of leachate recirculated and/or added liquid and their corresponding surface areas for each the subsequent reporting year. The EPA believes many landfills, especially those operating with a Research, Development, and Demonstration (RD&D) permit, already keep records and may submit reports containing quantities of liquids added. So, the effort to track these additional data is expected to be minimal. RD&D permits are issued through Resource Conservation and Recovery Act (RCRA) subtitle D, part 258 regulations for MSW landfills. The EPA is also aware of some state rules that require reporting of leachate or added liquids outside of the Clean Air Act reporting requirements. Consolidating these data in an electronic format in a central repository can help inform how leachate or added liquids affect LFG generation and collection whether air emission standards should be adjusted for wet landfills.

The EPA is also requiring the landfill to report the total waste disposed (Mg) in the area with recirculated leachate and/or added liquids, as well as the annual waste acceptance rates (Mg/yr) in those same areas. Recognizing that the waste quantities may be tracked at the scale house entry to the landfill and not the specific cell where the liquids are added, the EPA is allowing the landfill to report data based on on-site records or engineering estimates.

The EPA is exempting landfills in the closed landfill subcategory from this wet landfill report recognizing that this information would be difficult to obtain from this subcategory of landfills, these landfills are unlikely to still be adding liquids if closed, and also because the gas generation from these landfills is on the downward side of their gas generation curve. In addition, for similar reasons the EPA is allowing owners or operators of landfills to discontinue annual reporting of the wet landfill report after the landfill has submitted its closure report.

The EPA is also aware of annual LFG collected and annual LFG generation data electronically reported to 40 CFR part 98, subpart HH, of the GHGRP and therefore the EPA is not requesting reporting of these data in this rule to avoid duplicative requests. However, the EPA may link the wet landfill practices data collected under the landfills NSPS with the annual gas collected data under subpart HH in order to inform how liquids addition affects LFG emissions. Similarly, the EPA understands that precipitation may affect gas generation. However, since precipitation data are readily available through the National Weather Service, the EPA is not requiring reporting of this parameter. Instead, the EPA will use existing electronic data already available to link up with data collected under this final rule. These additional data will be used to assess the appropriateness of potential future action on wet areas of landfills.

The Paperwork Reduction Act (PRA) requires each federal agency to obtain OMB approval before undertaking a collection of information directed to 10 or more people. The PRA applies whether a "collection of information is mandatory, voluntary, or required to obtain or retain a benefit." The EPA believes the additional data on wet landfills will be beneficial for evaluating whether separate thresholds for wet landfills are appropriate when revising future MSW landfill standards. Because the EPA understands that many of the data elements in the wet landfill report, including quantities of leachate or other liquids added and the surface areas over which those liquids are added are tracked at a state level as part of a leachate management or RDD permit, the EPA does not anticipate these data. Additionally, the EPA is allowing landfill owners or operators to report the data elements in the wet landfill monitoring report using either engineering estimates or on-site records to minimize the burden on respondents, depending on the types of records the landfill owner/operator may keep.

This is a new rule and a new collections submitted to OMB under

EPA ICR number 2522.02. This collection is similar to collections for subpart Cc. Thus, many of the line item burden estimates in this ICR estimate are the same as the burdens submitted to OMB under ICR number 1893.06 for the most recent ICR renewal for subpart Cc.

4. Portable Gas Analyzers

Commenters on the proposed NSPS (79 FR 41796) requested that the EPA specify that portable gas composition analyzers are an acceptable alternative to Methods 3A or 3C, and noted that these devices are commonly used in practice to measure wellhead parameters and are calibrated according to the manufacturer's specifications. Currently, approvals of these analyzers are done on a case-by-case basis. Therefore, in the preamble for the proposed revisions of the Emission Guidelines (80 FR 52141), the EPA requested data or information on using a portable gas composition analyzer according to Method 3A for wellhead monitoring. The EPA also requested data on other reference methods used for calibrating these analyzers.

Comment: Many commenters supported the use of portable gas composition analyzers and requested that the EPA specify that these analyzers may be used as an approved alternative monitoring method for well monitoring. Three state agencies indicated the use of the portable analyzers is common practice. One of these agencies stated that Method 3A and Method 3C are designed to be used in ''quasi-CEMS'' and/or ''laboratory benchtop'' situations and most landfill operators are not using this type of equipment to test wellhead LFG; instead, landfill operators are using handheld-size portable analyzers. Another state agency stated that portable gas composition analyzers (*e.g.,* Landtec GEM 2000) are a standard for conducting MSW landfill well monitoring and the analyzers provide additional information on gas composition than what the current Emission Guidelines require, which provides operators with a better understanding of the condition of the landfill. This commenter said that a primary advantage of portable gas composition analyzers, for both landfills and regulators, is that these devices take and record the monitored readings (as well as other information on gas composition that is not required to be monitored in the Emission Guidelines), which can then be downloaded into a spreadsheet and prevent landfills from making data collection mistakes. The commenter suggested that the EPA and state air pollution control agencies would benefit if the EPA were to require landfills to submit, in their semi-annual reports, all of the monitoring data recorded by portable gas composition analyzers.

One commenter stated that most portable gas composition analyzers can be used to measure the oxygen level at the wellhead and can be calibrated according to Method 3A, but are unlikely to be calibrated according to Method 3C (to measure oxygen or nitrogen levels) because such calibration requires the use of gas chromatograph equipment with a thermal conductivity detector and integrator. The commenter said that Method 3A is straightforward and does not specify a particular technology. Several commenters specifically referenced the comments from an equipment manufacturer that provided specific details on how its Landtec GEM Series portable analyzers are able to comply with each specific requirement in Method 3A, including the calibration requirements. Two of these commenters said that portable gas composition analyzers should be allowed in both the Emissions Guidelines and NSPS. Another of these commenters requested that the EPA add language to the rule to recognize that balance gas is commonly used as a surrogate for nitrogen.

With regard to the EPA's request for data on other reference methods used for calibrating portable gas composition analyzers, one commenter suggested that the EPA allow ASTM D6522 as an alternative to Method 3A because an analyzer can easily be calibrated for oxygen alone following ASTM D6522. The commenter stated that although the QA/QC procedures in ASTM D6522 are different from Method 3A, they are just as rigorous as Method 3A. The commenter stated that it has extensive data available showing portable gas composition analyzers are routinely calibrated according to ASTM Method D6522 for measuring NOx, CO, and oxygen during engine testing. This commenter also stated that any analyzer or device must be calibrated according to an EPA approved method and not just manufacturer's specifications.

Response: The EPA appreciates the commenters providing information regarding the use of portable gas composition analyzers for landfill monitoring. Commenters provided data showing that their portable gas composition analyzers are used to monitor the oxygen level at a wellhead and are capable of meeting the calibration requirements in Method 3A. Therefore, in this action, we are clarifying the use of portable gas composition analyzers with Method 3A. A portable gas composition analyzer may be used to monitor the oxygen level at a wellhead provided that the analyzer is calibrated and meets all QA/QC according to Method 3A. Although we did not receive enough information regarding calibration methods that could be used on a portable gas composition analyzer to monitor the nitrogen level at a wellhead, any portable combustion monitor analyzer that uses gas chromatography and thermal conductivity technology may be used with Method 3C. Other technologies for the measurement of nitrogen may be used in lieu of Method 3C through the administrative alternative test method process outlined in 40 CFR 60.8(b)(2).

Regarding the suggestion to allow ASTM D6522–11 as an alternative to Method 3A, the EPA thanks the commenter for their perspective. As long as all the quality assurance is conducted as required by ASTM D6522–11, then ASTM D6522–11 may be used as an alternative to Method 3A for wellhead monitoring (prior to combustion). Examples of quality assurance required by ASTM D6522–11 include, but are not limited to: analyzers must have a linearity check, interference check, bias check using mid-level gases, stability check, and be calibrated before a test; and a calibration error check and the interference verification must be conducted after the testing has occurred. Due to a different sample matrix typically found in post-combustion gas streams as stated in the applicability of ASTM D6522–11, the interference check must be done on the oxygen measurement with the appropriate gases (*e.g.,* carbon dioxide, VOC mixture, and methane) and concentration ranges. The ASTM D6522–11 method also has calibrations before and calibration checks after testing. According to Methods 3A, 3C, and ASTM D6522–11, the data are valid only when they pass the bias check or zero and upscale calibration error check. The EPA does not believe manufacturers' specifications are rigorous enough to ensure data are of a proper quality.

5. More Precise Location Data

The EPA proposed more specific requirements for reporting the locations where measured methane surface emissions are 500 ppm above background (80 FR 52124). Specifically, the EPA proposed to require landfills to report the latitude and longitude coordinates of each SEM exceedance using an instrument with an accuracy of at least 3 meters. This includes surface methane readings above 500 ppm for landfills conducting quarterly SEM with

GCCS in place, as well as landfills that are conducting Tier 4 SEM to determine the timing of GCCS installation.

Comments: Several commenters supported and several commenters opposed the EPA's proposed requirement to report the latitude and longitude coordinates of each methane surface emissions exceedance using an instrument with an accuracy of at least 3 meters.

Of those commenters that supported the requirement, one said that making global positioning system (GPS) coordinates of each exceedance available would assist owners or operators in determining the location and timing of exceedances relative to the GCCS components and would also assist in inspections and enforcement. This commenter added that these requirements provided important compliance monitoring assurances as well as important information to landfill owners or operators regarding their GCCS effectiveness. Other supportive commenters argued that all SEM data and GPS coordinates should be recorded, no matter whether there is an exceedance. One of these commenters, a state agency, said that the NSPS and Emission Guidelines have historically required retention of only exceedance data, but GPS data correlated with SEM readings would be an invaluable addition to the monitoring procedure. Another commenter said recording all SEM data (rather than only exceedances) was necessary to show compliance with the monitoring requirement; and by linking the methane readings with positioning data, the time required to process the data would be reduced. Commenters said that by correlating the SEM readings directly with the location of the reading, facilities and their regulators could easily gain a clear picture of how the LFG collection system was functioning and anticipate problems before they arose by tracking trends in the data.

Of the commenters that opposed the requirement that owners or operators of landfills report the latitude and longitude coordinates of each exceedance using an instrument with an accuracy of at least 3 meters, one said it was unclear why coordinate information must be reported, given that it merely adds burden for sites to collect and report as well as for agencies to review. Two of these commenters argued that the added expense to purchase an instrument (*i.e.,* a GPS device), use that GPS device in the field, and then plot the GPS data on a map, may provide no additional value to the operator compared to marking exceedances with marker flags. One of these commenters stated that 3 meters is too much of an error range such that the use of GPS alone may not allow the operator to return to the exact spot of the exceedance, and may still necessitate the use of a marker flag. Another of these commenters added that the existing approach of marking exceedances at their exact physical location with a marker flag is actually more accurate because it does not rely on a technology with accuracy limitations.

Some of the commenters that oppose the requirement said that it is unclear from the docket materials (*e.g.,* the Regulatory Impact Analysis) whether the EPA evaluated: (1) If GPS equipment can achieve an accuracy of at least 3 meters; (2) the cost to purchase or rent GPS equipment; and/or (3) the size and weight of the GPS equipment with regard to requiring a technician to carry another field monitoring instrument. One of these commenters added that because GPS equipment is not typically integrated into other monitoring devices, monitoring technicians will be required to carry the GPS equipment in addition to the monitoring equipment, which could be difficult and present a safety concern.

Response: The EPA is finalizing a requirement for landfills to report the latitude and longitude coordinates of each surface emissions exceedance, as proposed, except the instrument accuracy must be at least 4 meters instead of 3 meters. GPS technology is readily available and is currently in use at landfills in California and other landfills employing electronic LFG data management systems. These GPS devices have the ability to identify latitude and longitude coordinates in decimal degrees with at least five decimal places. This level of accuracy and precision is consistent with the requirements in Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards (80 FR 75250). The EPA is aware of one device that is already in use by some landfills in California to conduct surface emissions monitoring and to create a more comprehensive understanding of the GCCS. The instrument, containing a flame ionization detector (FID), is linked by Bluetooth wireless technology to a GPS-enabled handheld field instrument. This instrument has an accuracy of 2–4 meters.

When reviewing site records on the location of the traversed path and where surface emission leaks were identified, inspectors will be able to identify areas of the landfill where surface monitoring activities may be incomplete, which may assist with targeting inspections to problem areas of the landfill. In addition, more precise location data will allow the landfill owner or operator to overlay the coordinates of surface exceedances against maps of the GCCS to determine spatial and temporal patterns of exceedances relative to GCCS components. Both the landfill owner or operator and regulators can use locational data to gain perspective on how the LFG collection system is functioning over time and will allow the landfill to track trends in GCCS performance and cover practices.

Using GPS locational data will provide a more robust and long-term record of GCCS performance compared to the short-term practice of simply marking an exceedance location with a marker flag. Owners or operators may continue the practice of marking exceedances with a flag, but GPS data will allow the landfill owner or operator to return readily to the location of the exceedance to not only take the required corrective action, but also to track and inform long-term performance of the GCCS to minimize emissions.

The EPA included the rental price of a Trimble Integrated Landfill Gas Solution device, which combines a FID linked by Bluetooth wireless technology to a GPS-enabled handheld field instrument, in the revised testing and monitoring cost analysis for both the final Emission Guidelines and final NSPS. The GPS location is recorded in real time as the technician traverses the path so the labor involved in gathering and recording the data with GPS coordinates is expected to be minimal. In fact, the recording of each surface reading and the corresponding locational data is automatic, in contrast to the older technology, which may have involved handwriting an exceedance in a notebook and then transposing the data to a computer after returning from the field. Eliminating transposing the data could reduce data entry errors and improve data accuracy and credibility. The GPS device is already in use by landfills that maintain an electronic LFG data management system to map long-term trends in GCCS performance. The GPS device weighs approximately 21 ounces (including battery weight) and can be clipped to a belt or attached to a backpack to allow the technician to complete the monitoring safely.

B. Tier 4

In the 2015 Emission Guidelines proposal, the EPA proposed Tier 4 as an alternative site-specific emission threshold determination for when a landfill must install and operate a GCCS (80 FR 52112). For both Tier 4 SEM for

determining the timing for GCCS installation and SEM to ensure a well operated GCCS, the EPA considered limiting SEM during windy conditions. Specifically, in the Emission Guidelines, the EPA proposed that SEM must be terminated when the average wind speed exceeds 5 mph or the instantaneous wind speed exceeds 10 mph. However, the EPA also proposed that the Administrator may approve alternatives to this wind speed surface monitoring termination for landfills consistently having measured winds in excess of these specified limits.

Comments. The EPA received numerous comments on the Tier 4 provisions included in the 2015 Emission Guidelines proposal. The discussion below includes all comments related to changes since the 2015 proposal; more detailed comments are available in the Response to Comments document. A summary of the initial comments received in response to our request for comments for a Tier 4 provision in the 2014 ANPRM was provided in the preamble to the proposal (80 FR 52112).

Which landfills should qualify. Some commenters believe that the EPA should limit the types of landfills that qualify for Tier 4. One commenter opposed the inclusion of a Tier 4 option for new landfills, stating that it allows a subset of new landfills to delay methane capture requirements when these landfills will be required to install a GCCS in the future and should have a GCCS designed and installed during landfill construction. One commenter encouraged the EPA to ban Tier 4 for landfills with a voluntary (non-regulatory) GCCS because it is possible that GCCS design, monitoring, recordkeeping, and reporting requirements could be avoided indefinitely through the use of a non-regulatory GCCS that may not provide the same level of control as required by the EPA landfills regulations. Another commenter thinks that Tier 4 could be conducted at landfills with a GCCS installed, but that the GCCS should follow typical operational conditions during the Tier 4 test. In other words, if portions of the site are typically offline due to decreased gas flow, the commenter (0215–0197) thinks those portions must remain offline during Tier 4. Further, one commenter believes that no means of gas control whatsoever should be employed during the Tier 4 exemption.

Frequency. There were a variety of opinions on how often SEM should be conducted for Tier 4. One commenter suggested the SEM should be done annually instead of quarterly. Two other commenters were concerned with reducing the frequency to semi-annually unless the landfill no longer accepted waste. One of these commenters noted that if a landfill has already crossed the 34 Mg/yr NMOC threshold and the facility continues to receive solid waste, then the expected gas generation will continue to increase.

Windy conditions. Many commenters, including many state agencies, opposed limiting surface monitoring during windy conditions, stating that the wind restrictions would be a significant inhibitor to completing the required monitoring in many regions of the country due to typical windy conditions. Commenters also stated that it would be difficult to schedule and reschedule dedicated sampling crews.

Commenters claimed that climate conditions across the United States are too variable, that monitoring the wind using an anemometer is not representative of wind conditions where the surface monitoring is required (5–10 cm of surface), and that it is difficult to assemble monitoring team and schedule monitoring events if they may be cancelled due to wind. One commenter supports the development of a Tier 4 SEM methodology that is functional during windy conditions. Other commenters support the removal of the wind speed criteria and replacement with a requirement that surface monitoring be performed during typical meteorological conditions. Lastly, one commenter pointed out that the Tier 4 proposal is inconsistent with the ongoing quarterly SEM requirements since Tier 4 has wind restrictions and the ongoing quarterly SEM does not.

One commenter noted that EPA recognized wind speed can skew the results of SEM. Another commenter did not submit comments specific to the wind speed limitations; however, this commenter supported the SEM approach in the CA LMR, which does include wind speed restrictions.

Reporting requirement. Commenters supported the notification requirement; however, one commenter believes landfills should not be required to reschedule monitoring events based on the availability of regulatory authorities. Furthermore, two commenters thought the notification requirement was acceptable but with the existing wind requirements, coordination with regulators could become even more challenging. Another commenter did not support the notification requirement because Tier 4 is voluntary.

Response: After considering public comments and input from small entity outreach, the EPA is finalizing Tier 4 SEM procedures for determining when a landfill must install a GCCS. Tier 4 provides operational flexibility and allows owners or operators of landfills that have exceeded the modeled NMOC emission rate threshold to demonstrate that site-specific surface methane emissions are below a specific threshold. Commenters raised some valid points, however, and based on our consideration of that input, we are making some adjustments to the final rule.

In response to public comments concerned with implementation of Tier 4 with wind speed restrictions, the EPA is retaining a wind speed limitation with allowance of a wind barrier when onsite wind speed exceeds the limits in the regulation. The EPA is also providing additional clarifications about probe placement (as described in sections IV.A.2 and V.B of this preamble) for Tier 4 SEM. In the proposed NSPS (80 FR 52136), the EPA acknowledged concerns about the accuracy of SEM under windy conditions. The EPA is including the wind speed restriction, because air movement can affect whether the monitor is accurately reading the methane concentration during surface monitoring. Because Tier 4 is an optional emission threshold methodology, the EPA believes that wind speed restrictions and the use of wind barriers are appropriate to ensure the reliability of the results, which in turn determine the timing of GCCS installation. We also refined the wind speed criteria to account for gusts up to 10 mph. The EPA is not finalizing a variance for wind speed, but is allowing the use of a wind barrier. In the proposed NSPS (80 FR 52136), the EPA acknowledged concerns about the accuracy of SEM under windy conditions. The EPA also expressed concern about whether monitors could accurately read methane concentrations or provide representative results. The EPA has provided the Tier 4 approach as a flexible alternative to traditional modeling based approaches; but still asserts the importance of accurate measurements due to the use of the SEM approach to determine installation of controls.

In addition, Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr but less than 50 Mg/yr using Tier 1 or Tier 2 (a landfill need not model emissions under Tier 3 before using Tier 4). Tier 3 was not required because tiers 1 and 2 are more commonly used. If both Tier 1 and Tier 2 indicate NMOC emissions of 50 Mg/yr or greater, then Tier 4 cannot be used. This change avoids a

potential conflict between what is required under the Emission Guidelines and what is required by the landfills NESHAP for landfills with modeled NMOC emissions greater than 50 Mg/yr. It also ensures that landfills with modeled NMOC emissions at 50 Mg/yr or more continue to be required to install controls at an NMOC level and on a schedule that is at least as stringent as the current NSPS (40 CFR part 60, subpart WWW). To demonstrate that NMOC emissions are less than 50 Mg/yr according to Tier 1 and Tier 2, landfill owners or operators will continue to calculate the NMOC emission rate and report results annually.

Regarding frequency of monitoring, the EPA is finalizing an approach where quarterly SEM is required for Tier 4 indefinitely unless the landfill is closed. Closed landfills would be able to reduce the frequency of surface emission monitoring to annually after four quarters of no surface exceedances. Landfills that are closed are on the downside of their gas generation profile.

Regarding landfills equipped with a non-regulatory GCCS, the EPA is allowing the non-regulatory GCCS to be in operation during the Tier 4 SEM demonstration, but only if the non-regulatory GCCS has operated for at least 75 percent of the hours the 12 months leading up to the Tier 4 SEM demonstration (6,570 hours), as discussed below. The EPA recognizes that many landfills have acted early to control their emissions and installed a GCCS before surpassing the size and NMOC emission thresholds in the landfills regulations in order to recover and utilize LFG methane for beneficial use, flare for carbon credits, control odors, or meet state-specific regulations that may be more stringent than the federal NSPS standards. Thus, during the SEM demonstration, the non-regulatory GCCS must continue to operate as it normally would to collect and control as much LFG as possible. Although these landfills do not operate their GCCS under the landfills NSPS, they employ the same technology that would be applied to comply with the landfills NSPS. Many of these non-regulatory GCCSs are located at sites that are likely to eventually exceed the NSPS size and NMOC emissions thresholds and thus if no exceedances are identified during a Tier 4 SEM, the system is operating at a level consistent with the landfills NSPS collection and control requirements and operational standards at a point in time earlier than when federal regulations would require. These near-term methane reductions from non-regulatory GCCS are beneficial to the environment and the goal of achieving short-term emission reductions of methane, a potent greenhouse gas. In addition, landfill owners or operators have incentive to operate the GCCS as efficiently as possible to collect and control LFG to avoid surface exceedances, as it would reduce paperwork requirements associated with the compliance provisions of the landfills NSPS. The non-regulatory GCCS would have to be robust to keep readings below 500 ppm methane during an SEM demonstration.

To not allow the Tier 4 demonstration while a non-regulatory GCCS is in operation under these circumstances would create a disincentive for landfill owners or operators to install control systems voluntarily before emissions reach the regulatory threshold for review. The requirement to operate the GCCS at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (described below) will ensure that the non-regulatory GCCS is in regular use and thus represents accurate operation of the facility.

The landfill owner or operator is allowed to operate the non-regulatory GCCS during the Tier 4 demonstration, but only if the non-regulatory GCCS has operated for at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (6,570 of 8,760 hours). To demonstrate that the non-regulatory GCCS operated at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration, landfill owners or operators must keep records of the total operating hours of the gas collection system as measured for each destruction device (*i.e.,* at the flare, engine, or other destruction device), as well as the annual operating hours where active gas flow was sent to each destruction device. If the non-regulatory GCCS has not operated at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration, then the landfill is not eligible for Tier 4. The EPA seeks to encourage use of voluntary non-regulatory GCCS systems for early gas collection before emissions reach the regulatory threshold for review, while still allowing landfill owners and operators to use Tier 4 surface emissions monitoring approach to determine if a GCCS is required. We believe that requiring the operation of the non-regulatory GCCS at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (described below) will ensure that the non-regulatory GCCS is in regular use and thus results would be representative of the operation of the landfill.

Regarding other recordkeeping and reporting requirements associated with Tier 4, landfill owners or operators choosing Tier 4 would continue to calculate the NMOC emission rate and report results in the annual report to demonstrate that NMOC emissions are less than 50 Mg/yr. Once there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill, the EPA is requiring a GCCS to be installed and operated within 30 months of the most recent NMOC emission rate report in which the calculated NMOC emission rate equals or exceeds 34 Mg/yr according to Tier 2. Starting the 30 months from the most recent NMOC emission rate report ensures that a GCCS is installed in a timely manner. The EPA believes that if a landfill owner or operator chooses to use Tier 4 SEM, it is appropriate to require the installation and operation of a GCCS when any reading of 500 ppm or greater is detected during the quarterly SEM event. Since Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr NMOC, but less than 50 Mg/yr using Tier 1 or Tier 2, we would expect the methane emissions at the landfill to be below the 500 ppm threshold. If an exceedance of the threshold is detected, it would be indicative of higher emissions than would normally be expected at a landfill.

The EPA is also finalizing a recordkeeping requirement to take and store digital photographs of the instrument setup. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration. The EPA believes these records will help provide credibility to the Tier 4 sampling results.

The EPA is also finalizing a requirement to notify delegated authorities 30 days prior to the Tier 4 test so that officials can be present to observe the SEM. This notification is consistent with other notification requirements for stack testing. This notification requirement will also mitigate concerns that the SEM is being conducted incorrectly and ensure transparency of results achieved during the SEM approach. In the event the Tier 4 SEM is postponed due to weather conditions or other unforeseen events, the EPA is requiring the owner or operator to notify the delegated authority to arrange a rescheduled Tier 4 SEM date.

Emerging Measurement Technologies. This rulemaking provides certain MSW landfill owners or operators the option of using either modeling or the Tier 4 SEM approach to determine whether controls are required to be installed at specific landfills. Current modeling approaches, which rely on the decomposition rate of different waste streams buried in a landfill, are prone to uncertainties due to inaccuracies in input data and often unverifiable assumptions. Current surface emission measurement methodologies can also have associated uncertainties.

New methane emissions measurement methodologies are emerging that are anticipated to provide landfill methane emission rates (mass per unit time) over time, thereby reducing significantly the uncertainty associated with current modeling and emission measurements approaches. Two promising examples of new methane measurement methodologies being used by research groups to quantify landfill methane emissions are mobile tracer correlation (TC)[44 45 46 47] and discrete area source eddy covariance (DASEC).[48]

1. *Mobile tracer correlation.* This methodology provides a ''snap-shot in time'' assessment of whole facility methane emissions using on-site release of atmospheric tracer gases. It provides a total mass emission rate of methane (or other gas) per unit of time. An instrumented vehicle driving 1 km to 4 km downwind of the landfill simultaneously measures the emitted landfill methane plume along with the superimposed tracer gas release. The landfill methane emission rate is determined through a simple ratio to the known tracer gas release rate. The technique has been demonstrated using a variety of tracer gases and instruments by a number of groups to investigate emissions from landfills and other sources. The mobile tracer correlation approach is under development by the EPA as a Category C ''other test method (OTM)'' with potential posting in 2017 (*https://www3.epa.gov/ttnemc01/prelim.html).*

2. *Eddy covariance (EC).* This micrometeorological method estimates the source emission rate from the vertical wind speed and gas concentration above the emitting surface. This technique measures the emissions flux in mass of methane (or other gas) per unit area. The technique is well-established for measurement of emission fluxes from spatially-extended homogenous sources, such as very large, flat fields. Discrete area source eddy covariance (DASEC) is an application of EC to finite, heterogeneous area sources. This application of EC has been recently demonstrated on landfills, although method development questions on the effects of topography and variable observational foot print remain. DASEC provides the potential for long term (near continuous) measurements of discrete sections of a landfill using solar-powered on-site instrumentation. Development of this type of long term measurement capability is critical to better understand and *track changes in landfill emissions overtime that may be caused by both site management and atmospheric factors.

In sum, as noted above, these techniques are still being investigated and additional work will be needed before the EPA can deem them ready for use in this application. Once additional research is completed, we believe that DASEC used in combination with mobile TC will provide a characterization of methane landfill emissions with significantly reduced uncertainty over current models or measurement techniques.

C. Changes To Address Closed or Non-Productive Areas

1. Closed Landfill Subcategory

In the 2015 Emission Guidelines proposal, the EPA proposed a separate subcategory for landfills that closed before August 27, 2015. These landfills would be subject to an NMOC emission threshold of 50 Mg/yr NMOC for determining when controls must be installed or removed, rather than the 34 Mg/yr NMOC emission threshold (or corresponding Tier 4 emission threshold) that would apply to open landfills. In addition, the EPA requested comments on extending the subcategory of closed landfills to those that close no later than 13 months after publication of the final Emission Guidelines in the **Federal Register**.

Comment: Commenters generally favored the creation of a closed landfill subcategory and believe it was appropriate for closed landfills to be categorized separately. One commenter agreed that a separate category is appropriate, but only if EPA decides to lower the NMOC emission threshold thus ensuring that closed landfills with low emissions are not burdened with a requirement to install a GCCS. Another commenter suggested that the EPA exempt closed landfills from 40 CFR part 60, subpart Cf, entirely since facilities that no longer have income from waste acceptance have financially planned for closure. The commenter believes that if these landfills were included in the new rule, it would cause financial burden.

Many commenters, including one state agency, support the expansion of the closed landfill subcategory to include those facilities that closed no later than 13 months of publication of the Emission Guidelines. Commenters believe it is critical that landfills that are planning to close are given the necessary time to meet all criteria and file required documentation to achieve closed status. Another commenter believes the EPA should provide the opportunity for landfills to be closed under the Emission Guidelines until the state or federal regulations implementing the revised Emission Guidelines are effective (*i.e.,* through a revised state or federal plan). This would allow more landfills nearing the end of their useful lifetime with little ability to change their fees or plan for longer GCCS operation the chance to close and remain under current regulations.

Response: After considering public comments, the EPA is finalizing the subcategory for closed landfills and is expanding the subcategory to include those landfills that close on or before September 27, 2017. Landfills in the closed landfill subcategory continue to be subject to a 50 Mg/yr NMOC emission rate threshold for installing a GCCS, consistent with the NMOC threshold in 40 CFR part 60, subparts Cc and WWW.

The EPA recognizes that after landfills stop accepting waste and close, LFG flows decline as well as the corresponding ability to achieve additional reductions. Many of these closed landfills are subject to the emission control requirements in the current Emission Guidelines (40 CFR part 60, subpart Cc, or corresponding state or federal plan) or the current

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[44] Development of a mobile tracer correlation method for assessment of air emissions from landfills and other area sources, Foster-Wittig, T.A.; Thoma, E.D.; Green, R.B.; Hater, G.R.; Swan, N.D.; Chanton, J.P. Atmos. Environ. 2015, 102 (0), 323–330.

[45] Quantification of methane emissions from 15 Danish landfills using the mobile tracer dispersion method, Mønster, J.; Samuelsson, J.; Kjeldsen, P.; Scheutz, C. Waste Manage. 2015, 35 (0), 177–186.

[46] Methane Emissions Measured at Two California Landfills by OTM–10 and an Acetylene Tracer Method, Green, R.B., Hater, G.R., Thoma, E.D., DeWees, J., Rella, C.W., Crosson, E.R., Goldsmith, C.D., Swan, N., Proceedings of the Global Waste Management Symposium, San Antonio, TX, October 3–6, 2010.

[47] Development of Mobile Measurement Method Series OTM 33; Thoma, E.D.; Brantley, H.L.; Squier, B.; DeWees, J.; Segall, R.; Merrill, R.; Proceedings of the Air and Waste Management Conference and Exhibition, Raleigh, NC, June 22–25, 2015.

[48] Using Eddy Covariance to Quantify Methane Emissions from a Dynamic Heterogeneous Area, Xu, L., Lin, X., Amen, J., Welding, K. and McDermitt, D. Impact of changes in barometric pressure on landfill methane emission. Global Biogeochemical Cycles 2014, 28(7), pp. 679–695.

NSPS (40 CFR part 60, subpart WWW) and have achieved significant reductions. However, commenters report that declining gas flows make it difficult to operate a GCCS according to the landfills regulations and many closed landfills must use supplemental fuel to properly operate control devices such as flares for example. In addition, many closed landfills no longer have income from tipping fees, and have either decommissioned their GCCS or are in process of doing so. Thus, the EPA recognizes that it could be financially burdensome for landfills that are already closed to restart or expand their GCCS. For these reasons, the EPA is finalizing the subcategory of closed landfills.

To give closed landfills or landfills that are planning to close more time to complete the steps to reach closure, the EPA is expanding the closed landfill subcategory to include those landfills that close on or before September 27, 2017. Closed landfills must submit a closure report to the Administrator within 30 days of waste acceptance cessation. The Administrator may request additional information as may be necessary to verify that permanent closure has taken place in accordance with the closure requirements under RCRA (40 CFR 258.60). Closure criteria include a requirement to prepare a written closure plan and to install a final cover system that is designed to minimize infiltration and erosion.

Landfills in the closed landfill subcategory of the Emission Guidelines would be exempt from initial reporting requirements in subpart Cf, provided that the landfill already met these requirements under subparts Cc or WWW of 40 CFR part 60.

For landfills that are expected to close after September 27, 2017, the EPA understands that gas quality will remain a concern and has revised the GCCS removal criteria, as discussed in section IV.A.5 of this preamble.

2. Criteria for Removing or Decommissioning a GCCS

The proposed revisions to the Emission Guidelines in 2015 modified the criteria that allow a landfill owner or operator to cap or remove the GCCS. Specifically, the proposal refined the 15-year criterion by allowing a landfill owner or operator to demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows. In addition, the EPA tightened the NMOC emissions criterion, requiring the controls until the NMOC emissions were below 34 Mg/yr for three consecutive quarters to be consistent with the emission threshold for installing controls. For closed landfills, the NMOC emissions criterion remained at 50 Mg/yr to be consistent with the emission threshold for the closed landfill subcategory. Finally, the proposed Emission Guidelines added an alternative removal criterion based on site-specific SEM of methane. This alternative would allow the owner or operator to demonstrate for four consecutive quarters that there are no surface emissions of 500 ppm or greater from the closed landfill or area of an open landfill that is closed. The EPA received numerous comments on the revised set of GCCS removal criteria.

Comment: Commenters did not agree on the proposed alternative to allow an SEM demonstration as a criterion for removing a GCCS. Commenters in favor of an SEM demonstration for GCCS removal agreed with the flexibility that the approach would offer, but commenters that opposed the criterion expressed concern about emissions once the GCCS was no longer operating.

Some commenters opposed SEM procedures for determining removal or decommissioning of the GCCS. One commenter expressed concerns with relying on surface emission testing because the intervals are too far apart to detect localized high emissions and low surface emission readings during a dormant period could lead to uncontrolled emissions at a later period. The commenter (0215–0121) added that even in a closed landfill the decay process is not complete and gas collection systems should stay in place. Another commenter opposed SEM specifically at closed areas of open landfills due to gas migration concerns and difficulty in defining these areas.

Several commenters representing industry and state agency interests supported the use of SEM procedures to help determine the removal or decommissioning of existing GCCS. Commenters supported the use of SEM to allow the flexibility to confirm when a closed landfill or area of an open landfill that is closed is no longer producing gas in significant quantities could remove or decommission all or a portion of the GCCS. Several of these commenters referenced a rationale similar to the one they provided for supporting the use of Tier 4 SEM for determining GCCS installation as discussed in section VI.B of this preamble.

Commenters that supported an SEM demonstration for GCCS removal presented several options on how to implement the SEM procedure. Several commenters requested that the EPA provide a ''step-down'' procedure for scaling down GCCS operations in nonproducing areas and allowing a GCCS to be removed from rule applicability. Two commenters made recommendations on SEM procedures for GCCS removal or decommissioning, which included shutting down the GCCS for 30 days following a Tier 2 test showing NMOC emissions below the threshold, then relying on subsequent SEM demonstrations and corrective action to determine whether the GCCS could remain off. Other commenters also stated that when considering SEM for removing the GCCS, quarterly SEM should be performed at steady state conditions. As LFG generation declines, one commenter suggested that some wells may be removed from service; however, such wells must not be turned on in order to pass quarterly SEM and subsequently turned back off for the remainder of the quarter. Another commenter suggested that EPA not rely solely on surface emissions when defining a closed landfill in arid areas, but instead should consider the gas quality being collected (methane, carbon dioxide, negative pressure, or nitrogen/oxygen content) when determining when a GCCS can be removed.

Regarding the 15-year criterion in the 2015 Emission Guidelines, several commenters noted that the provision to allow landfills to demonstrate the GCCS could not be operated for 15 years due to declining flow was vague, and more guidance was needed to provide instructions to landfills on how to demonstrate this to regulators.

Response: After considering public comments, the EPA is finalizing criteria for capping, removing, or decommissioning the GCCS that are similar to the criteria in 40 CFR part 60, subpart Cc, but have been adjusted to reflect the NMOC emission threshold in the final rule and to provide flexibility on the requirement to operate the GCCS for 15 years. The final criteria are: (1) The landfill is a closed landfill, (2) the GCCS has been in operation for 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows, and (3) three successive tests for NMOC emissions are below the NMOC emission threshold of 34 Mg/yr for open landfills and below 50 Mg/yr NMOC for closed landfills. The three successive tests for NMOC emissions makes the threshold for removing a GCCS consistent with the threshold for installing a GCCS. The EPA is not finalizing an alternative set of criteria for capping, removing, or decommissioning a GCCS that includes a SEM demonstration.

While a SEM approach has been allowed for installation of controls, the

EPA believes it is not appropriate to allow SEM demonstrations for capping, removing, or decommissioning a control system. The EPA recognizes the unique emissions profile for landfills including the ability of these sources to release emissions for decades. For these reasons, the EPA believes it is appropriate to ensure that controls are installed and properly maintained for the appropriate period of time. The EPA believes sufficient flexibility has been added to the control removal approach by allowing a demonstration of the system's inability to operate for 15 years due to declining gas flows and a calculation of the NMOC emission rate. Further, during the comment period, concerns were raised about changes in the waste mass over time and how the SEM approach could inadvertently allow landfills whose emissions were in a period of dormancy, rather than a decline in their emissions profile, to remove controls. Agency enforcement personnel are also aware of situations where the installation of additional wells led to additional gas capture at sites asserting declining emissions. The EPA understands the importance of gas capture from landfills and believes the SEM approach for control removal may have the unintended consequence of allowing controls to be removed when significant gas capture is still possible. As a result, the EPA is not finalizing the SEM approach for removal.

Several commenters noted that the provision provided in the 2015 Emission Guidelines to allow landfills to demonstrate the GCCS could not be operated for 15 years due to declining flow was vague, and more guidance was needed to provide instructions to landfills on how to demonstrate this to regulators.

Regarding the 15-year criterion, the EPA is retaining the requirement to operate the GCCS for 15 years, but is providing flexibility to address declining gas flow in areas where the GCCS has not operated for 15 years. If the landfill is closed and the NMOC emission rate is less than 34 Mg/yr, but the GCCS has not operated for 15 years, the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows. The EPA is providing this flexibility to address areas of declining gas flows due to the age of the waste, arid climate, or low organic content. Given that there are unique situations that could cause low gas flow, or low gas quality which would cause a GCCS to be unable to operate for 15 years, the EPA is not providing prescriptive criteria for how a landfill owner or operator can demonstrate that a GCCS could not operate for 15 years and will proceed with a site-specific approach for handling these unique cases. Some examples of data elements that could be used to demonstrate a GCCS is unable to operate may include supplemental fuel use at the flare to sustain operations or LFG quality sample measurements showing methane content lower than what is viable for combustion in the destruction device.

D. Startup, Shutdown, and Malfunction Provisions

In July 2014, the EPA proposed that the standards in subpart XXX apply at all times, including periods of startup or shutdown, and periods of malfunction. In addition, the proposed NSPS included recordkeeping and reporting requirements for all landfill owners or operators to estimate emissions during such periods.

Similarly, the EPA proposed standards that apply at all times in the August 2015 proposed Emission Guidelines. However, the EPA considered how the landfill emissions differ from those generated by industrial or manufacturing sources. Specifically, the EPA noted that landfill emissions are produced by a continuous biological process that cannot be stopped or restarted. Therefore, the primary concern related to SSM is with malfunction of the landfill GCCS and associated monitoring equipment, not with the startup or shutdown of the entire source. SSM periods that we have determined should be covered by the work practice standard are those periods when the landfill GCCS and associated monitoring equipment are not operating.

To address these SSM periods, the EPA proposed in the 2015 Emission Guidelines that in the event the collection or control system is not operating the gas mover system must be shut down and all valves in the GCCS contributing to venting of gas to the atmosphere must be closed within 1 hour of the collection or control system not operating. This provision is consistent with 40 CFR part 60, subpart WWW. Additionally, the EPA proposed recordkeeping of combustion temperature, bypass flow, and periods when the flare flame or the flare pilot flame is out. The EPA received numerous comments on the 2014 proposed changes to the NSPS and the additional proposed edits made in the 2015 Emission Guidelines. A summary of these comments are presented below.

Sierra Club v. *EPA, 551 F.3d 1019 (D.C. Cir. 2008).* Many commenters stated that the *Sierra Club* decision applies only to rules with numerical emission limits and not to rules that are specified as a work practice. One of these commenters elaborated that *Sierra Club* applies to section 111 of the Clean Air Act. Therefore, the commenter concluded that landfills subject to the NSPS are not bound by the findings of *Sierra Club* and instead they are legally allowed to develop a clear and achievable landfill rule by considering the unique circumstances that a landfill is a biological process that cannot be stopped or restarted and that the gas collection and control systems must periodically be shut down for maintenance, repair, and expansion.

Retain the 5 day/1-hour exemption for SSM events. Many commenters, including affected industry commenters and some state agencies, disagreed with removing the provisions in 40 CFR part 60, subpart WWW, which allow for exemption periods of 5 days for collection systems and 1 hour for treatment or control devices. These commenters indicated that by removing this provision, state and local agencies could misconstrue the rule to require that a landfill must operate the gas collection system at all times, even during SSM, including periods of collection system construction, expansion, and repair. These commenters suggested instead of removing the exemption provision during periods of SSM, compliance can be maintained as long as the landfill owner or operator minimizes emissions of LFG by following the applicable work practices and restores the system to operation as expeditiously as practicable.

One of the state agency commenters, suggested that the 5-day and 1-hour time limitations in subpart WWW are appropriate for most situations and instead of removing these exemptions, the new subpart XXX could provide a mechanism for the facility to apply to the Administration for an extension of those timeframes. On the contrary, one state agency commenter and an NGO agreed with the standards applying at all times, including periods of SSM.

If the 5 day/1-hour exemption is not retained, the EPA should add a work practice standard for SSM events. One commenter was concerned that the preamble language for the 2014 proposed Emission Guidelines does not clarify how a landfill can demonstrate compliance with the standard during SSM events stating that "compliance with proposed 40 CFR 60.34f(e) does not constitute compliance with the applicable standards in proposed 40 CFR 60.36f" and that "by shutting down flow to the flare or other control devices a source is unlikely to be in violation of

the 98 percent emission reduction requirements since there will be no gas flowing to the control device'' (see 80 FR 52134–52135). This commenter stated that EPA must clarify this confusion and specify a clear set of work practices (*e.g.,* shut down of the gas mover system and prevention of venting) that constitute compliance during SSM periods when the collection or control system is not operated. Several other industry commenters and the U.S. Small Business Administration also asked that the rule specifically accommodate periods when the collection system is not operating during activities associated with construction, expansion, repair, replacement, testing, upgrades, or other maintenance of the system or its components.

Reporting requirement to estimate NMOC emissions whenever the collection system or control system is not operating. Two commenters representing a state agency and an NGO supported reporting NMOC emissions during SSM periods. Several industry commenters provided numerous technical arguments to explain the infeasibility of accurately estimating NMOC emissions during the short periods of SSM. For example, methods to estimate LFG emissions are based on site-specific variables that estimate LFG generation over the life of the landfill, typically on an annual basis, and cannot be used to estimate hourly or daily emissions. Accordingly, the commenters contended that it is technically and practically inappropriate to require landfill owners/operators to make this estimate for the time periods that the gas collection or control systems are not operated, given the substantial technical uncertainties involved in estimating these emissions over discrete, short-term time periods. Further, other commenters noted that emissions during SSM are expected to be very low, reporting SSM emissions is an onerous and meaningless exercise and is likely to overestimate emissions.

Two commenters asked that if the reporting requirement is retained, the EPA should limit the reporting to periods when the flare is free venting because these are the only emissions that can be estimated accurately. Several commenters asked EPA to develop guidance on how to estimate emissions during SSM if this requirement is retained in the final rule.

Several commenters stated that because there should be no deviation from the rule when the work practices of the rule are followed, there are no excess emissions, and the reported emissions are not relevant to determining compliance. Commenters are concerned that if estimated NMOC emissions are reported, states will deem the reported emissions to be ''excess emissions,'' which could be treated as a serious violation. Therefore, reporting these emissions poses the risk of state or citizen suits for enforcement, even when a landfill is following all requirements of the rule.

Other Comments. Several commenters added that because SSM provisions apply to numerical emission limitations and a numerical limitation applies only to the control device (not the collection devices), commenters stated that SSM provisions should address only operation of the control devices during periods when LFG is routed from the collection system.

Several commenters indicated that EPA must retain an allowance of 5 days/1 hour for downtime events so that states do not file enforcement actions for downtime events that are shorter than the previously allowed 5 days/1-hour allowance. These commenters also asked the EPA to clarify that the 1-hour allowance for shutting vents allows for free venting for 1 hour such that venting during this time period does not constitute ''excess emissions'' that can be deemed a serious violation.

Response: The EPA recognizes that landfills are not typical affected sources that can be started up or shut down. Landfill emissions are produced by a continuous biological process that cannot be stopped or shut down. The EPA also recognizes that the primary concern is with malfunction of the LFG collection and control system and associated monitoring equipment, not with the startup, shutdown, or malfunction of the entire source. The EPA received extensive comments on the proposed requirements applicable to landfills during SSM events, as summarized above. Consistent with the recent Court decision that vacated the exemption in 40 CFR 63.6(f)(1) and (h)(1) for SSM (*Sierra Club* v. *EPA,* 551 F.3d 1019), the EPA has established standards in this rule that apply at all times.

The general provisions in 40 CFR part 60 provide that emissions in excess of the level of the applicable emissions limit during periods of SSM shall not be considered a violation of the applicable emission limit *unless otherwise specified in the applicable standard* (see 40 CFR 60.8(c)) (emphasis added). As reflected in the italicized language, an individual subpart can supersede this provision.

The EPA is finalizing a requirement in 40 CFR 60.465(e) whereby the standards apply at all times, including periods of SSM. However, the final rule incorporates a work practice during periods of SSM. During these SSM events, owners or operators must shut down the gas mover system and close within 1 hour all valves in the GCCS contributing to venting of the gas to the atmosphere. The landfill owner or operator must also keep records and submit reports of all periods when the collection and control device is not operating. The EPA, however, is not reinstating the 5-day exemption for SSM periods because the provision provides an exemption from compliance with the standard during SSM periods, which the EPA does not have the authority to do under the reasoning of the Sierra Club decision.

E. Other Corrections and Clarifications

1. Test Methods

In the 2014 proposed NSPS, the EPA did not include EPA Method 18 or EPA Method 25A. In the 2015 proposed Emission Guidelines, the EPA proposed to include Method 25A based on public comments received on the 2014 proposed NSPS and the EPA's recognition that the use of Method 25A is necessary for measuring outlet concentrations less than 50 ppm NMOC. However, the EPA did not propose to include Method 18 (80 FR 52112) because the EPA had determined that Method 18 was not appropriate or cost effective for testing the large number of NMOCs found in landfill samples. Specifically, 40 target analytes are listed in the current landfills section of AP–42 and 160 analytes are listed in the draft landfills section AP–42. The EPA determined that the extensive quality assurance required by the method makes the method technically and economically prohibitive for all the potential target analytes.

Comment: Commenters requested that the EPA retain both Method 18 and 25A in the final rule and cited a number of reasons that the EPA should retain them, including both technical and legal reasons. Commenters stated that landfill owners or operators have relied on these test methods to demonstrate compliance for performance testing of enclosed flares as a part of EPA policy for over a decade under 40 CFR 60.764 [60.754]. One commenter emphasized the importance of Method 25A because its use is required for many sources with an outlet concentration of less than 50 ppmv NMOC as carbon.

The commenters noted that the majority of LFG destruction devices show NMOC concentrations below 50 ppmv as carbon. Due to issues with Methods 25/25C in measuring NMOC

content under this level, commenters observed that the proposed NSPS rule change effectively removes the ability to accurately measure compliance with the 20 ppmv outlet standard for a large class of enclosed combustors. Commenter believes that Method 25A is the superior testing methodology for certain circumstances and is more commonly used in practice. Commenters cited limitations of Method 25, including sensitivity of the test method to water and carbon dioxide and the inability to measure NMOC content below 50 ppmv as carbon.

Commenters also contended that the EPA did not provide any justification for removing these methods. Commenters stated that the EPA did not provide any factual data, methodology, or any legal or policy justification for its proposed exclusion of Method 25A or Method 18; thus commenters claimed that the EPA did not satisfy the notice-and-comment requirements of the CAA.

Response: After considering public comments, the EPA is including both EPA Method 25A and Method 18 (on a limited basis, *i.e.,* compound specific) in the final landfills regulations (40 CFR part 60, subparts Cf and XXX).

After reviewing the comments received on the NSPS for new landfills proposed on July 17, 2014, the EPA recognizes that the use of Method 25A is necessary for measuring outlet concentrations less than 50 ppm NMOC. EPA Method 25A determines total gaseous organic concentration of vapor (total organic compounds). Because the rule regulates NMOC, EPA Method 18 or Method 3C are needed to determine the concentration of methane in the gas stream. Method 25A, in conjunction with Methods 18 or 3C (for methane), can be used to determine NMOC for the outlet concentrations less than 50 ppm NMOC as carbon. Note that Method 25A FIDs are insensitive to formaldehyde.

While Method 18 may be used in conjunction with Method 25A for methane or specific compounds of interest, there are limitations on the number of analytes that can be reasonably quantified in measuring the sum of all NMOCs. With the possibility of 40 target analytes listed in the current landfill section of AP–42 (160 analytes in the draft landfill AP–42), Method 18 is not an appropriate or cost effective method to test all NMOCs found in landfill samples. The extensive QA required by the method makes the method technically and economically prohibitive for all the potential target analytes.

2. Tier 2 Sampling Procedure

The EPA continues to believe that the number of samples required per hectare is appropriate for Tier 2. As described in 40 CFR 60.764, the EPA is reaffirming that the two samples are required per hectare and if additional samples are taken, all samples must be used in determining the site-specific NMOC concentration. Landfill owners or operators must also ensure that the probes are evenly distributed over the landfill surface. The EPA explored a number of methods, including a statistical approach, when establishing requirements for the number and location of Tier 2 samples for the original rule. Public commenters raised significant concerns with approaches based on equations. As such, the EPA determined that a simplified method (2 samples per hectare) was best and received no public comments to the contrary.

3. Non-degradable Waste

The EPA is reaffirming that all the waste must be included in calculating the design capacity. Non-degradable waste cannot be subtracted from the permitted landfill design capacity. However, non-degradable waste can be subtracted from the mass of solid waste when calculating the NMOC emission rate because such waste would not produce NMOC emissions. Non-degradable waste is defined as waste that does not break down through chemical or microbiological activity. Examples include concrete, municipal waste combustor ash, and metals. Petroleum contaminated soils (PCS) and paper mill sludges likely contain organics that could be emitted as MSW LFG emissions. Therefore, emissions from PCS and sludges would need to be accounted for in the emission estimate only. The EPA is also reaffirming that documentation of the nature and amount of non-degradable waste needs to be maintained when subtracting the mass of non-degradable waste from the total mass of waste for NMOC emission rate calculations.

VII. Impacts of This Final Rule

For most Emission Guidelines, the EPA analyzes the impacts in the year the standard is implemented. If the Emission Guidelines are promulgated and published in August 2016, then the implementation year would be 2017 based on the following: states have 9 months to prepare a state plan implementing the guidelines (May 2017); the EPA has 4 months to review the plan (September 2017); and if necessary, the state has an additional 2 months to revise and submit a corrected plan based on any comments from the EPA (November 2017). Concurrently, the EPA must promulgate a federal plan within 6 months after the state plan is due, consistent with 40 CFR 60.27(d), or November 2017. Thus, the EPA-approved state plan and updated federal plan implementing the Emission Guidelines are expected to become effective in November 2017. Although late 2017 is the estimated implementation year, the reporting and control timeframe allows 3 months to submit the first NMOC emission report and then 30 months after reporting the NMOC emission rate results before the GCCS is required to be installed. Therefore, the first year that affected landfills could have controls installed under the final rule will be late 2020.

Because of the necessarily lengthy implementation process, the EPA is assessing impacts in year 2025 as a representative year for the landfills Emission Guidelines. While the year 2025 differs somewhat from the expected first year of implementation for the Emission Guidelines (year 2020), the number of existing landfills required to install controls under the final rule in year 2025 is the same as those estimated to control in the estimated first year of implementation. Further, year 2025 represents a year in which several of the landfills subject to control requirements will have had to expand their GCCS according the expansion lag times set forth in 40 CFR part 60, subpart Cf.

The landfills dataset used for estimating the impacts of the Emission Guidelines is discussed in detail in the August 27, 2015 proposed revisions to the Emission Guidelines (80 FR 52116–52117). The EPA made several significant edits to the dataset since the August 2015 proposal, based on public comments received; new data made available from the landfills reporting 2014 emissions to 40 CFR part 98, subpart HH, of GHGRP; and consultations with EPA regional offices, and state and local authorities to identify additional landfills expected to undergo a modification within the next 5 years. After incorporating all of the updates to the inventory and removing the landfills expected to modify, the revised dataset to analyze the impacts of the final rule now has 1,851 existing landfills that accepted waste after

1987[49] and opened prior to 2014.[50] A detailed discussion of updates made to the landfill dataset is in the docketed memorandum, "Summary of Updated Landfill Dataset Used in the Cost and Emission Reduction Analysis of Landfills Regulations, 2016."

The methodology used for estimating the impacts of the Emission Guidelines is discussed in detail in the August 27, 2015 proposed revisions to the Emission Guidelines (80 FR 52116–52117). The EPA made several significant edits to the methodology since the August 2015 proposal based on public comments and comments on a separate peer review of the EPA Landfill Gas Energy Cost (LFGcost) model.[51] Notably, the EPA adjusted its assumption of gas collection efficiency to an average of 85 percent. The impacts analysis at the proposal did not apply a collection efficiency assumption. However, in consideration of public comments received and EPA assumptions in subpart HH of the GHGRP, and analyses performed for marginal abatement cost curves, the EPA has included an 85 percent average gas collection efficiency factor to reflect a more realistic indicator of GCCS performance.[52] In addition, Chapter 2.4 of the EPA AP–42 for MSW landfills cites a range of collection efficiencies for LFG between 60 and 85 percent. The EPA also adjusted the electricity purchase price and anticipated revenue estimates using forecasted commercial retail electricity rate data and forecasted electricity generation price data for different Energy Information Administration (EIA) Electricity Market Module regions.[53 54]

A detailed discussion of the methodology and equations used to estimate the impacts of the final rule are available in the docketed memorandum "Revised Methodology for Estimating Cost and Emission Impacts of MSW Landfill Regulations, 2016." The results of applying this methodology to the population of existing landfills potentially subject to the final rule are in the docketed memorandum "Revised Cost and Emission Impacts Resulting from the Landfill EG Review, 2016." Table 2 of this preamble summarizes the emission reductions and costs associated with the final rule.

TABLE 2—EMISSION REDUCTIONS AND COSTS FOR FINAL RULE IN YEAR 2025 AT EXISTING LANDFILLS (2012$)

Option	Landfills affected by final rule [a]	Number of landfills affected [b]	Number of landfills controlling	Number of landfills reporting but not controlling [c]	Annual Net cost (million $2012)	Annual NMOC reductions (Mg\yr)	Annual methane reductions (million Mg\yr)	Annual CO_2e reductions (million mt\yr) [d]	NMOC Cost effectiveness ($\Mg)	Methane cost effectiveness ($\Mg)	CO_2e Cost effectiveness ($\mt) [d]
Baseline (2.5 million Mg design capacity\50 Mg\yr NMOC).	All	1014	638	177	642	58,770	9.3	231	10,900	69.3	2.8
Incremental values vs. the Baseline											
Final Option (2.5 million Mg design capacity/34 Mg/yr NMOC).	Open	0	93	100	[e] 54.1	1,810	0.285	7.1	29,900	190	7.6

[a] The final option in this table shows the impacts of reducing the NMOC emission threshold to 34 Mg/yr on open landfills only, and retaining the NMOC threshold of 50 Mg/yr for the closed landfill subcategory.

[b] Landfills are affected by the landfills Emission Guidelines based on design capacity. Once affected, they calculate and report emissions until they exceed the NMOC threshold, which triggers control requirements. Since we are not changing the size threshold, there are no incremental landfills affected.

[c] Since the number of landfills affected remains the same as the baseline, the number of landfills reporting NMOC (but not controlling) decreases since more landfills will control emissions under the final rule.

[d] Results do not include secondary CO_2 impacts.

[e] The annualized net cost for the final Emission Guidelines is estimated to be $54.1 million (2012$) in 2025, when using a 7 percent discount rate. The annualized costs represent the costs compared to no changes to the current Emission Guidelines (*i.e.*, baseline) and include $92.6 million to install and operate a GCCS, as well as $0.76 million to complete the corresponding testing and monitoring. These control costs are offset by $39.3 million in revenue from electricity sales, which is incorporated into the net control costs for certain landfills that are expected to generate revenue by using the LFG to produce electricity.

A. What are the air quality impacts?

The EPA estimates that the final rule will achieve nearly an additional 3 percent reduction in NMOC from existing landfills, or 1,810 Mg/yr, when compared to the baseline, as shown in Table 2 of this preamble. The final rule would also achieve 0.285 million Mg of methane reductions (7.1 million mtCO2e) in 2025. These reductions are achieved by reducing the NMOC threshold from 50 Mg/yr to 34 Mg/yr open landfills.

B. What are the water quality and solid waste impacts?

Leachate is the liquid that passes through the landfilled waste and strips contaminants from the waste as the leachate percolates. Precipitation generates the vast majority of leachate volume. Installation of a gas collection system will generate additional liquid, in the form of gas condensate, and it will be routed to the same leachate treatment mechanisms in place for controlling precipitation-based leachate. Collected leachate can be treated on site or transported off site to wastewater treatment facilities. Some landfills have received permits allowing for recirculation of leachate in the landfill, which may further reduce the volume of leachate requiring treatment. Additional liquid generated from gas condensate is not expected to be significant and insufficient data are available to estimate the increases in leachate resulting from expanded gas collection and control requirements.

The additional gas collection and control components required by this final rule have finite lifetimes (approximately 15 years) and these

[49] November 8, 1987, is the date on which permit programs were established under the Hazardous and Solid Waste Amendments of RCRA. This date was also selected as the regulatory cutoff in the Emission Guidelines for landfills no longer receiving wastes because the EPA judged states would be able to identify active facilities as of this date. The data available to EPA include an open year without the month and so the analysis uses a cutoff year of 1988 for landfill closure year.

[50] July 17, 2014, is the proposal date of the revised NSPS for MSW landfills in 40 CFR part 60, subpart XXX. A landfill opening or commencing construction on its modification after this date would become subject to this new subpart and would not be subject to the revised Emission Guidelines. The EPA cannot predict the exact month a model landfill will open so the analysis uses a cutoff year of 2014.

[51] See the docketed 2016 RIA for additional discussion of changes made on the methodology for estimating impacts as a result of the LFGcost peer review.

[52] USEPA. Global Mitigation of Non-CO_2 Greenhouse Gases: 2010–2030. EPA–430–R–13–011.

[53] See the docketed 2016 RIA for additional discussion of changes made to electricity pricing assumptions.

[54] To map existing landfill sites to EIA's Electricity Market Module regions, the sites' geospatial coordinates were overlayed on a map of the EMM regions. The AEO Electricity Market Module regions are commensurate with the eGRID2012 primary regions for which a shapefile is available at *https://www.epa.gov/energy/download-egrid2012-shapefiles*. For expected new landfills within a state the specific location is unknown, therefore the landfill is located at the state's centroid for purposes of mapping the site to an EMM region.

pipes and wells will be capped or disposed of at the end of their useful life. There are insufficient data to quantify the solid waste resulting from disposal of this control infrastructure.

Further, the incremental costs of control for the final rule of $54.1 million in 2025 (7% discount rate, 2012$) are not expected to have an appreciable market effect on the waste disposal costs, tipping fees, or the amount of solid waste disposed in landfills because the costs for gas collection represent a small portion of the overall costs to design, construct, and operate a landfill. The handling of waste by the private companies in the industry was estimated to generate $55 billion of revenue in 2011, of which landfilling contributed $13 billion, while a more recent estimate shows the U.S. non-hazardous solid waste services industry generated about $60 billion in annual revenues in 2015. These revenue estimates do not include activity related to publicly owned landfills. For more information, see the ''Regulatory Impact Analysis for the Final Revisions to the Emission Guidelines for Existing Sources and the New Source Performance Standards in the Municipal Solid Waste Landfills Sector, 2016'' (hereafter ''2016 RIA'') included in the docket. There also is insufficient information to quantify the effect increased gas control costs might have on the amount of solid waste disposed in landfills versus other disposal mechanisms such as recycling, waste-to-energy, or composting. Note that elements of this final rule—notably lowering the NMOC threshold to 34 Mg/yr—provide additional incentives to separate waste.

C. What are the secondary air impacts?

Secondary air impacts may include grid emissions from purchasing electricity to operate the GCCS components, by-product emissions from combustion of LFG in flares or energy recovery devices, and offsets to conventional grid emissions from new LFG energy supply.

The secondary air impacts are presented as net impacts, considering both the energy demand and energy supply resulting from the final rule. The methodology used to prepare the estimated secondary impacts for this preamble is discussed in the docketed memorandum ''Revised Estimates of Secondary Impacts of the Landfills Emission Guidelines Review, 2016.''

While we do expect NOx and sulfur dioxide (SO_2) emission changes as a result of these guidelines, we expect these changes to be small and these changes have not been estimated. The net impacts were computed for CO_2e. After considering the offsets from LFG electricity, the impacts of the final rule are expected to reduce CO_2 emissions by 277,000 metric tons per year. These CO_2 emission reductions are in addition to the methane emission reductions achieved from the direct destruction of methane in flares or engines presented in Table 2 of this preamble.

D. What are the energy impacts?

The final rule is expected to have a very minimal impact on energy supply and consumption. Active gas collection systems require energy to operate the blowers and pumps and the final rule will increase the volume of LFG collected. When the least cost control is a flare, energy may be purchased from the grid to operate the blowers of the LFG collection system. However, when the least cost control option is an engine, the engine may provide this energy to the gas control system and then sell the excess to the grid. Considering the balance of energy generated and demanded from the estimated least cost controls, the final rule is estimated to supply 0.51 million megawatt hours (MWh) of additional renewable LFG energy per year, which will reduce the need for conventional fossil-based energy sources.

E. What are the cost impacts?

To meet the final rule emission thresholds, a landfill is expected to install the least cost control for combusting the LFG. The cost estimates evaluated each landfill to determine whether a gas collection and flare or a gas collection with flare and engine equipment would be least cost, after considering local power buyback rates and whether the quantity of LFG was sufficient to generate electricity. The control costs include the costs to install and operate gas collection infrastructure such as wells, header pipes, blowers, and an enclosed flare. For landfills for which the least cost control option is an engine, the costs also include the cost to install and operate one or more reciprocating internal combustion engines to convert the LFG into electricity. Revenue from electricity sales was incorporated into the net control costs using forecasted electricity generation price data from EIA Electricity Market Module regions. Testing and monitoring costs at controlled landfills include the cost to conduct initial performance tests on the enclosed flare or engine control equipment, quarterly surface monitoring, continuous combustion monitoring, and monthly wellhead monitoring. At uncontrolled landfills, the testing and monitoring costs include calculation and reporting of NMOC emission rates.

The nationwide incremental annualized net cost for the final rule is $54.1 million, when using a 7 percent discount rate and 2012$. The annualized net costs of $54.1 million represent the costs compared to no changes to the current Emission Guidelines (*i.e.,* baseline) and include $92.6 million to install and operate a GCCS, as well as $0.76 million to complete the corresponding testing and monitoring. These control costs are offset by $39.3 million in revenue from electricity sales, which is incorporated into the net control costs for certain landfills that are expected to generate revenue by using the LFG to produce electricity.

F. What are the economic impacts?

Because of the relatively low net cost of the final rule compared to the overall size of the MSW industry, as well as the lack of appropriate economic parameters or model, the EPA is unable to estimate the impacts on the supply and demand for MSW landfill services. However, because of the relatively low incremental costs, the EPA does not believe the final rule would lead to substantial changes in supply and demand for landfill services or waste disposal costs, tipping fees, or the amount of waste disposed in landfills. Hence, the overall economic impact of the final rule should be minimal on the affected industries and their consumers.

G. What are the benefits?

This final action is expected to result in significant emissions reductions from existing MSW landfills. By lowering the NMOC emissions threshold to 34 Mg/yr, these final guidelines would achieve reductions of more than 1,810 Mg/yr NMOC and 285,000 metric tons of methane (7.1 million $mtCO_2e$). In addition, the guidelines are expected to result in the net reduction of 277,000 metric tons CO_2, due to reduced demand for electricity from the grid as landfills generate electricity from LFG.

This rule is expected to result in significant public health and welfare benefits resulting from the climate benefits due to anticipated methane and CO_2 reductions. Methane is a potent GHG that, once emitted into the atmosphere, absorbs terrestrial infrared radiation that contributes to increased global warming and continuing climate change. Methane reacts in the atmosphere to form tropospheric ozone and stratospheric water vapor, both of which also contribute to global warming. When accounting for the

impacts of changing methane, tropospheric ozone, and stratospheric water vapor concentrations, the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (2013) found that historical emissions of methane accounted for about 30 percent of the total current warming influence (radiative forcing) due to historical emissions of greenhouse gases. Methane is therefore a major contributor to the climate change impacts described in section III.B of this preamble. The remainder of this section discusses the methane reductions expected from this proposed rule and the associated monetized benefits.

As discussed in section IV of this preamble, this rulemaking includes several changes to the Emission Guidelines for MSW landfills that will decrease methane emissions from this sector. Specifically, the final emission guideline changes are expected to reduce methane emissions from all landfills in 2025 by about 285,000 metric tons of methane.

We calculated the global social benefits of these methane emission reductions using estimates of SC–CH_4, a metric that estimates the monetary value of impacts associated with marginal changes in methane emissions in a given year. The SC–CH_4 estimates applied in this analysis were developed by Marten et al. (2014) and are discussed in greater detail below.

A similar metric, the social cost of CO_2 (SC–CO_2), provides important context for understanding the Marten et al. SC–CH_4 estimates.[55] The SC–CO_2 is a metric that estimates the monetary value of impacts associated with marginal changes in CO_2 emissions in a given year. It includes a wide range of anticipated climate impacts, such as net changes in agricultural productivity and human health, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. Estimates of the SC–CO_2 have been used by the EPA and other federal agencies to value the impacts of CO_2 emissions changes in benefit cost analysis for GHG-related rulemakings since 2008.

The SC–CO_2 estimates were developed over many years, using the best science available, and with input from the public. Specifically, an interagency working group (IWG) that included the EPA and other executive branch agencies and offices used three integrated assessment models (IAMs) to develop the SC–CO_2 estimates and recommended four global values for use in regulatory analyses. The SC–CO_2 estimates were first released in February 2010 and updated in 2013 using new versions of each IAM.

The 2010 SC–CO_2 Technical Support Document (TSD) provides a complete discussion of the methods used to develop these estimates and the current SC–CO_2 TSD presents and discusses the 2013 update (including recent minor technical corrections to the estimates).[56]

The SC–CO_2 TSDs discuss a number of limitations to the SC–CO_2 analysis, including the incomplete way in which the IAMs capture catastrophic and non-catastrophic impacts, their incomplete treatment of adaptation and technological change, uncertainty in the extrapolation of damages to high temperatures, and assumptions regarding risk aversion. Currently, IAMs do not assign value to all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature due to a lack of precise information on the nature of damages and because the science incorporated into these models understandably lags behind the most recent research. Nonetheless, these estimates and the discussion of their limitations represent the best available information about the social benefits of CO_2 reductions to inform benefit-cost analysis. The EPA and other agencies continue to engage in research on modeling and valuation of climate impacts with the goal to improve these estimates, and continue to consider feedback on the SC–CO_2 estimates from stakeholders through a range of channels, including public comments received on Agency rulemakings, a separate Office of Management and Budget (OMB) public comment solicitation, and through regular interactions with stakeholders and research analysts implementing the SC–CO_2 methodology. See the docketed 2016 RIA for additional details.

A challenge particularly relevant to this rule is that the IWG did not estimate the social costs of non-CO_2 GHG emissions at the time the SC–CO_2 estimates were developed. In addition, the directly modeled estimates of the social costs of non-CO_2 GHG emissions previously found in the published literature were few in number and varied considerably in terms of the models and input assumptions they employed[57] (EPA 2012). In the past, the EPA has sought to understand the potential importance of monetizing non-CO_2 GHG emissions changes through sensitivity analysis using an estimate of the GWP of CH_4 to convert emission impacts to CO_2 equivalents, which can then be valued using the SC–CO_2 estimates. This approach approximates the SC–CH_4 using estimates of the SC–CO_2 and the GWP of methane.

The published literature documents a variety of reasons that directly modeled estimates of SC–CH_4 are an analytical improvement over the estimates from the GWP approximation approach. Specifically, several recent studies found that GWP-weighted benefit estimates for CH_4 are likely to be lower than the estimates derived using directly modeled social cost estimates for these gases.[58] The GWP reflects only the relative integrated radiative forcing of a gas over 100 years in comparison to CO_2. The directly modeled social cost estimates differ from the GWP-scaled SC–CO_2 because the relative differences in timing and magnitude of the warming between gases are explicitly modeled, the non-linear effects of temperature change on economic damages are included, and rather than treating all impacts over a hundred years equally, the modeled damages over the time horizon considered (300 years in this case) are discounted to present value terms. A detailed discussion of the limitations of the GWP approach can be found in the 2016 RIA.

In general, the commenters on previous rulemakings strongly encouraged the EPA to incorporate the monetized value of non-CO_2 GHG impacts into the benefit cost analysis. However, they noted the challenges associated with the GWP approach, as discussed above, and encouraged the use of directly modeled estimates of the SC–CH_4 to overcome those challenges.

Since then, a paper by Marten et al. (2014) has provided the first set of published SC–CH_4 estimates in the peer-reviewed literature that are consistent with the modeling assumptions

[55] Previous analyses have commonly referred to the social cost of carbon dioxide emissions as the social cost of carbon or SCC. To more easily facilitate the inclusion of non-CO_2 GHGs in the discussion and analysis the more specific SC–CO_2 nomenclature is used to refer to the social cost of CO_2 emissions.

[56] Both the 2010 SC–CO_2 TSD and the current TSD are available at: *https://www.whitehouse.gov/omb/oira/social-cost-of-carbon.*

[57] U.S. EPA. 2012. Regulatory Impact Analysis Final New Source Performance Standards and Amendments to the National Emissions Standards for Hazardous Air Pollutants for the Oil and Natural Gas Industry. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division. April. *http://www.epa.gov/ttn/ecas/regdata/RIAs/oil_natural_gas_final_neshap_nsps_ria.pdf.* Accessed April 7, 2016.

[58] See Waldhoff et al. (2011); Marten and Newbold (2012); and Marten et al. (2014).

underlying the SC–CO_2 estimates.[59] [60] Specifically, the estimation approach of Marten et al. used the same set of three IAMs, five socioeconomic-emissions scenarios, equilibrium climate sensitivity distribution, three constant discount rates, and aggregation approach used by the IWG to develop the SC–CO_2 estimates.

The SC–CH_4 estimates from Marten, et al. (2014) are presented in Table 3 of this preamble. More detailed discussion of the methodology, results, and a comparison to other published estimates can be found in the 2016 RIA and in Marten, et al.

TABLE 3—SOCIAL COST OF CH_4, 2012–2050 [a]

[In 2012$ per metric ton (Source: Marten et al., 2014 [b])]

Year	SC–CH_4			
	5% Average	3% Average	2.5% Average	3% 95th percentile
2012	$430	$1000	$1400	$2800
2015	490	1100	1500	3000
2020	580	1300	1700	3500
2025	700	1500	1900	4000
2030	820	1700	2200	4500
2035	970	1900	2500	5300
2040	1100	2200	2800	5900
2045	1300	2500	3000	6600
2050	1400	2700	3300	7200

[a] The values are emissions-year specific. Estimates using several discount rates are included because the literature shows that estimates of the SC–CO_2 (and SC–CH_4) are sensitive to assumptions about the discount rate, and because no consensus exists on the appropriate rate to use in an intergenerational context (where costs and benefits are incurred by different generations). The fourth value is the 95th percentile of the SC–CH_4 estimates across three models using a 3 percent discount rate. It is included to represent higher-than-expected impacts from temperature change further out in the tails of the SC–CH_4 distribution.

[b] The estimates in this table have been adjusted to reflect recent minor technical corrections to the SC–CO_2 estimates. See the Corrigendum to Marten et al. (2014), *http://www.tandfonline.com/doi/abs/10.1080/14693062.2015.1070550.*

The application of these directly modeled SC–CH_4 estimates from Marten et al. (2014) in a benefit-cost analysis of a regulatory action is analogous to the use of the SC–CO_2 estimates. In addition, the limitations for the SC–CO_2 estimates discussed above likewise apply to the SC–CH_4 estimates, given the consistency in the methodology.

In early 2015, the EPA conducted a peer review of the application of the Marten, et al. (2014) non-CO_2 social cost estimates in regulatory analysis and received responses that supported this application. See the 2016 RIA for a detailed discussion.

The EPA also carefully considered the full range of public comments and associated technical issues on the Marten et al. SC–CH_4 estimates received through this rulemaking. The comments addressed the technical details of the SC–CO2 estimates and the Marten et al. SC–CH4 estimates as well as their application to this rulemaking analysis. One comment letter also provided constructive recommendations to improve the SC–CO2 and SC–CH4 estimates in the future. Based on the evaluation of the public comments on this rulemaking, the favorable peer review of the Marten et al. application, and past comments urging the EPA to value non-CO_2 GHG impacts in its rulemakings, the agency has concluded that the estimates represent the best scientific information on the impacts of climate change available in a form appropriate for incorporating the damages from incremental CH_4 emissions changes into regulatory analysis. The EPA has included those benefits in the main benefits analysis. See the EPA's Response to Comments document for the complete response to comments received on the SC–CH_4 as part of this rulemaking.

The methane benefits based on Marten et al. (2014) are presented for the year 2025. Applying this approach to the methane reductions estimated for these guidelines, the 2025 methane benefits vary by discount rate and range from about $200 million to approximately $1.1 billion; the mean SC–CH_4 at the 3-percent discount rate results in an estimate of about $430 million in 2025, as presented in Table 4 of this preamble.

TABLE 4—ESTIMATED GLOBAL BENEFITS OF CH_4 REDUCTIONS IN 2025

[In millions, 2012$]

Million metric tons CH_4	Discount rate and statistic			
	5% Average	3% Average	2.5% Average	3% 95th percentile
0.285	$200	$430	$550	$1,100

The vast majority of this action's climate-related benefits are associated with methane reductions. Additional climate-related benefits are expected from the guidelines' secondary air impacts, specifically, a net reduction in CO_2 emissions. Monetizing the net CO_2 reductions with the SC–CO_2 estimates described in this section yields benefits

[59] Marten et al. (2014) also provided the first set of SC–N_2O estimates that are consistent with the assumptions underlying the IWG SC–CO_2 estimates.

[60] Marten, A. L., E. A. Kopits, C. W. Griffiths, S. C. Newbold & A. Wolverton (2014). Incremental CH_4 and N_2O mitigation benefits consistent with the U.S. Government's SC–CO_2 estimates, Climate Policy, DOI: 10.1080/14693062.2014.912981.

of $14 million in the year 2025 (average SC–CO_2, 3 percent discount rate, 2012$). Monetized climate benefits associated with reductions in methane and secondary CO2 emissions are approximately $440 million in 2025 (2012$), based on the average SC–CH_4 at a 3 percent discount rate and the average SC–CO2 at a 3 percent discount rate. See the 2016 RIA for more details.

In addition to the limitation discussed above, and the referenced documents, there are additional impacts of individual GHGs that are not currently captured in the IAMs used in the directly modeled approach of Marten et al. (2014), and therefore not quantified for the rule. For example, the NMOC portion of LFG can contain a variety of air pollutants, including VOC and various organic HAP. VOC emissions are precursors to both $PM_{2.5}$ and ozone formation, while methane is a GHG and a precursor to global ozone formation. These pollutants are associated with substantial health effects, welfare effects, and climate effects, which are discussed in section III.B of this preamble. The ozone generated by methane has important non-climate impacts on agriculture, ecosystems, and human health. The 2016 RIA describes the specific impacts of methane as an ozone precursor in more detail and discusses studies that have estimated monetized benefits of these methane generated ozone effects. The EPA continues to monitor developments in this area of research.

Finally, these final Emission Guidelines will yield benefits from reductions in VOC and HAP emissions and from reductions in methane as a precursor to global background concentrations of tropospheric ozone. With the data available, we are not able to provide quantified health benefit estimates for the reduction in exposure to HAP, ozone, and $PM_{2.5}$ for this rule. This is not to imply that there are no benefits of the rules; rather, it is a reflection of the difficulties in modeling the direct and indirect impacts of the reductions in emissions for this sector with the data currently available.[61] In addition to health improvements, there will be improvements in visibility effects, ecosystem effects, and climate effects.

Although we do not have sufficient information or modeling available to provide quantitative estimates of the health benefits associated with HAP, ozone, and $PM_{2.5}$ reductions, we include a qualitative assessment of the public health effects associated with exposure to HAP, ozone, and $PM_{2.5}$ in the 2016 RIA for this rule. These qualitative impact assessments are briefly summarized in section III.B of this preamble, but for more detailed information, please refer to the 2016 RIA, which is available in the docket.

Based on the monetized benefits and costs of the final emission guidelines, the annual net benefits of the rule are estimated to be $390 million ($2012) in 2025 based on the average SC–CH4 at a 3 percent discount rate and costs at a 7 percent discount rate.

VIII. Statutory and Executive Order Reviews

Additional information about these statues and Executive Orders can be found at *http://www2.epa.gov/laws-regulations/laws-and-executive-orders.*

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is an economically significant regulatory action that was submitted to OMB for review. Any changes made in response to OMB recommendations have been documented in the docket. The EPA prepared an economic analysis of the potential costs and benefits associated with the proposed Emission Guidelines. The analysis is documented in the 2016 RIA, which is available in docket EPA–HQ–OAR–2014–0451 and is briefly summarized in section VII of this preamble.

B. Paperwork Reduction Act (PRA)

OMB has approved the information collection activities contained in this rule under the PRA and has assigned OMB control number 2060–NEW. The Information Collection Request (ICR) document that the EPA prepared for the final Emission Guidelines has been assigned EPA ICR number 2522.02. You can find a copy of the ICR in the docket for this rule, and it is briefly summarized here.

The information required to be collected is necessary to identify the regulated entities subject to the final rule and to ensure their compliance with the final Emission Guidelines. The recordkeeping and reporting requirements are mandatory and are being established under authority of CAA section 114 (42 U.S.C. 7414). All information other than emissions data submitted as part of a report to the agency for which a claim of confidentiality is made will be safeguarded according to CAA section 114(c) and the EPA's implementing regulations at 40 CFR part 2, subpart B.

Respondents/affected entities: MSW landfills that accepted waste after November 8, 1987, and commenced construction, reconstruction, or modification on or before July 17, 2014.

Respondent's obligation to respond: Mandatory (40 CFR part 60, subpart Cf).

Estimated number of respondents: 1,192 MSW landfills.

Frequency of response: Initially, occasionally, and annually.

Total estimated burden: 679,668 hours (per year) for the responding facilities and 17,829 hours (per year) for the agency. These are estimates for the average annual burden for the first 3 years after the rule is final. Burden is defined at 5 CFR 1320.3(b).

Total estimated cost: $45,225,362 (per year), which includes annualized capital or operation and maintenance costs, for the responding facilities and 1,161,840 (per year) for the agency. These are estimates for the average annual cost for the first 3 years after the rule is final.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for the EPA's regulations in 40 CFR are listed in 40 CFR part 9.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. Specifically, Emission Guidelines established under CAA section 111(d) do not impose any requirements on regulated entities and, thus, will not have a significant economic impact upon a substantial number of small entities. After Emission Guidelines are promulgated, states and U.S. territories establish standards on existing sources, and it is those state requirements that could potentially impact small entities.

[61] Previous studies have estimated the monetized benefits-per-ton of reducing VOC emissions associated with the effect that those emissions have on ambient $PM_{2.5}$ levels and the health effects associated with $PM_{2.5}$ exposure (Fann, Fulcher, and Hubbell, 2009). While these ranges of benefit-per-ton estimates can provide useful context, the geographic distribution of VOC emissions from the MSW landfills sector are not consistent with emissions modeled in Fann, Fulcher, and Hubbell (2009). In addition, the benefit-per-ton estimates for VOC emission reductions in that study are derived from total VOC emissions across all sectors. Coupled with the larger uncertainties about the relationship between VOC emissions and $PM_{2.5}$ and the highly localized nature of air quality responses associated with HAP and VOC reductions, these factors lead us to conclude that the available VOC benefit-per-ton estimates are not appropriate to calculate monetized benefits of these rules, even as a bounding exercise.

Our analysis here is consistent with the analysis of the analogous situation arising when the EPA establishes National Ambient Air Quality Standards (NAAQS), which do not impose any requirements on regulated entities. As here, any impact of a NAAQS on small entities would only arise when states take subsequent action to maintain and/or achieve the NAAQS through their state implementation plans. See *American Trucking Assoc.* v. *EPA,* 175 F.3d 1029, 1043–45 (D.C. Cir. 1999). (NAAQS do not have significant impacts upon small entities because NAAQS themselves impose no regulations upon small entities.)

Nevertheless, the EPA is aware that there is substantial interest in the rule among small entities. The EPA conducted stakeholder outreach as detailed in sections XI.C and XI.E of the preamble to the proposed Standards of Performance for MSW Landfills (79 FR 41828–41829; July 17, 2014) and in sections VIII.C and VIII.E of this preamble. The EPA convened a Small Business Advocacy Review (SBAR) Panel in 2013 for the landfills rulemaking. The EPA originally planned a review of the Emission Guidelines and NSPS in one action, but the actions were subsequently divided into separate rulemakings. The SBAR Panel evaluated the assembled materials and small-entity comments on issues related to the rule's potential effects and significant alternative regulatory approaches. A copy of the "Summary of Small Entity Outreach" is available in the rulemaking docket EPA–HQ–OAR–2014–0451. While formulating the provisions of the rule, the EPA considered the input provided over the course of the stakeholder outreach as well as the input provided in the many public comments, and we have incorporated many of the suggestions in this final rule.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate of $100 million or more as described in UMRA, 2 U.S.C. 1531–1538. The final Emission Guidelines apply to landfills that were constructed, modified, or reconstructed after November 8, 1987, and that commenced construction, reconstruction, or modification on or before July 17, 2014. Impacts resulting from the final Emission Guidelines are below the applicable threshold.

We note however, that the final Emission Guidelines may significantly or uniquely affect small governments because small governments operate landfills. The EPA consulted with small governments concerning the regulatory requirements that might significantly or uniquely affect them. In developing this rule, the EPA consulted with small governments pursuant to a plan established under section 203 of the UMRA to address impacts of regulatory requirements in the rule that might significantly or uniquely affect small governments. The EPA also held meetings as discussed in section VIII.E of this preamble under Federalism consultations.

E. Executive Order 13132: Federalism

The EPA has concluded that the final Emission Guidelines may have federalism implications, because the rule imposes substantial direct compliance costs on state or local governments and the federal government will not provide the funds necessary to pay those costs.

The EPA provides the following federalism summary impact statement. The EPA consulted with state and local officials, including their representative national organizations, early in the process of developing the proposed action to permit them to have meaningful and timely input into its development. In developing the regulatory options reflected in the proposed rule as well as this final action, the EPA consulted with 8 national organizations representing state and local elected officials, including the National Governors Association, the National League of Cities, the National Association of Counties, the National Conference of State Legislatures, the United States Conference of Mayors, the County Executives of America, the Council of State Governments, and the National Association of Towns and Townships. Additionally, the Environmental Council of the States, the National Association of Clean Air Agencies and the Association of State and Territorial Solid Waste Management Officials participated in pre-proposal briefings. Finally, in addition to these associations, over 140 officials representing state and local governments across the nation participated in at least one of three pre-proposal briefings in the Fall of 2013 (September 10, 2013, November 7, 2013, and November 14, 2013.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between the EPA and state and local governments, the EPA specifically solicited input prior to proposal from these intergovernmental associations, their members, and the participating state and local officials during and in follow-up to these briefings. As a result of the first phase of pre-proposal intergovernmental outreach, the EPA received comments from [over 40] entities representing State and local governments. As the development of the rule continued, and in the interest of sharing additional information with its intergovernmental partners prior to proposing the rule, EPA conducted an additional Federalism outreach meeting on April 15, 2015.

The principal intergovernmental concerns raised during the pre-proposal consultations, as well as during the proposed rule's public comment period, include: Implementation concerns associated with shortening of gas collection system installation and/or expansion timeframes; concerns regarding significant lowering of the design capacity or emission thresholds; the need for clarifications associated with wellhead operating parameters; and, the need for consistent, clear, and rigorous surface monitoring requirements. In response to these comments and based upon the data currently available, the EPA has decided not to adjust the design capacity or significantly lower the emission threshold. The EPA has also decided not to adjust the time allotted for installation of the GCCS or expansion of the wellfield. In 80 FR 52121 (the proposed rule), the EPA highlighted specific concerns raised by commenters, which included state agencies as well as landfill owners and operators, about the interaction between shortened lag times and design plan approvals, costs and safety concerns associated with reduced lag times, and the need for flexibility for lag time adjustments. Wellhead operating parameters have been adjusted to limit corrective action requirements to negative pressure and temperature. The EPA also acknowledged concerns about wellhead operating parameters in 80 FR 52121 and reviewed public comments in favor of and against retention of the parameters during the public comment period as described in section VI.A.1 of this preamble.

As described section VI.B of this preamble, the EPA is finalizing a SEM approach for determining GCCS installation. Commenters were generally supportive of this approach and recognized the additional flexibility provided as an alternative to the traditional approach for determining GCCS installation based on a series of models. The EPA is also finalizing a subcategory for closed landfills as outlined in section VI.C of this preamble. While federalism commenters primarily supported this approach, some representatives of local

governments opposed it due to trends in ownership and size of landfills and the perception that landfills owned by these entities should not benefit from subcategorization.

A complete list of the comments from State and local governments has been provided to OMB and has been placed in the docket for this rulemaking. In addition, the detailed response to comments from these entities is contained in the EPA's Response to Comments document for this rulemaking.

As required by section 8(a) of Executive Order 13132, the EPA included a certification from its Federalism Official stating that the EPA had met the Executive Order's requirements in a meaningful and timely manner when it sent the draft of this final action to OMB for review pursuant to Executive Order 12866. A copy of this certification is included in the public version of the official record for this final action.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action has tribal implications. However, it will neither impose substantial direct compliance costs on federally recognized tribal governments, nor preempt tribal law. The database used to estimate impacts of the final 40 CFR part 60, subpart Cf, identified one tribe, the Salt River Pima-Maricopa Indian Community, which owns three landfills potentially subject to the final Emission Guidelines. One of these landfills is open, the Salt River Landfill, and is already controlling emissions under the current NSPS/EG framework, so while subject to this subpart, the costs of this proposal are not substantial. The two other landfills are closed and anticipated to meet the definition of the closed landfill subcategory. One of the closed landfills, the Tri Cities Landfill, is already controlling emissions under the current NSPS/EG framework and will not incur substantial additional compliance costs under subpart Cf. The other landfill, North Center Street Landfill, is not estimated to install controls under the current NSPS/EG framework.

As required by section 7(a), the EPA's Tribal Consultation Official has certified that the requirements of the Executive Order have been met in a meaningful and timely manner. A copy of the certification is included in the docket for this action.

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

This action is subject to Executive Order 13045 (62 FR 19885, April 23, 1997) because it is a significant regulatory action as defined by Executive Order 12866, and the EPA believes that the environmental health or safety risk addressed by this action has a disproportionate effect on children. Accordingly, the EPA has evaluated the environmental health and welfare effects of climate change on children.

Greenhouse gases including methane contribute to climate change and are emitted in significant quantities by the landfill sector. The EPA believes that the GHG emission reductions resulting from implementation of this final rule will further improve children's health.

The assessment literature cited in the EPA's 2009 Endangerment Finding concluded that certain populations and life stages, including children, the elderly, and the poor, are most vulnerable to climate-related health effects. The assessment literature since 2009 strengthens these conclusions by providing more detailed findings regarding these groups' vulnerabilities and the projected impacts they may experience.

These assessments describe how children's unique physiological and developmental factors contribute to making them particularly vulnerable to climate change. Impacts to children are expected from heat waves, air pollution, infectious and waterborne illnesses, and mental health effects resulting from extreme weather events. In addition, children are among those especially susceptible to most allergic diseases, as well as health effects associated with heat waves, storms, and floods. Additional health concerns may arise in low income households, especially those with children, if climate change reduces food availability and increases prices, leading to food insecurity within households.

More detailed information on the impacts of climate change to human health and welfare is provided in section III.B of this preamble.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This action is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Further, we have concluded that the final Emission Guidelines are not likely to have any adverse energy effects because the energy demanded to operate these control systems will be offset by additional energy supply from LFG energy projects.

I. National Technology Transfer and Advancement Act (NTTAA) and 1 CFR Part 51

The final Emission Guidelines involve technical standards. For the final Emission Guidelines, the EPA has decided to use EPA Methods 2, 2E, 3, 3A, 3C, 18, 21, 25, 25A, and 25C of 40 CFR part 60, appendix A.

The EPA identified 15 voluntary consensus standards (VCS) as being potentially applicable (ASTM D3154–00 (2006), ASTM D3464–96 (2007), ASTM D3796–90 (2001), ANSI/ASME PTC 19–10–1981 Part 10, ASME B133.9–1994 (2001), ISO 10396:1993 (2007), ISO 12039:2001, ISO 10780:1994, ASTM D5835–95 (2013), ASTM D6522–11, ASTM D6420–99 (2010), CAN/CSA Z223.2–M86 (1999), ASTM D6060–96 (2009), ISO 14965:2000(E), EN 12619(1999)). The EPA determined that 14 of the 15 candidate VCS identified for measuring emissions of pollutants or their surrogates subject to emission standards in the rule would not be practical due to lack of equivalency, documentation, validation data, and other important technical and policy considerations. The agency identified no equivalent standards for Methods 2E, 21, and 25C. However, one voluntary consensus standard was identified as acceptable alternative to EPA test method for the purposes of this rule.

The voluntary consensus standard ASTM D6522–11, Standard Test Method for the Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers" is an acceptable alternative to Method 3A when used at the wellhead before combustion. It is advisable to know the flammability and check the Lower Explosive Limit of the flue gas constituents, prior to sampling, in order to avoid undesired ignition of the gas. The results of ASTM D6522–11 may be used to determine nitrogen oxides and carbon monoxide emission concentrations from natural gas combustion at stationary sources. This test method may also be used to monitor emissions during short-term emission tests or periodically in order to optimize process operation for nitrogen oxides and carbon monoxide control.

The EPA's review, including review of comments for these 15 methods, is documented in the memorandum, "Voluntary Consensus Standard Results

for Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills, 2016'' in the docket for this rulemaking (EPA–HQ–OAR–2014–0451).

In this rule, the EPA is finalizing regulatory text for 40 CFR part 60, subpart Cf, that includes incorporation by reference in accordance with requirements of 1 CFR 51.5. Specifically, the EPA is incorporating by reference ASTM D6522–11. You may obtain a copy from American Society for Testing and Materials, 100 Barr Harbor Drive, Post Office Box C700, West Conshohocken, PA 19428–2959 or *http://www.astm.org.*

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes the human health or environmental risk addressed by this action will not have potential disproportionately high and adverse human health or environmental effects on minority, low-income, or indigenous populations. The EPA has determined this because the rulemaking increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority, low-income, or indigenous populations. To the extent that any minority, low-income, or indigenous subpopulation is disproportionately impacted by hazardous air emissions due to the proximity of their homes to sources of these emissions, that subpopulation also stands to see increased environmental and health benefit from the emission reductions called for by this rule.

The EPA has provided meaningful participation opportunities for minority, low-income, indigenous populations and tribes during the rulemaking process by conducting and participating in community calls and webinars. Documentation of these activities can be found in the July 13, 2016, document titled, ''2016 Environmental Justice Screening Report for Municipal Solid Waste Landfills,'' a copy of which is available in the docket for this action (EPA–HQ–OAR–2014–0451).

The EPA is committed to assisting states and communities to develop plans that ensure there are no disproportionate, adverse impacts on overburdened communities. To provide information fundamental to that process, the EPA has conducted a proximity analysis for this final rulemaking that summarizes demographic data on the communities located near landfills.[62] The EPA understands that, in order to prevent disproportionately, high and adverse human health or environmental effects on these communities, both states and communities must have information on the communities living near facilities, including demographic data, and that accessing and using census data files requires expertise that some community groups may lack. Therefore, the EPA used census data from the American Community Survey (ACS) 2008–2012 to conduct a proximity analysis that can be used by states and communities as they develop state plans and as they later assess the final plans' impacts. The analysis and its results are presented in the EJ Screening Report for Municipal Solid Waste Landfills, which is located in the docket for this rulemaking at EPA–HQ–OAR–2014–0451.

The proximity analysis provides detailed demographic information on the communities located within a 3-mile radius of each affected landfill in the U.S. Included in the analysis is the breakdown by percentage of community characteristics such as income and minority status. The analysis shows a higher percentage of communities of color and people without high school diplomas living near landfills than national averages. It is important to note that the impacts of landfill emissions are not limited to a 3-mile radius and the impacts of both potential increases and decreases in landfill emissions can be felt many miles away. Still, being aware of the characteristics of communities closest to landfills is a starting point in understanding how changes in the landfill's air emissions may affect the air quality experienced by some of those already experiencing environmental burdens.

As stated in the Executive Order 12898 discussion located in section XIII.J of this preamble, the EPA believes that all communities will benefit from this final rulemaking because this action addresses the impacts of climate change by climate co-benefits achieved through reductions in the methane component of LFG. The EPA also believes that the information provided in the proximity analysis will promote engagement between vulnerable communities and their states and will be useful for states as they develop their plans.

Additionally, the EPA encourages states to conduct their own analyses of community considerations when developing their plans. Each state is uniquely knowledgeable about its own communities and well-positioned to consider the possible impacts of plans on vulnerable communities within its state. Conducting state-specific analyses would not only help states assess possible impacts of plan options, but it would also enhance a state's understanding of the means to engage these communities that would most effectively reach them and lead to valuable exchanges of information and concerns. A state analysis, together with the proximity analysis conducted by the EPA, would provide a solid foundation for engagement between a state and its communities.

Such state-specific analyses need not be exhaustive. An examination of the options a state is considering for its plan, and any projections of likely resulting increases in landfill emissions affecting low-income populations, communities of color populations, or indigenous communities, would be informative for communities. The analyses could include available air quality monitoring data and information from air quality models, and, if available, take into account information about local health vulnerabilities such as asthma rates or access to healthcare. Alternatively, a simple analysis may consider expected landfill utilization in geographic proximity to overburdened communities. The EPA will provide states with information on its publicly available environmental justice screening and mapping tool, EJ SCREEN, which they may use in conducting a state-specific analysis. Additionally, the EPA encourages states to submit a copy of their analysis if they choose to conduct one, with their initial and final plan submittals.

K. Congressional Review Act (CRA)

This action is subject to the CRA, and the EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is a ''major rule'' as defined by 5 U.S.C. 804(2).

List of Subjects in 40 CFR Part 60

Environmental protection, Administrative practice and procedure, Air pollution control, Incorporation by reference, Reporting and recordkeeping requirements.

Dated: July 14, 2016.

Gina McCarthy,

Administrator.

For the reasons stated in the preamble, the Environmental Protection Agency amends title 40, chapter I of the Code of Federal Regulations as follows:

[62] The proximity analysis was conducted using the EPA's environmental justice mapping and screening tool, EJSCREEN.

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

■ 1. The authority citation for part 60 continues to read as follows:

Authority: 42 U.S.C. 7401 *et seq.*

■ 2. Section 60.17 is amended:
■ a. By redesignating paragraphs (h)(185) through (206) as paragraphs (h)(186) through (207), respectively; and
■ b. By adding a new paragraph (h)(185).

The addition reads as follows:

§ 60.17 Incorporations by reference.

* * * * *

(h) * * *

(185) ASTM D6522–11 Standard Test Method for Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers (Approved December 1, 2011), IBR approved for § 60.37f(a).

* * * * *

■ 3. Part 60 is amended by adding subpart Cf to read as follows:

Subpart Cf—Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills

Sec.
60.30f Scope and delegated authorities.
60.31f Designated facilities.
60.32f Compliance times.
60.33f Emission Guidelines for municipal solid waste landfill emissions.
60.34f Operational standards for collection and control systems.
60.35f Test methods and procedures.
60.36f Compliance provisions.
60.37f Monitoring of operations.
60.38f Reporting guidelines.
60.39f Recordkeeping guidelines.
60.40f Specifications for active collection systems.
60.41f Definitions.

Subpart Cf—Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills

§ 60.30f Scope and delegated authorities.

This subpart establishes Emission Guidelines and compliance times for the control of designated pollutants from certain designated municipal solid waste (MSW) landfills in accordance with section 111(d) of the Clean Air Act and subpart B of this part.

(a) If you are the Administrator of an air quality program in a state or United States protectorate with one or more existing MSW landfills that commenced construction, modification, or reconstruction on or before July 17, 2014, you must submit a state plan to the U.S. Environmental Protection Agency (EPA) that implements the Emission Guidelines contained in this subpart. The requirements for state plans are specified in subpart B of this part.

(b) You must submit a state plan to EPA by May 30, 2017.

(c) The following authorities will not be delegated to state, local, or tribal agencies:

(1) Approval of alternative methods to determine the NMOC concentration or a site-specific methane generation rate constant (k).

(2) [Reserved]

§ 60.31f Designated facilities.

(a) The designated facility to which these Emission Guidelines apply is each existing MSW landfill for which construction, reconstruction, or modification was commenced on or before July 17, 2014.

(b) Physical or operational changes made to an existing MSW landfill solely to comply with an emission guideline are not considered a modification or reconstruction and would not subject an existing MSW landfill to the requirements of a standard of performance for new MSW landfills.

(c) For purposes of obtaining an operating permit under title V of the Clean Air Act, the owner or operator of an MSW landfill subject to this subpart with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters is not subject to the requirement to obtain an operating permit for the landfill under part 70 or 71 of this chapter, unless the landfill is otherwise subject to either part 70 or 71. For purposes of submitting a timely application for an operating permit under part 70 or 71, the owner or operator of an MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters on the effective date of EPA approval of the state's program under section 111(d) of the Clean Air Act, and not otherwise subject to either part 70 or 71, becomes subject to the requirements of § 70.5(a)(1)(i) or § 71.5(a)(1)(i) of this chapter 90 days after the effective date of such section 111(d) program approval, even if the design capacity report is submitted earlier.

(d) When an MSW landfill subject to this subpart is closed as defined in this subpart, the owner or operator is no longer subject to the requirement to maintain an operating permit under part 70 or 71 of this chapter for the landfill if the landfill is not otherwise subject to the requirements of either part 70 or 71 and if either of the following conditions are met:

(1) The landfill was never subject to the requirement to install and operate a gas collection and control system under § 60.33f; or

(2) The landfill meets the conditions for control system removal specified in § 60.33f(f).

(e) When an MSW landfill subject to this subpart is in the closed landfill subcategory, the owner or operator is not subject to the following reports of this subpart, provided the owner or operator submitted these reports under the provisions of subpart WWW of this part; 40 CFR part 62, subpart GGG; or a state plan implementing subpart Cc of this part on or before July 17, 2014:

(1) Initial design capacity report specified in § 60.38f(a).

(2) Initial or subsequent NMOC emission rate report specified in § 60.38f(c), provided that the most recent NMOC emission rate report indicated the NMOC emissions were below 50 Mg/yr.

(3) Collection and control system design plan specified in § 60.38f(d).

(4) Closure report specified in § 60.38f(f).

(5) Equipment removal report specified in § 60.38f(g).

(6) Initial annual report specified in § 60.38f(h).

(7) Initial performance test report in § 60.38f(i).

§ 60.32f Compliance times.

Planning, awarding of contracts, installing, and starting up MSW landfill air emission collection and control equipment that is capable of meeting the Emission Guidelines under § 60.33f must be completed within 30 months after the date an NMOC emission rate report shows NMOC emissions equal or exceed 34 megagrams per year (50 megagrams per year for the closed landfill subcategory); or within 30 months after the date of the most recent NMOC emission rate report that shows NMOC emissions equal or exceed 34 megagrams per year (50 megagrams per year for the closed landfill subcategory), if Tier 4 surface emissions monitoring shows a surface emission concentration of 500 parts per million methane or greater.

§ 60.33f Emission Guidelines for municipal solid waste landfill emissions.

(a) *Landfills.* For approval, a state plan must require each owner or operator of an MSW landfill having a design capacity greater than or equal to 2.5 million megagrams by mass and 2.5 million cubic meters by volume to collect and control MSW landfill

emissions at each MSW landfill that meets the following conditions:

(1) The landfill has accepted waste at any time since November 8, 1987, or has additional design capacity available for future waste deposition.

(2) The landfill commenced construction, reconstruction, or modification on or before July 17, 2014.

(3) The landfill has an NMOC emission rate greater than or equal to 34 megagrams per year or Tier 4 surface emissions monitoring shows a surface emission concentration of 500 parts per million methane or greater.

(4) The landfill in the closed landfill subcategory and has an NMOC emission rate greater than or equal to 50 megagrams per year or Tier 4 surface emissions monitoring shows a surface emission concentration of 500 parts per million methane or greater.

(b) *Collection system.* For approval, a state plan must include provisions for the installation of a gas collection and control system meeting the requirements in paragraphs (b)(1) through (3) and (c) of this section at each MSW landfill meeting the conditions in paragraph (a) of this section.

(1) *Collection system.* Install and start up a collection and control system that captures the gas generated within the landfill within 30 months after:

(i) The first annual report in which the NMOC emission rate equals or exceeds 34 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the NMOC emission rate is less than 34 megagrams per year, as specified in § 60.38f(d)(4); or

(ii) The first annual NMOC emission rate report for a landfill in the closed landfill subcategory in which the NMOC emission rate equals or exceeds 50 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the NMOC emission rate is less than 50 megagrams per year, as specified in § 60.38f(d)(4); or

(iii) The most recent NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year based on Tier 2, if the Tier 4 surface emissions monitoring shows a surface methane emission concentration of 500 parts per million methane or greater as specified in § 60.38f(d)(4)(iii).

(2) *Active.* An active collection system must:

(i) Be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control system equipment.

(ii) Collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade.

(iii) Collect gas at a sufficient extraction rate.

(iv) Be designed to minimize off-site migration of subsurface gas.

(3) *Passive.* A passive collection system must:

(i) Comply with the provisions specified in paragraphs (b)(2)(i), (ii), and (iv) of this section.

(ii) Be installed with liners on the bottom and all sides in all areas in which gas is to be collected. The liners must be installed as required under § 258.40 of this chapter.

(c) *Control system.* For approval, a state plan must include provisions for the control of the gas collected from within the landfill through the use of control devices meeting the following requirements, except as provided in § 60.24.

(1) A non-enclosed flare designed and operated in accordance with the parameters established in § 60.18 except as noted in § 60.37f(d); or

(2) A control system designed and operated to reduce NMOC by 98 weight percent; or when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen or less. The reduction efficiency or concentration in parts per million by volume must be established by an initial performance test to be completed no later than 180 days after the initial startup of the approved control system using the test methods specified in § 60.35f(d). The performance test is not required for boilers and process heaters with design heat input capacities equal to or greater than 44 megawatts that burn landfill gas for compliance with this subpart.

(i) If a boiler or process heater is used as the control device, the landfill gas stream must be introduced into the flame zone.

(ii) The control device must be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in § 60.37f.

(iii) For the closed landfill subcategory, the initial or most recent performance test conducted to comply with subpart WWW of this part; 40 CFR part 62, subpart GGG; or a state plan implementing subpart Cc of this part on or before July 17, 2014 is sufficient for compliance with this subpart.

(3) Route the collected gas to a treatment system that processes the collected gas for subsequent sale or beneficial use such as fuel for combustion, production of vehicle fuel, production of high-Btu gas for pipeline injection, or use as a raw material in a chemical manufacturing process. Venting of treated landfill gas to the ambient air is not allowed. If the treated landfill gas cannot be routed for subsequent sale or beneficial use, then the treated landfill gas must be controlled according to either paragraph (c)(1) or (2) of this section.

(4) All emissions from any atmospheric vent from the gas treatment system are subject to the requirements of paragraph (b) or (c) of this section. For purposes of this subpart, atmospheric vents located on the condensate storage tank are not part of the treatment system and are exempt from the requirements of paragraph (b) or (c) of this section.

(d) *Design capacity.* For approval, a state plan must require each owner or operator of an MSW landfill having a design capacity less than 2.5 million megagrams by mass or 2.5 million cubic meters by volume to submit an initial design capacity report to the Administrator as provided in § 60.38f(a). The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. Any density conversions must be documented and submitted with the report. Submittal of the initial design capacity report fulfills the requirements of this subpart except as provided in paragraphs (d)(1) and (2) of this section.

(1) The owner or operator must submit an amended design capacity report as provided in § 60.38f(b).

Note to paragraph (d)(1): Note that if the design capacity increase is the result of a modification, as defined in this subpart, that was commenced after July 17, 2014, then the landfill becomes subject to subpart XXX of this part instead of this subpart. If the design capacity increase is the result of a change in operating practices, density, or some other change that is not a modification as defined in this subpart, then the landfill remains subject to this subpart.

(2) When an increase in the maximum design capacity of a landfill with an initial design capacity less than 2.5 million megagrams or 2.5 million cubic meters results in a revised maximum design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the owner or operator

must comply with paragraph (e) of this section.

(e) *Emissions.* For approval, a state plan must require each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters to either install a collection and control system as provided in paragraphs (b) and (c) of this section or calculate an initial NMOC emission rate for the landfill using the procedures specified in § 60.35f(a). The NMOC emission rate must be recalculated annually, except as provided in § 60.38f(c)(3).

(1) If the calculated NMOC emission rate is less than 34 megagrams per year, the owner or operator must:

(i) Submit an annual NMOC emission rate report according to § 60.38f(c), except as provided in § 60.38f(c)(3); and

(ii) Recalculate the NMOC emission rate annually using the procedures specified in § 60.35f(a) until such time as the calculated NMOC emission rate is equal to or greater than 34 megagrams per year, or the landfill is closed.

(A) If the calculated NMOC emission rate, upon initial calculation or annual recalculation required in paragraph (e)(1)(ii) of this section, is equal to or greater than 34 megagrams per year, the owner or operator must either: Comply with paragraphs (b) and (c) of this section; calculate NMOC emissions using the next higher tier in § 60.35f; or conduct a surface emission monitoring demonstration using the procedures specified in § 60.35f(a)(6).

(B) If the landfill is permanently closed, a closure report must be submitted to the Administrator as provided in § 60.38f(f), except for exemption allowed under § 60.31f(e)(4).

(C) For the closed landfill subcategory, if the most recently calculated NMOC emission rate is equal to or greater than 50 megagrams per year, the owner or operator must either: Submit a gas collection and control system design plan as specified in § 60.38f(d), except for exemptions allowed under § 60.31f(e)(3), and install a collection and control system as provided in paragraphs (b) and (c) of this section; calculate NMOC emissions using the next higher tier in § 60.35f; or conduct a surface emission monitoring demonstration using the procedures specified in § 60.35f(a)(6).

(2) If the calculated NMOC emission rate is equal to or greater than 34 megagrams per year using Tier 1, 2, or 3 procedures, the owner or operator must either: submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year as specified in § 60.38f(d), except for exemptions allowed under § 60.31f(e)(3); calculate NMOC emissions using a higher tier in § 60.35f; or conduct a surface emission monitoring demonstration using the procedures specified in § 60.35f(a)(6).

(3) For the closed landfill subcategory, if the calculated NMOC emission rate is equal to or greater than 50 megagrams per year using Tier 1, 2, or 3 procedures, the owner or operator must either: Submit a collection and control system design plan as specified in § 60.38f(d), except for exemptions allowed under § 60.31f(e)(3); calculate NMOC emissions using a higher tier in § 60.35f; or conduct a surface emission monitoring demonstration using the procedures specified in § 60.35f(a)(6).

(f) *Removal criteria.* The collection and control system may be capped, removed, or decommissioned if the following criteria are met:

(1) The landfill is a closed landfill (as defined in § 60.41f). A closure report must be submitted to the Administrator as provided in § 60.38f(f).

(2) The collection and control system has been in operation a minimum of 15 years or the landfill owner or operator demonstrates that the GCCS will be unable to operate for 15 years due to declining gas flow.

(3) Following the procedures specified in § 60.35f(b), the calculated NMOC emission rate at the landfill is less than 34 megagrams per year on three successive test dates. The test dates must be no less than 90 days apart, and no more than 180 days apart.

(4) For the closed landfill subcategory (as defined in § 60.41), following the procedures specified in § 60.35f(b), the calculated NMOC emission rate at the landfill is less than 50 megagrams per year on three successive test dates. The test dates must be no less than 90 days apart, and no more than 180 days apart.

§ 60.34f Operational standards for collection and control systems.

For approval, a state plan must include provisions for the operational standards in this section for an MSW landfill with a gas collection and control system used to comply with the provisions of § 60.33f(b) and (c). Each owner or operator of an MSW landfill with a gas collection and control system used to comply with the provisions of § 60.33f(b) and (c) must:

(a) Operate the collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for:

(1) Five (5) years or more if active; or

(2) Two (2) years or more if closed or at final grade.

(b) Operate the collection system with negative pressure at each wellhead except under the following conditions:

(1) A fire or increased well temperature. The owner or operator must record instances when positive pressure occurs in efforts to avoid a fire. These records must be submitted with the annual reports as provided in § 60.38f(h)(1).

(2) Use of a geomembrane or synthetic cover. The owner or operator must develop acceptable pressure limits in the design plan.

(3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes must be approved by the Administrator as specified in § 60.38f(d).

(c) Operate each interior wellhead in the collection system with a landfill gas temperature less than 55 degrees Celsius (131 degrees Fahrenheit). The owner or operator may establish a higher operating temperature value at a particular well. A higher operating value demonstration must be submitted to the Administrator for approval and must include supporting data demonstrating that the elevated parameter neither causes fires nor significantly inhibits anaerobic decomposition by killing methanogens. The demonstration must satisfy both criteria in order to be approved (*i.e.,* neither causing fires nor killing methanogens is acceptable).

(d) Operate the collection system so that the methane concentration is less than 500 parts per million above background at the surface of the landfill. To determine if this level is exceeded, the owner or operator must conduct surface testing using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in § 60.36(d). The owner or operator must conduct surface testing around the perimeter of the collection area and along a pattern that traverses the landfill at no more than 30-meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations. Thus, the owner or operator must monitor any openings that are within an area of the landfill where waste has been placed and a gas collection system is required. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan must be developed that includes a topographical map with the monitoring route and the

rationale for any site-specific deviations from the 30-meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing.

(e) Operate the system such that all collected gases are vented to a control system designed and operated in compliance with § 60.33f(c). In the event the collection or control system is not operating, the gas mover system must be shut down and all valves in the collection and control system contributing to venting of the gas to the atmosphere must be closed within 1 hour of the collection or control system not operating.

(f) Operate the control system at all times when the collected gas is routed to the system.

(g) If monitoring demonstrates that the operational requirements in paragraph (b), (c), or (d) of this section are not met, corrective action must be taken as specified in § 60.36f(a)(3) and (5) or (c). If corrective actions are taken as specified in § 60.36f, the monitored exceedance is not a violation of the operational requirements in this section.

§ 60.35f Test methods and procedures.

For approval, a state plan must include provisions in this section to calculate the landfill NMOC emission rate or to conduct a surface emission monitoring demonstration.

(a)(1) *NMOC Emission Rate.* The landfill owner or operator must calculate the NMOC emission rate using either Equation 1 provided in paragraph (a)(1)(i) of this section or Equation 2 provided in paragraph (a)(1)(ii) of this section. Both Equation 1 and Equation 2 may be used if the actual year-to-year solid waste acceptance rate is known, as specified in paragraph (a)(1)(i) of this section, for part of the life of the landfill and the actual year-to-year solid waste acceptance rate is unknown, as specified in paragraph (a)(1)(ii) of this section, for part of the life of the landfill. The values to be used in both Equation 1 and Equation 2 are 0.05 per year for k, 170 cubic meters per megagram for Lo, and 4,000 parts per million by volume as hexane for the C_{NMOC}. For landfills located in geographical areas with a 30-year annual average precipitation of less than 25 inches, as measured at the nearest representative official meteorologic site, the k value to be used is 0.02 per year.

(i)(A) Equation 1 must be used if the actual year-to-year solid waste acceptance rate is known.

$$M_{NMOC} = \sum_{i=1}^{n} 2\,k\,L_o M_i (e^{-kt_i})(C_{NMOC})(3.6\,x\,10^{-9}) \qquad \text{(Eq. 1)}$$

Where:

M_{NMOC} = Total NMOC emission rate from the landfill, megagrams per year.
k = Methane generation rate constant, year^{-1}.
L_o = Methane generation potential, cubic meters per megagram solid waste.
M_i = Mass of solid waste in the ith section, megagrams.
t_i = Age of the ith section, years.
C_{NMOC} = Concentration of NMOC, parts per million by volume as hexane.
3.6×10^{-9} = Conversion factor.

(B) The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value for M_i if documentation of the nature and amount of such wastes is maintained.

(ii)(A) Equation 2 must be used if the actual year-to-year solid waste acceptance rate is unknown.

$$M_{NMOC} = 2L_oR\ (e^{-kc} - e^{-kt})\ C_{NMOC}(3.6 \times 10^{-9}) \qquad \text{(Eq. 2)}$$

Where:

M_{NMOC} = Mass emission rate of NMOC, megagrams per year.
L_o = Methane generation potential, cubic meters per megagram solid waste.
R = Average annual acceptance rate, megagrams per year.
k = Methane generation rate constant, year^{-1}.
t = Age of landfill, years.
C_{NMOC} = Concentration of NMOC, parts per million by volume as hexane.
c = Time since closure, years; for an active landfill c = 0 and $e^{-kc} = 1$.
3.6×10^{-9} = Conversion factor.

(B) The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value of R, if documentation of the nature and amount of such wastes is maintained.

(2) *Tier 1.* The owner or operator must compare the calculated NMOC mass emission rate to the standard of 34 megagrams per year.

(i) If the NMOC emission rate calculated in paragraph (a)(1) of this section is less than 34 megagrams per year, then the owner or operator must submit an NMOC emission rate report according to § 60.38f(c), and must recalculate the NMOC mass emission rate annually as required under § 60.33f(e).

(ii) If the NMOC emission rate calculated in paragraph (a)(1) of this section is equal to or greater than 34 megagrams per year, then the landfill owner or operator must either:

(A) Submit a gas collection and control system design plan within 1 year as specified in § 60.38f(d) and install and operate a gas collection and control system within 30 months according to § 60.33f(b) and (c);

(B) Determine a site-specific NMOC concentration and recalculate the NMOC emission rate using the Tier 2 procedures provided in paragraph (a)(3) of this section; or

(C) Determine a site-specific methane generation rate constant and recalculate the NMOC emission rate using the Tier 3 procedures provided in paragraph (a)(4) of this section.

(3) *Tier 2.* The landfill owner or operator must determine the site-specific NMOC concentration using the following sampling procedure. The landfill owner or operator must install at least two sample probes per hectare, evenly distributed over the landfill surface that has retained waste for at least 2 years. If the landfill is larger than 25 hectares in area, only 50 samples are required. The probes should be evenly distributed across the sample area. The sample probes should be located to avoid known areas of nondegradable solid waste. The owner or operator must collect and analyze one sample of landfill gas from each probe to determine the NMOC concentration using Method 25 or 25C of appendix A of this part. Taking composite samples from different probes into a single cylinder is allowed; however, equal sample volumes must be taken from each probe. For each composite, the sampling rate, collection times, beginning and ending cylinder vacuums, or alternative volume measurements must be recorded to verify that composite volumes are equal. Composite sample volumes should not be less than one liter unless evidence can be provided to substantiate the

accuracy of smaller volumes. Terminate compositing before the cylinder approaches ambient pressure where measurement accuracy diminishes. If more than the required number of samples is taken, all samples must be used in the analysis. The landfill owner or operator must divide the NMOC concentration from Method 25 or 25C by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane. If the landfill has an active or passive gas removal system in place, Method 25 or 25C samples may be collected from these systems instead of surface probes provided the removal system can be shown to provide sampling as representative as the two sampling probe per hectare requirement. For active collection systems, samples may be collected from the common header pipe. The sample location on the common header pipe must be before any gas moving, condensate removal, or treatment system equipment. For active collection systems, a minimum of three samples must be collected from the header pipe.

(i) Within 60 days after the date of determining the NMOC concentration and corresponding NMOC emission rate, the owner or operator must submit the results according to § 60.38f(j)(2).

(ii) The landfill owner or operator must recalculate the NMOC mass emission rate using Equation 1 or Equation 2 provided in paragraph (a)(1)(i) or (ii) of this section using the average site-specific NMOC concentration from the collected samples instead of the default value provided in paragraph (a)(1) of this section.

(iii) If the resulting NMOC mass emission rate is less than 34 megagrams per year, then the owner or operator must submit a periodic estimate of NMOC emissions in an NMOC emission rate report according to § 60.38f(c), and must recalculate the NMOC mass emission rate annually as required under § 60.33f(e). The site-specific NMOC concentration must be retested every 5 years using the methods specified in this section.

(iv) If the NMOC mass emission rate as calculated using the Tier 2 site-specific NMOC concentration is equal to or greater than 34 megagrams per year, the owner or operator must either:

(A) Submit a gas collection and control system design plan within 1 year as specified in § 60.38f(d) and install and operate a gas collection and control system within 30 months according to § 60.33f(b) and (c);

(B) Determine a site-specific methane generation rate constant and recalculate the NMOC emission rate using the site-specific methane generation rate using the Tier 3 procedures specified in paragraph (a)(4) of this section; or

(C) Conduct a surface emission monitoring demonstration using the Tier 4 procedures specified in paragraph (a)(6) of this section.

(4) *Tier 3.* The site-specific methane generation rate constant must be determined using the procedures provided in Method 2E of appendix A of this part. The landfill owner or operator must estimate the NMOC mass emission rate using Equation 1 or Equation 2 in paragraph (a)(1)(i) or (ii) of this section and using a site-specific methane generation rate constant, and the site-specific NMOC concentration as determined in paragraph (a)(3) of this section instead of the default values provided in paragraph (a)(1) of this section. The landfill owner or operator must compare the resulting NMOC mass emission rate to the standard of 34 megagrams per year.

(i) If the NMOC mass emission rate as calculated using the Tier 2 site-specific NMOC concentration and Tier 3 site-specific methane generation rate is equal to or greater than 34 megagrams per year, the owner or operator must either:

(A) Submit a gas collection and control system design plan within 1 year as specified in § 60.38f(d) and install and operate a gas collection and control system within 30 months according to § 60.33f(b) and (c); or

(B) Conduct a surface emission monitoring demonstration using the Tier 4 procedures specified in paragraph (a)(6) of this section.

(ii) If the NMOC mass emission rate is less than 34 megagrams per year, then the owner or operator must recalculate the NMOC mass emission rate annually using Equation 1 or Equation 2 in paragraph (a)(1) of this section and using the site-specific Tier 2 NMOC concentration and Tier 3 methane generation rate constant and submit a periodic NMOC emission rate report as provided in § 60.38f(c). The calculation of the methane generation rate constant is performed only once, and the value obtained from this test must be used in all subsequent annual NMOC emission rate calculations.

(5) *Other methods.* The owner or operator may use other methods to determine the NMOC concentration or a site-specific methane generation rate constant as an alternative to the methods required in paragraphs (a)(3) and (4) of this section if the method has been approved by the Administrator.

(6) *Tier 4.* The landfill owner or operator must demonstrate that surface methane emissions are below 500 parts per million. Surface emission monitoring must be conducted on a quarterly basis using the following procedures. Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr but less than 50 Mg/yr using Tier 1 or Tier 2. If both Tier 1 and Tier 2 indicate NMOC emissions are 50 Mg/yr or greater, then Tier 4 cannot be used. In addition, the landfill must meet the criteria in paragraph (a)(6)(viii) of this section.

(i) The owner or operator must measure surface concentrations of methane along the entire perimeter of the landfill and along a pattern that traverses the landfill at no more than 30-meter intervals using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in § 60.36f(d).

(ii) The background concentration must be determined by moving the probe inlet upwind and downwind at least 30 meters from the waste mass boundary of the landfill.

(iii) Surface emission monitoring must be performed in accordance with section 8.3.1 of Method 21 of appendix A of this part, except that the probe inlet must be placed no more than 5 centimeters above the landfill surface; the constant measurement of distance above the surface should be based on a mechanical device such as with a wheel on a pole.

(A) The owner or operator must use a wind barrier, similar to a funnel, when onsite average wind speed exceeds 4 miles per hour or 2 meters per second or gust exceeding 10 miles per hour. Average on-site wind speed must also be determined in an open area at 5-minute intervals using an on-site anemometer with a continuous recorder and data logger for the entire duration of the monitoring event. The wind barrier must surround the SEM monitor, and must be placed on the ground, to ensure wind turbulence is blocked. SEM cannot be conducted if average wind speed exceeds 25 miles per hour.

(B) Landfill surface areas where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover, and all cover penetrations must also be monitored using a device meeting the specifications provided in § 60.36f(d).

(iv) Each owner or operator seeking to comply with the Tier 4 provisions in paragraph (a)(6) of this section must maintain records of surface emission monitoring as provided in § 60.39f(g) and submit a Tier 4 surface emissions report as provided in § 60.38f(d)(4)(iii).

(v) If there is any measured concentration of methane of 500 parts per million or greater from the surface of the landfill, the owner or operator must submit a gas collection and control system design plan within 1 year of the first measured concentration of methane of 500 parts per million or greater from the surface of the landfill according to § 60.38f(d) and install and operate a gas collection and control system according to § 60.33f(b) and (c) within 30 months of the most recent NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year based on Tier 2.

(vi) If after four consecutive quarterly monitoring periods at a landfill, other than a closed landfill, there is no measured concentration of methane of 500 parts per million or greater from the surface of the landfill, the owner or operator must continue quarterly surface emission monitoring using the methods specified in this section.

(vii) If after four consecutive quarterly monitoring periods at a closed landfill there is no measured concentration of methane of 500 parts per million or greater from the surface of the landfill, the owner or operator must conduct annual surface emission monitoring using the methods specified in this section.

(viii) If a landfill has installed and operates a collection and control system that is not required by this subpart, then the collection and control system must meet the following criteria:

(A) The gas collection and control system must have operated for at least 6,570 out of 8,760 hours preceding the Tier 4 surface emissions monitoring demonstration.

(B) During the Tier 4 surface emissions monitoring demonstration, the gas collection and control system must operate as it normally would to collect and control as much landfill gas as possible.

(b) After the installation and startup of a collection and control system in compliance with this subpart, the owner or operator must calculate the NMOC emission rate for purposes of determining when the system can be capped, removed, or decommissioned as provided in § 60.33f(f), using Equation 3:

$$M_{NMOC} = 1.89 \times 10^{-3} Q_{LFG} C_{NMOC} \qquad \text{(Eq. 3)}$$

Where:

M_{NMOC} = Mass emission rate of NMOC, megagrams per year.

Q_{LFG} = Flow rate of landfill gas, cubic meters per minute.

C_{NMOC} = NMOC concentration, parts per million by volume as hexane.

(1) The flow rate of landfill gas, Q_{LFG}, must be determined by measuring the total landfill gas flow rate at the common header pipe that leads to the control system using a gas flow measuring device calibrated according to the provisions of section 10 of Method 2E of appendix A of this part.

(2) The average NMOC concentration, C_{NMOC}, must be determined by collecting and analyzing landfill gas sampled from the common header pipe before the gas moving or condensate removal equipment using the procedures in Method 25 or Method 25C of appendix A of this part. The sample location on the common header pipe must be before any condensate removal or other gas refining units. The landfill owner or operator must divide the NMOC concentration from Method 25 or Method 25C by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane.

(3) The owner or operator may use another method to determine landfill gas flow rate and NMOC concentration if the method has been approved by the Administrator.

(i) Within 60 days after the date of calculating the NMOC emission rate for purposes of determining when the system can be capped or removed, the owner or operator must submit the results according to § 60.38f(j)(2).

(ii) [Reserved]

(c) When calculating emissions for Prevention of Significant Deterioration purposes, the owner or operator of each MSW landfill subject to the provisions of this subpart must estimate the NMOC emission rate for comparison to the Prevention of Significant Deterioration major source and significance levels in § 51.166 or § 52.21 of this chapter using Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP–42) or other approved measurement procedures.

(d) For the performance test required in § 60.33f(c)(1), the net heating value of the combusted landfill gas as determined in § 60.18(f)(3) is calculated from the concentration of methane in the landfill gas as measured by Method 3C. A minimum of three 30-minute Method 3C samples are determined. The measurement of other organic components, hydrogen, and carbon monoxide is not applicable. Method 3C may be used to determine the landfill gas molecular weight for calculating the flare gas exit velocity under § 60.18(f)(4).

(1) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results of the performance tests required by paragraph (b) or (d) of this section, including any associated fuel analyses, according to § 60.38f(j)(1).

(2) [Reserved]

(e) For the performance test required in § 60.33f(c)(2), Method 25 or 25C (Method 25C may be used at the inlet only) of appendix A of this part must be used to determine compliance with the 98 weight-percent efficiency or the 20 parts per million by volume outlet NMOC concentration level, unless another method to demonstrate compliance has been approved by the Administrator as provided by § 60.38f(d)(2). Method 3, 3A, or 3C must be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. Method 18 may be used in conjunction with Method 25A on a limited basis (compound specific, *e.g.*, methane) or Method 3C may be used to determine methane. The methane as carbon should be subtracted from the Method 25A total hydrocarbon value as carbon to give NMOC concentration as carbon. The landfill owner or operator must divide the NMOC concentration as carbon by 6 to convert the C_{NMOC} as carbon to C_{NMOC} as hexane. Equation 4 must be used to calculate efficiency:

$$\text{Control Efficiency} = (NMOC_{in} - NMOC_{out})/(NMOC_{in}) \qquad \text{(Eq. 4)}$$

Where:

$NMOC_{in}$ = Mass of NMOC entering control device.

$NMOC_{out}$ = Mass of NMOC exiting control device.

(1) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results of the performance tests, including any associated fuel analyses, according to § 60.38f(j)(1).

(2) [Reserved]

§ 60.36f Compliance provisions.

For approval, a state plan must include the compliance provisions in this section.

(a) Except as provided in § 60.38f(d)(2), the specified methods in paragraphs (a)(1) through (6) of this section must be used to determine whether the gas collection system is in compliance with § 60.33f(b)(2).

(1) For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with § 60.33f(b)(2)(i), either Equation 5 or Equation 6 in paragraph (a)(1)(i) or (ii) of this section must be used. The methane generation rate constant (k) and methane generation potential (L_o) kinetic factors should be those published in the most recent AP–42 or other site-specific values demonstrated to be appropriate and approved by the Administrator. If k has been determined as specified in § 60.35f(a)(4), the value of k determined from the test must be used. A value of no more than 15 years must be used for the intended use period of the gas mover equipment. The active life of the landfill is the age of the landfill plus the estimated number of years until closure.

(i) For sites with unknown year-to-year solid waste acceptance rate:

$$Q_m = 2L_oR\ (e^{-kc} - e^{-kt}) \qquad \text{(Eq. 5)}$$

Where:

Q_m = Maximum expected gas generation flow rate, cubic meters per year.

L_o = Methane generation potential, cubic meters per megagram solid waste.

R = Average annual acceptance rate, megagrams per year.

k = Methane generation rate constant, $year^{-1}$.

t = Age of the landfill at equipment installation plus the time the owner or operator intends to use the gas mover equipment or active life of the landfill, whichever is less. If the equipment is installed after closure, t is the age of the landfill at installation, years.

c = Time since closure, years (for an active landfill c = 0 and $e^{-kc} = 1$).

(ii) For sites with known year-to-year solid waste acceptance rate:

$$Q_M = \sum_{i=1}^{n} 2kL_oM_i(e^{-kt_i}) \qquad \text{(Eq. 6)}$$

Where:

Q_M = Maximum expected gas generation flow rate, cubic meters per year.

k = Methane generation rate constant, $year^{-1}$.

L_o = Methane generation potential, cubic meters per megagram solid waste.

M_i = Mass of solid waste in the ith section, megagrams.

t_i = Age of the ith section, years.

(iii) If a collection and control system has been installed, actual flow data may be used to project the maximum expected gas generation flow rate instead of, or in conjunction with, Equation 5 or Equation 6 in paragraph (a)(1)(i) or (ii) of this section. If the landfill is still accepting waste, the actual measured flow data will not equal the maximum expected gas generation rate, so calculations using Equation 5 or Equation 6 or other methods must be used to predict the maximum expected gas generation rate over the intended period of use of the gas control system equipment.

(2) For the purposes of determining sufficient density of gas collectors for compliance with § 60.33f(b)(2)(ii), the owner or operator must design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the Administrator, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards.

(3) For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with § 60.33f(b)(2)(iii), the owner or operator must measure gauge pressure in the gas collection header applied to each individual well monthly. If a positive pressure exists, action must be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under § 60.34f(b). Any attempted corrective measure must not cause exceedances of other operational or performance standards.

(i) If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement of positive pressure, the owner or operator must conduct a root cause analysis and correct the exceedance as soon as practicable, but not later than 60 days after positive pressure was first measured. The owner or operator must keep records according to § 60.39f(e)(3).

(ii) If corrective actions cannot be fully implemented within 60 days following the positive pressure measurement for which the root cause analysis was required, the owner or operator must also conduct a corrective action analysis and develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the positive pressure measurement. The owner or operator must submit the items listed in § 60.38f(h)(7) as part of the next annual report. The owner or operator must keep records according to § 60.39f(e)(4).

(iii) If corrective action is expected to take longer than 120 days to complete after the initial exceedance, the owner or operator must submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Administrator, according to § 60.38f(h)(7) and (k). The owner or operator must keep records according to § 60.39f(e)(5).

(4) [Reserved]

(5) For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator must monitor each well monthly for temperature as provided in § 60.34f(c). If a well exceeds the operating parameter for temperature, action must be initiated to correct the exceedance within 5 calendar days. Any attempted corrective measure must not

cause exceedances of other operational or performance standards.

(i) If a landfill gas temperature less than 55 degrees Celsius (131 degrees Fahrenheit) cannot be achieved within 15 calendar days of the first measurement of landfill gas temperature greater than 55 degrees Celsius (131 degrees Fahrenheit), the owner or operator must conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after a landfill gas temperature greater than 55 degrees Celsius (131 degrees Fahrenheit) was first measured. The owner or operator must keep records according to § 60.39f(e)(3).

(ii) If corrective actions cannot be fully implemented within 60 days following the positive pressure measurement for which the root cause analysis was required, the owner or operator must also conduct a corrective action analysis and develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the measurement of landfill gas temperature greater than 55 degrees Celsius (131 degrees Fahrenheit). The owner or operator must submit the items listed in § 60.38f(h)(7) as part of the next annual report. The owner or operator must keep records according to § 60.39f(e)(4).

(iii) If corrective action is expected to take longer than 120 days to complete after the initial exceedance, the owner or operator must submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Administrator, according to § 60.38f(h)(7) and (k). The owner or operator must keep records according to § 60.39f(e)(5).

(6) An owner or operator seeking to demonstrate compliance with § 60.33f(b)(2)(iv) through the use of a collection system not conforming to the specifications provided in § 60.40f must provide information satisfactory to the Administrator as specified in § 60.38f(d)(3) demonstrating that off-site migration is being controlled.

(b) For purposes of compliance with § 60.34f(a), each owner or operator of a controlled landfill must place each well or design component as specified in the approved design plan as provided in § 60.38f(d). Each well must be installed no later than 60 days after the date on which the initial solid waste has been in place for a period of:

(1) Five (5) years or more if active; or

(2) Two (2) years or more if closed or at final grade.

(c) The following procedures must be used for compliance with the surface methane operational standard as provided in § 60.34f(d):

(1) After installation and startup of the gas collection system, the owner or operator must monitor surface concentrations of methane along the entire perimeter of the collection area and along a pattern that traverses the landfill at no more than 30-meter intervals (or a site-specific established spacing) for each collection area on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in paragraph (d) of this section.

(2) The background concentration must be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells.

(3) Surface emission monitoring must be performed in accordance with section 8.3.1 of Method 21 of appendix A of this part, except that the probe inlet must be placed within 5 to 10 centimeters of the ground. Monitoring must be performed during typical meteorological conditions.

(4) Any reading of 500 parts per million or more above background at any location must be recorded as a monitored exceedance and the actions specified in paragraphs (c)(4)(i) through (v) of this section must be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of § 60.34f(d).

(i) The location of each monitored exceedance must be marked and the location and concentration recorded. For location, you must determine the latitude and longitude coordinates using an instrument with an accuracy of at least 4 meters. The coordinates must be in decimal degrees with at least five decimal places.

(ii) Cover maintenance or adjustments to the vacuum of the adjacent wells to increase the gas collection in the vicinity of each exceedance must be made and the location must be re-monitored within 10 calendar days of detecting the exceedance.

(iii) If the re-monitoring of the location shows a second exceedance, additional corrective action must be taken and the location must be monitored again within 10 days of the second exceedance. If the re-monitoring shows a third exceedance for the same location, the action specified in paragraph (c)(4)(v) of this section must be taken, and no further monitoring of that location is required until the action specified in paragraph (c)(4)(v) of this section has been taken.

(iv) Any location that initially showed an exceedance but has a methane concentration less than 500 parts per million methane above background at the 10-day re-monitoring specified in paragraph (c)(4)(ii) or (iii) of this section must be re-monitored 1 month from the initial exceedance. If the 1-month re-monitoring shows a concentration less than 500 parts per million above background, no further monitoring of that location is required until the next quarterly monitoring period. If the 1-month re-monitoring shows an exceedance, the actions specified in paragraph (c)(4)(iii) or (v) of this section must be taken.

(v) For any location where monitored methane concentration equals or exceeds 500 parts per million above background three times within a quarterly period, a new well or other collection device must be installed within 120 calendar days of the initial exceedance. An alternative remedy to the exceedance, such as upgrading the blower, header pipes or control device, and a corresponding timeline for installation may be submitted to the Administrator for approval.

(5) The owner or operator must implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis.

(d) Each owner or operator seeking to comply with the provisions in paragraph (c) of this section or § 60.35f(a)(6) must comply with the following instrumentation specifications and procedures for surface emission monitoring devices:

(1) The portable analyzer must meet the instrument specifications provided in section 6 of Method 21 of appendix A of this part, except that "methane" replaces all references to "VOC".

(2) The calibration gas must be methane, diluted to a nominal concentration of 500 parts per million in air.

(3) To meet the performance evaluation requirements in section 8.1 of Method 21 of appendix A of this part, the instrument evaluation procedures of section 8.1 of Method 21 must be used.

(4) The calibration procedures provided in sections 8 and 10 of Method 21 of appendix A of this part must be followed immediately before commencing a surface monitoring survey.

(e) The provisions of this subpart apply at all times, including periods of startup, shutdown, or malfunction. During periods of startup, shutdown, and malfunction, you must comply with the work practice specified in § 60.34f(e) in lieu of the compliance provisions in § 60.36f.

§ 60.37f Monitoring of operations.

For approval, a state plan must include the monitoring provisions in this section, except as provided in § 60.38f(d)(2).

(a) Each owner or operator seeking to comply with § 60.33f(b)(2) for an active gas collection system must install a sampling port and a thermometer, other temperature measuring device, or an access port for temperature measurements at each wellhead and:

(1) Measure the gauge pressure in the gas collection header on a monthly basis as provided in § 60.36f(a)(3); and

(2) Monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as follows:

(i) The nitrogen level must be determined using Method 3C, unless an alternative test method is established as allowed by § 60.38f(d)(2).

(ii) Unless an alternative test method is established as allowed by § 60.38f(d)(2), the oxygen level must be determined by an oxygen meter using Method 3A, 3C, or ASTM D6522–11 (incorporated by reference, see § 60.17). Determine the oxygen level by an oxygen meter using Method 3A, 3C, or ASTM D6522–11 (if sample location is prior to combustion) except that:

(A) The span must be set between 10 and 12 percent oxygen;

(B) A data recorder is not required;

(C) Only two calibration gases are required, a zero and span;

(D) A calibration error check is not required; and

(E) The allowable sample bias, zero drift, and calibration drift are ±10 percent.

(iii) A portable gas composition analyzer may be used to monitor the oxygen levels provided:

(A) The analyzer is calibrated; and

(B) The analyzer meets all quality assurance and quality control requirements for Method 3A or ASTM D6522–11 (incorporated by reference, see § 60.17).

(3) Monitor temperature of the landfill gas on a monthly basis as provided in § 60.36f(a)(5). The temperature measuring device must be calibrated annually using the procedure in this part 60, appendix A–1, Method 2, Section 10.3.

(b) Each owner or operator seeking to comply with § 60.33f(c) using an enclosed combustor must calibrate, maintain, and operate according to the manufacturer's specifications, the following equipment:

(1) A temperature monitoring device equipped with a continuous recorder and having a minimum accuracy of ±1 percent of the temperature being measured expressed in degrees Celsius or ±0.5 degrees Celsius, whichever is greater. A temperature monitoring device is not required for boilers or process heaters with design heat input capacity equal to or greater than 44 megawatts.

(2) A device that records flow to the control device and bypass of the control device (if applicable). The owner or operator must:

(i) Install, calibrate, and maintain a gas flow rate measuring device that must record the flow to the control device at least every 15 minutes; and

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism must be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(c) Each owner or operator seeking to comply with § 60.33f(c) using a non-enclosed flare must install, calibrate, maintain, and operate according to the manufacturer's specifications the following equipment:

(1) A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame.

(2) A device that records flow to the flare and bypass of the flare (if applicable). The owner or operator must:

(i) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the control device at least every 15 minutes; and

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism must be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(d) Each owner or operator seeking to demonstrate compliance with § 60.33f(c) using a device other than a non-enclosed flare or an enclosed combustor or a treatment system must provide information satisfactory to the Administrator as provided in § 60.38f(d)(2) describing the operation of the control device, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The Administrator must review the information and either approve it, or request that additional information be submitted. The Administrator may specify additional appropriate monitoring procedures.

(e) Each owner or operator seeking to install a collection system that does not meet the specifications in § 60.40f or seeking to monitor alternative parameters to those required by §§ 60.34f through 60.37f must provide information satisfactory to the Administrator as provided in § 60.38f(d)(2) and (3) describing the design and operation of the collection system, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The Administrator may specify additional appropriate monitoring procedures.

(f) Each owner or operator seeking to demonstrate compliance with the 500 parts per million surface methane operational standard in § 60.34f(d) must monitor surface concentrations of methane according to the procedures provided in § 60.36f(c) and the instrument specifications in § 60.36f(d). Any closed landfill that has no monitored exceedances of the operational standard in three consecutive quarterly monitoring periods may skip to annual monitoring. Any methane reading of 500 parts per million or more above background detected during the annual monitoring returns the frequency for that landfill to quarterly monitoring.

(g) Each owner or operator seeking to demonstrate compliance with the control system requirements in § 60.33f(c) using a landfill gas treatment system must maintain and operate all monitoring systems associated with the treatment system in accordance with the site-specific treatment system monitoring plan required in § 60.39f(b)(5)(ii) and must calibrate, maintain, and operate according to the manufacturer's specifications a device that records flow to the treatment system and bypass of the treatment system (if applicable). The owner or operator must:

(1) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the treatment system at least every 15 minutes; and

(2) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism must be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(h) The monitoring requirements of paragraphs (b), (c) (d) and (g) of this section apply at all times the affected source is operating, except for periods of monitoring system malfunctions, repairs associated with monitoring system malfunctions, and required monitoring

system quality assurance or quality control activities. A monitoring system malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data. Monitoring system failures that are caused in part by poor maintenance or careless operation are not malfunctions. You are required to complete monitoring system repairs in response to monitoring system malfunctions and to return the monitoring system to operation as expeditiously as practicable.

§ 60.38f Reporting guidelines.

For approval, a state plan must include the reporting provisions listed in this section, as applicable, except as provided under §§ 60.24 and 60.38f(d)(2).

(a) *Design capacity report.* For existing MSW landfills subject to this subpart, the initial design capacity report must be submitted no later than 90 days after the effective date of EPA approval of the state's plan under section 111(d) of the Clean Air Act. The initial design capacity report must contain the following information:

(1) A map or plot of the landfill, providing the size and location of the landfill, and identifying all areas where solid waste may be landfilled according to the permit issued by the state, local, or tribal agency responsible for regulating the landfill.

(2) The maximum design capacity of the landfill. Where the maximum design capacity is specified in the permit issued by the state, local, or tribal agency responsible for regulating the landfill, a copy of the permit specifying the maximum design capacity may be submitted as part of the report. If the maximum design capacity of the landfill is not specified in the permit, the maximum design capacity must be calculated using good engineering practices. The calculations must be provided, along with the relevant parameters as part of the report. The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. If the owner or operator chooses to convert the design capacity from volume to mass or from mass to volume to demonstrate its design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, the calculation must include a site-specific density, which must be recalculated annually. Any density conversions must be documented and submitted with the design capacity report. The state, local, or tribal agency or the Administrator may request other reasonable information as may be necessary to verify the maximum design capacity of the landfill.

(b) *Amended design capacity report.* An amended design capacity report must be submitted providing notification of an increase in the design capacity of the landfill, within 90 days of an increase in the maximum design capacity of the landfill to meet or exceed 2.5 million megagrams and 2.5 million cubic meters. This increase in design capacity may result from an increase in the permitted volume of the landfill or an increase in the density as documented in the annual recalculation required in § 60.39f(f).

(c) *NMOC emission rate report.* For existing MSW landfills covered by this subpart with a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the NMOC emission rate report must be submitted following the procedure specified in paragraph (j)(2) of this section no later than 90 days after the effective date of EPA approval of the state's plan under section 111(d) of the Clean Air Act. The NMOC emission rate report must be submitted to the Administrator annually following the procedure specified in paragraph (j)(2) of this section, except as provided for in paragraph (c)(3) of this section. The Administrator may request such additional information as may be necessary to verify the reported NMOC emission rate.

(1) The NMOC emission rate report must contain an annual or 5-year estimate of the NMOC emission rate calculated using the formula and procedures provided in § 60.35f(a) or (b), as applicable.

(2) The NMOC emission rate report must include all the data, calculations, sample reports and measurements used to estimate the annual or 5-year emissions.

(3) If the estimated NMOC emission rate as reported in the annual report to the Administrator is less than 34 megagrams per year in each of the next 5 consecutive years, the owner or operator may elect to submit, following the procedure specified in paragraph (j)(2) of this section, an estimate of the NMOC emission rate for the next 5-year period in lieu of the annual report. This estimate must include the current amount of solid waste-in-place and the estimated waste acceptance rate for each year of the 5 years for which an NMOC emission rate is estimated. All data and calculations upon which this estimate is based must be provided to the Administrator. This estimate must be revised at least once every 5 years. If the actual waste acceptance rate exceeds the estimated waste acceptance rate in any year reported in the 5-year estimate, a revised 5-year estimate must be submitted to the Administrator. The revised estimate must cover the 5-year period beginning with the year in which the actual waste acceptance rate exceeded the estimated waste acceptance rate.

(4) Each owner or operator subject to the requirements of this subpart is exempted from the requirements to submit an NMOC emission rate report, after installing a collection and control system that complies with § 60.33f(b) and (c), during such time as the collection and control system is in operation and in compliance with §§ 60.34f and 60.36f.

(d) *Collection and control system design plan.* The state plan must include a process for state review and approval of the site-specific design plan for each gas collection and control system. The collection and control system design plan must be prepared and approved by a professional engineer and must meet the following requirements:

(1) The collection and control system as described in the design plan must meet the design requirements in § 60.33f(b) and (c).

(2) The collection and control system design plan must include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, recordkeeping, or reporting provisions of §§ 60.34f through 60.39f proposed by the owner or operator.

(3) The collection and control system design plan must either conform to specifications for active collection systems in § 60.40f or include a demonstration to the Administrator's satisfaction of the sufficiency of the alternative provisions to § 60.40f.

(4) Each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters must submit a copy of the collection and control system design plan cover page that contains the engineer's seal to the Administrator within 1 year of the first NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year, except as follows:

(i) If the owner or operator elects to recalculate the NMOC emission rate after Tier 2 NMOC sampling and analysis as provided in § 60.35f(a)(3) and the resulting rate is less than 34 megagrams per year, annual periodic reporting must be resumed, using the Tier 2 determined site-specific NMOC concentration, until the calculated NMOC emission rate is equal to or greater than 34 megagrams per year or

the landfill is closed. The revised NMOC emission rate report, with the recalculated NMOC emission rate based on NMOC sampling and analysis, must be submitted, following the procedures in paragraph (j)(2) of this section, within 180 days of the first calculated exceedance of 34 megagrams per year.

(ii) If the owner or operator elects to recalculate the NMOC emission rate after determining a site-specific methane generation rate constant k, as provided in Tier 3 in § 60.35f(a)(4), and the resulting NMOC emission rate is less than 34 megagrams per year, annual periodic reporting must be resumed. The resulting site-specific methane generation rate constant k must be used in the NMOC emission rate calculation until such time as the emissions rate calculation results in an exceedance. The revised NMOC emission rate report based on the provisions of § 60.35f(a)(4) and the resulting site-specific methane generation rate constant k must be submitted, following the procedure specified in paragraph (j)(2) of this section, to the Administrator within 1 year of the first calculated NMOC emission rate equaling or exceeding 34 megagrams per year.

(iii) If the owner or operator elects to demonstrate that site-specific surface methane emissions are below 500 parts per million methane, based on the provisions of § 60.35f(a)(6), then the owner or operator must submit annually a Tier 4 surface emissions report as specified in this paragraph (d)(4)(iii) following the procedure specified in paragraph (j)(2) of this section until a surface emissions readings of 500 parts per million methane or greater is found. If the Tier 4 surface emissions report shows no surface emissions readings of 500 parts per million methane or greater for four consecutive quarters at a closed landfill, then the landfill owner or operator may reduce Tier 4 monitoring from a quarterly to an annual frequency. The Administrator may request such additional information as may be necessary to verify the reported instantaneous surface emission readings. The Tier 4 surface emissions report must clearly identify the location, date and time (to the nearest second), average wind speeds including wind gusts, and reading (in parts per million) of any value 500 parts per million methane or greater, other than non-repeatable, momentary readings. For location, you must determine the latitude and longitude coordinates using an instrument with an accuracy of at least 4 meters. The coordinates must be in decimal degrees with at least five decimal places. The Tier 4 surface emission report should also include the results of the most recent Tier 1 and Tier 2 results in order to verify that the landfill does not exceed 50 Mg/yr of NMOC.

(A) The initial Tier 4 surface emissions report must be submitted annually, starting within 30 days of completing the fourth quarter of Tier 4 surface emissions monitoring that demonstrates that site-specific surface methane emissions are below 500 parts per million methane, and following the procedure specified in paragraph (j)(2) of this section.

(B) The Tier 4 surface emissions rate report must be submitted within 1 year of the first measured surface exceedance of 500 parts per million methane, following the procedure specified in paragraph (j)(2) of this section.

(iv) If the landfill is in the closed landfill subcategory, the owner or operator must submit a collection and control system design plan to the Administrator within 1 year of the first NMOC emission rate report in which the NMOC emission rate equals or exceeds 50 megagrams per year, except as follows:

(A) If the owner or operator elects to recalculate the NMOC emission rate after Tier 2 NMOC sampling and analysis as provided in § 60.35f(a)(3) and the resulting rate is less than 50 megagrams per year, annual periodic reporting must be resumed, using the Tier 2 determined site-specific NMOC concentration, until the calculated NMOC emission rate is equal to or greater than 50 megagrams per year or the landfill is closed. The revised NMOC emission rate report, with the recalculated NMOC emission rate based on NMOC sampling and analysis, must be submitted, following the procedure specified in paragraph (j)(2) of this section, within 180 days of the first calculated exceedance of 50 megagrams per year.

(B) If the owner or operator elects to recalculate the NMOC emission rate after determining a site-specific methane generation rate constant k, as provided in Tier 3 in § 60.35f(a)(4), and the resulting NMOC emission rate is less than 50 megagrams per year, annual periodic reporting must be resumed. The resulting site-specific methane generation rate constant k must be used in the NMOC emission rate calculation until such time as the emissions rate calculation results in an exceedance. The revised NMOC emission rate report based on the provisions of § 60.35f(a)(4) and the resulting site-specific methane generation rate constant k must be submitted, following the procedure specified in paragraph (j)(2) of this section, to the Administrator within 1 year of the first calculated NMOC emission rate equaling or exceeding 50 megagrams per year.

(C) The landfill owner or operator elects to demonstrate surface emissions are low, consistent with the provisions in paragraph (d)(4)(iii) of this section.

(D) The landfill has already submitted a gas collection and control system design plan consistent with the provisions of subpart WWW of this part; 40 CFR part 62, subpart GGG; or a state plan implementing subpart Cc of this part.

(5) The landfill owner or operator must notify the Administrator that the design plan is completed and submit a copy of the plan's signature page. The Administrator has 90 days to decide whether the design plan should be submitted for review. If the Administrator chooses to review the plan, the approval process continues as described in paragraph (c)(6) of this section. However, if the Administrator indicates that submission is not required or does not respond within 90 days, the landfill owner or operator can continue to implement the plan with the recognition that the owner or operator is proceeding at their own risk. In the event that the design plan is required to be modified to obtain approval, the owner or operator must take any steps necessary to conform any prior actions to the approved design plan and any failure to do so could result in an enforcement action.

(6) Upon receipt of an initial or revised design plan, the Administrator must review the information submitted under paragraphs (d)(1) through (3) of this section and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with landfill gas system design, alternative systems may be necessary. A wide variety of system designs are possible, such as vertical wells, combination horizontal and vertical collection systems, or horizontal trenches only, leachate collection components, and passive systems. If the Administrator does not approve or disapprove the design plan, or does not request that additional information be submitted within 90 days of receipt, then the owner or operator may continue with implementation of the design plan, recognizing they would be proceeding at their own risk.

(7) If the owner or operator chooses to demonstrate compliance with the emission control requirements of this subpart using a treatment system as defined in this subpart, then the owner or operator must prepare a site-specific

treatment system monitoring plan as specified in § 60.39f(b)(5).

(e) *Revised design plan.* The owner or operator who has already been required to submit a design plan under paragraph (d) of this section, or under subpart WWW of this part; 40 CFR part 62, subpart GGG; or a state plan implementing subpart Cc of this part, must submit a revised design plan to the Administrator for approval as follows:

(1) At least 90 days before expanding operations to an area not covered by the previously approved design plan.

(2) Prior to installing or expanding the gas collection system in a way that is not consistent with the design plan that was submitted to the Administrator according to paragraph (d) of this section.

(f) *Closure report.* Each owner or operator of a controlled landfill must submit a closure report to the Administrator within 30 days of ceasing waste acceptance. The Administrator may request additional information as may be necessary to verify that permanent closure has taken place in accordance with the requirements of 40 CFR 258.60. If a closure report has been submitted to the Administrator, no additional wastes may be placed into the landfill without filing a notification of modification as described under § 60.7(a)(4).

(g) *Equipment removal report.* Each owner or operator of a controlled landfill must submit an equipment removal report to the Administrator 30 days prior to removal or cessation of operation of the control equipment.

(1) The equipment removal report must contain the following items:

(i) A copy of the closure report submitted in accordance with paragraph (f) of this section; and

(ii) A copy of the initial performance test report demonstrating that the 15-year minimum control period has expired, unless the report of the results of the performance test has been submitted to the EPA via the EPA's CDX, or information that demonstrates that the GCCS will be unable to operate for 15 years due to declining gas flows. In the equipment removal report, the process unit(s) tested, the pollutant(s) tested, and the date that such performance test was conducted may be submitted in lieu of the performance test report if the report has been previously submitted to the EPA's CDX; and

(iii) Dated copies of three successive NMOC emission rate reports demonstrating that the landfill is no longer producing 34 megagrams or greater of NMOC per year, unless the NMOC emission rate reports have been submitted to the EPA via the EPA's CDX. If the NMOC emission rate reports have been previously submitted to the EPA's CDX, a statement that the NMOC emission rate reports have been submitted electronically and the dates that the reports were submitted to the EPA's CDX may be submitted in the equipment removal report in lieu of the NMOC emission rate reports; or

(iv) For the closed landfill subcategory, dated copies of three successive NMOC emission rate reports demonstrating that the landfill is no longer producing 50 megagrams or greater of NMOC per year, unless the NMOC emission rate reports have been submitted to the EPA via the EPA's CDX. If the NMOC emission rate reports have been previously submitted to the EPA's CDX, a statement that the NMOC emission rate reports have been submitted electronically and the dates that the reports were submitted to the EPA's CDX may be submitted in the equipment removal report in lieu of the NMOC emission rate reports.

(2) The Administrator may request such additional information as may be necessary to verify that all of the conditions for removal in § 60.33f(f) have been met.

(h) *Annual report.* The owner or operator of a landfill seeking to comply with § 60.33f(e)(2) using an active collection system designed in accordance with § 60.33f(b) must submit to the Administrator, following the procedures specified in paragraph (j)(2) of this section, an annual report of the recorded information in paragraphs (h)(1) through (7) of this section. The initial annual report must be submitted within 180 days of installation and startup of the collection and control system. The initial annual report must include the initial performance test report required under § 60.8, as applicable, unless the report of the results of the performance test has been submitted to the EPA via the EPA's CDX. In the initial annual report, the process unit(s) tested, the pollutant(s) tested and the date that such performance test was conducted may be submitted in lieu of the performance test report if the report has been previously submitted to the EPA's CDX. The initial performance test report must be submitted, following the procedure specified in paragraph (j)(1) of this section, no later than the date that the initial annual report is submitted. For enclosed combustion devices and flares, reportable exceedances are defined under § 60.39f(c)(1).

(1) Value and length of time for exceedance of applicable parameters monitored under § 60.37f(a)(1), (b), (c), (d), and (g).

(2) Description and duration of all periods when the gas stream was diverted from the control device or treatment system through a bypass line or the indication of bypass flow as specified under § 60.37f.

(3) Description and duration of all periods when the control device or treatment system was not operating and length of time the control device or treatment system was not operating.

(4) All periods when the collection system was not operating.

(5) The location of each exceedance of the 500 parts per million methane concentration as provided in § 60.34f(d) and the concentration recorded at each location for which an exceedance was recorded in the previous month. For location, you must determine the latitude and longitude coordinates using an instrument with an accuracy of at least 4 meters. The coordinates must be in decimal degrees with at least five decimal places.

(6) The date of installation and the location of each well or collection system expansion added pursuant to § 60.36f(a)(3), (a)(5), (b), and (c)(4).

(7) For any corrective action analysis for which corrective actions are required in § 60.36f(a)(3) or (5) and that take more than 60 days to correct the exceedance, the root cause analysis conducted, including a description of the recommended corrective action(s), the date for corrective action(s) already completed following the positive pressure reading, and, for action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates.

(i) *Initial performance test report.* Each owner or operator seeking to comply with § 60.33f(c) must include the following information with the initial performance test report required under § 60.8:

(1) A diagram of the collection system showing collection system positioning including all wells, horizontal collectors, surface collectors, or other gas extraction devices, including the locations of any areas excluded from collection and the proposed sites for the future collection system expansion;

(2) The data upon which the sufficient density of wells, horizontal collectors, surface collectors, or other gas extraction devices and the gas mover equipment sizing are based;

(3) The documentation of the presence of asbestos or nondegradable material for each area from which collection wells have been excluded based on the presence of asbestos or nondegradable material;

(4) The sum of the gas generation flow rates for all areas from which collection wells have been excluded based on nonproductivity and the calculations of gas generation flow rate for each excluded area;

(5) The provisions for increasing gas mover equipment capacity with increased gas generation flow rate, if the present gas mover equipment is inadequate to move the maximum flow rate expected over the life of the landfill; and

(6) The provisions for the control of off-site migration.

(j) *Electronic reporting.* The owner or operator must submit reports electronically according to paragraphs (j)(1) and (2) of this section.

(1) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results of each performance test according to the following procedures:

(i) For data collected using test methods supported by the EPA's Electronic Reporting Tool (ERT) as listed on the EPA's ERT Web site (*https://www3.epa.gov/ttn/chief/ert/ert_info.html*) at the time of the test, you must submit the results of the performance test to the EPA via the Compliance and Emissions Data Reporting Interface (CEDRI). CEDRI can be accessed through the EPA's Central Data Exchange (CDX) (*https://cdx.epa.gov/*). Performance test data must be submitted in a file format generated through the use of the EPA's ERT or an alternative file format consistent with the extensible markup language (XML) schema listed on the EPA's ERT Web site, once the XML schema is available. If you claim that some of the performance test information being submitted is confidential business information (CBI), you must submit a complete file generated through the use of the EPA's ERT or an alternate electronic file consistent with the XML schema listed on the EPA's ERT Web site, including information claimed to be CBI, on a compact disc, flash drive or other commonly used electronic storage media to the EPA. The electronic media must be clearly marked as CBI and mailed to U.S. EPA/OAQPS/CORE CBI Office, Attention: Group Leader, Measurement Policy Group, MD C404–02, 4930 Old Page Rd., Durham, NC 27703. The same ERT or alternate file with the CBI omitted must be submitted to the EPA via the EPA's CDX as described earlier in this paragraph (j)(1)(i).

(ii) For data collected using test methods that are not supported by the EPA's ERT as listed on the EPA's ERT Web site at the time of the test, you must submit the results of the performance test to the Administrator at the appropriate address listed in § 60.4.

(2) Each owner or operator required to submit reports following the procedure specified in this paragraph must submit reports to the EPA via the CEDRI. (CEDRI can be accessed through the EPA's CDX.) The owner or operator must use the appropriate electronic report in CEDRI for this subpart or an alternate electronic file format consistent with the XML schema listed on the CEDRI Web site (*https://www3.epa.gov/ttn/chief/cedri/index.html*). If the reporting form specific to this subpart is not available in CEDRI at the time that the report is due, the owner or operator must submit the report to the Administrator at the appropriate address listed in § 60.4. Once the form has been available in CEDRI for 90 calendar days, the owner or operator must begin submitting all subsequent reports via CEDRI. The reports must be submitted by the deadlines specified in this subpart, regardless of the method in which the reports are submitted.

(k) *Corrective action and the corresponding timeline.* The owner or operator must submit according to paragraphs (k)(1) and (2) of this section.

(1) For corrective action that is required according to § 60.36f(a)(3)(iii) or (a)(5)(iii) and is expected to take longer than 120 days after the initial exceedance to complete, you must submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Administrator as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature monitoring value of 55 degrees Celsius (131 degrees Fahrenheit) or above. The Administrator must approve the plan for corrective action and the corresponding timeline.

(2) For corrective action that is required according to § 60.36f(a)(3)(iii) or (a)(5)(iii) and is not completed within 60 days after the initial exceedance, you must submit a notification to the Administrator as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature exceedance.

(l) *Liquids addition.* The owner or operator of an affected landfill with a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters that has employed leachate recirculation or added liquids based on a Research, Development, and Demonstration permit (issued through Resource Conservation and Recovery Act, subtitle D, part 258) within the last 10 years must submit to the Administrator, annually, following the procedure specified in paragraph (j)(2) of this section, the following information:

(1) Volume of leachate recirculated (gallons per year) and the reported basis of those estimates (records or engineering estimates).

(2) Total volume of all other liquids added (gallons per year) and the reported basis of those estimates (records or engineering estimates).

(3) Surface area (acres) over which the leachate is recirculated (or otherwise applied).

(4) Surface area (acres) over which any other liquids are applied.

(5) The total waste disposed (megagrams) in the areas with recirculated leachate and/or added liquids based on on-site records to the extent data are available, or engineering estimates and the reported basis of those estimates.

(6) The annual waste acceptance rates (megagrams per year) in the areas with recirculated leachate and/or added liquids, based on on-site records to the extent data are available, or engineering estimates.

(7) The initial report must contain items in paragraph (l)(1) through (6) of this section per year for the most recent 365 days as well as for each of the previous 10 years, to the extent historical data are available in on-site records, and the report must be submitted no later than:

(i) September 27, 2017, for landfills that commenced construction, modification, or reconstruction after July 17, 2014 but before August 29, 2016; or

(ii) 365 days after the date of commenced construction, modification, or reconstruction for landfills that commence construction, modification, or reconstruction after August 29, 2016.

(8) Subsequent annual reports must contain items in paragraph (l)(1) through (6) of this section for the 365-day period following the 365-day period included in the previous annual report, and the report must be submitted no later than 365 days after the date the previous report was submitted.

(9) Landfills in the closed landfill subcategory are exempt from reporting requirements contained in paragraphs (l)(1) through (7) of this section.

(10) Landfills may cease annual reporting of items in paragraphs (l)(1) through (6) of this section once they have submitted the closure report in § 60.38f(f).

(m) *Tier 4 notification.* (1) The owner or operator of an affected landfill with

a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters must provide a notification of the date(s) upon which it intends to demonstrate site-specific surface methane emissions are below 500 parts per million methane, based on the Tier 4 provisions of § 60.35f(a)(6). The landfill must also include a description of the wind barrier to be used during the SEM in the notification. Notification must be postmarked not less than 30 days prior to such date.

(2) If there is a delay to the scheduled Tier 4 SEM date due to weather conditions, including not meeting the wind requirements in § 60.35f (a)(6)(iii)(A), the owner or operator of a landfill shall notify the Administrator by email or telephone no later than 48 hours before any known delay in the original test date, and arrange an updated date with the Administrator by mutual agreement.

§ 60.39f Recordkeeping guidelines.

For approval, a state plan must include the recordkeeping provisions in this section.

(a) Except as provided in § 60.38f(d)(2), each owner or operator of an MSW landfill subject to the provisions of § 60.33f(e) must keep for at least 5 years up-to-date, readily accessible, on-site records of the design capacity report that triggered § 60.33f(e), the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable.

(b) Except as provided in § 60.38f(d)(2), each owner or operator of a controlled landfill must keep up-to-date, readily accessible records for the life of the control system equipment of the data listed in paragraphs (b)(1) through (5) of this section as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring must be maintained for a minimum of 5 years. Records of the control device vendor specifications must be maintained until removal.

(1) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.33f(b):

(i) The maximum expected gas generation flow rate as calculated in § 60.36f(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the Administrator.

(ii) The density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in § 60.40f(a)(1).

(2) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.33f(c) through use of an enclosed combustion device other than a boiler or process heater with a design heat input capacity equal to or greater than 44 megawatts:

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

(ii) The percent reduction of NMOC determined as specified in § 60.33f(c)(2) achieved by the control device.

(3) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.33f(c)(2)(i) through use of a boiler or process heater of any size: A 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 testing.

(4) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.33f(c)(1) through use of a non-enclosed 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 § 60.18; and continuous 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.

(5) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.33f(c)(3) through use of a landfill gas treatment system:

(i) *Bypass records.* Records of the flow of landfill gas to, and bypass of, the treatment system.

(ii) *Site-specific treatment monitoring plan,* to include:

(A) Monitoring records of parameters that are identified in the treatment system monitoring plan and that ensure the treatment system is operating properly for each intended end use of the treated landfill gas. At a minimum, records should include records of filtration, de-watering, and compression parameters that ensure the treatment system is operating properly for each intended end use of the treated landfill gas.

(B) Monitoring methods, frequencies, and operating ranges for each monitored operating parameter based on manufacturer's recommendations or engineering analysis for each intended end use of the treated landfill gas.

(C) Documentation of the monitoring methods and ranges, along with justification for their use.

(D) Identify who is responsible (by job title) for data collection.

(E) Processes and methods used to collect the necessary data.

(F) Description of the procedures and methods that are used for quality assurance, maintenance, and repair of all continuous monitoring systems.

(c) Except as provided in § 60.38f(d)(2), each owner or operator of a controlled landfill subject to the provisions of this subpart must keep for 5 years up-to-date, readily accessible continuous records of the equipment operating parameters specified to be monitored in § 60.37f as well as up-to-date, readily accessible records for periods of operation during which the parameter boundaries established during the most recent performance test are exceeded.

(1) The following constitute exceedances that must be recorded and reported under § 60.38f:

(i) For enclosed combustors except for boilers and process heaters with design heat input capacity of 44 megawatts (150 million British thermal unit per hour) or greater, all 3-hour periods of operation during which the average temperature was more than 28 degrees Celsius (82 degrees Fahrenheit) below the average combustion temperature during the most recent performance test at which compliance with § 60.33f(c) was determined.

(ii) For boilers or process heaters, whenever there is a change in the location at which the vent stream is introduced into the flame zone as required under paragraph (b)(3) of this section.

(2) Each owner or operator subject to the provisions of this subpart must keep up-to-date, readily accessible continuous records of the indication of flow to the control system and the indication of bypass flow or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines, specified under § 60.37f.

(3) Each owner or operator subject to the provisions of this subpart who uses a boiler or process heater with a design heat input capacity of 44 megawatts or greater to comply with § 60.33f(c) must keep an up-to-date, readily accessible record of all periods of operation of the boiler or process heater. (Examples of such records could include records of steam use, fuel use, or monitoring data collected pursuant to other state, local,

tribal, or federal regulatory requirements.)

(4) Each owner or operator seeking to comply with the provisions of this subpart by use of a non-enclosed flare must keep up-to-date, readily accessible continuous records of the flame or flare pilot flame monitoring specified under § 60.37f(c), and up-to-date, readily accessible records of all periods of operation in which the flame or flare pilot flame is absent.

(5) Each owner or operator of a landfill seeking to comply with § 60.33f(e) using an active collection system designed in accordance with § 60.33f(b) must keep records of periods when the collection system or control device is not operating.

(d) Except as provided in § 60.38f(d)(2), each owner or operator subject to the provisions of this subpart must keep for the life of the collection system an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label on each collector that matches the labeling on the plot map.

(1) Each owner or operator subject to the provisions of this subpart must keep up-to-date, readily accessible records of the installation date and location of all newly installed collectors as specified under § 60.36f(b).

(2) Each owner or operator subject to the provisions of this subpart must keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as provided in § 60.40f(a)(3)(i) as well as any nonproductive areas excluded from collection as provided in § 60.40f(a)(3)(ii).

(e) Except as provided in § 60.38f(d)(2), each owner or operator subject to the provisions of this subpart must keep for at least 5 years up-to-date, readily accessible records of the following:

(1) All collection and control system exceedances of the operational standards in § 60.34f, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance.

(2) Each owner or operator subject to the provisions of this subpart must also keep records of each wellhead temperature monitoring value of 55 degrees Celsius (131 degrees Fahrenheit) or above, each wellhead nitrogen level at or above 20 percent, and each wellhead oxygen level at or above 5 percent.

(3) For any root cause analysis for which corrective actions are required in § 60.36f(a)(3) or (5), keep a record of the root cause analysis conducted, including a description of the recommended corrective action(s) taken, and the date(s) the corrective action(s) were completed.

(4) For any root cause analysis for which corrective actions are required in § 60.36f(a)(3)(ii) or (a)(5)(ii), keep a record of the root cause analysis conducted, the corrective action analysis, the date for corrective action(s) already completed following the positive pressure reading or high temperature reading, and, for action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates.

(5) For any root cause analysis for which corrective actions are required in § 60.36f(a)(3)(iii) or (a)(5)(iii), keep a record of the root cause analysis conducted, the corrective action analysis, the date for corrective action(s) already completed following the positive pressure reading or high temperature reading, for action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates, and a copy of any comments or final approval on the corrective action analysis or schedule from the regulatory agency.

(f) Landfill owners or operators who convert design capacity from volume to mass or mass to volume to demonstrate that landfill design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, as provided in the definition of ''design capacity'', must keep readily accessible, on-site records of the annual recalculation of site-specific density, design capacity, and the supporting documentation. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable.

(g) Landfill owners or operators seeking to demonstrate that site-specific surface methane emissions are below 500 parts per million by conducting surface emission monitoring under the Tier 4 procedures specified in § 60.35f(a)(6) must keep for at least 5 years up-to-date, readily accessible records of all surface emissions monitoring and information related to monitoring instrument calibrations conducted according to sections 8 and 10 of Method 21 of appendix A of this part, including all of the following items:

(1) Calibration records:

(i) Date of calibration and initials of operator performing the calibration.

(ii) Calibration gas cylinder identification, certification date, and certified concentration.

(iii) Instrument scale(s) used.

(iv) A description of any corrective action taken if the meter readout could not be adjusted to correspond to the calibration gas value.

(v) If an owner or operator makes their own calibration gas, a description of the procedure used.

(2) Digital photographs of the instrument setup. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration.

(3) Timestamp of each surface scan reading:

(i) Timestamp should be detailed to the nearest second, based on when the sample collection begins.

(ii) A log for the length of time each sample was taken using a stopwatch (*e.g.,* the time the probe was held over the area).

(4) Location of each surface scan reading. The owner or operator must determine the coordinates using an instrument with an accuracy of at least 4 meters. Coordinates must be in decimal degrees with at least five decimal places.

(5) Monitored methane concentration (parts per million) of each reading.

(6) Background methane concentration (parts per million) after each instrument calibration test.

(7) Adjusted methane concentration using most recent calibration (parts per million).

(8) For readings taken at each surface penetration, the unique identification location label matching the label specified in paragraph (d) of this section.

(9) Records of the operating hours of the gas collection system for each destruction device.

(h) Except as provided in § 60.38f(d)(2), each owner or operator subject to the provisions of this subpart must keep for at least 5 years up-to-date, readily accessible records of all collection and control system monitoring data for parameters measured in § 60.37f(a)(1), (2), and (3).

(i) Any records required to be maintained by this subpart that are submitted electronically via the EPA's CDX may be maintained in electronic format.

(j) For each owner or operator reporting leachate or other liquids addition under § 60.38f(l), keep records of any engineering calculations or company records used to estimate the quantities of leachate or liquids added, the surface areas for which the leachate or liquids were applied, and the

estimates of annual waste acceptance or total waste in place in the areas where leachate or liquids were applied.

§ 60.40f Specifications for active collection systems.

For approval, a state plan must include the specifications for active collection systems in this section.

(a) Each owner or operator seeking to comply with § 60.33f(b) must site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the following procedures unless alternative procedures have been approved by the Administrator.

(1) The collection devices within the interior must be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues must be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, resistance to the refuse decomposition heat, and ability to isolate individual components or sections for repair or troubleshooting without shutting down entire collection system.

(2) The sufficient density of gas collection devices determined in paragraph (a)(1) of this section must address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior.

(3) The placement of gas collection devices determined in paragraph (a)(1) of this section must control all gas producing areas, except as provided by paragraphs (a)(3)(i) and (ii) of this section.

(i) Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under § 60.39f(d). The documentation must provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and must be provided to the Administrator upon request.

(ii) Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material must be documented and provided to the Administrator upon request. A separate NMOC emissions estimate must be made for each section proposed for exclusion, and the sum of all such sections must be compared to the NMOC emissions estimate for the entire landfill.

(A) The NMOC emissions from each section proposed for exclusion must be computed using Equation 7:

$$Q_i = 2kL_oM_i(e^{-kt_i})(C_{NMOC})(3.6\ x\ 10^{-9}) \qquad \text{(Eq. 7)}$$

Where:

Q_i = NMOC emission rate from the ith section, megagrams per year.

k = Methane generation rate constant, $year^{-1}$.

L_o = Methane generation potential, cubic meters per megagram solid waste.

M_i = Mass of the degradable solid waste in the ith section, megagram.

t_i = Age of the solid waste in the ith section, years.

C_{NMOC} = Concentration of NMOC, parts per million by volume.

3.6×10^{-9} = Conversion factor.

(B) If the owner or operator is proposing to exclude, or cease gas collection and control from, nonproductive physically separated (*e.g.,* separately lined) closed areas that already have gas collection systems, NMOC emissions from each physically separated closed area must be computed using either Equation 3 in § 60.35f or Equation 7 in paragraph (a)(3)(ii)(A) of this section.

(iii) The values for k and C_{NMOC} determined in field testing must be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (the distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, L_o, and C_{NMOC} provided in § 60.35f or the alternative values from § 60.35f must be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph (a)(3)(i) of this section.

(b) Each owner or operator seeking to comply with § 60.33f(b) must construct the gas collection devices using the following equipment or procedures:

(1) The landfill gas extraction components must be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: Convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system must extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors must be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations must be situated with regard to the need to prevent excessive air infiltration.

(2) Vertical wells must be placed so as not to endanger underlying liners and must address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors must be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices must be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.

(3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly must include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices must be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.

(c) Each owner or operator seeking to comply with § 60.33f(c) must convey the landfill gas to a control system in compliance with § 60.33f(c) through the collection header pipe(s). The gas mover equipment must be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:

(1) For existing collection systems, the flow data must be used to project the maximum flow rate. If no flow data

exist, the procedures in paragraph (c)(2) of this section must be used.

(2) For new collection systems, the maximum flow rate must be in accordance with § 60.36f(a)(1).

§ 60.41f Definitions.

Terms used but not defined in this subpart have the meaning given them in the Clean Air Act and in subparts A and B of this part.

Active collection system means a gas collection system that uses gas mover equipment.

Active landfill means a landfill in which solid waste is being placed or a landfill that is planned to accept waste in the future.

Administrator means the Administrator of the U.S. Environmental Protection Agency or his/her authorized representative or the Administrator of a state air pollution control agency.

Closed area means a separately lined area of an MSW landfill in which solid waste is no longer being placed. If additional solid waste is placed in that area of the landfill, that landfill area is no longer closed. The area must be separately lined to ensure that the landfill gas does not migrate between open and closed areas.

Closed landfill means a landfill in which solid waste is no longer being placed, and in which no additional solid wastes will be placed without first filing a notification of modification as prescribed under § 60.7(a)(4). Once a notification of modification has been filed, and additional solid waste is placed in the landfill, the landfill is no longer closed.

Closed landfill subcategory means a closed landfill that has submitted a closure report as specified in § 60.38f(f) on or before September 27, 2017.

Closure means that point in time when a landfill becomes a closed landfill.

Commercial solid waste means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

Controlled landfill means any landfill at which collection and control systems are required under this subpart as a result of the NMOC emission rate. The landfill is considered controlled at the time a collection and control system design plan is prepared in compliance with § 60.33f(e)(2).

Corrective action analysis means a description of all reasonable interim and long-term measures, if any, that are available, and an explanation of why the selected corrective action(s) is/are the best alternative(s), including, but not limited to, considerations of cost effectiveness, technical feasibility, safety, and secondary impacts.

Design capacity means the maximum amount of solid waste a landfill can accept, as indicated in terms of volume or mass in the most recent permit issued by the state, local, or tribal agency responsible for regulating the landfill, plus any in-place waste not accounted for in the most recent permit. If the owner or operator chooses to convert the design capacity from volume to mass or from mass to volume to demonstrate its design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, the calculation must include a site-specific density, which must be recalculated annually.

Disposal facility means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

Emission rate cutoff means the threshold annual emission rate to which a landfill compares its estimated emission rate to determine if control under the regulation is required.

Enclosed combustor means an enclosed firebox which maintains a relatively constant limited peak temperature generally using a limited supply of combustion air. An enclosed flare is considered an enclosed combustor.

Flare means an open combustor without enclosure or shroud.

Gas mover equipment means the equipment (*i.e.,* fan, blower, compressor) used to transport landfill gas through the header system.

Gust means the highest instantaneous wind speed that occurs over a 3-second running average.

Household waste means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including, but not limited to, single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas). Household waste does not include fully segregated yard waste. Segregated yard waste means vegetative matter resulting exclusively from the cutting of grass, the pruning and/or removal of bushes, shrubs, and trees, the weeding of gardens, and other landscaping maintenance activities. Household waste does not include construction, renovation, or demolition wastes, even if originating from a household.

Industrial solid waste means solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of the Resource Conservation and Recovery Act, parts 264 and 265 of this chapter. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: electric power generation; fertilizer/agricultural chemicals; food and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

Interior well means any well or similar collection component located inside the perimeter of the landfill waste. A perimeter well located outside the landfilled waste is not an interior well.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile as those terms are defined under § 257.2 of this title.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing MSW landfill. A lateral expansion is not a modification unless it results in an increase in the design capacity of the landfill.

Leachate recirculation means the practice of taking the leachate collected from the landfill and reapplying it to the landfill by any of one of a variety of methods, including pre-wetting of the waste, direct discharge into the working face, spraying, infiltration ponds, vertical injection wells, horizontal gravity distribution systems, and pressure distribution systems.

Modification means an increase in the permitted volume design capacity of the landfill by either lateral or vertical expansion based on its permitted design capacity as of July 17, 2014. Modification does not occur until the owner or operator commences construction on the lateral or vertical expansion.

Municipal solid waste landfill or *MSW landfill* means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land. An MSW landfill may also receive other types of Resource Conservation and Recovery Act (RCRA) Subtitle D wastes (§ 257.2 of this title) such as commercial solid waste,

nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste. Portions of an MSW landfill may be separated by access roads. An MSW landfill may be publicly or privately owned. An MSW landfill may be a new MSW landfill, an existing MSW landfill, or a lateral expansion.

Municipal solid waste landfill emissions or *MSW landfill emissions* means gas generated by the decomposition of organic waste deposited in an MSW landfill or derived from the evolution of organic compounds in the waste.

NMOC means nonmethane organic compounds, as measured according to the provisions of § 60.35f.

Nondegradable waste means any waste that does not decompose through chemical breakdown or microbiological activity. Examples are, but are not limited to, concrete, municipal waste combustor ash, and metals.

Passive collection system means a gas collection system that solely uses positive pressure within the landfill to move the gas rather than using gas mover equipment.

Protectorate means American Samoa, the Commonwealth of Puerto Rico, the District of Columbia, Guam, the Northern Mariana Islands, and the Virgin Islands.

Root cause analysis means an assessment conducted through a process of investigation to determine the primary cause, and any other contributing causes, of positive pressure at a wellhead.

Sludge means the term sludge as defined in 40 CFR 258.2.

Solid waste means the term solid waste as defined in 40 CFR 258.2.

State means any of the 50 United States and the protectorates of the United States.

State plan means a plan submitted pursuant to section 111(d) of the Clean Air Act and subpart B of this part that implements and enforces this subpart.

Sufficient density means any number, spacing, and combination of collection system components, including vertical wells, horizontal collectors, and surface collectors, necessary to maintain emission and migration control as determined by measures of performance set forth in this part.

Sufficient extraction rate means a rate sufficient to maintain a negative pressure at all wellheads in the collection system without causing air infiltration, including any wellheads connected to the system as a result of expansion or excess surface emissions, for the life of the blower.

Treated landfill gas means landfill gas processed in a treatment system as defined in this subpart.

Treatment system means a system that filters, de-waters, and compresses landfill gas for sale or beneficial use.

*Untreated landfil*l gas means any landfill gas that is not treated landfill gas.

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Part III

Environmental Protection Agency

40 CFR Part 60

Standards of Performance for Municipal Solid Waste Landfills; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

[EPA–HQ–OAR–2003–0215; FRL–9949–51–OAR]

RIN 2060–AM08

Standards of Performance for Municipal Solid Waste Landfills

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is finalizing a new subpart that updates the Standards of Performance for Municipal Solid Waste Landfills. Under section 111 of the Clean Air Act, the EPA must review, and, if appropriate, revise standards of performance at least every 8 years. The EPA's review of the standards for municipal solid waste landfills considered landfills that commence construction, reconstruction, or modification after July 17, 2014. The final standards also reflect changes to the population of landfills and an analysis of the timing and methods for reducing emissions. This action will achieve additional reductions in emissions of landfill gas and its components, including methane, by lowering the emissions threshold at which a landfill must install controls. This action also incorporates new data and information received in response to the proposed rulemaking and addresses other regulatory issues including surface emissions monitoring, wellhead monitoring, and the definition of landfill gas treatment system.

The new subpart will reduce emissions of landfill gas, which contains both nonmethane organic compounds and methane. Landfills are a significant source of methane, which is a potent greenhouse gas pollutant. These avoided emissions will improve air quality and reduce the potential for public health and welfare effects associated with exposure to landfill gas emissions.

DATES: This final rule is effective on October 28, 2016.

The incorporation by reference of certain publications listed in the regulations is approved by the Director of the Federal Register as of October 28, 2016.

ADDRESSES: The EPA has established a docket for this action under Docket ID No. EPA–HQ–OAR–2003–0215. All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available electronically through *http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: For information concerning this final rule, contact Ms. Hillary Ward, Fuels and Incineration Group, Sector Policies and Programs Division, Office of Air Quality Planning and Standards (E143–05), Environmental Protection Agency, Research Triangle Park, NC 27711; telephone number: (919) 541–3154; fax number: (919) 541–0246; email address: *ward.hillary@epa.gov.*

SUPPLEMENTARY INFORMATION:

Acronyms and Abbreviations. The following acronyms and abbreviations are used in this document.

ANPRM Advance notice of proposed rulemaking
ANSI American National Standards Institute
BMP Best management practice
BSER Best system of emission reduction
Btu British thermal unit
CAA Clean Air Act
CA LMR California Landfill Methane Rule
CBI Confidential business information
CDX Central Data Exchange
CEDRI Compliance and Emissions Data Reporting Interface
CFR Code of Federal Regulations
CO_2 Carbon dioxide
CO_2e Carbon dioxide equivalent
EIA Energy Information Administration
EPA Environmental Protection Agency
ERT Electronic Reporting Tool
FID Flame ionization detector
GCCS Gas collection and control system
GHG Greenhouse gas
GHGRP Greenhouse Gas Reporting Program
GWP Global warming potential
HAP Hazardous air pollutant
HOV Higher operating value
IAMS Integrated assessment models
ICR Information collection request
IPCC Intergovernmental Panel on Climate Change
IWG Interagency working group
lb/MMBtu Pounds per million British thermal unit
LFG Landfill gas
LFGCost Landfill Gas Energy Cost Model
m^3 Cubic meters
Mg Megagram
Mg/yr Megagram per year
mph Miles per hour
MSW Municipal solid waste
$mtCO_2e$ Metric tons of carbon dioxide equivalent
MW Megawatt
MWh Megawatt hour
NAICS North American Industry Classification System
NESHAP National Emission Standards for Hazardous Air Pollutants
NMOC Nonmethane organic compound
NRC National Research Council
NSPS New source performance standards
NTTAA National Technology Transfer and Advancement Act
OAQPS Office of Air Quality Planning and Standards
OMB Office of Management & Budget
PM Particulate matter
$PM_{2.5}$ Fine particulate matter
ppm Parts per million
RCRA Resource Conservation and Recovery Act
RD&D Research, development, and demonstration
RFA Regulatory Flexibility Act
RIA Regulatory Impact Analysis
SBAR Small Business Advocacy Review
$SC–CH_4$ Social cost of methane
$SC–CO_2$ Social cost of carbon dioxide
SEM Surface emissions monitoring
SER Small entity representative
SO_2 Sulfur dioxide
SSM Startup, shutdown, and malfunction
Tg Teragram
TTN Technology Transfer Network
U.S. United States
USGCRP U.S. Global Change Research Program
VCS Voluntary consensus standard
VOC Volatile organic compound
WWW World Wide Web

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I. Executive Summary

A. Purpose of Regulatory Action

This action finalizes changes to the Standards of Performance for Municipal Solid Waste (MSW) Landfills (landfills new source performance standards or landfills NSPS) resulting from the EPA's review of the landfills NSPS under Clean Air Act (CAA) section 111. The EPA's review identified a number of advances in technology and operating practices for reducing emissions of landfill gas (LFG) and the final changes are based on our evaluation of those advances and our understanding of LFG emissions. In order to avoid possible confusion regarding which MSW landfills would actually be subject to these requirements, the EPA is establishing a new subpart XXX (40 CFR part 60, subpart XXX) rather than merely updating the existing subpart WWW (40 CFR part 60, subpart WWW). The requirements in new subpart XXX apply to MSW landfills for which construction, reconstruction, or modification commenced after July 17, 2014, the date of the proposed rule. The requirements in subpart WWW continue to apply to MSW landfills for which construction, reconstruction, or modification was commenced on or after May 30, 1991 and on or before July 17, 2014. For a discussion of how changes in applicability affect sources currently subject to subparts Cc and WWW, see the proposed Emission Guidelines (80 FR 52110, August 27, 2016).

The resulting changes to the NSPS found in subpart XXX will achieve additional reductions in emissions of LFG and its components, including methane. This final rule is consistent with the President's 2013 Climate Action Plan,[1] which directs federal agencies to focus on "assessing current emissions data, addressing data gaps, identifying technologies and best practices for reducing emissions, and identifying existing authorities and incentive-based opportunities to reduce methane emissions." The final rule is also consistent with the President's Methane Strategy,[2] which directs the EPA's regulatory and voluntary programs to continue to pursue emission reductions through regulatory updates and to encourage LFG energy recovery through voluntary programs. These directives are discussed in detail in section III.A of this preamble. This regulatory action also resolves and clarifies several implementation issues that were previously addressed in amendments proposed on May 23, 2002 (67 FR 36475) and September 8, 2006 (71 FR 53271).

1. Need for Regulatory Action

Several factors led to today's final action. First, section 111 of the Clean Air Act (CAA) (42 U.S.C. 7411) requires the EPA to review standards of performance at least every 8 years and, if appropriate, revise the standards to reflect improvements in methods for reducing emissions. Second, a mandatory duty lawsuit was filed against the EPA for failure to review the NSPS by the statutorily required deadline. Under a consent decree resolving that lawsuit, the EPA agreed to propose a review and take final action on the proposal. Third, the EPA has concluded that landfill owners or operators, as well as regulators, need clarification regarding issues that have arisen during implementation of the existing standards. Implementation issues include the definition of LFG treatment, among other topics. Fourth, landfills are a significant source of methane, a very potent greenhouse gas, for which there are cost-effective means of reduction, so this rule is an important element of the United States' work to reduce emissions that are contributing to climate change.

2. Legal Authority

CAA section 111(b)(1)(B) (42 U.S.C. 7411(b)(1)(B)) requires the EPA to "at least every 8 years review and, if appropriate, revise" new source performance standards. CAA section 111(a)(1) (42 U.S.C. 7411(a)(1)) provides that performance standards are to "reflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." We refer to this level of control as the best system of emission reduction or "BSER."

As indicated above, the EPA has decided to finalize its review of the landfill NSPS in a new subpart rather than update existing requirements in 40 CFR part 60, subpart WWW. The EPA believes that either approach is legally permissible.[3] The final subpart XXX will appear in 40 CFR part 60 and will apply to landfills that commence construction, reconstruction, or modification after July 17, 2014.

B. Summary of Major Provisions

The final NSPS apply to landfills that commenced construction, reconstruction, or modification after July 17, 2014 (the date of publication of the proposed NSPS). The final rule provisions are described below.

Thresholds for Installing Controls. The final NSPS retain the current design capacity threshold of 2.5 million megagrams (Mg) and 2.5 million cubic meters (m^3), but reduce the nonmethane

[1] Executive Office of the President, "The President's Climate Action Plan" June 2013. *https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.*

[2] Executive Office of the President, "Climate Action Plan Strategy to Reduce Methane, March 2014. *https://www.whitehouse.gov/sites/default/files/strategy_to_reduce_methane_emissions_2014-03-28_final.pdf.*

[3] The EPA believes that it has the legal authority in updating an NSPS to either propose and make changes to the existing subpart or to promulgate a new subpart and has previously done both. In either case, any substantive changes to the NSPS apply only to sources for which construction, reconstruction, or modification commenced on or after the date on which the proposed changes were published in the **Federal Register** (July 17, 2014).

organic compounds (NMOC) emission threshold for the installation and removal of a gas collection and control system (GCCS) from 50 megagrams per year (Mg/yr) to 34 Mg/yr. An MSW landfill that exceeds the design capacity threshold must install and start up a GCCS within 30 months after LFG emissions reach or exceed an NMOC level of 34 Mg/yr. (A megagram is also known as a metric ton, which is equal to 1.1 United States (U.S.) short tons or about 2,205 pounds.) Consistent with the existing NSPS (40 CFR part 60, subpart WWW), the owner or operator of a landfill may control the gas by routing it to a non-enclosed flare, an enclosed combustion device, or a treatment system that processes the collected gas for subsequent sale or beneficial use.

Emission Threshold Determination. The EPA is finalizing an alternative site-specific emission threshold methodology for when a landfill must install and operate a GCCS. This alternative methodology, referred to as ''Tier 4,'' is based on surface emission monitoring (SEM) and demonstrates whether or not surface emissions are below a specific threshold. The Tier 4 SEM demonstration allows landfills that exceed the threshold using modeled NMOC emission rates using Tier 1 or 2 to demonstrate that actual site-specific surface methane emissions are below the threshold. A landfill that can demonstrate that surface emissions are below 500 parts per million (ppm) for four consecutive quarters does not trigger the requirement to install a GCCS even if Tier 1, 2, or 3 calculations indicate that the 34 Mg/yr threshold has been exceeded. Landfills that have calculated NMOC emissions of 50 Mg/yr or greater are not eligible for the Tier 4 emission threshold determination in order to prevent conflicting requirements between subpart XXX and the landfills NESHAP (40 CFR part 63, subpart AAAA). Many landfills that are subject to subpart XXX will also be subject to the landfills NESHAP. The landfills NESHAP requires landfills that exceed the size threshold (2.5 million Mg and 2.5 million m^3) and exceed the NMOC emissions threshold (50 Mg/yr) to install and operate a GCCS.

Low LFG Producing Areas. The EPA is also finalizing criteria for determining when it is appropriate to cap or remove all or a portion of the GCCS. The final criteria for capping or removing all or a portion of the GCCS are: (1) The landfill is closed, (2) the GCCS has operated for at least 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows, and (3) the calculated NMOC emission rate at the landfill is less than 34 Mg/yr on three successive test dates.

Landfill Gas Treatment. In the final NSPS, the EPA has addressed two issues related to LFG treatment. First, the EPA is clarifying that the use of treated LFG is not limited to use as a fuel for a stationary combustion device but may be used for other beneficial uses such as vehicle fuel, production of high-British thermal unit (Btu) gas for pipeline injection, or use as a raw material in a chemical manufacturing process. Second, the EPA is finalizing the definition of *treated landfill gas* that applies to LFG processed in a treatment system meeting the requirements in 40 CFR part 60, subpart XXX and defining *treatment system* as a system that filters, de-waters, and compresses LFG for sale or beneficial use. The definition of treatment system allows the level of treatment to be tailored to the type and design of the specific combustion equipment or the other beneficial uses such as vehicle fuel, production of high-Btu gas for pipeline injection, or use as a raw material in a chemical manufacturing process in which the LFG is used. Owners or operators must develop a site-specific treatment system monitoring plan that includes monitoring parameters addressing all three elements of treatment (filtration, de-watering, and compression) to ensure the treatment system is operating properly for the intended end use of the treated LFG. They also must keep records that demonstrate that such parameters effectively monitor filtration, de-watering, and compression system performance necessary for the end use of the treated LFG.

Wellhead Operational Standards. The EPA is finalizing changes to certain operational standards (*i.e.,* the requirement to meet specific operating limits) for nitrogen/oxygen level at the wellheads. Landfill owners or operators are not required to take corrective action based on exceedances of specified operational standards for nitrogen/oxygen levels at wellheads, but they must continue to monitor and maintain records of nitrogen/oxygen levels on a monthly basis in order to inform any necessary adjustments to the GCCS and must maintain records of monthly readings. The operational standard, corrective action, and corresponding recordkeeping and reporting remain for temperature and maintaining negative pressure at the wellhead.

Surface Monitoring. The EPA is finalizing the requirement to monitor all surface penetrations at landfills. In final 40 CFR part 60, subpart XXX, landfills must conduct SEM at all cover penetrations and openings within the area of the landfill where waste has been placed and a gas collection system is required to be in place and operating according to the operational standards in final 40 CFR part 60, subpart XXX. Specifically, landfill owners or operators must conduct surface monitoring on a quarterly basis at the specified intervals and where visual observations indicate elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations.

Startup, Shutdown, and Malfunction. The EPA is finalizing a requirement that standards of performance in the NSPS apply at all times, including periods of startup, shutdown, and malfunction (SSM). The EPA is also finalizing an alternative standard during SSM events: In the event the collection or control system is not operating, the gas mover system must be shut down and all valves in the collection and control system that could contribute to venting of the gas to the atmosphere must be closed within 1 hour of the collection or control system not operating.

Other Clarifications. The EPA is finalizing a number of clarifications to address several issues that have been raised by landfill owners or operators during implementation of the current NSPS and Emission Guidelines. These clarifications include adding criteria for when an affected source must update its design plan and clarifying when landfill owners or operators must submit requests to extend the timeline for taking corrective action. The EPA is also updating several definitions in the NSPS. In addition, while the EPA is not mandating organics diversion, we are finalizing two specific compliance flexibilities in the NSPS to encourage wider adoption of organics diversion and GCCS Best Management Practices (BMPs) for emission reductions at landfills. These compliance flexibilities are discussed in sections VI.A.1 and VI.A.2 (wellhead monitoring) and section V.B and VI.B (Tier 4 emission threshold determination) of this preamble.

C. Costs and Benefits

The final NSPS are expected to significantly reduce emissions of LFG and its components, which include methane, volatile organic compounds (VOC), and hazardous air pollutants (HAP). Landfills are a significant source of methane emissions, and in 2014 landfills represented the third largest source of human-related methane emissions in the U.S. This rulemaking applies to landfills that commence

construction, modification, or reconstruction after July 17, 2014. In the 5 years following July 17, 2014, the EPA estimates that 14 landfills will commence construction and 123 landfills will modify. Note that landfills are not expected to reconstruct (63 FR 32745, June 16, 1998).

To comply with the emissions limits in the final rule, owners or operators of new or modified MSW landfills are expected to install the least-cost control for collecting and treating or combusting LFG. The annualized net cost for the final NSPS is estimated to be $6.0 million (2012$) in 2025, when using a 7 percent discount rate. The annualized costs represent the costs compared to no changes to the current NSPS (*i.e.,* baseline) and include $11 million to install and operate a GCCS, as well as $0.08 million to complete the corresponding testing and monitoring. These control costs are offset by $5.1 million in revenue from electricity sales, which is incorporated into the net control costs for certain landfills that are expected to generate revenue by using the LFG to produce electricity.

Installation of a GCCS to comply with the 34 Mg/yr NMOC emissions threshold at new or modified landfills would achieve reductions of 281 Mg/yr NMOC and 44,300 Mg/yr methane (about 1.1 million metric tons of carbon dioxide equivalent per year ($mtCO_2e$/yr)) beyond the baseline in year 2025. In addition, the final rule is expected to result in the net reduction of 26,000 Mg-CO_2, due to reduced demand by landfills for electricity from the grid as landfills generate electricity from LFG. The NMOC portion of LFG can contain a variety of air pollutants, including VOC and various organic HAP. VOC emissions are precursors to both fine particulate matter ($PM_{2.5}$) and ozone formation. These pollutants, along with methane, are associated with substantial health effects, welfare effects, and climate effects. The EPA expects that the reduced emissions will result in improvements in air quality and lessen the potential for health effects associated with exposure to air pollution related emissions, and result in climate benefits due to reductions of the methane component of LFG.

The EPA estimates that the final rule's estimated methane emission reductions and secondary CO_2 emission reductions in the year 2025 would yield global monetized climate benefits of $31 million to approximately $180 million, depending on the discount rate. Using the mean social cost of methane (SC-CH_4) and social cost of CO_2 (SC-CO_2), at a 3-percent discount rate, results in an estimate of about $68 million in 2025 (2012$).

The SC-CH_4 and SC-CO_2 are the monetary values of impacts associated with marginal changes in methane and CO_2 emissions, respectively, in a given year. Each metric includes a wide range of anticipated climate impacts, such as net changes in agricultural productivity, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning.

With the data available, we are not able to provide quantified health benefit estimates for the reduction in exposure to HAP, ozone, and $PM_{2.5}$ for this rule. This is not to imply that there are no such benefits of the rule; rather, it is a reflection of the difficulties in modeling the direct and indirect impacts of the reductions in emissions for this sector with the data currently available.

Based on the monetized benefits and costs, the annual net benefits of the standards are estimated to be $62 million ($2012) in 2025, based on the average SC-CH_4 at a 3 percent discount rate, average SC-CO_2 at a 3 percent discount rate, and costs at a 7 percent discount rate.

II. General Information

A. Does this action apply to me?

This final rule addresses MSW landfills that are new, reconstructed, or modified after July 17, 2014, and associated solid waste management programs. Potentially affected categories include those listed in Table 1 of this preamble.

TABLE 1—REGULATED ENTITIES

Category	NAICS[a]	Examples of affected facilities
Industry: Air and water resource and solid waste management.	924110	Solid waste landfills
Industry: Refuse systems—solid waste landfills	562212	Solid waste landfills
State, local, and tribal government agencies	924110	Administration of air and water resource and solid waste management programs

[a] North American Industry Classification System.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by the new subpart. To determine whether your facility would be regulated by this action, you should carefully examine the applicability criteria in final 40 CFR 60.760 of subpart XXX. If you have any questions regarding the applicability of the final subpart to a particular entity, contact the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

B. Where can I get a copy of this document and other related information?

In addition to being available in the docket, an electronic copy of this action is available through EPA's Technology Transfer Network (TTN) Web site, a forum for information and technology exchange in various areas of air pollution control. Following signature by the EPA Administrator, the EPA will post a copy of this action at *http://www.epa.gov/ttnatw01/landfill/landflpg.html.* Following publication in the **Federal Register**, the EPA will post the **Federal Register** version of the final rule and key technical documents at this same Web site.

III. Background

On July 17, 2014, the EPA proposed a new NSPS subpart (40 CFR part 60, subpart XXX) based on its ongoing review of the MSW Landfills NSPS (40 CFR part 60, subpart WWW) (79 FR 41796). On August 27, 2015 (80 FR 52162), the EPA issued a supplemental proposal to achieve additional reductions of LFG and its components, including methane, through a lower emission threshold at which MSW landfills must install and operate a GCCS. On August 27, 2015, the EPA issued a concurrent proposal for revised Emission Guidelines for existing MSW Landfills (80 FR 52100). The EPA considered information it received in response to an Advanced Notice of Proposed Rulemaking (ANPRM) for the MSW landfills Emission Guidelines (79 FR 41772) and a Notice of Proposed Rulemaking for existing landfills (80 FR 52100), in addition to the Notice of

Proposed Rulemaking for new landfills (79 FR 41796), in evaluating these final provisions for new sources.

A. Landfill Gas Emissions and Climate Change

In June 2013, President Obama issued a Climate Action Plan that directed federal agencies to focus on "assessing current emissions data, addressing data gaps, identifying technologies and best practices for reducing emissions, and identifying existing authorities and incentive-based opportunities to reduce methane emissions." [4] Methane is a potent greenhouse gas (GHG) that is 28–36 times greater than carbon dioxide (CO_2) and has an atmospheric life of about 12 years.[5] Because of methane's potency as a GHG and its atmospheric life, reducing methane emissions is one of the best ways to achieve near-term beneficial impacts in mitigating global climate change.

The "Climate Action Plan: Strategy to Reduce Methane Emissions" [6] (the Methane Strategy) was released in March 2014. The strategy recognized the methane reductions achieved through the EPA's regulatory and voluntary programs to date. It also directed the EPA to continue to pursue emission reductions through regulatory updates and to encourage LFG energy recovery through voluntary programs.

The EPA recognized the climate benefits associated with reducing methane emissions from landfills nearly 25 years ago. The 1991 NSPS Background Information Document [7] asserted that the reduction of methane emissions from MSW landfills was one of many options available to reduce global warming. The NSPS for MSW landfills, promulgated in 1996, also recognized the climate co-benefits of controlling methane (61 FR 9917, March 12, 1996).

A recent study assessed EPA regulations and voluntary programs over the period 1993–2013 and found that they were responsible for the reduction of about 130 million metric tons of methane emissions (equal to about 18 percent of the total U.S. methane emissions over that time period), leading to a reduction in atmospheric concentrations of methane of about 28 parts per billion in 2013 [8] (compared to an observed increase in methane concentrations of about 80 ppb over those 20 years).

The review and final revision of the MSW landfills NSPS capitalizes on additional opportunities to achieve methane reductions while acknowledging historical agency perspectives and research on climate, a charge from the President's Climate Action Plan, the Methane Strategy, and improvements in the science surrounding GHG emissions.

LFG is a collection of air pollutants, including methane and NMOC. LFG is typically composed of 50-percent methane, 50-percent CO_2, and less than 1-percent NMOC by volume. The NMOC portion of LFG can contain various organic HAP and VOC. When the Emission Guidelines and NSPS were promulgated in 1996, NMOC was selected as a surrogate for MSW LFG emissions because NMOC contains the air pollutants that at that time were of most concern due to their adverse effects on health and welfare. Today, methane's effects on climate change are also considered important. In 2014, methane emissions from MSW landfills represented 18.2 percent of total U.S. methane emissions and 1.9 percent of total U.S. GHG emissions (in carbon dioxide equivalent (CO_2e)).[9] In 2014, MSW landfills continued to be the third largest source of human-related methane emissions in the U.S., releasing an estimated 133.1 million metric tons of CO_2e.[10] For these reasons and because additional emissions reductions can be achieved at a reasonable cost, the EPA is finalizing changes to the NSPS that are based on reducing the NMOC and methane components of LFG.

B. What are the public health and welfare effects of landfill gas emissions?

1. Health Effects of VOC and Various Organic HAP

VOC emissions are precursors to both $PM_{2.5}$ and ozone formation. As documented in previous analyses (U.S. EPA, 2006,[11] 2010,[12] and 2014[13]), exposure to $PM_{2.5}$ and ozone is associated with significant public health effects. $PM_{2.5}$ is associated with health effects, including premature mortality for adults and infants, cardiovascular morbidity such as heart attacks, and respiratory morbidity such as asthma attacks, acute bronchitis, hospital admissions and emergency room visits, work loss days, restricted activity days and respiratory symptoms, as well as welfare impacts such as visibility impairment.[14] Ozone is associated with health effects, including hospital and emergency department visits, school loss days and premature mortality, as well as ecological effects (*e.g.*, injury to vegetation and climate change).[15] Nearly 30 organic HAP have been identified in uncontrolled LFG, including benzene, toluene, ethyl benzene, and vinyl chloride.[16] Benzene is a known human carcinogen.

[4] Executive Office of the President, "The President's Climate Action Plan" June 2013. *https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.*

[5] The IPCC updates GWP estimates with each new assessment report, and in the latest assessment report, AR5, the latest estimate of the methane GWP ranged from 28–36, compared to a GWP of 25 in AR4. The impacts analysis in this final rule is based on AR4 instead of AR5 (*i.e.*, a GWP of 25) to be consistent with and comparable to key Agency emission quantification programs such as the Inventory of Greenhouse Gas Emissions and Sinks (GHG Inventory), and the GHGRP.

[6] Executive Office of the President, "Climate Action Plan Strategy to Reduce Methane", March 2014. *https://www.whitehouse.gov/sites/default/files/strategy_to_reduce_methane_emissions_2014-03-28_final.pdf.*

[7] Air Emissions from Municipal Solid Waste Landfills-Background Information for Proposed Standards and Guidelines, U.S. EPA (EPA–450/3–90–011a) (NTIS PB 91–197061) page 2–15.

[8] Melvin, A.M.; Sarofim, M.C.; Crimmins, A.R., "Climate benefits of U.S. EPA programs and policies that reduced methane emissions 1993–2013", Environmental Science & Technology, 2016, in press. *http://pubs.acs.org/doi/pdf/10.1021/acs.est.6b00367.* DOI 10.1021/acs.est.6b00367.

[9] Total U.S. methane emissions were 731 Teragram (Tg) CO_2e and total U.S. GHG emissions were 6,870.5 Tg in 2014. A teragram is equal to 1 million Mg. (A megagram is also known as a metric ton, which is equal to 1.1 U.S. short tons or about 2,205 pounds.) U.S. EPA "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014." Table ES–2. Available at *http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html.*

[10] Ibid, Section 7. Waste, Table 7–3.

[11] U.S. EPA. *RIA. National Ambient Air Quality Standards for Particulate Matter,* Chapter 5. Office of Air Quality Planning and Standards, Research Triangle Park, NC. October 2006. Available on the Internet at *http://www.epa.gov/ttn/ecas/regdata/RIAs/Chapter%205--Benefits.pdf.*

[12] U.S. EPA. *RIA. National Ambient Air Quality Standards for Ozone.* Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2010. Available on the Internet at *http://www.epa.gov/ttn/ecas/regdata/RIAs/s1-supplemental_analysis_full.pdf.*

[13] U.S. EPA. *RIA. National Ambient Air Quality Standards for Ozone.* Office of Air Quality Planning and Standards, Research Triangle Park, NC. December 2014. Available on the Internet at *http://www.epa.gov/ttnecas1/regdata/RIAs/20141125ria.pdf.*

[14] U.S. EPA. Integrated Science Assessment for Particulate Matter (Final Report). EPA–600–R–08–139F. National Center for Environmental Assessment—RTP Division. December 2009. Available at *http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546.*

[15] U.S. EPA. Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). EPA/600/R–05/004aF–cF. Washington, DC: U.S. EPA. February 2006. Available on the Internet at *http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=149923.*

[16] U.S. EPA. 1998. Office of Air and Radiation, Office of Air Quality Planning and Standards. "Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 2: Solid Waste Disposal, Section 2.4: Municipal Solid Waste Landfills". Available at: *http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s04.pdf.*

2. Climate Impacts of Methane Emissions

In addition to the improvements in air quality and resulting benefits to human health and the non-climate welfare effects discussed above, reducing emissions from landfills is expected to result in climate co-benefits due to reductions of the methane component of LFG. Methane is a potent GHG with a global warming potential (GWP) 28–36 times greater than CO_2, which accounts for methane's stronger absorption of infrared radiation per ton in the atmosphere, but also its shorter lifetime (on the order of 12 years compared to centuries or millennia for CO_2).[17 18] According to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report, methane is the second leading long-lived climate forcer after CO_2 globally.[19]

In 2009, based on a large body of robust and compelling scientific evidence, the EPA Administrator issued an Endangerment Finding under CAA section 202(a)(1).[20] In the Endangerment Finding, the Administrator found that the current, elevated concentrations of GHGs in the atmosphere—already at levels unprecedented in human history—may reasonably be anticipated to endanger public health and welfare of current and future generations in the U.S. We summarize these adverse effects on public health and welfare briefly here.

3. Public Health Impacts Detailed in the 2009 Endangerment Finding

The 2009 Endangerment Finding documented that climate change caused by human emissions of GHGs threatens the health of Americans. By raising average temperatures, climate change increases the likelihood of heat waves, which are associated with increased deaths and illnesses. While climate change also increases the likelihood of reductions in cold-related mortality, evidence indicates that the increases in heat mortality will be larger than the decreases in cold mortality in the United States. Compared to a future without climate change, climate change is expected to increase ozone pollution over broad areas of the U.S., including in the largest metropolitan areas with the worst ozone problems, and thereby increase the risk of morbidity and mortality. Climate change is also expected to cause more intense hurricanes and more frequent and intense storms of other types and heavy precipitation, with impacts on other areas of public health, such as the potential for increased deaths, injuries, infectious and waterborne diseases, and stress-related disorders. Children, the elderly, and the poor are among the most vulnerable to these climate-related health effects.

4. Public Welfare Impacts Detailed in the 2009 Endangerment Finding

The 2009 Endangerment Finding documented that climate change impacts touch nearly every aspect of public welfare. Among the multiple threats caused by human emissions of GHGs, climate changes are expected to place large areas of the country at serious risk of reduced water supplies, increased water pollution, and increased occurrence of extreme events such as floods and droughts. Coastal areas are expected to face a multitude of increased risks, particularly from rising sea level and increases in the severity of storms. These communities face storm and flooding damage to property, or even loss of land due to inundation, erosion, wetland submergence and habitat loss.

Impacts of climate change on public welfare also include threats to social and ecosystem services. Climate change is expected to result in an increase in peak electricity demand. Extreme weather from climate change threatens energy, transportation, and water resource infrastructure. Climate change may also exacerbate ongoing environmental pressures in certain settlements, particularly in Alaskan indigenous communities, and is very likely to fundamentally rearrange U.S. ecosystems over the 21st century. Though some benefits may balance adverse effects on agriculture and forestry in the next few decades, the body of evidence points towards increasing risks of net adverse impacts on U.S. food production, agriculture and forest productivity as temperature continues to rise. These impacts are global and may exacerbate problems outside the U.S. that raise humanitarian, trade, and national security issues for the U.S.

5. New Scientific Assessments

In 2009, based on a large body of robust and compelling scientific evidence, the EPA Administrator issued the Endangerment Finding under CAA section 202(a)(1).[21] In the Endangerment Finding, the Administrator found that the current, elevated concentrations of GHGs in the atmosphere—already at levels unprecedented in human history—may reasonably be anticipated to endanger public health and welfare of current and future generations in the U.S. The D.C. Circuit later upheld the Endangerment Finding from all challenges. *Coalition for Responsible Regulation* v. *EPA,* 684 F. 3d 102, 116–26 (D.C. Cir. 2012).

Since the administrative record concerning the Endangerment Finding closed following the EPA's 2010 Reconsideration Denial, the climate has continued to change, with new records being set for a number of climate indicators such as global average surface temperatures, Arctic sea ice retreat, CO_2 concentrations, and sea level rise. Additionally, a number of major scientific assessments have been released that improve understanding of the climate system and strengthen the case that GHGs endanger public health and welfare both for current and future generations. These assessments, from the Intergovernmental Panel on Climate Change (IPCC), the U.S. Global Change Research Program (USGCRP), and the National Research Council (NRC), include: IPCC's 2012 Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) and the 2013–2014 Fifth Assessment Report (AR5), the USGCRP's 2014 National Climate Assessment, Climate Change Impacts in the United States (NCA3), and the NRC's 2010 Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean (Ocean Acidification), 2011 Report on Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia (Climate Stabilization Targets), 2011 National Security Implications for U.S. Naval Forces (National Security Implications), 2011 Understanding Earth's Deep Past: Lessons for Our Climate Future

[17] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[18] Note that this final uses a GWP value for methane of 25 for CO_2 equivalency calculations, consistent with the GHG emissions inventories and the IPCC Fourth Assessment Report.

[19] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[20] "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 FR 66496 (Dec. 15, 2009) ("Endangerment Finding").

[21] "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 FR 66496 (Dec. 15, 2009) ("Endangerment Finding").

(Understanding Earth's Deep Past), 2012 Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, 2012 Climate and Social Stress: Implications for Security Analysis (Climate and Social Stress), and 2013 Abrupt Impacts of Climate Change (Abrupt Impacts) assessments.

The conclusions of the recent scientific assessments confirm and strengthen the science that supported the 2009 Endangerment Finding. The NCA3 indicates that climate change "threatens human health and well-being in many ways, including impacts from increased extreme weather events, wildfire, decreased air quality, threats to mental health, and illnesses transmitted by food, water, and disease-carriers such as mosquitoes and ticks." [22] Most recently, the USGCRP released a new assessment, "The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment" (also known as the USGCRP Climate and Health Assessment). This assessment finds that "climate change impacts endanger our health" and that in the United States we have "observed climate-related increases in our exposure to elevated temperatures; more frequent, severe, or longer lasting extreme events; diseases transmitted through food, water, or disease vectors such as ticks and mosquitoes; and stresses to mental health and well-being." The assessment determines that "[e]very American is vulnerable to the health impacts associated with climate change." Climate warming will also likely "make it harder for any given regulatory approach to reduce ground-level ozone pollution", and, unless offset by reductions of ozone precursors, it is likely that "climate-driven increases in ozone will cause premature deaths, hospital visits, lost school days, and acute respiratory symptoms." [23]

Assessments state that certain populations are particularly vulnerable to climate change. The USGCRP Climate and Health Assessment assesses several disproportionately vulnerable populations, including those with low income, some communities of color, immigrant groups, indigenous peoples, pregnant women, vulnerable occupational groups, persons with disabilities, and persons with preexisting or chronic medical conditions. The Climate and Health Assessment also concludes that children's unique physiology and developing bodies contribute to making them particularly vulnerable to climate change. Children also have unique behaviors and exposure pathways that could increase their exposure to environmental stressors, like contaminants in dust or extreme heat events. Impacts from climate change on children are likely from heat waves, air pollution, infectious and waterborne illnesses, disruptions in food safety and security, and mental health effects resulting from extreme weather events. For example, climate change can disrupt food safety and security by significantly reducing food quality, availability and access. Children are more susceptible to this disruption because nutrition is important during critical windows of development and growth. Older people are at much higher risk of mortality during extreme heat events and pre-existing health conditions also make older adults susceptible to cardiac and respiratory impacts of air pollution and to more severe consequences from infectious and waterborne diseases. Limited mobility among older adults can also increase health risks associated with extreme weather and floods.

The new assessments also confirm and strengthen the science that supported the 2009 Endangerment Finding. The NRC assessment Understanding Earth's Deep Past stated that "[b]y the end of this century, without a reduction in emissions, atmospheric CO_2 is projected to increase to levels that Earth has not experienced for more than 30 million years." In fact, that assessment stated that "the magnitude and rate of the present GHG increase place the climate system in what could be one of the most severe increases in radiative forcing of the global climate system in Earth history." [24] Because of these unprecedented changes in atmospheric concentrations, several assessments state that we may be approaching critical, poorly understood thresholds. The NRC Abrupt Impacts report analyzed the potential for abrupt climate change in the physical climate system and abrupt impacts of ongoing changes that, when thresholds are crossed, could cause abrupt impacts for society and ecosystems. The report considered destabilization of the West Antarctic Ice Sheet (which could cause 3–4 m of potential sea level rise) as an abrupt climate impact with unknown but probably low probability of occurring this century. The report categorized a decrease in ocean oxygen content (with attendant threats to aerobic marine life); increase in intensity, frequency, and duration of heat waves; and increase in frequency and intensity of extreme precipitation events (droughts, floods, hurricanes, and major storms) as climate impacts with moderate risk of an abrupt change within this century. The NRC Abrupt Impacts report also analyzed the threat of rapid state changes in ecosystems and species extinctions as examples of an irreversible impact that is expected to be exacerbated by climate change. Species at most risk include those whose migration potential is limited, whether because they live on mountaintops or fragmented habitats with barriers to movement, or because climatic conditions are changing more rapidly than the species can move or adapt. While some of these abrupt impacts may be of low or moderate probability in this century, the probability for a significant change in many of these processes after 2100 was judged to be higher, with severe impacts likely should the abrupt change occur. Future temperature changes will be influenced by what emissions path the world follows. In its high emission scenario, the IPCC AR5 projects that global temperatures by the end of the century will likely be 2.6 °C to 4.8 °C (4.7 to 8.6 °F) warmer than today. There is very high confidence that temperatures on land and in the Arctic will warm even faster than the global average. However, according to the NCA3, significant reductions in emissions would lead to noticeably less future warming beyond mid-century, and therefore less impact to public health and welfare. According to the NCA3, regions closer to the poles are projected to receive more precipitation, while the dry subtropics expand (colloquially, this has been summarized as wet areas getting wet and dry regions getting drier), while "[t]he widespread trend of increasing heavy downpours is expected to continue, with precipitation becoming less frequent but more intense." Meanwhile, the NRC Climate Stabilization Targets assessment found that the area burned by wildfire in parts of western North America is expected to grow by 2 to 4 times for 1 °C (1.8 °F) of warming. The NCA also found that "[e]xtrapolation of the present observed trend suggests an essentially ice-free Arctic in summer before mid-century." Retreating snow and ice, and emissions of carbon dioxide and methane released from thawing permafrost, are very likely to amplify future warming.

Since the 2009 Endangerment Finding, the IPCC AR5, the USGCRP

[22] USGCRP, Third National Climate Assessment, p. 221.

[23] See also Kleeman, M.J., S.-H. Chen, and R.A. Harley. 2010. Climate change impact on air quality in California: Report to the California Air Resources Board. *http://www.arb.ca.gov/research/apr/past/04-349.pdf.*

[24] National Research Council, Understanding Earth's Deep Past, p. 138.

NCA3, and three of the new NRC assessments provide estimates of projected global average sea level rise. These estimates, while not always directly comparable as they assume different emissions scenarios and baselines, are at least 40 percent larger than, and in some cases more than twice as large as, the projected rise estimated in the IPCC AR4 assessment, which was referred to in the 2009 Endangerment Finding. The NRC Sea Level Rise assessment projects a global average sea level rise of 0.5 to 1.4 meters by 2100. The NRC National Security Implications assessment suggests that "the Department of the Navy should expect roughly 0.4 to 2 meters global average sea-level rise by 2100." The NRC Climate Stabilization Targets assessment states that a global average temperature increase of 3 °C will lead to a global average sea level rise of 0.5 to 1 meter by 2100. These NRC and IPCC assessments continue to recognize and characterize the uncertainty inherent in accounting for melting ice sheets in sea level rise projections.

In addition to future impacts, the NCA3 emphasizes that climate change driven by human emissions of GHGs is already happening now and it is happening in the U.S. According to the IPCC AR5 and the NCA3, there are a number of climate-related changes that have been observed recently, and these changes are projected to accelerate in the future:

- The planet warmed about 0.85 °C (1.5 °F) from 1880 to 2012. It is extremely likely (>95 percent probability) that human influence was the dominant cause of the observed warming since the mid-20th century, and likely (>66 percent probability) that human influence has more than doubled the probability of occurrence of heat waves in some locations. In the Northern Hemisphere, the last 30 years were likely the warmest 30 year period of the last 1400 years.
- Global sea levels rose 0.19 m (7.5 inches) from 1901 to 2010. Contributing to this rise was the warming of the oceans and melting of land ice. It is likely that 275 gigatons per year of ice melted from land glaciers (not including ice sheets) since 1993, and that the rate of loss of ice from the Greenland and Antarctic ice sheets increased substantially in recent years, to 215 gigatons per year and 147 gigatons per year respectively since 2002. For context, 360 gigatons of ice melt is sufficient to cause global sea levels to rise 1 mm.
- Annual mean Arctic sea ice has been declining at 3.5 to 4.1 percent per decade, and Northern Hemisphere snow cover extent has decreased at about 1.6 percent per decade for March and 11.7 percent per decade for June.
- Permafrost temperatures have increased in most regions since the 1980s, by up to 3 °C (5.4 °F) in parts of Northern Alaska.
- Winter storm frequency and intensity have both increased in the Northern Hemisphere. The NCA3 states that the increases in the severity or frequency of some types of extreme weather and climate events in recent decades can affect energy production and delivery, causing supply disruptions, and compromise other essential infrastructure such as water and transportation systems.

In addition to the changes documented in the assessment literature, there have been other climate milestones of note. According to the National Oceanic and Atmospheric Administration (NOAA), methane concentrations in 2014 were about 1,823 parts per billion, 150 percent higher than concentrations were in 1750. After a few years of nearly stable concentrations from 1999 to 2006, methane concentrations have resumed increasing at about 5 parts per billion per year.[25] Concentrations today are likely higher than they have been for at least the past 800,000 years.[26] Arctic sea ice has continued to decline, with September of 2012 marking the record low in terms of Arctic sea ice extent, 40 percent below the 1979–2000 median. Sea level has continued to rise at a rate of 3.2 mm per year (1.3 inches/decade) since satellite observations started in 1993, more than twice the average rate of rise in the 20th century prior to 1993.[27] And 2015 was the warmest year globally in the modern global surface temperature record, going back to 1880, breaking the record previously held by 2014; this now means that the last 15 years have been 15 of the 16 warmest years on record.[28]

These assessments and observed changes raise concerns that reducing emissions of GHGs across the globe is necessary in order to avoid the worst impacts of climate change, and underscore the urgency of reducing emissions now. In 2011 the NRC Committee on America's Climate Choices listed a number of reasons "why it is imprudent to delay actions that at least begin the process of substantially reducing emissions."[29] For example, they stated:

- The faster emissions are reduced, the lower the risks posed by climate change. Delays in reducing emissions could commit the planet to a wide range of adverse impacts, especially if the sensitivity of the climate to GHGs is on the higher end of the estimated range.
- Waiting for unacceptable impacts to occur before taking action is imprudent because the effects of GHG emissions do not fully manifest themselves for decades and, once manifested, many of these changes will persist for hundreds or even thousands of years.
- In the committee's judgment, the risks associated with doing business as usual are a much greater concern than the risks associated with engaging in strong response efforts.

Overview of Climate Change Impacts in the United States

The NCA3 assessed the climate impacts in eight regions of the U.S., noting that changes in physical climate parameters such as temperatures, precipitation, and sea ice retreat were already having impacts on forests, water supplies, ecosystems, flooding, heat waves, and air quality. The U.S. average temperatures have similarly increased by 1.3 to 1.9 degrees F since 1895, with most of that increase occurring since 1970, and the most recent decade was the U.S.'s hottest as well as the world's hottest. Moreover, the NCA3 found that future warming is projected to be much larger than recent observed variations in temperature, with 2 to 4 degrees F warming expected in most areas of the U.S. over the next few decades, and up to 10 degrees F possible by the end of the century assuming continued increases in emissions. Extreme heat events will continue to become more common, and extreme cold less common. Additionally, precipitation is considered likely to increase in the northern states, decrease in the southern states, and with the heaviest precipitation events projected to increase everywhere.

In the Northeast, temperatures increased almost 2 °F from 1895 to 2011, precipitation increased by about 5 inches (10 percent), and sea level rise of about a foot has led to an increase in coastal flooding. In the future, if emissions continue to increase, the Northeast is projected to experience 4.5 to 10 °F of warming by the 2080s. This is expected to lead to more heat waves, coastal and river flooding, and intense precipitation events. Sea levels in the Northeast are expected to increase faster than the global average because of subsidence, and models suggest changing ocean currents may further increase the rate of sea level rise.

In the Southeast, average annual temperature during the last century cycled between warm and cool periods. A warm peak occurred during the 1930s

[25] Ed Dlugokencky, NOAA/ESRL (*www.esrl.noaa.gov/gmd/ccgg/trends_ch4/*).

[26] U.S. Environmental Protection Agency. 2014. Climate change indicators in the United States,2014. Third edition. EPA 430–R–14–004. *www.epa.gov/climatechange/indicators.*

[27] Blunden, J., and D.S. Arndt, Eds., 2015: State of the Climate in 2014. Bull. Amer. Meteor. Soc., 96 (7), S1–S267.

[28] *http://www.ncdc.noaa.gov/sotc/global/201513.*

[29] NRC, 2011: America's Climate Choices, The National Academies Press, p. 2.

and 1940s followed by a cool period and temperatures then increased again from 1970 to the present by an average of 2 °F. Louisiana has already lost 1,880 square miles of land in the last 80 years due to sea level rise and other contributing factors. The Southeast is exceptionally vulnerable to sea level rise, extreme heat events, hurricanes, and decreased water availability. Major risks of further warming include significant increases in the number of hot days (95 °F or above) and decreases in freezing events, as well as exacerbated ground level ozone in urban areas. Projections suggest that there may be fewer hurricanes in the Atlantic in the future, but they will be more intense, with more Category 4 and 5 storms. The NCA identified New Orleans, Miami, Tampa, Charleston, and Virginia Beach as cities at particular risk of flooding.

In the Northwest, temperatures increased by about 1.3 °F between 1895 and 2011. Snowpack in the Northwest is an important freshwater source for the region. More precipitation falling as rain instead of snow has reduced the snowpack, and warmer springs have corresponded to earlier snowpack melting and reduced stream flows during summer months. Drier conditions have increased the extent of wildfires in the region. Average annual temperatures are projected to increase by 3.3 °F to 9.7 °F by the end of the century (depending on future global GHG emissions), with the greatest warming is expected during the summer. Continued increases in global GHG emissions are projected to result in up to a 30 percent decrease in summer precipitation. Warmer waters are expected to increase disease and mortality in important fish species, including Chinook and sockeye salmon.

In Alaska, temperatures have changed faster than anywhere else in the U.S. Annual temperatures increased by about 3 °F in the past 60 years. Warming in the winter has been even greater, rising by an average of 6 °F. Glaciers in Alaska are melting at some of the fastest rates on Earth. Permafrost soils are also warming and beginning to thaw. Drier conditions had already contributed to more large wildfires in the 10 years prior to the NCA3 than in any previous decade since the 1940s, when recordkeeping began, and subsequent years have seen even more wildfires. By the end of this century, continued increases in GHG emissions are expected to increase temperatures by 10 to 12 °F in the northernmost parts of Alaska, by 8 to 10 °F in the interior, and by 6 to 8 °F across the rest of the state. These increases will exacerbate ongoing arctic sea ice loss, glacial melt, permafrost thaw and increased wildfire, and threaten humans, ecosystems, and infrastructure.

In the Southwest, temperatures are now about 2 °F higher than the past century, and are already the warmest that region has experienced in at least 600 years. The NCA notes that there is evidence that climate-change induced warming on top of recent drought has influenced tree mortality, wildfire frequency and area, and forest insect outbreaks. At the time of publication of the NCA, even before the last 2 years of extreme drought in California, tree ring data was already indicating that the region might be experiencing its driest period in 800 years. The Southwest is projected to warm an additional 5.5 to 9.5 °F over the next century if emissions continue to increase. Winter snowpack in the Southwest is projected to decline (consistent with recent record lows), reducing the reliability of surface water supplies for cities, agriculture, cooling for power plants, and ecosystems. Sea level rise along the California coast is projected to worsen coastal erosion, increase flooding risk for coastal highways, bridges, and low-lying airports, and pose a threat to groundwater supplies in coastal cities. Also, ''[t]he combination of a longer frost-free season, less frequent cold air outbreaks, and more frequent heat waves accelerates crop ripening and maturity, reduces yields of corn, tree fruit, and wine grapes, stresses livestock, and increases agricultural water consumption.'' Increased drought, higher temperatures, and bark beetle outbreaks are likely to contribute to continued increases in wildfires.

The rate of warming in the Midwest has markedly accelerated over the past few decades. Temperatures rose by more than 1.5 °F from 1900 to 2010, but between 1980 and 2010 the rate of warming was three times faster than from 1900 through 2010. Precipitation generally increased over the last century, with much of the increase driven by intensification of the heaviest rainfalls. Several types of extreme weather events in the Midwest (*e.g.*, heat waves and flooding) have already increased in frequency and/or intensity due to climate change. In the future, if emissions continue increasing, the Midwest is expected to experience 5.6 to 8.5 °F of warming by the 2080s, leading to more heat waves. Specific vulnerabilities highlighted by the NCA include long-term decreases in agricultural productivity, changes in the composition of the region's forests, increased public health threats from heat waves and degraded air and water quality, negative impacts on transportation and other infrastructure associated with extreme rainfall events and flooding, and risks to the Great Lakes including shifts in invasive species, increases in harmful algal blooms, and declining beach health.

High temperatures (more than 100 °F in the Southern Plains and more than 95 °F in the Northern Plains) are projected to occur much more frequently by mid-century. Increases in extreme heat will increase heat stress for residents, energy demand for air conditioning, and water losses. In Hawaii, other Pacific islands, and the Caribbean, rising air and ocean temperatures, shifting rainfall patterns, changing frequencies and intensities of storms and drought, decreasing base flow in streams, rising sea levels, and changing ocean chemistry will affect ecosystems on land and in the oceans, as well as local communities, livelihoods, and cultures. Low islands are particularly at risk.

In Hawaii and the Pacific islands, ''[w]armer oceans are leading to increased coral bleaching events and disease outbreaks in coral reefs, as well as changed distribution patterns of tuna fisheries. Ocean acidification will reduce coral growth and health. Warming and acidification, combined with existing stresses, will strongly affect coral reef fish communities.'' For Hawaii and the Pacific islands, future sea surface temperatures are projected to increase 2.3 °F by 2055 and 4.7 °F by 2090 under a scenario that assumes continued increases in emissions.

Methane Specific Impacts. Methane is also a precursor to ground-level ozone, which can cause a number of harmful effects on public health and the environment. Additionally, ozone is a short-lived climate forcer that contributes to global warming. In remote areas, methane is an important precursor to tropospheric ozone formation.[30] Almost half of the global annual mean ozone increase since preindustrial times is believed to be due to anthropogenic methane.[31] Projections of future emissions also indicate that methane is likely to be a key contributor to ozone concentrations in the future.[32] Unlike nitrogen oxide (NO_X) and VOC, which affect ozone concentrations regionally and at hourly time scales, methane emissions affect ozone concentrations globally and on decadal

[30] U.S. EPA. 2013. ''Integrated Science Assessment for Ozone and Related Photochemical Oxidants (Final Report).'' EPA–600–R–10–076F. National Center for Environmental Assessment—RTP Division. Available at *http://www.epa.gov/ncea/isa/*.

[31] *Ibid.*

[32] *Ibid.*

time scales given methane's relatively long atmospheric lifetime compared to these other ozone precursors.[33] Reducing methane emissions, therefore, may contribute to efforts to reduce global background ozone concentrations that contribute to the incidence of ozone-related health effects.[34 35 36] These benefits are global and occur in both urban and rural areas.

C. What is the EPA's authority for reviewing the NSPS?

Section 111 of the Clean Air Act (CAA) requires the EPA Administrator to list categories of stationary sources that in the Administrator's judgment cause or contribute significantly to air pollution that may reasonably be anticipated to endanger public health or welfare. 42 U.S.C. 7411(b)(1)(A). The EPA must then issue performance standards for new (and modified or reconstructed) sources in each source category. 42 U.S.C. 7411(b)(1)(B). These standards are referred to as new source performance standards or NSPS. The EPA has the authority to define the scope of the source categories, determine the pollutants for which standards should be developed, set the emission level of the standards, and distinguish among classes, type and sizes within categories in establishing the standards. 42 U.S.C. 7411(b).

On March 12, 1996 (61 FR 9905), under the authority of CAA section 111(b)(1)(A), the EPA added the MSW landfills source category to the priority list in 40 CFR 60.16 because, in the judgment of the Administrator, the source category contributes significantly to air pollution that may reasonably be anticipated to endanger public health and welfare. In that same notice, the EPA promulgated new source performance standards, which apply to new (and modified or reconstructed) landfills under the authority of CAA section 111(b)(1)(B), and emission guidelines, which apply to existing landfills, under the authority of CAA section 111(d). In the March 12, 1996 notice, the EPA defined the MSW landfills source category, identified municipal solid waste landfill emissions (commonly referred to as landfill gas) as the pollutant for which standards should be developed, identified which landfills would be covered, and determined the applicability threshold and emission level of the standards.

CAA section 111(a)(1) (42 U.S.C. 7411(a)(1)) provides that standards of performance are to "reflect the degree of emission limitation achievable through the application of the best system of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." We refer to this level of control as the best system of emission reduction or BSER. When promulgated in 1996, BSER for MSW landfills was determined to be a well-designed and well-operated LFG collection and control system with a control device capable of reducing NMOC by 98 percent by weight. NMOC was established as a surrogate for LFG in the final rule.

The CAA also requires the EPA to review the NSPS at least every 8 years to determine if the level of control that was previously established remains appropriate. Specifically, CAA section 111(b)(1)(B) (42 U.S.C. 7411(b)(1)(B)) requires the EPA to "at least every 8 years review and, if appropriate, revise" standards of performance. The Administrator need not review a standard, however, if the "Administrator determines that such review is not appropriate in light of readily available information on the efficacy" of the standard. While not required to do so, the EPA has authority to revise an NSPS to add emission limits for pollutants or emission sources not currently concurrent with its review of the NSPS (77 FR 49494, August 16, 2012).

In determining BSER, we typically conduct a review that identifies what emission reduction systems exist and how much they reduce air pollution in practice. Next, for each control system identified, we evaluate its costs, energy requirements, and any nonair quality health and environmental impacts. Based on our evaluation, we determine BSER for each pollutant to be regulated and establish an appropriate standard of performance based on the identified BSER. The resultant standard is usually expressed either as a numerical emissions limit, *e.g.*, ppm or pounds per million British thermal unit (lb/MMBtu), or a percent reduction requirement. Although the standards are based on the identified BSER, the EPA may not require the use of a particular technology to comply with a performance standard unless the Administrator determines that it is not feasible to prescribe or enforce a standard of performance. (CAA 111(b)(5), 42 U.S.C. 7411(b)(5).) Thus, except in rare circumstances, sources remain free to select any control measures that will meet the requirements of the standard(s). Upon promulgation, an NSPS becomes a national standard with which all new, reconstructed, and modified sources must comply. (CAA 111(e), 42 U.S.C. 7411(e).)

D. What is the purpose and scope of this action?

The purpose of this action is to (1) Present the results of the EPA's review of the MSW landfills NSPS, (2) finalize revisions to the NSPS based on that review, and (3) resolve or clarify several implementation issues that were addressed in prior proposed amendments published on May 23, 2002 (67 FR 36475) and September 8, 2006 (71 FR 53271) as they apply to new, modified, or reconstructed sources. The final revisions appear in 40 CFR part 60, subpart XXX.[37] Although the EPA is not required to respond to comments received on the July 17, 2014, ANPRM (79 FR 41772) for the MSW landfills Emission Guidelines or comments it received on the concurrent proposal for revised Emission Guidelines for existing MSW landfills, in this document, the EPA is summarizing several comments it received to provide a framework and support the rationale for the final revisions to the NSPS.

E. How would the changes in applicability affect sources currently subject to subparts Cc and WWW?

Landfills currently subject to 40 CFR part 60, subparts Cc and WWW are considered "existing" with the promulgation of this new NSPS subpart XXX and are not affected by any changes to the NSPS resulting from this review. Each MSW landfill for which construction, modification, or reconstruction commenced on or before July 17, 2014, the date of proposal of the standard for new landfill under subpart XXX, is an existing source. Under section 111, a source is either new, *i.e.*, construction, modification, or reconstruction commenced after a proposed NSPS is published in the **Federal Register** (CAA section 111(a)(1))

[33] *Ibid.*

[34] West, J.J., Fiore, A.M. 2005. "Management of tropospheric ozone by reducing methane emissions." *Environ. Sci. Technol.* 39:4685–4691.

[35] Anenberg, S.C., et al. 2009. "Intercontinental impacts of ozone pollution on human mortality," *Environ. Sci. & Technol.* 43: 6482–6487.

[36] Sarofim, M.C., Waldhoff, S.T., Anenberg, S.C. 2015. "Valuing the Ozone-Related Health Benefits of Methane Emission Controls," Environ. Resource Econ. DOI 10.1007/s10640–015–9937–6.

[37] Rather than merely updating 40 CFR part 60, subpart WWW, the existing NSPS, the EPA has determined that the most appropriate way to proceed is to establish a new subpart that includes both the verbatim restatement of certain provisions in the existing NSPS and revisions to, or the addition of, other provisions.

or existing, *i.e.,* any source other than a new source (CAA section 111(a)(6)). Since the revised NSPS apply to new (and modified or reconstructed) sources, any source that is not subject to subpart XXX will be subject to the revised Emission Guidelines found in 40 CFR part 60, subpart Cf. Any existing MSW landfill that modifies or reconstructs after July 17, 2014 would become a new source subject to the NSPS subpart XXX.

IV. Summary of the Final NSPS

A. What are the control requirements?

1. Design Capacity and Emissions Thresholds

The revised NSPS retain the current design capacity threshold of 2.5 million Mg and 2.5 million m^3, but reduce the NMOC emission threshold for the installation and removal of a GCCS from 50 Mg/yr to 34 Mg/yr for landfills that commence construction, reconstruction, or modification after July 17, 2014. An MSW landfill that exceeds the design capacity threshold must install and start up a GCCS within 30 months after LFG emissions reach or exceed an NMOC level of 34 Mg/yr NMOC. The owner or operator of a landfill may control the gas by routing it to a non-enclosed flare, an enclosed combustion device, or a treatment system that processes the collected gas for subsequent sale or beneficial use.

2. Tier 4

The current NSPS (40 CFR part 60, subpart WWW) provides that owners or operators determine whether the landfill has exceeded the NMOC emissions threshold using one of three available modeling approaches, known as Tiers 1, 2 and 3. The EPA is finalizing in subpart XXX an additional optional methodology based on site-specific surface methane emissions to determine when a landfill must install and operate a GCCS. This alternative emission threshold methodology, referred to as ''Tier 4,'' is based on SEM and demonstrates that surface methane emissions are below a specific threshold. The Tier 4 SEM demonstration allows certain landfills that exceed modeled NMOC emission rate thresholds using Tier 1 or 2 to demonstrate that site-specific surface methane emissions are below a surface concentration threshold. A landfill that can demonstrate that surface emissions are below 500 ppm for four consecutive quarters does not trigger the requirement to install a GCCS even if Tier 1, 2, or 3 calculations indicate that the 34 Mg/yr threshold has been exceeded. Owners or operators continue to keep detailed records of each quarterly monitoring demonstration and must submit a Tier 4 surface emissions report annually. Upon a surface emissions reading of greater than 500 ppm methane, the landfill must submit a GCCS design plan and install and operate a GCCS.

Tier 4 is based on the results of quarterly site-specific methane emissions monitoring of the perimeter of the landfill and entire surface of the landfill along a pattern that traverses the landfill at 30-meter (98-ft) intervals, in addition to monitoring areas where visual observations may indicate elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations. If the landfill opts to use Tier 4 and there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill, the owner or operator must install a GCCS, and the landfill cannot return to Tier 1, 2, or 3 modeling to demonstrate that emissions are below the NMOC threshold.

Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr, but less than 50 Mg/yr using Tier 1 or Tier 2. If both Tier 1 and Tier 2 indicate NMOC emissions of 50 Mg/yr or greater, Tier 4 cannot be used (a landfill need not model emissions under Tier 3 before using Tier 4). In order to verify that the landfill is eligible for Tier 4, the EPA is finalizing a provision to require landfill owners or operators that choose to use Tier 4 to continue to conduct Tier 1 and Tier 2 NMOC emission rate calculations and report results in the annual report.

In addition, the EPA is finalizing specific requirements for the use of Tier 4 for emission threshold determinations related to wind speed. Since accurate measurements can be compromised in even moderately windy conditions, the EPA is requiring the owner or operator to use a wind barrier, similar to a funnel or other device, to minimize surface air turbulence when onsite wind speed exceeds the limits in the rule. Thus, when a wind barrier is used, the final rule allows the Tier 4 surface emissions demonstration to proceed when the average on-site wind speed exceeds 4 mph, or gusts exceed 10 mph. Tier 4 measurements cannot be conducted if the average wind speed exceeds 25 mph. Although we are aware of the use of wind barriers in the field, the EPA intends to provide additional guidance on their use. In addition, the owner or operator must take digital photographs of the instrument setup, including the wind barrier. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration. The owner or operator must maintain those photographs per the recordkeeping requirements. Wind speed must be measured with an on-site anemometer with a continuous recorder and data logger for the entire duration of the monitoring event. The average wind speed must be determined at 5-minute intervals. The gust must be determined at 3-second intervals. Further, when taking surface measurements, the sampling probe must be held no more than 5 centimeters above the landfill surface (*e.g.,* using a mechanical device such as a wheel on a pole).

The EPA is also limiting the use of Tier 4 at landfills with a GCCS installed. In order for a landfill with an operational GCCS to qualify for Tier 4, the GCCS must have operated for at least 75 percent of the 12 months prior to initiating Tier 4 testing. The EPA is finalizing reporting and recordkeeping requirements for the annual operating hours of destruction devices in order to verify that a landfill with a GCCS installed and opting for Tier 4 meets the GCCS criteria for having operated the system.

The EPA is also finalizing reporting and recordkeeping requirements to improve the transparency of SEM testing. To ensure that a GCCS is installed in a timely manner, the EPA is requiring a GCCS to be installed and operated within 30 months of the most recent NMOC emission rate report in which the calculated NMOC emission rate equals or exceeds 34 Mg/yr according to Tier 2, once there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill. To improve the transparency of SEM testing, landfill owners or operators must notify the delegated authority 30 days prior to conducting Tier 4 tests and maintain records of all SEM monitoring data and calibrations.

3. Criteria for Removing GCCS

Landfill emissions increase as waste is added to a landfill, but decline over time; as waste decays, a landfill produces less and less methane and other pollutants. In the proposed revisions to the NSPS (79 FR 41811), the EPA requested comment on whether the three criteria for control device removal in 40 CFR part 60, subpart WWW were appropriate for proposed 40 CFR part 60, subpart XXX, and whether alternative criteria such as consecutive

quarterly measurements below a surface emission threshold should also be considered. Additionally, in the proposed revisions to the Emission Guidelines (80 FR 52112), the EPA recognized that many open landfills subject to control requirements contain inactive areas that have experienced declining LFG flows. The EPA is finalizing criteria for determining when it is appropriate to cap, remove, or decommission a portion of the GCCS. The criteria for capping, removing, or decommissioning the GCCS are: (1) The landfill is closed, (2) the calculated NMOC emission rate at the landfill is less than 34 Mg/yr on three successive test dates, and (3) the GCCS has operated for at least 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows.

4. Excluding Non-Productive Areas From Control

In the proposed revisions to the NSPS (79 FR 41817), the EPA recognized that there are situations in which the quantity of gas production has greatly declined in separate closed areas of some landfills, and the methane content has fallen such that the area is producing insufficient gas to properly operate a GCCS and control device. Thus, the EPA is finalizing a provision that allows the use of actual flow data when estimating NMOC emissions for the purposes of excluding low- or non-productive areas of the landfill from control. To determine whether NMOC emissions from non-productive areas of the landfill are less than 1 percent of the total landfill NMOC emissions (and hence controls are not required), subpart WWW relies on modeled (calculated) NMOC rates (see 40 CFR 60.759(a)(3)(ii)). To refine the measurements of these non-productive areas, subpart XXX (40 CFR 60.769(a)(3)(ii)) allows owners or operators of landfills with physically separated, closed areas to either model NMOC emission rates, or determine the flow rate of LFG using actual measurements, to determine NMOC emissions. Using actual flow measurements yields a more precise measurement of NMOC emissions for purposes of demonstrating the closed area represents less than 1 percent of the landfill's total NMOC emissions. The NSPS has historically allowed owners or operators to exclude from control areas that are non-productive. In the final rule, the retained the 1 percent criteria level, rather than raising it, to prevent landfills from excluding areas from control unless emissions were very low. But, to help owners or operators demonstrate that a non-productive area may be excluded from control, the final rule allows the owner or operator to use site-specific flow measurements to determine NMOC emissions.

5. Landfill Gas Treatment

The EPA is finalizing two provisions related to LFG treatment. First, the EPA is clarifying that the use of treated LFG is not limited to use as a fuel for a stationary combustion device but also allows other beneficial uses such as vehicle fuel, production of high-Btu gas for pipeline injection, and use as a raw material in a chemical manufacturing process. Second, the EPA is defining "treated landfill gas" as LFG processed in a treatment system meeting the requirements in 40 CFR part 60, subpart XXX and defining "treatment system" as a system that filters, de-waters, and compresses LFG for sale or beneficial use. Owners or operators must develop a site-specific treatment system monitoring plan that includes monitoring parameters addressing all three elements of treatment (filtration, de-watering, and compression) to ensure the treatment system is operating properly for each intended end use of the treated LFG. They also must keep records that demonstrate that such parameters effectively monitor filtration, de-watering, and compression system performance necessary for each end use of the treated LFG. The treatment system monitoring plan must be submitted as part of the landfill's Title V permit application. The permitting authority will review the permit application, including the treatment system monitoring plan, as part of the general permitting process. The treatment system monitoring parameters would be included in the permit as applicable requirements and thus become enforceable conditions (*i.e.,* the landfill monitors the treatment system monitoring parameters and maintains them in the specified range).

B. What are the monitoring, recordkeeping, and reporting requirements?

1. Wellhead Monitoring

The operational standard, corrective action, and corresponding recordkeeping and reporting remain for temperature and maintaining negative pressure at the wellhead. The EPA is removing the operational standards (*i.e.,* the requirement to meet operating limits) for nitrogen/oxygen at the wellheads. Thus, the EPA is removing the corresponding requirement to take corrective action for exceedances of nitrogen/oxygen at the wellheads. These adjustments to the wellhead monitoring parameters apply to all landfills. Although landfill owners or operators are not required to take corrective action based on exceedances of nitrogen/oxygen levels at wellheads, they are required to monitor and maintain records of nitrogen/oxygen levels at wellheads on a monthly basis to inform any necessary adjustments to the GCCS and must maintain records of all monthly readings. The landfill owner or operator must make these records available to the Administrator (EPA Administrator or administrator of a state air pollution control agency or his or her designee) upon request.

2. Surface Monitoring

The EPA is finalizing the proposed requirement to monitor all surface penetrations. Landfills must conduct SEM at all cover penetrations and openings within the area of the landfill where waste has been placed and a GCCS is required to be in place and operating according to the operational standards in 40 CFR part 60, subpart XXX. Specifically, landfill owners or operators must conduct surface monitoring on a quarterly basis around the entire perimeter of the collection area, and along a pattern that traverses the landfill at no more than 30-meter intervals, at all cover penetrations, and where visual observations may indicate elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover. Cover penetrations include wellheads, but do not include items such as survey stakes, fencing or litter fencing, flags, signs, trees, and utility poles.

3. Corrective Action

The owner or operator must measure the LFG temperature at the wellhead and gauge pressure in the gas collection header applied to each individual well on a monthly basis. If there is an exceedance (*i.e.,* LFG temperature of 55 degrees Celsius (131 degrees Fahrenheit) or positive pressure), the owner or operator must initiate corrective action within 5 days. If the temperature exceedance or negative pressure cannot be achieved within 15 days, then the owner or operator must determine the appropriate corrective action by conducting a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after the first measurement of the temperature exceedance or positive pressure. For corrective action that takes longer than 60 days to fully implement, the owner or operator must also conduct a corrective action analysis and develop

an implementation schedule for the corrective action that does not exceed 120 days. The owner or operator must also notify the Administrator of any corrective action exceeding 60 days within 75 days and also include a description of the root cause analysis, corrective action analysis and implementation schedule in the annual report. If corrective action is expected to take longer than 120 days after the initial exceedance, the owner or operator must submit the corrective action plan and corresponding implementation timeline to the Administrator for approval within 75 days of the first measurement of positive pressure. Owners or operators must keep records of corrective action analyses. Owners or operators must include corrective action records in the annual compliance report for corrective actions that take greater than 60 days to implement.

4. Update and Approval of Design Plan

The EPA is reaffirming some requirements and revising others to address design plans. Design plans must continue to be prepared and approved by a professional engineer. The landfill owner or operator must then notify the Administrator that the plan is completed and provide a copy of the plan's signature page. The Administrator will now have 90 days to make a decision about whether the plan should be submitted for review. If the Administrator chooses to review, the approval process continues at outlined in this section. However, if the Administrator indicates that submission is not required or doesn't respond within 90 days, the landfill owner or operator can continue to implement the plan with the recognition that they are proceeding at their own risk. In the event that the design plan is required to be modified to obtain approval, the owner/operator must take any steps necessary to conform any prior actions to the approved design plan and any failure to do so could result in an enforcement action.

The EPA is also finalizing two criteria for when an affected source must update its design plan and submit it to the Administrator for approval. A revised design plan must be submitted on the following timeline: (1) Within 90 days of expanding operations to an area not covered by the previously approved design plan; and (2) prior to installing or expanding the gas collection system in a manner other than the one described in the previous design plan. The final rule continues to require landfill owners or operators to prepare both an initial and revised design plan.

5. Electronic Reporting

The EPA is requiring owners or operators of new or modified MSW Landfills to submit electronic copies of certain required performance test reports, NMOC emission rate reports, annual reports, Tier 4 emission rate reports, and wet landfilling practices through the EPA's Central Data Exchange (CDX) using the Compliance and Emissions Data Reporting Interface (CEDRI). Owners or operators are allowed to maintain electronic copies of the records in lieu of hardcopies to satisfy federal recordkeeping requirements.

The requirement to submit performance test data electronically to the EPA applies only to those performance tests conducted using test methods that are supported by the Electronic Reporting Tool (ERT). A listing of the pollutants and test methods supported by the ERT is available at: *www3.epa.gov/ttn/chief/ert/ert_info.html.* When the EPA adds new methods to the ERT, a notice will be sent out through the Clearinghouse for Inventories and Emissions Factors (CHIEF) Listserv (*www.epa.gov/air-emissions-inventories/emissions-inventory-listservs*) and a notice of availability will be added to the ERT Web site. You are encouraged to check the ERT Web site regularly for up-to-date information on methods supported by the ERT.

The EPA believes that the electronic submittal of the reports addressed in this rulemaking will increase the usefulness of the data contained in those reports, is in keeping with current trends in data availability, will further assist in the protection of public health and the environment and will ultimately result in less burden on the regulated community. Electronic reporting can also eliminate paper-based, manual processes, thereby saving time and resources, simplifying data entry, eliminating redundancies, minimizing data reporting errors and providing data quickly and accurately to the affected facilities, air agencies, the EPA and the public.

The EPA Web site that stores the submitted electronic data, WebFIRE, will be easily accessible to everyone and will provide a user-friendly interface that any stakeholder could access. By making the records, data, and reports addressed in this rulemaking readily available, the EPA, the regulated community, and the public will benefit when the EPA conducts its CAA-required reviews. As a result of having reports readily accessible, our ability to carry out comprehensive reviews will be increased and achieved within a shorter period of time.

We anticipate fewer or less substantial information collection requests (ICRs) in conjunction with prospective CAA-required reviews may be needed. Under an electronic reporting system, the EPA would have air emissions and performance test data in hand; we would not have to collect these data from the regulated industry. The data would provide useful information on actual emissions, types of controls in place, locations of facilities, and other data that the EPA uses in conducting required reviews or future assessments. We expect this to result in a decrease in time spent by industry to respond to data collection requests. We also expect the ICRs to contain less extensive stack testing provisions, as we will already have stack test data electronically. Reduced testing requirements would be a cost savings to industry. The EPA should also be able to conduct these required reviews more quickly. While the regulated community may benefit from a reduced burden of ICRs, the general public benefits from the agency's ability to provide these required reviews more quickly, resulting in increased public health and environmental protection.

Air agencies could benefit from more streamlined and automated review of the electronically submitted data. Having reports and associated data in electronic format will facilitate review through the use of software "search" options, as well as the downloading and analyzing of data in spreadsheet format. The ability to access and review air emission report information electronically will assist air agencies to more quickly and accurately determine compliance with the applicable regulations, potentially allowing a faster response to violations which could minimize harmful air emissions. This benefits both air agencies and the general public.

For a more thorough discussion of electronic reporting required by this rule, see the discussion in the 2014 proposed NSPS (79 FR 41818) and the 2015 proposed Emission Guidelines (80 FR 52127). In summary, in addition to supporting regulation development, control strategy development, and other air pollution control activities, having an electronic database populated with performance test data will save industry, air agencies, and the EPA significant time, money, and effort while improving the quality of emission inventories and air quality regulations and enhancing the public's access to this important information.

6. Landfills Recirculating Leachate or Adding Other Liquids

In the 2014 ANPRM and 2015 proposed Emission Guidelines, the EPA solicited input on whether additional action should be taken to address emissions from wet landfills. As discussed in section VI.A.3 of this preamble, there were a wide variety of perspectives provided in the public comments, and while many commenters supported separate thresholds for wet landfills, the EPA did not receive sufficient data to support a separate subcategory for landfills adding leachate or other liquids. In addition, the EPA has several other pending regulatory actions that could affect wet landfills. Accordingly, the EPA believes it is appropriate to further assess emissions from wet landfills prior to taking additional action. Therefore, the EPA is finalizing electronic reporting of additional data elements, as discussed in Section V.A.2 of this preamble, to inform potential action on wet landfills in the future.

C. Startup, Shutdown, and Malfunction Provisions

The standards in 40 CFR part 60, subpart XXX apply at all times, including periods of startup or shutdown, and periods of malfunction. The EPA is reaffirming the work practice standard that is applicable during SSM events wherein the landfill owner or operator is required to shut down the gas mover system and close all valves in the collection and control system potentially contributing to the venting of the gas to the atmosphere within 1 hour of the collection or control system not operating. The landfill owner or operator must also keep records and submit reports of all periods when the collection and control device is not operating.

D. Other Corrections and Clarifications

The EPA is finalizing the following clarifications and corrections to subpart XXX, which are consistent with the May 23, 2002 and September 8, 2006 proposed amendments to subpart WWW.

Consistent with the May 23, 2002 and September 8, 2006 proposed amendments, the EPA is finalizing language in subpart XXX to exempt owners/operators of boilers and process heaters with design capacities of 44 megawatts or greater from the requirement to conduct an initial performance test (40 CFR 60.762(b)(2)(iii)(B)).

Consistent with the September 8, 2006 proposed amendments, the EPA is finalizing the removal of the term ''combustion'' from the requirement to monitor temperature of enclosed combustors (40 CFR 60.768(b)(2)(i) and 40 CFR 60.768(c)(1)(i)).

Consistent with the September 8, 2006 proposed amendments, we are amending the definition of ''household waste'' and adding a definition of ''segregated yard waste'' in subpart XXX (40 CFR 60.761) to clarify our intent regarding the applicability of the landfills NSPS to landfills that do not accept household waste, but accept segregated yard waste.

V. Summary of Significant Changes Since Proposal

A. Changes to Monitoring, Recordkeeping, and Reporting

1. Corrective Action

We are revising the procedural requirements for correcting positive pressure and temperature by allowing owners or operators 60 days to correct exceedances. If the owner or operator cannot achieve negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) by 60 days after the initial exceedance, owners or operators must conduct a root cause analysis to identify the most appropriate corrective action, which can include, but is not limited to, expanding the GCCS. For corrective action that takes longer than 60 days, owners or operators must develop an implementation schedule to complete the corrective action as soon as practicable, but no more than 120 days following the initial positive pressure or temperature reading. Additionally, owners or operators must keep records of the corrective action analysis. Owners or operators must submit the corrective action and corresponding implementation timeline to the Administrator for approval when implementation of the corrective action is expected to take longer than 120 days after the initial exceedance.

This change provides flexibility to owners or operators in determining the appropriate remedy, as well as the timeline for implementing the remedy.

2. Landfills Recirculating Leachate or Adding Other Liquids

The EPA is adding electronic reporting requirements for wet areas of landfills. The additional reporting applies to areas of the landfill that have recirculated leachate within the last 10 years and to areas where other liquids were added within the last 10 years.

The EPA is requiring these landfills to annually report quantities of liquids added and/or leachate recirculated. The first report will contain historical quantities, where those data are available in on-site records. The EPA is also requiring the landfill to report the surface area over which the liquids are added or the leachate is recirculated during each reporting year. The EPA is also requiring the landfill to report the total waste disposed in the area with recirculated leachate or added liquids as well as the annual waste acceptance rates in those same areas. As discussed in Section VI.A.3 of this preamble, this additional electronic reporting for wet landfills will inform potential future action on wet landfills.

3. Portable Gas Analyzers

We are allowing the use of portable gas composition analyzers in conjunction with Method 3A to monitor the oxygen level at a wellhead. The portable gas composition analyzer may be used to monitor the oxygen level at a wellhead provided that the analyzer is calibrated and meets all QA/QC requirements according to Method 3A. ASTM D6522–11 may be used as an alternative to Method 3A for wellhead monitoring as long as all the quality assurance is conducted as required by ASTM D6522–11. To use ASTM D6522–11, the sample location must be prior to combustion.

This change allows owners or operators to employ proven, reliable devices that are commonly used in practice to measure wellhead parameters. This change also eliminates the need for the landfill owner or operator to request portable analyzers as an alternative, as well as the need for agency review or approval of such requests. In addition to providing reliable results when used properly, portable analyzers have a number of benefits, including common use, the ability to provide additional information on gas composition, and the ability to download data to a spreadsheet for easy access and analysis.

4. More Precise Location Data

The EPA is finalizing a requirement for landfills to report the latitude and longitude coordinates of each surface emissions exceedance (500 ppm methane or greater) with an instrument accuracy of at least 4 meters. This change will provide a more robust and long-term record of GCCS performance. Landfill owners or operators and regulators can use locational data to gain perspective on how the LFG collection system is functioning over time and owners or operators will be able to track trends in GCCS performance and cover practices to ensure a well operating system and minimize emissions.

5. Update and Approval of Design Plan

Landfill owners or operators must submit an updated design plan for approval based on the following criteria: (1) Within 90 days of expanding operations to an area not covered by the previously approved design plan; and (2) before installing or expanding the gas collection system in a way that is not consistent to the previous design plan. In the final NSPS, the EPA removed a third criteria that was proposed: Update the design plan prior to implementing an approved alternative operating parameter value for temperature, nitrogen, or oxygen, if the owner or operator has requested alternative operating parameter values.

B. Tier 4

In the 2014 proposed NSPS, the EPA requested comment on whether to include an additional tier, ''Tier 4,'' which would allow the use of site-specific measurements of surface methane emissions to determine if installation of a GCCS is required. In the 2015 proposed Emission Guidelines, the EPA proposed Tier 4 to determine if a landfill needed to install and operate a GCCS based on surface emission monitoring using EPA Method 21 (80 FR 52112). As indicated in section IV.A.2 of this preamble, the EPA is finalizing the use of Tier 4 SEM as an alternative way of determining when a landfill must install a GCCS. The details of the Tier 4 emission threshold methodology are presented in sections IV.A.2 and VI.B of this preamble.

C. Changes To Address Closed or Non-Productive Areas

Criteria for Removing GCCS. Since the emission threshold was reduced from 40 Mg/yr in the 2014 NSPS proposal to 34 Mg/yr in the 2015 supplemental NSPS proposal, the EPA is editing the criteria for removal in this final rule to be consistent with the final NMOC threshold of 34 Mg/yr. In addition, the EPA is finalizing an option for the landfill to demonstrate the GCCS will be unable to operate for 15 years due to declining gas flows to provide additional flexibility on low producing areas. The GCCS can be capped, removed, or decommissioned when a landfill owner or operator demonstrates that (1) the landfill is closed, (2) the calculated NMOC emission rate at the landfill is less than 34 Mg/yr on three consecutive test dates, and (3) the GCCS has operated for at least 15 years or the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows.

D. Startup, Shutdown, and Malfunction Provisions

In the 2014 NSPS proposal (79 FR 41812), the EPA clarified that performance standards apply at all times, including periods of SSM. The EPA also added requirements to estimate emissions during SSM events. Consistent with *Sierra Club* v. *EPA, 551 F.3d 1019 (D.C. Cir. 2008),* the EPA is clarifying that standards outlined in the NSPS apply at all times. In recognition of the unique nature of landfill emissions and consistent with the need for standards to apply at all times, including during periods of SSM, the EPA is reaffirming a work practice standard that applies during SSM events. During such events, owners or operators must shut down the gas mover system and close within 1 hour all valves in the collection and control system contributing to the potential venting of the gas to the atmosphere. The landfill owner or operator must also keep records and submit reports of all periods when the collection and control device is not operating.

E. Definitions for Treated Landfill Gas and Treatment System and Treatment System Monitoring

The definition of treated LFG is clarified to include not only use as a fuel for stationary combustion devices, but also allows other beneficial uses such as vehicle fuel, production of high-Btu gas for pipeline injection, and use as a raw material in a chemical manufacturing process. Additionally, the treatment system is defined as a system that filters, de-waters, and compresses LFG for sale or beneficial use. Further, the EPA is requiring site-specific treatment system monitoring plans that include monitoring parameters that address filtration, de-watering, and compression to ensure the treatment system is operating properly for the intended end use of the treated LFG.

F. Other Corrections and Clarifications

The use of EPA Method 25A and Method 18 (on a limited basis, *e.g.,* specific compounds like methane) are included in the final rule. Method 25A in conjunction with Method 18 (for methane) or Method 3C can be used to determine NMOC for the outlet concentrations that are less than 50 ppm NMOC as carbon.

VI. Rationale for Significant Changes Since Proposal

After considering public comments and further analyzing the available data, the EPA made several changes in this final rule relative to what we proposed. A complete list of public comments received on the proposed rule and the responses to them can be viewed in the *document,* ''Responses to Public Comments on EPA's Standards of Performance for Municipal Solid Waste Landfills and Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills: Proposed Rules'' (hereafter ''Response to Comments document''), which is available in Docket EPA–HQ–OAR–2003–0215. This section of this preamble summarizes comments and presents responses for only provisions that have changed since the 2014 proposed NSPS and 2015 supplemental proposal.

A. Changes to Monitoring, Recordkeeping, and Reporting

1. Wellhead Monitoring

In the 2014 proposed NSPS, the EPA requested comment on alternative wellhead monitoring requirements, including potential removal of the temperature and nitrogen/oxygen monitoring requirements, or a reduction in the frequency of this monitoring. For example, the EPA indicated that it could reduce the frequency of wellhead monitoring for these three parameters (temperature and nitrogen/oxygen) from monthly to a quarterly or semi-annual schedule. The EPA requested comments on whether the potential exclusion should apply to a subset of landfills or landfill areas based on beneficial use of LFG.

In the 2015 proposed Emission Guidelines, the EPA proposed to remove the operational standards (*i.e.,* the requirement to meet operating limits) for temperature and nitrogen/oxygen at the wellheads, thus removing the corresponding requirement to take corrective action for exceedances of these parameters. This approach was taken to eliminate the need for owners or operators to request higher operating values (HOVs) for these parameters, submit alternative timelines for corrective action, or expand the GCCS to address exceeding these wellhead standards. The EPA proposed to maintain the requirement to monitor nitrogen/oxygen and temperature on a monthly basis, but to remove the requirement to report exceedances from fluctuations or variations in these parameters in the annual reports. Instead of annual reporting, the EPA proposed that landfill owners or operators maintain the records of this monthly monitoring on site to inform any necessary adjustments to the GCCS and make these records available to the Administrator upon request. The EPA proposed to maintain the requirement to

operate the GCCS at negative pressure and in a manner that collects the most LFG and minimizes losses of LFG through the surface of the landfill. The EPA also requested comments on whether it should add a requirement to monitor wellhead flowrate, or any other wellhead monitoring parameters, that would help to ensure a well-operated GCCS (80 FR 52138).

Comment: Several commenters want the EPA to maintain the wellhead operational standards, including states, industry consultants, and environmental organizations, with one environmental organization stating that these wellhead parameters are the only warning signal for potential fire hazard. One state stated that the removal of the operational standards could lead to some landfill owners or operators not operating the GCCS in an effective manner, thus creating a potential for increased LFG emissions through the landfill surface.

Many other commenters supported removing the nitrogen/oxygen and temperature operational standards, including industry, some states, and the Small Business Association. Several commenters indicated that a lack of response or approval of HOV requests or alternative timelines for corrective action, despite appropriate justification, is a significant administrative barrier in the current NSPS and Emission Guidelines. These commenters stated that a lack of response to or approval of HOVs results in owners or operators having to install new wells to correct for temperature or oxygen exceedance even though such expansion of the GCCS does not correct the exceedance and may be contrary to a well-operated GCCS. One commenter stated that removing the operational standards would alleviate one of the most significant barriers to installing interim gas collection measures and would alleviate the corresponding administrative burden of requesting HOVs. Other commenters stated that removing the operational standards would not only reduce administrative burden, but would also facilitate early installation of GCCS and the use of appropriate best management practices to maximize gas collection. Two comments from state agencies agreed with removing the operational standards, and agreed with retaining monthly monitoring of temperature and nitrogen/oxygen and retaining the corresponding monitoring data.

Several commenters suggested that certain monitoring data should be reported on a semi-annual basis so that agencies can identify or prevent fires. For example, state agency commenters suggested that the EPA require semi-annual reporting of wellhead readings above 5 percent oxygen and 130 degrees Fahrenheit, which was supported by supplemental comments received from the industry and industry trade organizations. One commenter also suggested reporting of any subsurface fire. One regional agency wanted the results to be reported if temperature exceeds 150 degrees Fahrenheit and also suggested reporting any methane to carbon dioxide ratio less than 1.

Commenters that supported the removal of the operational standards for temperature and nitrogen/oxygen also contended that the nitrogen/oxygen and temperature wellhead parameters are poor indicators of landfill fires or inhibited decomposition and that landfill owners or operators already have their own incentive to prevent landfill fires. Commenters added that expanding the LFG collection system by drilling new wells may introduce more air into the landfill, which can exacerbate a fire and actually increase oxygen content. Commenters that favored retaining the operational standards for temperature and nitrogen/oxygen contend that temperature and nitrogen/oxygen data are essential to inform regulators of the presence of potential for a landfill fire.

Response: After carefully considering public comments and available data, the EPA is removing the operational standards (*i.e.,* the requirement to meet operating limits) for nitrogen/oxygen, but not temperature. Landfill owners or operators must continue to monitor nitrogen/oxygen on a monthly basis, however, to ensure that the GCCS is well maintained and operated, collects the most LFG, and minimizes losses of LFG through the surface of the landfill. Landfill owners or operators must maintain records of this monthly monitoring and make these records available to the Administrator upon request. The EPA is requiring monthly monitoring and recordkeeping for these wellhead monitoring parameters (*i.e.,* oxygen, nitrogen, temperature, and pressure), since these are key indicators that are already being monitored by landfill owner or operators to determine how well the landfill is being operated, including the capturing and destroying landfill gas, promoting efficient anaerobic decomposition and/or preventing landfill fires.

Because of concerns regarding fire hazards, the EPA is retaining the operational standard for temperature. Landfill owners or operators must electronically submit, as part of their annual report, all readings that show LFG temperatures greater than 55 degrees Celsius (131 degrees Fahrenheit), and document the root cause and corrective action taken to correct for this exceedance, as discussed in section VI.A.2 of this preamble. While several commenters supported removing the temperature parameters, other commenters were concerned with fire risks if the parameter was removed. In addition, given the EPA experience with consent decrees and other enforcement actions involving elevated temperature values, the EPA has decided to retain temperature as an operating standard in the final rule. This overall approach will reduce the number of requests for HOVs and alternative timeliness for nitrogen/oxygen parameters. In addition, note that regulatory agencies can request data records of oxygen, nitrogen, or temperature monitoring, as measured on a monthly basis, at any time.

Landfills are subject to 40 CFR part 60, subpart A. These provisions require landfill owners or operators, to the extent practicable, to maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Due to the extreme environmental consequences of a subsurface landfill fire, these provisions obligate landfill owners or operators to take all practical steps necessary to avoid landfill fires. While this action removes requirements to meet operational standards for nitrogen/oxygen at wellheads and to make corrective actions, landfill owners or operators must continue all due diligence to ensure that the GCCS is not overdrawn, thereby creating a flammable subsurface environment. Because the corrective action requirements for certain parameters have been retained, the EPA is reaffirming its provisions for HOVs. The HOV provisions were originally enacted to address variations in temperature between landfills and between wells. With a sufficient demonstration (*i.e.,* supporting data showing the elevated parameter does not cause fires or significantly inhibit anaerobic decomposition by killing methanogens), an HOV may be established for temperature, nitrogen, or oxygen at a particular well. The EPA encourages regulatory authorities review requests for HOVs in a timely manner and to make use of these mechanisms where appropriate.[38]

[38] The EPA asserts the importance of case specific HOV requests and approvals. However, to address concerns from HOV request reviewers and those

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2. Corrective Action

In a 1998 **Federal Register** notice (63 FR 32748, June 16, 1998), the EPA amended the wellhead monitoring provisions of 40 CFR part 60, subpart WWW to allow an alternative timeline for correcting wellhead exceedances to be submitted to the Administrator for approval. The rule change made the wellhead monitoring provisions consistent with the SEM provisions, which allow an alternative remedy and corresponding timeline for correcting an exceedance to be submitted to the Administrator for approval. The EPA noted in the 1998 preamble that any timeline extending more than 120 days must be approved by the regulating agency. Since 1998, questions have been raised about the timing of correcting wellhead exceedances and whether a landfill needs agency approval for corrective action timelines that exceed 15 calendar days but are less than the 120 days allowed for expanding the GCCS.

The EPA clarified in the proposed subpart XXX that, with the exception of system expansion, all corrective actions expected to exceed 15 calendar days should be submitted to the agency for approval of an alternate timeline. Additionally, the EPA proposed that if a landfill owner or operator expects the system expansion to exceed the 120-day allowance period, it should submit a request and justification for an alternative timeline. Further, the EPA solicited comment on extending the requirement for notification from 15 days to as soon as practicable, but no later than 60 days.

The proposed Emission Guidelines noted that the proposed removal of operational standards for nitrogen/oxygen and temperature would drastically reduce the number of requests for alternative corrective action timelines. However, the requirement to maintain negative pressure at the wellhead remained in the proposal. Therefore, the EPA proposed a timeline for correcting positive pressure, including a requirement to submit an alternative corrective action timeline request to the Administrator if the landfill cannot restore negative pressure within 15 calendar days or the initial failure to maintain negative pressure and the landfill is unable to (or does not plan to) expand the gas collection within 120 days of the initial exceedance.

The EPA explained in the preamble for the 2015 Emission Guidelines proposal that it did not specify a schedule in the proposed rule language by when a landfill would need to submit alternative timeline requests because the EPA determined that investigating and determining the appropriate corrective action, as well as the schedule for implementing corrective action, would be site specific and depend on the reason for the exceedance (80 FR 52126). In addition, the EPA requested comment (80 FR 52126) on an alternative timeline that extends the requirement for notification from 15 days to as soon as practicable, but no later than 60 days from when an exceedance is identified.

Comment: The EPA received comments on the proposed changes, including the time allowed for corrective action and for submitting alternative timeline requests for approval by the Administrator. Regarding the timeframe for submitting a request, several state agencies recommended extending the 15-day timeline for a request to be submitted and indicated that 15 days is not sufficient time to evaluate the problem and plan for corrective action, which may often involve construction activities. There were varied opinions from the state agencies on what length of time beyond 15 days is appropriate. Two agencies supported an extension to as soon as practicable but no later than 60 days, while other agencies specified that the request should be submitted within 30 days from the initial exceedance.

Industry representatives from private and publicly owned landfills as well as waste industry consultants opposed the requirement to submit a request for an alternative corrective action timeline within 15 days. The commenters were concerned that 15 days is not enough time to assess the appropriate solution across miles of interconnected piping. In addition, the commenters were concerned that a 15-day time period would increase the paperwork for both the landfill and the reviewing regulatory agency. One commenter indicated that while many repairs can be completed within 60 days, some repairs, especially in cold weather climates, may take longer. One industry commenter suggested that a timeframe of 90 days to complete any adjustments or repairs is appropriate. If the corrections could not be made within 90 days, the commenter stated that the landfill would be prepared to have the system expanded within 120 days.

Industry commenters raised the issue that the timeline for corrective action for surface exceedances in the current subpart WWW regulations, 40 CFR 60.755(c)(4)(v), allow 120 days to install a new well or other collection device or submit an alternative timeline for another corrective action. These commenters also indicated that the 1998 NSPS amendments modified the corrective action for wellhead parameter exceedances to be consistent with the timeframe allowed for correcting surface exceedances (63 FR 32748, June 16, 1998). The commenters also noted that the 1998 amendments recognized that installation of a new well may not always be the appropriate corrective action for remedying a wellhead exceedance.

Despite the 1998 rule amendments, several of these industry commenters note that interpretation and implementation of the 1998 amendments to 40 CFR 60.755(a)(3) have been inconsistent, with some agencies only requiring the landfill owner or operator to submit requests if the corrective action will take longer than 120 days. Other states have taken the position that any exceedances that cannot be resolved within 15 days must automatically result in a requirement to expand the GCCS. One commenter referenced determinations that required landfills to submit an alternative timeline request within 15 days. One commenter indicated that the original rule never anticipated notification and a request for an alternative compliance timeline within 15 days, while another commenter indicated that the state of Texas requires landfills to submit alternative timelines only if the corrective action requires more than 120 days to complete.

In consideration of the 1998 final rule notice, industry commenters, recommended that EPA require landfill owners or operators to submit an alternative timeline request for approval as soon as practicable and only in circumstances in which a system expansion or alternative corrective action will require more than 120 days to complete. One of the commenters suggested that this approach was consistent with the Petroleum Refineries NSPS (40 CFR part 60, subpart Ja). The commenter noted that while the Landfills NSPS requires special approval to avoid the default corrective action of expanding the GCCS, the Refineries NSPS requires a root cause analysis to identify the appropriate corrective action, without specifying a default approach. The Refineries NSPS requires a root cause analysis and a corrective action analysis for exceedances and requires the facility to implement the corrective action within

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submitting requests, an example of regulatory guidance for HOV demonstrations can be found at *http://www.epa.ohio.gov/portals/34/document/guidance/gd_1002.pdf.*

45 days. If the corrective action cannot be completed in 45 days, the refinery must document and record all corrective actions completed to date. For actions not fully completed by day 45, they must develop an implementation schedule, as soon as practicable, for beginning and completing all corrective action.

One commenter provided some ideas for landfills to demonstrate good faith effort to comply with the 120-day corrective action schedule. They suggested the rules clarify that the landfill owner or operator is required to submit a notification to the agency that identifies and describes the diagnosis performed, the results of the diagnosis, identifies the corrective measure or alternative remedy to be implemented and reason(s) why system expansion is not appropriate to correct the exceedance. Under such an approach, corrective measures other than expansion that take 0–60 days to complete from the initial exceedance would not require any notification or approval but they would be documented in the annual compliance report. For corrective actions other than expansion that take longer than 60 days but less than 120 days to complete, the landfill owner or operator would notify the regulatory agency by day 75 from the date of the initial exceedance. This would allow 45 days for the agency to review and comment, and such notification would not require agency approval so as not to delay the site from proceeding with and completing the corrective action, as long as the corrective actions are completed within the 120-day timeframe.

Industry commenters indicated that the timeline for corrective action is affected by other regulations. Two of these commenters noted that any corrective action that involves disturbing the final landfill cover could delay diagnosing the problem. All of these commenters noted that a 60-day timeframe is problematic for landfills affected by the Asbestos NESHAP (40 CFR part 61, subpart M), which requires a 45-day notification prior to disturbing areas that may have asbestos containing material.

Response: The EPA is retaining the corrective action requirements for temperature in addition to negative pressure. The EPA recognizes the importance of temperature as a critical indicator of landfill fires and its effect on methanogens. Further, removal of the corrective action requirements for temperature could have the unintended consequence of improper operation of a GCCS, which could lead to a subsurface fire. Due to the important of this parameter, e-reporting requirements for excessive temperatures have also been established to better assess landfill fires.[39]

After carefully considering the comments received and evaluating the available data, the EPA is finalizing corrective action requirements that generally give owners or operators 60 days to investigate and determine the appropriate corrective action and then implement that action. The EPA has retained the requirements for temperature and positive pressure, in that if positive pressure or temperature exceedances exist, action must be initiated to correct the exceedances within 5 calendar days. This requirement has been retained to ensure the landfill takes prompt action to ensure the GCCS remains well-operated. The EPA recognizes, however, that the appropriate corrective action, as well as a schedule to implement it, is site-specific and depends on the reason for the exceedance. Therefore, for corrective action that takes longer than 60 days after the initial exceedance to implement, the EPA is providing flexibility for the landfill to determine the appropriate course of action based on a root cause analysis. Specifically, if the owner or operator cannot achieve negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) at the GCCS wellhead within 15 days, then the owner or operator must conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after positive pressure or temperature above 55 degrees Celsius (131 degrees Fahrenheit) was first measured. An implementation schedule is required for exceedances that take longer than 60 days to correct. A root cause analysis is an assessment conducted through a process of investigation to determine the primary cause(s), and any other contributing cause(s), of positive pressure at a wellhead or temperature above 55 degrees Celsius (131 degrees Fahrenheit). The root cause analysis and documentation of the corrective action taken to restore negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) must be kept on site as a record, but they do not have to be submitted or approved.

If negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) cannot be achieved within 60 days, then the owner or operator must develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the positive pressure or temperature reading. The implementation schedule, root cause analysis, and documentation of the corrective action taken to restore negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit) must be submitted in the facility's next annual report, but these items do not have to be approved.

If the exceedance cannot be corrected (or is not expected to be corrected) within 120 days, then the owner or operator must submit the root cause analysis, plan for corrective action to restore negative pressure or temperature of 55 degrees Celsius (131 degrees Fahrenheit), and the corresponding implementation timeline to the Administrator. The Administrator must approve the plan for corrective action and the corresponding timeline. The owner or operator must submit the proposed corrective action and timeline to the Administrator for approval as soon as practicable but no later than 75 days after the initial exceedance. Requiring approval by the regulatory agency for corrective action timelines that extend beyond 120 days is consistent with the corrective action timeline for surface emissions in 40 CFR 60.765(c)(4)(v). This approach also prevents the landfill owner or operator from delaying submittals for corrective action requests until day 120. Once the negative pressure has been restored, the facility must document the corrective actions taken in the facility's next annual report.

For the corrective action required to address positive pressure, the owner or operator must keep a record of the root cause analysis conducted, including a description of the recommended corrective action(s); the date for corrective action(s) already completed following the positive pressure reading; and for action(s) not already completed within 60 days of the initial positive pressure reading, a schedule for implementation, including proposed commencement and completion dates. For corrective actions taking longer than 60 days to correct the exceedance, the owner or operator would also include in the annual report the root cause analysis, recommended corrective action(s), date corrective actions were completed, and schedule for implementing corrective actions. The owner or operator must also notify the Administrator within 75 days. For corrective actions that take longer than 120 days to correct the exceedance, the

[39] The need to rely on temperature in addition to pressure is also illustrated in the report titled Subsurface Heating Events at Solid Waste and Construction and Demolition Debris Landfills: Best Management Practices at *http://www.epa.ohio.gov/portals/34/document/guidance/subsurface%20heating%20events.1009.pdf.*

owner or operator would include, in a separate notification submitted to the Administrator for approval as soon as practicable, but no later than 75 days after the initial positive pressure reading, the root cause analysis, recommended corrective action(s), date corrective actions taken to date were completed, and proposed schedule for implementing corrective actions.

3. Landfills Recirculating Leachate or Adding Other Liquids

In the 2014 ANPRM and 2015 proposed Emission Guidelines, the EPA solicited input on whether additional action should be taken to address emissions from wet landfills (*i.e.,* landfills that recirculate leachate or add liquids). Commenters differed on whether the EPA should require separate thresholds or different lag times for landfills that recirculate leachate or add liquids. (The lag time is the time period between when the landfill exceeds the emission rate threshold and when controls are required to be installed and started up.) Commenters supported more environmentally protective requirements for wet landfills and asserted that wet landfills produce more methane but actually collect less. Commenters stated that the EPA should shorten the lag time for installing controls. Other commenters opposed separate requirements for wet landfills and contended that additional requirements for wet landfills would achieve minimal emission reductions and would result in a significant additional burden for landfills that recirculate leachate. One commenter said that the EPA should focus on potential emission reductions at landfills that recirculate leachate.

Commenters also differed on what methane generation rate (k-value) should be used in the landfills NSPS for wet landfills. One commenter indicated that they have previously provided several studies on k-values for wet landfills to EPA and urged the EPA to update the emission factors for wet landfills based on this literature prior to adjusting the control requirements at landfills recirculating leachate or adding other liquids. Another commenter asked the EPA to use higher, more representative k-values, or perhaps a sensitivity analysis for a range of k-values to estimate the impacts of controlling emissions from wet landfills in the landfills NSPS.

Based on the diverse nature of the feedback provided and several other outstanding EPA actions affecting the control requirements and emission factors for wet landfills, the EPA is not creating separate emission threshold or lag time requirements for wet landfills in this action. Instead, the EPA believes it is appropriate to further assess emissions from wet landfills prior to taking additional action on control requirements or changes to the k-values. As a result, the EPA is finalizing additional electronic reporting requirements for wet landfills with a design capacity of 2.5 million Mg or greater to inform potential future action on wet landfills. The final rule is limiting reporting of this additional data to wet landfills that meet the current size threshold of 2.5 million Mg of design capacity to be consistent with the universe of landfills that are affected by the rule.

Specifically, the final NSPS requires annual electronic reporting of the volume of leachate recirculated (gallons per year) and the volume of other liquids added (gallons per year), as well as the surface area over which the leachate is recirculated (or sprayed), and the surface area (acres) over which any leachate or liquids are applied. The quantity of leachate recirculated or liquids added should be based on company records or engineering estimates. The initial report will collect historical data for the 10 years preceding the initial annual reporting year, to the extent the data are available in on-site records, along with data corresponding to the initial reporting year. After the initial report, the other annual electronic reports will include only the quantities of leachate recirculated and/or added liquid and their corresponding surface areas for each the subsequent reporting year. The EPA believes many landfills, especially those operating with a Research, Development, and Demonstration (RD&D) permit, already keep records and may submit reports containing quantities of liquids added. So, the effort to track these additional data is expected to be minimal. RD&D permits are issued through Resource Conservation and Recovery Act (RCRA) subtitle D part 258 regulations for MSW landfills. The EPA is also aware of some state rules that require reporting of leachate or added liquids outside of the Clean Air Act reporting requirements. Consolidating these data in an electronic format in a central repository can help inform how leachate or added liquids affect LFG generation and collection whether air emission standards should be adjusted for wet landfills.

The EPA is also requiring the landfill to report the total waste disposed (Mg) in the area with recirculated leachate and/or added liquids, as well as the annual waste acceptance rates (Mg/yr) in those same areas. Recognizing that the waste quantities may be tracked at the scale house entry to the landfill and not the specific cell where the liquids are added, the EPA is allowing the landfill to report data based on on-site records or engineering estimates.

The EPA is allowing owners or operators of landfills to discontinue annual reporting of the wet landfill report after the landfill has submitted its closure report recognizing that this information would be difficult to obtain after the landfill closed, these landfills are unlikely to still be adding liquids if closed, and also because the gas generation from these landfills are on the downward side of their gas generation curve.

The EPA is also aware of annual LFG collected and annual LFG generation data electronically reported to 40 CFR part 98, subpart HH of the GHGRP and therefore the EPA is not requesting reporting of these data in this rule to avoid duplicative requests. However, the EPA may link the wet landfill practices data collected under the landfills NSPS with the annual gas collected data under subpart HH in order to inform how liquids addition affects LFG emissions. Similarly, the EPA understands that precipitation may affect gas generation. However, since precipitation data are readily available through the National Weather Service, the EPA is not requiring reporting of this parameter. Instead, the EPA will use existing electronic data already available to link up with data collected under this final rule. These additional data will be used to assess the appropriateness of potential future action on wet areas of landfills.

The Paperwork Reduction Act (PRA) requires each federal agency to obtain OMB approval before undertaking a collection of information directed to 10 or more people. The PRA applies whether a "collection of information is mandatory, voluntary, or required to obtain or retain a benefit." The EPA believes the additional data on wet landfills will be beneficial for evaluating whether separate thresholds for wet landfills are appropriate when revising future MSW landfill standards. Because the EPA understands that many of the data elements in the wet landfill report, including quantities of leachate or other liquids added and the surface areas over which those liquids are added are tracked at a state level as part of a leachate management or RD&D permit, the EPA does not anticipate these data. Additionally, the EPA is allowing landfill owners or operators to report the data elements in the wet landfill

monitoring report using either engineering estimates or on-site records to minimize the burden on respondents, depending on the types of records the landfill owner/operator may keep.

This is a new rule and a new collections submitted to OMB under EPA ICR number 2498.03. This collection is similar to collections for subpart WWW. Thus, many of the line item burden estimates in this ICR estimate are the same as the burdens submitted to OMB under ICR number 1557.09 for the most recent ICR renewal for subpart WWW.

4. Portable Analyzers

Commenters on the proposed NSPS (79 FR 41796) requested that the EPA specify that portable gas composition analyzers are an acceptable alternative to Methods 3A or 3C, and noted that these devices are commonly used in practice to measure wellhead parameters and are calibrated according to the manufacturer's specifications. Currently, approvals of these analyzers are done on a case-by-case basis. Therefore, in the preamble for the proposed revisions of the Emission Guidelines (80 FR 52141), the EPA requested data or information on using a portable gas composition analyzer according to Method 3A for wellhead monitoring. The EPA also requested data on other reference methods used for calibrating these analyzers.

Comment: Many commenters supported the use of portable gas composition analyzers and requested that the EPA specify that these analyzers may be used as an approved alternative monitoring method for well monitoring. Three state agencies indicated the use of the portable analyzers is common practice. One of these agencies stated that Method 3A and Method 3C are designed to be used in "quasi-CEMS" and/or "laboratory benchtop" situations and most landfill operators are not using this type of equipment to test wellhead LFG; instead, landfill operators are using handheld-size portable analyzers. Another state agency stated that portable gas composition analyzers (*e.g.,* Landtec GEM 2000) are a standard for conducting MSW landfill well monitoring and the analyzers provide additional information on gas composition than what the current Emission Guidelines require, which provides operators with a better understanding of the condition of the landfill. This commenter said that a primary advantage of portable gas composition analyzers, for both landfills and regulators, is that these devices take and record the monitored readings (as well as other information on gas composition that is not required to be monitored in the Emission Guidelines), which can then be downloaded into a spreadsheet and prevent landfills from making data collection mistakes. The commenter suggested that the EPA and state air pollution control agencies would benefit if the EPA were to require landfills to submit, in their semi-annual reports, all of the monitoring data recorded by portable gas composition analyzers.

One commenter stated that most portable gas composition analyzers can be used to measure the oxygen level at the wellhead and can be calibrated according to Method 3A, but are unlikely to be calibrated according to Method 3C (to measure oxygen or nitrogen levels) because such calibration requires the use of gas chromatograph equipment with a thermal conductivity detector and integrator. The commenter said that Method 3A is straightforward and does not specify a particular technology. Several commenters specifically referenced the comments from an equipment manufacturer, which provided specific details on how its Landtec GEM Series portable analyzers are able to comply with each specific requirement in Method 3A, including the calibration requirements. Two of these commenters said that portable gas composition analyzers should be allowed in both the Emissions Guidelines and NSPS. Another of these commenters requested that the EPA add language to the rule to recognize that balance gas is commonly used as a surrogate for nitrogen.

With regard to the EPA's request for data on other reference methods used for calibrating portable gas composition analyzers, one commenter suggested that the EPA allow ASTM D6522 as an alternative to Method 3A because an analyzer can easily be calibrated for oxygen alone following ASTM D6522. The commenter stated that although the QA/QC procedures in ASTM D6522 are different from Method 3A, they are just as rigorous as Method 3A. The commenter stated that it has extensive data available showing portable gas composition analyzers are routinely calibrated according to ASTM Method D6522 for measuring NOx, CO, and oxygen during engine testing. This commenter also stated that any analyzer or device must be calibrated according to an EPA approved method and not just manufacturer's specifications.

Response: The EPA appreciates the commenters providing information regarding the use of portable gas composition analyzers for landfill monitoring. Commenters provided data showing that their portable gas composition analyzers are used to monitor the oxygen level at a wellhead and are capable of meeting the calibration requirements in Method 3A. Therefore, in today's action, we are clarifying the use of portable gas composition analyzers with Method 3A. A portable gas composition analyzer may be used to monitor the oxygen level at a wellhead provided that the portable analyzer is calibrated and meets all QA/QC according to Method 3A. Although we did not receive enough information regarding calibration methods that could be used on a portable gas composition analyzer to monitor the nitrogen level at a wellhead, any portable combustion monitor analyzer that uses gas chromatography and thermal conductivity technology may be used with Method 3C. Other technologies for the measurement of nitrogen may be used in lieu of Method 3C through the administrative alternative test method process outlined in 40 CFR 60.8(b)(2).

Regarding the suggestion to allow ASTM D6522–11 as an alternative to Method 3A, the EPA thanks the commenter for their perspective. As long as all the quality assurance is conducted as required by ASTM D6522–11, then ASTM D6522–11 may be used as an alternative to Method 3A for wellhead monitoring (prior to combustion). Examples of quality assurance required by ASTM D6522–11 include, but are not limited to: Analyzers must have a linearity check, interference check, bias check using mid-level gases, stability check, and be calibrated before a test; and a calibration error check and the interference verification must be conducted after the testing has occurred. Due to a different sample matrix typically found in post-combustion gas streams as stated in the applicability of ASTM D6522–11, the interference check must be done on the oxygen measurement with the appropriate gases (*e.g.,* carbon dioxide, VOC mixture, and methane) and concentration ranges. The ASTM D6522–11 method also has calibrations before and calibration checks after testing. According to Methods 3A, 3C, and ASTM D6522–11, the data are valid only when they pass the bias check or zero and upscale calibration error check. The EPA does not believe manufacturers' specifications are rigorous enough to ensure data are of a proper quality.

5. More Precise Location Data

The EPA proposed more specific requirements for reporting the locations where measured methane surface emissions are 500 ppm above

background in the 2015 proposed Emission Guidelines (80 FR 52124). Specifically, the EPA proposed to require landfills to report the latitude and longitude coordinates of each surface emissions monitoring (SEM) exceedance using an instrument with an accuracy of at least 3 meters. This includes surface methane readings above 500 ppm for landfills conducting quarterly SEM with GCCS in place, as well as landfills that are conducting Tier 4 SEM to determine the timing of GCCS installation.

Comments: Several commenters support and several commenters oppose the EPA's proposed requirement to report the latitude and longitude coordinates of each methane surface emissions exceedance using an instrument with an accuracy of at least 3 meters.

Of those commenters that support the requirement, one said that making global positioning system (GPS) coordinates of each exceedance available will assist owners or operators in determining the location and timing of exceedances relative to the GCCS components and would also assist in inspections and enforcement. This commenter added that these requirements provide important compliance monitoring assurances as well as important information to landfill owners or operators regarding their GCCS effectiveness. Other supportive commenters argued that all SEM data and GPS coordinates should be recorded, no matter whether there is an exceedance. One of these commenters, a state agency, said that the NSPS and Emission Guidelines have historically required retention of only exceedance data, but GPS data correlated with SEM readings would be an invaluable addition to the monitoring procedure. Another commenter said recording all SEM data (rather than only exceedances) is necessary to show compliance with the monitoring requirement; and by linking the methane readings with positioning data, the time required to process the data will be reduced. Commenters said that by correlating the SEM readings directly with the location of the reading, facilities and their regulators can easily gain a clear picture of how the LFG collection system was functioning and anticipate problems before they arise by tracking trends in the data.

Of the commenters that oppose the requirement that owners or operators of landfills report the latitude and longitude coordinates of each exceedance using an instrument with an accuracy of at least 3 meters, one said it is unclear why coordinate information must be reported, given that it merely adds burden for sites to collect and report as well as for agencies to review. Two of these commenters argued that the added expense to purchase an instrument (*i.e.,* a GPS device), use that GPS device in the field, and then plot the GPS data on a map, may provide no additional value to the operator compared to marking exceedances with marker flags. One of these commenters stated that 3 meters is too much of an error range such that the use of GPS alone may not allow the operator to return the exact spot of the exceedance, and may still necessitate the use of a marker flag. Another of these commenters added that the existing approach of marking exceedances at their exact physical location with a marker flag is actually more accurate because it does not rely on a technology with accuracy limitations.

Some of the commenters that oppose the requirement said that it is unclear from the docket materials (*e.g.,* the Regulatory Impact Analysis) whether the EPA evaluated: (1) If GPS equipment can achieve an accuracy of at least 3 meters; (2) the cost to purchase or rent GPS equipment; and/or (3) the size and weight of the GPS equipment with regard to requiring a technician to carry another field monitoring instrument. One of these commenters added that because GPS equipment is not typically integrated into other monitoring devices, monitoring technicians will be required to carry the GPS equipment in addition to the monitoring equipment, which could be difficult and present a safety concern.

Response: The EPA is finalizing a requirement for landfills to report the latitude and longitude coordinates of each surface emissions exceedance, as proposed in the 2015 Emission Guidelines, except the instrument accuracy must be at least 4 meters instead of 3 meters. GPS technology is readily available and is currently in use at landfills in California and other landfills employing electronic LFG data management systems. These GPS devices have the ability to identify latitude and longitude coordinates in decimal degrees with at least five decimal places. This level of accuracy and precision is consistent with the requirements finalized in the Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards (80 FR 75250). The EPA is aware of one device that is already in use by some landfills in California to conduct surface emissions monitoring and to create a more comprehensive understanding of the GCCS. The instrument, containing a flame ionization detector (FID), is linked by Bluetooth wireless technology to a GPS-enabled handheld field instrument. This instrument has an accuracy of 2–4 meters.

When reviewing site records on the location of the traversed path and where surface emission leaks were identified, inspectors will be able to identify areas of the landfill where surface monitoring activities may be incomplete, which may assist with targeting inspections to problem areas of the landfill. In addition, more precise location data will allow the landfill owner or operator to overlay the coordinates of surface exceedances against maps of the GCCS to determine spatial and temporal patterns of exceedances relative to GCCS components. Both the landfill owner or operator and regulators can use locational data to gain perspective on how the LFG collection system is functioning over time and will allow the landfill to track trends in GCCS performance and cover practices.

Using GPS locational data will provide a more robust and long-term record of GCCS performance compared to the short-term practice of simply marking an exceedance location with a marker flag. Owners or operators may continue the practice of marking exceedances with a flag, but GPS data will allow the landfill owner or operator to return readily to the location of the exceedance to not only take the required corrective action, but also to track and inform long-term performance of the GCCS to minimize emissions.

The EPA included the rental price of a Trimble Integrated Landfill Gas Solution device, which combines a FID linked by Bluetooth wireless technology to a GPS-enabled handheld field instrument, in the revised testing and monitoring cost analysis for both the final NSPS and final Emission Guidelines. The GPS location is recorded in real time as the technician traverses the path so the labor involved in gathering and recording the data with GPS coordinates is expected to be minimal. In fact, the recording of each surface reading and the corresponding locational data is automatic, in contrast to the older technology, which may have involved handwriting an exceedance in a notebook and then transposing the data to a computer after returning from the field. Eliminating transposing the data could reduce data entry errors and improve data accuracy and credibility. The GPS device is already in use by landfills that maintain an electronic LFG data management system to map long-term trends in GCCS performance. The GPS device weighs approximately 21 ounces (including

battery weight) and can be clipped to a belt or attached to a backpack to allow the technician to complete the monitoring safely.

6. Update and Approval of Design Plan

The EPA proposed three criteria for when a design plan must be submitted for approval: (1) Within 90 days of expanding operations to an area not covered by the previously approved design plan; (2) before installing or expanding the gas collection system in a way that is not consistent with the previous design plan; and (3) prior to implementing an approved alternative operating parameter value for temperature, nitrogen, or oxygen, if the owner or operator has requested alternative operating parameter values. Further, the EPA proposed to maintain the same site-specific design plan review and approval procedures while soliciting comment on ways to streamline the design plan submission and approval procedures. Similarly, the August 2015 proposed Emission Guidelines included the first two criteria but omitted the third criteria to submit an updated design plan prior to implementing an approved alternative operating parameter value for temperature, nitrogen, or oxygen.

Comment: Commenters opposed the requirement to update the design plan prior to implementing an approved alternative operating parameter value for temperature, nitrogen, or oxygen because the requirement to obtain approval of the updated design plan creates a duplicative approval process for these alternative values. Commenters stated that the EPA has removed operational flexibility and placed additional burden on the regulatory agencies by requiring this update and approval process for design plans. Several commenters noted that there is no approval timeline, which leaves landfills in limbo regarding their operations, even when alternative operating values have already been approved for the landfill.

Response: As discussed in Section VI.A.1 of this preamble, the EPA is finalizing the removal of operational standards for nitrogen/oxygen levels at the wellhead. High temperature values will be reported electronically on an annual basis. Thus, the EPA has also removed the criterion to update the design plan for alternative operational standards. The EPA did not finalize this criterion, in order to minimize additional burden on approving agencies and landfill owners or operators. See the Response to Comments document located in the docket for this final rule for additional discussion related to updates and approval of the design plan.

B. Tier 4

The proposed subpart XXX included three different tiers that are available to an affected landfill to estimate whether or not the landfill exceeds the NMOC emission threshold, thus requiring collection and controls. The EPA requested comment on whether to include an additional tier, ''Tier 4'', which would allow the use of site-specific measurements of surface methane emissions to determine if installation of a GCCS is required.

Further, in the Emission Guidelines, the EPA proposed Tier 4 as an alternative site-specific emission threshold determination for when a landfill must install and operate a GCCS (80 FR 52112). Under the proposed Tier 4, landfills could demonstrate that surface methane emissions are below 500 ppm for four consecutive quarters based on the results of quarterly site-specific methane emissions monitoring of the perimeter of the landfill and entire surface of the landfill along a pattern that traverses the landfill at 30-meter (98-ft) intervals, in addition to where visual observations may indicate elevated concentrations of LFG, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations. Once a landfill opts to use Tier 4, any reading of 500 ppm or greater would require the installation and operation of a GCCS within 30 months of the Tier 2 exceedance. For both Tier 4 SEM for determining the timing for GCCS installation and SEM to ensure a well-operated GCCS, the EPA considered limiting SEM during windy conditions. Specifically, in the Emission Guidelines, the EPA proposed that SEM must be terminated when the average wind speed exceeds 5 mph or the instantaneous wind speed exceeds 10 mph. However, the EPA also proposed that the Administrator may approve alternatives to this wind speed SEM termination for landfills consistently having measured winds in excess of these specified limits.

The EPA received several comments on both the general request for comment on a Tier 4 provision in the 2014 NSPS proposal as well as more specific comments on the proposed Tier 4 provision included in the 2015 Emission Guidelines proposal. These comments are summarized below.

Comment: Many commenters, representing industry, state regulatory agencies, and environmental interests, supported the Tier 4 SEM approach for determining when a GCCS must be installed. In addition, the Environmental Defense Fund (EDF) presented the idea of a surface concentration threshold as one of many potential alternatives to further reduce emissions from landfills in its January 2013 whitepaper.[40] Commenters stated that the option to conduct site-specific measurements using SEM is a more accurate indication of when gas collection is necessary to reduce emissions, compared to modeled emission rates. SEM is a data-driven approach that is better able to adjust for differentials in gas generation that may be a result of climate differences, waste acceptance rates, and cover soil materials that vary between landfills in different regions of the United States. One of these commenters claims that modeling can also cause landfills to install GCCS prematurely, incurring a financial burden that is not warranted.

One commenter disagreed with using Tier 4 to determine the timing of GCCS installation and suggested that the approach provides landfills another option to delay installation of controls. This commenter suggested either removing the provision or making Tier 4 much more stringent. Other commenters expressed concern about state agencies' lack of experience with SEM and time to determine whether Tier 4 monitoring requires a GCCS to be installed. These commenters also requested guidance for Tier 4 implementation procedures.

Commenters disagreed on the potential benefits of a Tier 4 option. Commenters representing both industry and environmental interests asserted the SEM option would encourage landfill owners or operators to implement methane reduction practices, such as the use of oxidative landfill covers, organic waste diversion, and interim gas control measures (horizontal gas collectors, connecting a leachate collection recovery system into a GCCS), noting that such practices could be implemented more quickly and more cost-effectively than a GCCS installed in accordance with the design plan requirements of the current NSPS. One commenter indicated that the use of SEM in determining the need to install a GCCS would reduce costs and energy consumption for landfills otherwise required to install controls. The commenter also asserted that landfills would not generate a sufficient amount of gas to support a collection system but would remain below surface emission thresholds based on site-specific

[40] Environmental Defense Fund. Recommendations and Considerations for EPA's Forthcoming Revisions to Section 111 Standards for MSW Landfills. January 2, 2013. See EPA–HQ–OAR–2003–0215–0050.

measurements. Two commenters disagreed that Tier 4 would encourage organics diversion at landfills. One of these commenters agreed that Tier 4 would encourage the use of other methane reduction practices such as oxidative covers and interim gas controls, but these practices would be done at the expense of more effective installation of active GCCS.

Commenters made several specific suggestions regarding details of how Tier 4 should be implemented, including which landfills should qualify for Tier 4, the areas subject to SEM under Tier 4, the surface emission concentration to identify exceedances and how many exceedances would be needed to trigger GCCS installation under Tier 4, the ordering of Tiers 1–3 relative to Tier 4, and meteorological conditions necessary to achieve robust results. A summary of each of these implementation comments is presented below.

Which landfills should qualify. Some commenters believe that the EPA should limit the types of landfills that qualify for Tier 4. One commenter opposed the inclusion of a Tier 4 option for new landfills, stating that it allows a subset of new landfills to delay methane capture requirements when these landfills will be required to install a GCCS in the future and should have a GCCS designed and installed during landfill construction. One commenter encouraged the EPA to ban Tier 4 for landfills with a voluntary (non-regulatory) GCCS because it is possible that GCCS design, monitoring, recordkeeping, and reporting requirements could be avoided indefinitely through the use of a non-regulatory GCCS that may not provide the same level of control as required by the EPA landfills regulations. Another commenter thinks that Tier 4 could be conducted at landfills with a GCCS installed, but that the GCCS should follow typical operational conditions during the Tier 4 test. In other words, if portions of the site are typically offline due to decreased gas flow, the commenter thinks those portions must remain offline during Tier 4. Further, one commenter believes that no means of gas control whatsoever should be employed during the Tier 4 exemption.

Which areas. Commenters also recommended certain Tier 4 procedures for GCCS installation. They recommended conducting Tier 4 over the parts of the landfill that are required to install a GCCS, following the SEM methods currently established in 40 CFR part 60, subpart WWW. If no exceedances of 500 ppm over background concentration occur, then GCCS installation would not be required. Quarterly SEM would be conducted thereafter until the landfill or area of the landfill is closed. Closed areas would also be reviewed using the SEM approach, but if no exceedances occur, those closed areas would no longer be required to be tested.

Surface exceedances and corrective action. Regarding how many surface exceedances identified using Tier 4 should trigger GCCS installation requirements, commenters generally supported some form of corrective action allowance. Some commenters recommended that if an exceedance occurred during Tier 4 SEM testing, then landfill owners or operators should follow the same procedures and timelines for remediation and re-monitoring as outlined in 40 CFR part 60, subpart WWW. These commenters further suggested that if an exceedance could not be remediated under the existing subpart WWW procedures, then the landfill would be required to prepare a GCCS design plan within 1 year of the initial exceedance and install a GCCS within the monitored area within 30 months of the initial exceedance. One commenter claimed that a lack of corrective action would cause facilities to avoid using Tier 4, causing it to seldom be used. Another commenter recommended some level of corrective action, because a single exceedance would not mean that LFG emissions were sufficient to necessitate GCCS installation. One commenter recommended providing a short period of time for corrective action and re-testing before GCCS installation. Other commenters recommend that Tier 4 SEM be modified to allow for a single, 10-day corrective action period for each exceedance of the 500 ppm threshold. Another commenter agreed to allow 10 days to correct the first exceedance, but also recommended allowing 10 days to correct the second exceedance, 1 year from the third exceedance to prepare the GCCS design plan, and 30 months from the initial exceedance to install the GCCS.

Order of tiers. In regards to moving through the tiers, commenters presented one of two opinions. Some commenters suggested that Tier 4 be available for use in place of or in addition to performing a Tier 1 or Tier 2 analysis. Several commenters suggested that Tier 4 could be employed at any point following a Tier 1 or Tier 2 test where the calculated NMOC emission rate was greater than the NMOC threshold for installing a GCCS. On the other hand, another commenter suggested that Tier 4 become the new Tier 3.

Threshold concentration. Commenters disagreed on the appropriate surface threshold concentration. Several commenters did not support a threshold below 500 ppm. Other commenters supported the adoption of a 200 ppm threshold for Tier 4 consistent with the CA Landfill Methane Rule (LMR) and incorporating an integrated limit of 25 ppm for Tier 4.

Frequency. There were a variety of opinions on how often SEM should be conducted for Tier 4. One commenter (suggested the SEM should be done annually instead of quarterly. Two other commenters were concerned with reducing the frequency to semi-annually unless the landfill no longer accepted waste. One of these commenters noted that if a landfill has already crossed the 34 Mg/yr NMOC threshold and the facility continues to receive solid waste, then the expected gas generation will continue to increase.

Wind restrictions. In the 2015 Emission Guidelines, the EPA proposed Tier 4 as an alternative site-specific emission threshold for determining when a landfill must install and operate a GCCS. For both Tier 4 SEM for determining the timing for GCCS installation and SEM to ensure a well-operated GCCS, the EPA considered limiting SEM during windy conditions. Specifically, in the 2015 Emission Guidelines, the EPA proposed that SEM must be terminated when the average wind speed exceeds 5 mph or the instantaneous wind speed exceeds 10 mph. However, the EPA also proposed that the Administrator may approve alternatives to this wind speed surface monitoring termination for landfills consistently having measured winds in excess of these specified limits.

Many commenters, including many state agencies, opposed limiting surface monitoring during windy conditions, stating that the wind restrictions would be a significant inhibitor to completing the required monitoring in many regions of the country due to typical windy conditions. Commenters also stated that it would be difficult to schedule and reschedule dedicated sampling crews.

Commenters claimed that climate conditions across the United States are too variable, that monitoring the wind using an anemometer is not representative of wind conditions where the surface monitoring is required (5–10 cm of surface), and that it is difficult to assemble monitoring teams and schedule monitoring events if they may be cancelled due to wind. One commenter supports the development of a Tier 4 SEM methodology that is functional during windy conditions.

Other commenters support the removal of the wind speed criteria and replacement with a requirement that surface monitoring be performed during typical meteorological conditions. Lastly, one commenter pointed out that the Tier 4 proposal is inconsistent with the ongoing quarterly SEM requirements since Tier 4 has wind restrictions and the ongoing quarterly SEM does not.

One commenter noted that EPA recognized wind speed can skew the results of SEM. Another commenter did not submit comments specific to the wind speed limitations; however, this commenter supported the SEM approach in the CA LMR, which does include wind speed restrictions.

Traverse pattern. One commenter recommended that EPA require enhanced SEM as part of Tier 4 demonstrations, including tighter walking patterns, consistent with the CA LMR.

Recordkeeping and reporting requirement. Some commenters believed the requirement to maintain all data was burdensome and that landfills should only be required to document exceedances of the 500 ppm threshold. These same commenters supported the notification requirement; however, one commenter believes landfills should not be required to reschedule monitoring events based on the availability of regulatory authorities. Furthermore, two commenters thought the notification requirement was acceptable but with the existing wind requirements, coordination with regulators could become even more challenging. Another commenter did not support the notification requirement because Tier 4 is voluntary.

Response: After considering public comments and input from small entity outreach, the EPA is finalizing Tier 4 SEM procedures for determining when a landfill must install a GCCS. Tier 4 provides operational flexibility and allows owners or operators of landfills that have exceeded the modeled NMOC emission rate threshold to demonstrate that site-specific surface methane emissions are below a specific threshold.

The EPA agrees with commenters that the Tier 4 SEM option will encourage landfill owners or operators to implement methane reduction practices, such as the use of oxidative landfill covers, organic waste diversion, and interim gas control measures and that such practices can be implemented more quickly and more cost-effectively than an NSPS-compliant GCCS. Such measures can directly affect surface emissions and when employed would help a landfill ensure that surface emissions are low. The EPA expects that delaying installation of a regulatory GCCS will not have a significant negative impact on public health or the environment, if the surface emissions can be demonstrated to be kept below the threshold with early control or voluntary control measures. In fact, the EPA expects that alternative methane reduction operational practices employed by landfill owners or operators who are interested in Tier 4 will reduce near-term emissions of LFG from the surface of the landfill.

Under Tier 4, the landfill owner or operator would continue to calculate the NMOC emission rate using Tiers 1, 2, or 3, and report results in the annual report to demonstrate that NMOC emissions are less than 50 Mg/yr. However, a landfill that can demonstrate that surface emissions are below 500 ppm over the entire perimeter of the landfill and along a pattern that traverses the landfill at 30-meter intervals for four consecutive quarters will not trigger the requirement to install a GCCS even if Tier 1, 2, or 3 calculations indicate that the 34 Mg/yr threshold has been exceeded. Regarding frequency of monitoring, the EPA is finalizing an approach where quarterly SEM is required for Tier 4 indefinitely unless the landfill is closed. Closed landfills would be able to reduce the frequency of surface emission monitoring to annually after four quarters of no surface exceedances of 500 ppm methane or greater. Landfills that are closed are on the downside of their gas generation profile.

Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr but less than 50 Mg/yr using Tier 1 or Tier 2. Tier 3 was not required because tiers 1 and 2 are more commonly used. If both Tier 1 and Tier 2 indicate NMOC emissions of 50 Mg/yr or greater, then Tier 4 cannot be used. This change avoids a potential conflict between what is required under the Emission Guidelines and what is required by the landfills NESHAP for landfills with modeled NMOC emissions greater than 50 Mg/yr. It also ensures that landfills with modeled NMOC emissions at 50 Mg/yr or more continue to be required to install controls at an NMOC level and on a schedule that is at least as stringent as the current NSPS (40 CFR part 60, subpart WWW). To demonstrate that NMOC emissions are less than 50 Mg/yr according to Tier 1 and Tier 2, landfill owners or operators will continue to calculate the NMOC emission rate and report results annually.

If the landfill opts to use Tier 4 for its emission threshold determination and there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill, the owner or operator must install a GCCS, and the landfill cannot go back to using Tiers 1, 2, or 3. Once there is any measured concentration of methane of 500 ppm or greater from the surface of the landfill, the EPA is requiring a GCCS to be installed and operated within 30 months of the most recent NMOC emission rate report with a calculated NMOC emission rate of 34 Mg/yr or greater according to Tier 2. Starting the 30 months from the most recent NMOC emission rate report ensures that a GCCS is installed in a timely manner. The EPA believes that if a landfill owner or operator chooses to use Tier 4 SEM, it is appropriate to require the installation and operation of a GCCS when any reading of 500 ppm or greater is detected during the quarterly SEM event. Since Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr NMOC, but less than 50 Mg/yr using Tier 1 or Tier 2, we would expect the methane emissions at the landfill to be below the 500 ppm threshold. If an exceedance of the threshold is detected, it would be indicative of higher emissions than would normally be expected at a landfill.

The EPA is requiring installation of a GCCS upon any measured concentration of methane of 500 ppm or greater from the surface of the landfill—without any corrective action, to ensure that landfills employ operational practices that minimize emissions. A reading of 500 ppm methane for a landfill that has modeled NMOC emissions greater than or equal to 34 Mg/yr NMOC would indicate that the landfill conditions warrant installation of a GCCS.

The EPA selected a 500 ppm threshold for Tier 4 because 500 ppm is consistent with the level the EPA determined to be appropriate to demonstrate that a GCCS is well-designed and well-operated. In other words, when conducted properly, SEM is a good indicator of how well a GCCS is operating overall. For landfills without a GCCS (including those that may be using other LFG mitigation strategies), the level of 500 ppm methane will demonstrate that site-specific surface methane emissions are as low as those allowed at a landfill with a well-operated and well-designed GCCS in place. (See the docketed memorandum "Establishing a Site-Specific Emission Threshold Alternative for MSW Landfills, 2015.") Therefore,

the EPA believes this alternative site-specific concentration threshold will achieve the goal of minimizing methane emissions to the atmosphere. In addition, this approach is consistent with the surface concentration threshold approach in the CA LMR.

In response to public comments concerned with implementation of Tier 4 with wind speed restrictions, the EPA is retaining a wind speed limitation but allowing the use of a wind barrier when onsite wind speed exceeds the limits in the regulation. The EPA is also providing additional clarifications about probe placement (as described in section IV.A.2 of this preamble) for Tier 4 SEM. In the proposed NSPS (80 FR 52136), the EPA acknowledged concerns about the accuracy of SEM under windy conditions. The EPA is including the wind speed restriction, because air movement can affect whether the monitor is accurately reading the methane concentration during surface monitoring. Because Tier 4 is an optional emission threshold methodology, the EPA believes that wind speed restrictions and the use of wind barriers are appropriate to ensure the reliability of the results, which in turn determine the timing of GCCS installation. We also refined the wind speed criteria to account for gusts up to 10 mph and clarified that measurements must be terminated if the average wind speed exceeds 25 mph.

Regarding landfills equipped with a non-regulatory GCCS, the EPA is allowing the non-regulatory GCCS to be in operation during the Tier 4 SEM demonstration, but only if the non-regulatory GCCS has operated for at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (6,570 hours), as discussed below. The EPA recognizes that many landfills have acted early to control their emissions and installed a GCCS before surpassing the size and NMOC emission thresholds in the landfills regulations in order to recover and utilize LFG methane for beneficial use, flare for carbon credits, control odors, or meet state-specific regulations that may be more stringent than the federal NSPS standards. Thus, during the SEM demonstration, the non-regulatory GCCS must continue to operate as it normally would to collect and control as much LFG as possible. Although these landfills do not operate their GCCS under the landfills NSPS, they employ the same technology that would be applied to comply with the landfills NSPS. Many of these non-regulatory GCCSs are located at sites that are likely to eventually exceed the NSPS size and NMOC emissions thresholds and thus if no exceedances are identified during a Tier 4 SEM, the system is operating at a level consistent with the landfills NSPS collection and control requirements and operational standards at a point in time earlier than when federal regulations would require. These near-term methane reductions from non-regulatory GCCS are beneficial to the environment and the goal of achieving short-term emission reductions of methane, a potent greenhouse gas. In addition, landfill owners or operators have incentive to operate the GCCS as efficiently as possible to collect and control LFG to avoid surface exceedances, as it would reduce paperwork requirements associated with the compliance provisions of the landfills NSPS. The non-regulatory GCCS would have to be robust to keep readings below 500 ppm methane during an SEM demonstration.

To not allow the Tier 4 demonstration while a non-regulatory GCCS is in operation under these circumstances would create a disincentive for landfill owners or operators to install control systems voluntarily before emissions reach the regulatory threshold for review. The requirement to operate the GCCS at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (described below) will ensure that the non-regulatory GCCS is in regular use and thus represents accurate operation of the facility.

The landfill owner or operator is allowed to operate the non-regulatory GCCS during the Tier 4 demonstration, but only if the non-regulatory GCCS has operated for at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (6,570 of 8,760 hours). To demonstrate that the non-regulatory GCCS operated at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration, landfill owners or operators must keep records of the total operating hours of the gas collection system as measured for each destruction device (*i.e.,* at the flare, engine, or other destruction device), as well as the annual operating hours where active gas flow was sent to each destruction device. If the non-regulatory GCCS has not operated at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration, then the landfill is not eligible for Tier 4. The EPA seeks to encourage use of voluntary non-regulatory GCCS systems for early gas collection before emissions reach the regulatory threshold for review, while still allowing landfill owners and operators to use Tier 4 surface emissions monitoring approach to determine if a GCCS is required. We believe that requiring the operation of the non-regulatory GCCS at least 75 percent of the hours during the 12 months leading up to the Tier 4 SEM demonstration (described below) will ensure that the non-regulatory GCCS is in regular use and thus results would be representative of the operation of the landfill.

Regarding other recordkeeping and reporting requirements associated with Tier 4, the EPA is finalizing the requirement to retain all surface data readings, including calibration data and traverse path and sampling location data based on GPS coordinates up to 5 decimal places. This approach will improve transparency of Tier 4 results, and make them readily available to any inspector coming to the landfill. Further, many sites already use data loggers to collect and store SEM readings and evaluate geospatial surface emission trends over time and the EPA disagrees that it would be overly burdensome to record these data and maintain them on-site. While the final rule is specifically requiring an electronic record of the latitude and longitude coordinates of each surface measurement, the EPA is not specifying a file extension for storing a record of an actual digital map file because each landfill or each regulatory agency may employ different GIS mapping or data management software programs. Instead, the EPA believes the electronic record of latitude and longitude coordinates associated with each surface emission sample will be more appropriate to withstand variation in technology versions over time or across different agencies, while still providing for a record format that can be easily converted into a map. The records will also include wind speed data, a timestamp (to the nearest second) of when the sample collection begins, and a log of the length of time each sample was taken (*e.g.,* the time the probe was held over the surface for each sample). The EPA is also finalizing a recordkeeping requirement to take and store digital photographs of the instrument setup. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration. The EPA believes these records will help provide credibility to the Tier 4 sampling results.

The EPA is also finalizing a requirement to notify delegated authorities 30 days prior to the Tier 4 test so that officials can be present to observe the SEM. This notification is

consistent with other notification requirements for stack testing. This notification requirement will also mitigate concerns that the SEM is being conducted incorrectly and ensure transparency of results achieved during the SEM approach. In the event the Tier 4 SEM is postponed due to weather conditions or other unforeseen events, the EPA is requiring the owner or operator to notify the delegated authority to arrange a rescheduled Tier 4 SEM date.

Emerging Measurement Technologies. Today's rulemaking provides certain MSW landfill owners or operators the option of using either modeling or the Tier 4 SEM approach to determine whether controls are required to be installed at specific landfills. Current modeling approaches, which rely on the decomposition rate of different waste streams buried in a landfill, are prone to uncertainties due to inaccuracies in input data and often unverifiable assumptions. Current surface emission measurement methodologies can also have associated uncertainties.

New methane emissions measurement methodologies are emerging that are anticipated to provide landfill methane emission rates (mass per unit time) over time, thereby reducing significantly the uncertainty associated with current modeling and emission measurements approaches. Two promising examples of new methane measurement methodologies being used by research groups to quantify landfill methane emissions are mobile tracer correlation (TC)[41][42][43][44] and discrete area source eddy covariance (DASEC).[45]

1. *Mobile tracer correlation.* This methodology provides a "snap-shot in time" assessment of whole facility methane emissions using on-site release of atmospheric tracer gases. It provides a total mass emission rate of methane (or other gas) per unit of time. An instrumented vehicle driving 1 km to 4 km downwind of the landfill simultaneously measures the emitted landfill methane plume along with the superimposed tracer gas release. The landfill methane emission rate is determined through a simple ratio to the known tracer gas release rate. The technique has been demonstrated using a variety of tracer gases and instruments by a number of groups to investigate emissions from landfills and other sources. The mobile tracer correlation approach is under development by the EPA as a Category C "other test method (OTM)" with potential posting in 2017 (*https://www3.epa.gov/ttnemc01/prelim.html*).

2. *Eddy covariance (EC).* This micrometeorological method estimates the source emission rate from the vertical wind speed and gas concentration above the emitting surface. This technique measures the emissions flux in mass of methane (or other gas) per unit area. The technique is well-established for measurement of emission fluxes from spatially-extended homogenous sources, such as very large, flat fields. Discrete area source eddy covariance (DASEC) is an application of EC to finite, heterogeneous area sources. This application of EC has been recently demonstrated on landfills, although method development questions on the effects of topography and variable observational foot print remain. DASEC provides the potential for long term (near continuous) measurements of discrete sections of a landfill using solar-powered on-site instrumentation. Development of this type of long term measurement capability is critical to better understand and track changes in landfill emissions overtime that may be caused by both site management and atmospheric factors.

In sum, as noted above, these techniques are still being investigated and additional work will be needed before the EPA can deem them ready for use in this application. Once additional research is completed, we believe that DASEC used in combination with mobile TC will provide a characterization of methane landfill emissions with significantly reduced uncertainty over current models or measurement techniques.

C. Changes To Address Closed or Non-Productive Areas

The EPA proposed criteria that allow a landfill owner or operator to cap or remove the GCCS from certain areas of the landfill where gas generation is expected to be diminished. Specifically, the 2014 proposed NSPS allowed GCCS removal when the landfill is closed, the GCCS has been operated for a minimum of 15 years, and the NMOC gas produced by the landfill is calculated below 40 Mg/yr for three consecutive quarters.

Comment: Commenters opposed the 15-year criteria for GCCS equipment, stating that the requirement is arbitrary and does not account for the site-specific conditions. One commenter added that the 15-year criteria presents significant compliance challenges and costs for a facility and the NSPS presents few options to address low flow and gas quality conditions. Another commenter contended that the length of time a GCCS has been operating in a portion of a landfill is unrelated to the productivity of that area and that the age of the waste is more relevant. Other commenters believe that regardless of how long a GCCS system has actually been in operation, closed landfills should be able to discontinue operations based on site-specific emission levels. One commenter believes that a closed MSW landfill should be able to remove NSPS control requirements once the site demonstrates that it emits less than the emissions threshold based on actual LFG flow and site-specific NMOC concentration in accordance with 40 CFR 60.764(b) regardless of the age of the GCCS or how long it has operated.

Several commenters noted that the provision provided in the 2015 Emission Guidelines to allow landfills to demonstrate the GCCS could not be operated for 15 years due to declining flow was vague, and more guidance was needed to provide instructions to landfills on how to demonstrate this to regulators.

Response: After considering public comments, the EPA is finalizing criteria for capping, removing, or decommissioning the GCCS that are similar to the criteria in 40 CFR part 60, subpart WWW, but have been adjusted to reflect the NMOC emission threshold in the final rule and to provide flexibility on the requirement to operate the GCCS for 15 years. The final criteria are: (1) The landfill is closed, (2) the GCCS has been in operation for 15 years or the landfill owner or operator demonstrates that the GCCS will be unable to operate for 15 years due to declining gas flow, and (3) three successive tests for NMOC emissions are below the NMOC emission threshold of 34 Mg/yr.

The EPA is requiring that NMOC emission rate of the landfill must be less than 34 Mg/yr on three successive test dates. This makes the threshold for removing a GCCS consistent with the threshold for installing a GCCS. In addition, the EPA is retaining the requirement to operate the GCCS for 15 years, but is providing flexibility to address declining gas flow in areas where the GCCS has not operated for 15

[41] Development of a mobile tracer correlation method for assessment of air emissions from landfills and other area sources, Foster-Wittig, T.A.; Thoma, E.D.; Green, R.B.; Hater, G.R.; Swan, N.D.; Chanton, J.P. Atmos. Environ. 2015, 102 (0), 323–330.

[42] Quantification of methane emissions from 15 Danish landfills using the mobile tracer dispersion method, Mønster, J.; Samuelsson, J.; Kjeldsen, P.; Scheutz, C. Waste Manage. 2015, 35 (0), 177–186.

[43] Methane Emissions Measured at Two California Landfills by OTM–10 and an Acetylene Tracer Method, Green, R.B., Hater, G.R., Thoma, E.D., DeWees, J., Rella, C.W., Crosson, E.R., Goldsmith, C.D., Swan, N., Proceedings of the Global Waste Management Symposium, San Antonio, TX, October 3–6, 2010.

[44] Development of Mobile Measurement Method Series OTM 33; Thoma, E.D.; Brantley, H.L.; Squier, B.; DeWees, J.; Segall, R.; Merrill, R.; Proceedings of the Air and Waste Management Conference and Exhibition, Raleigh, NC, June 22–25, 2015.

[45] Using Eddy Covariance to Quantify Methane Emissions from a Dynamic Heterogeneous Area, Xu, L., Lin, X., Amen, J., Welding, K. and McDermitt, D. Impact of changes in barometric pressure on landfill methane emission. Global Biogeochemical Cycles 2014, 28(7), pp. 679–695.

years. If the landfill is closed and the NMOC emission rate is less than 34 Mg/yr, but the GCCS has not operated for 15 years, the landfill owner or operator can demonstrate that the GCCS will be unable to operate for 15 years due to declining gas flows. The EPA is providing this flexibility to address areas of declining gas flows due to the age of the waste, arid climate, or low organic content. Given that there are unique situations that could cause low gas flow, or low gas quality which would cause a GCCS to be unable to operate for 15 years, the EPA is not providing prescriptive criteria for how a landfill owner or operator can demonstrate that a GCCS could not operate for 15 years and will proceed with a site-specific approach for handling these unique cases. Some examples of data elements that could be used to demonstrate a GCCS is unable to operate may include supplemental fuel use at the flare to sustain operations or LFG quality sample measurements showing methane content lower than what is viable for combustion in the destruction device.

D. Startup, Shutdown, and Malfunction Provisions

In July 2014, the EPA proposed that the standards in subpart XXX apply at all times, including periods of startup or shutdown, and periods of malfunction. In addition, the proposed NSPS included recordkeeping and reporting requirements for all landfill owners or operators to estimate emissions during such periods.

Similarly, the EPA proposed standards that apply at all times in the August 2015 proposed Emission Guidelines. However, the EPA considered how the landfill emissions differ from those generated by industrial or manufacturing sources. Specifically, the EPA noted that landfill emissions are produced by a continuous biological process that cannot be stopped or restarted. Therefore, the primary concern related to SSM is with malfunction of the landfill GCCS and associated monitoring equipment, not with the startup or shutdown of the entire source. SSM periods that we have determined should be covered by the work practice standard are those periods when the landfill GCCS and associated monitoring equipment are not operating.

To address these SSM periods, the EPA proposed in the 2015 Emission Guidelines that in the event the collection or control system is not operating the gas mover system must be shut down and all valves in the GCCS contributing to venting of gas to the atmosphere must be closed within 1 hour of the collection or control system not operating. This provision is consistent with 40 CFR part 60, subpart WWW. Additionally, the EPA proposed recordkeeping of combustion temperature, bypass flow, and periods when the flare flame or the flare pilot flame is out. The EPA received numerous comments on the 2014 proposed changes to the NSPS and the additional proposed edits made in the 2015 Emission Guidelines. A summary of these comments is presented below.

Sierra Club v. *EPA, 551 F.3d 1019 (D.C. Cir. 2008).* Many commenters stated that the *Sierra Club* decision, which addressed SSM conditions in EPA rules, applies only to rules with numerical emission limits and not to rules that are specified as a work practice. One of these commenters elaborated that *Sierra Club* applies to section 111 of the Clean Air Act. Therefore, the commenter concluded that landfills subject to the NSPS are not bound by the findings of *Sierra Club* and instead they are legally allowed to develop a clear and achievable landfill rule by considering the unique circumstances that a landfill is a biological process that cannot be stopped or restarted and that the gas collection and control systems must periodically be shut down for maintenance, repair, and expansion.

Retain the 5 day/1-hour exemption for SSM events. Many commenters, including affected industry commenters and some state agencies, disagreed with removing the provisions in 40 CFR part 60, subpart WWW which allow for a 5-day exemption period for collection systems and 1-hour exemption period for treatment or control devices. These commenters indicated that by removing this provision, state and local agencies could misconstrue the rule to require that a landfill must operate the gas collection system at all times, even during SSM, including periods of collection system construction, expansion, and repair. These commenters suggested instead of removing the exemption provision during periods of SSM, compliance can be maintained as long as the landfill owner or operator minimizes emissions of LFG by following the applicable work practices and restores the system to operation as expeditiously as practicable.

One of the state agency commenters, suggested that the 5-day and 1-hour time limitations in subpart WWW are appropriate for most situations and instead of removing these exemptions, the new subpart XXX could provide a mechanism for the facility to apply to the Administration for an extension of those timeframes. On the contrary, one state agency commenter and an NGO agreed with the standards applying at all times, including periods of SSM.

If the 5 day/1-hour exemption is not retained, the EPA should add a work practice standard for SSM events. One commenter was concerned that the preamble language for the 2014 proposed Emission Guidelines does not clarify how a landfill can demonstrate compliance with the standard during SSM events, stating that "compliance with proposed 40 CFR 60.34f(e) does not constitute compliance with the applicable standards in proposed 40 CFR 60.36f" and that "by shutting down flow to the flare or other control devices a source is unlikely to be in violation of the 98 percent emission reduction requirements since there will be no gas flowing to the control device" (emphasis added, see 80 FR 52134–52135). This commenter stated that the EPA must clarify this confusion and specify a clear set of work practices (*e.g.,* shut down of the gas mover system and prevention of venting) that constitute compliance during SSM periods when the collection or control system is not operated. Several other industry commenters and the U.S. Small Business Administration also asked that the rule specifically accommodate periods when the collection system is not operating during activities associated with construction, expansion, repair, replacement, testing, upgrades, or other maintenance of the system or its components.

Reporting requirement to estimate NMOC emissions whenever the collection system or control system is not operating. Two commenters representing a state agency and an NGO supported reporting NMOC emissions during SSM periods. Several industry commenters provided numerous technical arguments to explain the infeasibility of accurately estimating NMOC emissions during the short periods of SSM. For example, methods to estimate LFG emissions are based on site-specific variables that estimate LFG generation over the life of the landfill, typically on an annual basis, and cannot be used to estimate hourly or daily emissions. Accordingly, the commenters contended that it is technically and practically inappropriate to require landfill owners/operators to make this estimate for the time periods that the gas collection or control systems are not operated, given the substantial technical uncertainties involved in estimating these emissions over discrete, short-term time periods. Further, other commenters noted that emissions during SSM are expected to be very low,

reporting SSM emissions is an onerous and meaningless exercise and is likely to overestimate emissions.

Two commenters asked that if the reporting requirement is retained, the EPA should limit the reporting to periods when the flare is free venting because these are the only emissions that can be estimated accurately. Several commenters asked EPA to develop guidance on how to estimate emissions during SSM if this requirement is retained in the final rule.

Several commenters stated that because there should be no deviation from the rule when the work practices of the rule are followed, there are no excess emissions, and the reported emissions are not relevant to determining compliance. Commenters are concerned that if estimated NMOC emissions are reported, states will deem the reported emissions to be ''excess emissions,'' which could be treated as a serious violation. Therefore, reporting these emissions poses the risk of state or citizen suits for enforcement, even when a landfill is following all requirements of the rule.

Other Comments. Several commenters added that because SSM provisions apply to numerical emission limitations and a numerical limitation applies only to the control device (not the collection devices), commenters stated that SSM provisions should address only operation of the control devices during periods when LFG is routed from the collection system.

Several commenters indicated that the EPA must retain an allowance of 5 days/1 hour for downtime events so that states do not file enforcement actions for downtime events that are shorter than the previously allowed 5 days/1-hour allowance. These commenters also asked the EPA to clarify that the 1-hour allowance for shutting vents allows for free venting for 1 hour such that venting during this time period does not constitute ''excess emissions'' that can be deemed a serious violation.

Response: The EPA recognizes that landfills are not typical affected sources that can be started up or shut down. Landfill emissions are produced by a continuous biological process that cannot be stopped or shut down. The EPA also recognizes that the primary concern is with malfunction of the LFG collection and control system and associated monitoring equipment, not with the startup, shutdown, or malfunction of the entire source. The EPA received extensive comments on the proposed requirements applicable to landfills during SSM events, as summarized above. Consistent with the recent Court decision that vacated the exemption in 40 CFR 63.6(f)(1) and (h)(1) for SSM (*Sierra Club* v. *EPA,* 551 F.3d 1019), the EPA has established standards in this rule that apply at all times.

The general provisions in 40 CFR part 60 provide that emissions in excess of the level of the applicable emissions limit during periods of SSM shall not be considered a violation of the applicable emission limit *unless otherwise specified in the applicable standard* (see 40 CFR 60.8(c)) (emphasis added). As reflected in the italicized language, an individual subpart can supersede this provision.

The EPA is finalizing a requirement in 40 CFR 60.465(e) whereby the standards apply at all times, including periods of SSM. However, the final rule reaffirms the work practice during periods of SSM (40 CFR 60.763(e)). During these SSM events, owners or operators must shut down the gas mover system and close within 1 hour all valves in the GCCS contributing to venting of the gas to the atmosphere. This provision is consistent with 40 CFR part 60, subpart WWW. The landfill owner or operator must also keep records and submit reports of all periods when the collection and control device is not operating. The EPA, however, is not reinstating the 5-day exemption for SSM periods because the provision provides an exemption from compliance with the standard during SSM periods, which the EPA does not have the authority to do under the reasoning of the Sierra Club decision.

E. Definitions of Treated Landfill Gas and Treatment System

The EPA proposed clarifications related to LFG treatment in the proposal. Specifically, the EPA proposed to clarify that the use of treated LFG is not limited to use as a fuel for a stationary combustion device but also allows other beneficial uses such as vehicle fuel, production or high-Btu gas for pipeline injection, and use as a raw material in a chemical manufacturing process. The EPA also proposed to clarify what constitutes LFG treatment by updating the definition to include specific numerical values for filtration and dewatering in order to provide long-term protection of the combustion equipment. Specifically, the 2014 proposed NSPS included a treatment definition that required the water dew point of LFG to be reduced to at least 45 degrees Fahrenheit, rather than lowered by at least 20 °F, and specified a location for the temperature monitoring device that would demonstrate continuous compliance with the 45 degrees Fahrenheit requirement. As an alternative to these numerical values, the EPA also requested comment on an alternative definition for treatment system as a system that filers, de-waters, and compresses LFG. Additionally, the EPA requested comment on the use of treatment system monitoring plans to document procedures to ensure that the LFG has been adequately treated for the intended use.

Similarly, the 2015 proposal to revise the Emission Guidelines for existing landfills included the clarification that the use of treated LFG is not limited to use as a fuel for a stationary combustion device and proposed a definition for LFG treatment. Specifically, the Emission Guidelines proposed a definition of treatment system as a system that filters, de-waters, and compresses LFG for sale or beneficial use. This definition did not include specific numerical values in order to allow tailoring of the level of treatment to the type and design of the specific combustion or other equipment for other beneficial uses in which LFG is used.

Further, the Emission Guidelines included a proposed requirement for owners or operators to develop a site-specific treatment system monitoring plan that would include monitoring parameters addressing all three elements of treatment (filtration, de-watering, and compression) to ensure the treatment system is operating properly for the intended end use of the treated LFG. Additional records that demonstrate that such parameters effectively monitor filtration, de-watering, and compression system performance were also proposed.

Consistent with public comments received on previous landfills documents (67 FR 36475, May 23, 2002; 71 FR 53271, September 8, 2006; 79 FR 41796, July 17, 2014; 79 FR 41772, July 17, 2014), as well as input from participants in small entity outreach, the EPA is finalizing a definition of treatment system as a system that filters, de-waters, and compresses LFG to levels determined by the landfill owner or operators based on the beneficial end use of the gas. The EPA agrees with commenters that the extent of filtration, de-watering, and compression can be site-specific and equipment-dependent, and that different levels of LFG treatment are required for the protection of combustion devices that use treated LFG as a fuel.

Many commenters on the proposed NSPS opposed basing LFG treatment on specific numerical values for filtration and de-watering because this ''one-size-fits-all'' approach was not appropriate, and provided no emission reductions.

One commenter specifically noted the impact of the costs of these requirements on small entities. Additional discussion of the concerns related to costs can be found in the Response to Comments document located in the docket for this rulemaking.

Commenters also supported the use of a site-specific treatment system monitoring plan in place of the proposed numeric values and continuous monitoring and recordkeeping requirements. However, these commenters opposed submission of these monitoring plans for approval from the Administrator. Specifically, the commenters stated that LFG treatment systems are closed loop systems that process LFG for beneficial use and are not control devices that are subject to emission limits. Two commenters cited specific examples from recent rulemaking actions that have similar operation, maintenance, and monitoring plans that are prepared, followed, maintained, and made available to the Administrator for review upon request. For example, the greenhouse gas reporting program (GHGRP) rules require each reporting facility to prepare, follow, and maintain a monitoring plan which is made available to an inspector upon request. Another example cited included the Operation, Maintenance and Monitoring Plan required in the NESHAP for Brick and Structural Clay Products Manufacturing and the NESHAP for Clay Ceramics Manufacturing which were finalized on September 24, 2015.

In consideration of these comments, the EPA is finalizing a requirement that owners or operators must develop a site-specific treatment system monitoring plan that includes monitoring parameters that address filtration, de-watering, and compression to ensure the LFG treatment system is properly operating for the intended end use of the treated LFG. The EPA is also finalizing a requirement that landfills owners or operators seeking to demonstrate compliance using a LFG treatment system must maintain and operate all monitoring systems in accordance with the site-specific treatment system monitoring plan and maintain records of parameters that ensure the treatment is operating properly for the intended use of the gas. The EPA is not finalizing the requirement that these monitoring plans obtain Administrator approval because the treatment system monitoring plan must be submitted as part of the landfill's Title V air pollution control permit application and these monitoring parameters would be integrated into the permit as enforceable conditions (*i.e.,* the landfill monitors the treatment system monitoring parameters and maintains them in the specified range).

The EPA is also finalizing revisions to 40 CFR 60.762(b)(2)(iii)(C) to clarify that if treated LFG cannot be beneficially used for reasons such as end-user capacity limitations, market conditions for gas sales, or unforeseeable shutdowns of the beneficial use equipment, then the treated gas must be controlled in a flare. The flare requirements apply to any gas routed to flares, regardless of whether the LFG is treated. The intent is to require all gas not used for beneficial use to be controlled in either a non-enclosed flare or a control system designed to reduce NMOC by 98 weight-percent to an outlet NMOC concentration of less than 20 ppm, in accordance with 40 CFR 60.762(b)(A) or (B).

F. Other Corrections and Clarifications

1. Test Methods

In the 2014 proposed NSPS, the EPA did not include EPA Method 18 or EPA Method 25A. In the 2015 proposed Emissions Guidelines, the EPA proposed to include Method 25A based on public comments received on the 2014 proposed NSPS and the EPA's recognition that the use of Method 25A is necessary for measuring outlet concentrations less than 50 ppm NMOC. However, the EPA did not propose to include Method 18 (80 FR 52112) because the EPA had determined that Method 18 was not appropriate or cost effective for testing the large number of NMOCs found in landfill samples. Specifically, 40 target analytes are listed in the current landfills section of AP–42 and 160 analytes are listed in the draft landfills section AP–42. The EPA determined that the extensive quality assurance required by the method makes the method technically and economically prohibitive for all the potential target analytes.

Comment: Commenters (requested that the EPA retain both Methods 18 and 25A in the final rule and cited a number of reasons that the EPA should retain them, including both technical and legal reasons. Commenters stated that landfill owners or operators have relied on these test methods to demonstrate compliance for performance testing of enclosed flares as a part of EPA policy for over a decade under 40 CFR 60.764 [60.754]. One commenter emphasized the importance of Method 25A because its use is required for many sources with an outlet concentration of less than 50 ppmv NMOC as carbon.

The commenters noted that the majority of LFG destruction devices show NMOC concentrations below 50 ppmv as carbon. Due to issues with Methods 25/25C in measuring NMOC content under this level, commenters observed that the proposed NSPS rule change effectively removes the ability to accurately measure compliance with the 20 ppmv outlet standard for a large class of enclosed combustors. Commenter believes that Method 25A is the superior testing methodology for certain circumstances and is more commonly used in practice. Commenters cited limitations of Method 25, including sensitivity of the test method to water and carbon dioxide and the inability to measure NMOC content below 50 ppmv as carbon.

Commenters also contended that the EPA did not provide any justification for removing these methods. Commenters stated that the EPA did not provide any factual data, methodology, or any legal or policy justification for its proposed exclusion of Method 25A or Method 18; thus commenters claimed that the EPA did not satisfy the notice-and-comment requirements of the CAA.

Response: After considering public comments, the EPA is including both EPA Method 25A and EPA Method 18 in the final landfills regulations (40 CFR part 60, subparts Cf and XXX).

After reviewing the comments received on the NSPS for new landfills proposed on July 17, 2014, the EPA recognizes that the use of Method 25A is necessary for measuring outlet concentrations less than 50 ppm NMOC. EPA Method 25A determines total gaseous organic concentration of vapor (total organic compounds). Because the rule regulates NMOC, EPA Method 18 or Method 3C is needed to determine the concentration of methane in the gas stream. Method 25A, in conjunction with Methods 18 or 3C (for methane), can be used to determine NMOC for the outlet concentrations less than 50 ppm NMOC as carbon. Note that Method 25A flame ionization detectors are insensitive to formaldehyde.

While Method 18 may be used in conjunction with Method 25A for methane or specific compounds of interest, there are limitations on the number of analytes that can be reasonably quantified in measuring the sum of all NMOCs. With the possibility of 40 target analytes listed in the current landfill section of AP–42 (160 analytes in the draft landfill AP–42), Method 18 is not an appropriate or cost effective method to test all NMOCs found in landfill samples. The extensive QA required by the method makes the method technically and economically

prohibitive for all the potential target analytes.

2. Tier 2 Sampling Procedure

The EPA continues to believe that the number of samples required per hectare is appropriate for Tier 2. As described in 40 CFR 60.764, the EPA is reaffirming that the two samples are required per hectare and if additional samples are taken, all samples must be used in determining the site-specific NMOC concentration. Landfill owners or operators must also ensure that the probes are evenly distributed over the landfill surface. The EPA explored a number of methods, including a statistical approach, when establishing requirements for the number and location of Tier 2 samples for the original rule. Public commenters raised significant concerns with approaches based on equations. As such, the EPA determined that a simplified method (2 samples per hectare) was best and received no public comments to the contrary.

3. Specifications for Active GCCS

The EPA received a comment saying that proposed 40 CFR 60.769(a)(1) referenced the term ''perimeter areas'' and noted that this term was not well defined or explained. The EPA has removed this phrase to avoid confusion. The intent is that all wells installed in the boundary of the waste mass that are connected to the active GCCS should be operated according to 40 CFR 60.769. The final rule language is clearer on this point.

The EPA also added a phrase to 40 CFR 60.769(a)(1) based on public comment to ensure that GCCS design allows for the ability to isolate a well or section and still be able to operate the remainder of the active collection system.

4. Wellhead Pressure Monitoring

In response to public comments, we are clarifying the location and type of pressure required to be measured monthly at each wellhead to demonstrate whether the requirement to maintain negative pressure is being met.

5. Definition of Modification

In the 2014 proposed NSPS, the EPA included ''mass or volume'' in the definition of modification. Based on public comments, which correctly point out that mass can change based on the density of the waste received, we are finalizing the definition of modification consistent with the definition in subpart WWW, which is based on volume only. We also changed the reference to ''horizontal'' to ''lateral'' within the modification definition to be consistent with the defined term ''lateral expansion''.

6. Definition of Sludge and Solid Waste

We are updating the definitions of sludge and solid waste to reference the terms as defined in 40 CFR 258.2 for consistency with the terms as defined in RCRA.

7. Non-degradable Waste

The EPA is reaffirming that all the waste must be included in calculating the design capacity. Non-degradable waste cannot be subtracted from the permitted landfill design capacity. However, non-degradable waste can be subtracted from the mass of solid waste when calculating the NMOC emission rate because such waste would not produce NMOC emissions. Non-degradable waste is defined as waste that does not break down through chemical or microbiological activity. Examples include concrete, municipal waste combustor ash, and metals. Petroleum contaminated soils (PCS) and paper mill sludges likely contain organics that could be emitted as MSW LFG emissions. Therefore, emissions from PCS and sludges would need to be accounted for in the emission estimate only. The EPA is also reaffirming that documentation of the nature and amount of non-degradable waste needs to be maintained when subtracting the mass of non-degradable waste from the total mass of waste for NMOC emission rate calculations.

VII. Impacts of This Final Rule

For most NSPS, impacts are expressed 5 years after the effective date of the rule. However, for the landfills NSPS, impacts are expressed 10 years after the effective date (year 2025) because the landfills regulations require controls at a given landfill only after the NMOC emission rate reaches the level of the regulatory threshold, which may take a number of years. Further, once the NMOC emission rate is exceeded, the reporting and control timeframe allows 3 months to submit the first NMOC emission report and then 30 months after exceeding the NMOC emission threshold before the GCCS is required to be installed. Additionally, the regulations allow the collection and control devices to be capped or removed at each landfill after certain criteria are met, which includes having the GCCS operate a minimum of 15 years. Controls would not be required over the same time period for all landfills. The impacts are a direct result of control; therefore, the annualized impacts change from year to year. By 2025, over 80 percent of the greenfield landfills and modified landfills affected by the NSPS are expected to have installed controls and thus, the EPA considered the impacts of the final rule relative to the baseline in 2025.

The landfills dataset used for estimating the impacts of the NSPS is discussed in detail in the August 27, 2015 supplemental proposal for the NSPS (80 FR 52163). The EPA made several significant edits to the dataset since the August 2015 supplemental proposal, based on public comments received; new data made available from the landfills reporting 2014 emissions to 40 CFR part 98, subpart HH of the GHGRP; and consultations with EPA regional offices, and state and local authorities to identify additional landfills expected to undergo a modification within the next 5 years. After incorporating all of the updates to the inventory and adding the landfills expected to modify, the revised dataset to analyze the impacts of the final rule now has 137 landfills that commenced construction, reconstruction, or modification after July 17, 2014.[46] A detailed discussion of updates made to the dataset is in the docketed memorandum, ''Summary of Updated Landfill Dataset Used in the Cost and Emission Reduction Analysis of Landfills Regulations, 2016.''

The methodology used for estimating the impacts of the NSPS is discussed in detail in the August 27, 2015 supplemental proposal to the NSPS (80 FR 52163). The EPA made several significant edits to the dataset since the August 2015 supplemental proposal based on public comments and comments on a separate peer review of the EPA Landfill Gas Energy Cost (LFGcost) model.[47] Notably, the EPA adjusted its assumption of gas collection efficiency to an average of 85 percent. The impacts analysis at the proposal or supplemental proposal did not apply a collection efficiency assumption. However, in consideration of public comments received and EPA assumptions in subpart HH of the GHGRP, and analyses performed for marginal abatement cost curves, the EPA has included an 85 percent average

[46] July 17, 2014, is the proposed date of the revised NSPS for MSW landfills in 40 CFR part 60, subpart XXX. A landfill opening or commencing construction on its modification after this date would become subject to this new subpart and would not be subject to the revised emission guidelines. The EPA cannot predict the exact month a model landfill will open so the analysis uses a cutoff year of 2014.

[47] See the docketed 2016 RIA for additional discussion of changes made on the methodology for estimating impacts as a result of the LFGcost peer review.

gas collection efficiency factor to reflect a more realistic indicator of GCCS performance.[48] In addition, Chapter 2.4 of the EPA AP–42 for MSW landfills cites a range of collection efficiencies for LFG between 60 and 85 percent, with an average of 75 percent. The EPA also adjusted electricity purchase price and anticipated revenue estimates using forecasted commercial retail electricity rate data and forecasted electricity generation price data for different Energy Information Administration (EIA) Electricity Market Module regions.[49] [50]

A detailed discussion of the methodology and equations used to estimate the impacts of the final rule are available in the docketed memorandum "Updated Methodology for Estimating Cost and Emission Impacts of MSW Landfill Regulations, 2016." The results of applying this methodology to the population of new or modified landfills potentially subject to the final rule are in the docketed memorandum "Revised Cost and Emission Impacts Resulting from the Landfill NSPS Review, 2016." Table 2 of this preamble summarizes the emission reductions and costs associated with the final rule.

TABLE 2—EMISSION REDUCTIONS AND COSTS FOR FINAL RULE IN YEAR 2025 AT NEW OR MODIFIED LANDFILLS

[2012$]

Option	No. of landfills affected [b]	No. of landfills controlling	No. of landfills reporting but not controlling [c]	Annual net cost (million $2012)	Annual NMOC reductions (Mg/yr)	Annual methane reductions (million Mg/yr)	Annual CO_2e reductions (million mt/yr) [d]	NMOC cost effectiveness ($/Mg)	Methane cost effectiveness ($/Mg)	CO_2e cost effectiveness ($/mt) [d]
Baseline (2.5 million Mg design capacity/ 50 Mg/yr NMOC)	128	103	25	90.4	10,520	1.7	41.4	8,600	54.6	2.2
Option (2.5 million Mg design capacity/34 Mg/yr NMOC)	0	12	– 13	6.0 [e]	281	.04	1.1	21,470	136	5.5

[a] Options in this table show the impacts of reducing the NMOC emission threshold below baseline levels for all landfills.

[b] Landfills are affected by the landfills NSPS based on design capacity. Once affected, they calculate and report emissions until they exceed the NMOC threshold, which triggers control requirements. Since we are not changing the size threshold, there are no incremental landfills affected.

[c] Since the number of landfills affected remains the same as the baseline, the number of landfills reporting NMOC (but not controlling) decreases since more landfills will control emissions under the final rule.

[d] Results do not include secondary CO_2 impacts.

[e] The annualized costs represent the costs compared to no changes to the current NSPS (*i.e.,* baseline) and include $11 million to install and operate a GCCS, as well as $0.08 million to complete the corresponding testing and monitoring. These control costs are offset by $5.1 million in revenue from electricity sales, which is incorporated into the net control costs for certain landfills that are expected to generate revenue by using the LFG to produce electricity.

A. What are the air quality impacts?

The EPA estimates that the final rule will achieve nearly an additional 3 percent reduction in NMOC from new, reconstructed, or modified landfills, or 281 Mg/yr, when compared to the baseline, as shown in Table 2 of this preamble. The final rule would also achieve 44,300 Mg/yr of methane reductions (1.1 million mtCO2e/yr). These reductions are achieved by reducing the NMOC threshold from 50 Mg/yr to 34 Mg/yr.

B. What are the water quality and solid waste impacts?

Leachate is the liquid that passes through the landfilled waste and strips contaminants from the waste as the leachate percolates. Precipitation generates the vast majority of leachate volume. Installation of a gas collection system will generate additional liquid, in the form of gas condensate, and it will be routed to the same leachate treatment mechanisms in place for controlling precipitation-based leachate. Collected leachate can be treated on site or transported off site to wastewater treatment facilities. Some landfills have received permits allowing for recirculation of leachate in the landfill, which may further reduce the volume of leachate requiring treatment. Additional liquid generated from gas condensate is not expected to be significant and insufficient data are available to estimate the increases in leachate resulting from expanded gas collection and control requirements.

The additional gas collection and control components required by this final rule have finite lifetimes (approximately 15 years) and these pipes and wells will be capped or disposed of at the end of their useful life. There are insufficient data to quantify the solid waste resulting from disposal of this control infrastructure.

Further, the incremental costs of control for the final rule of $6.0 million in 2025 (7 percent discount, 2012$) are not expected to have an appreciable market effect on the waste disposal costs, tipping fees, or the amount of solid waste disposed in landfills because the costs for gas collection represent a small portion of the overall costs to design, construct, and operate a landfill. The handling of waste by the private companies in the industry was estimated to generate $55 billion of revenue in 2011, of which landfilling contributed $13 billion, while a more recent estimate shows the U.S. non-hazardous solid waste services industry generated about $60 billion in annual revenues in 2015. These revenue estimates do not include activity related to publicly owned landfills. For more information, see the "Regulatory Impact Analysis for the Final Revisions to the Emission Guidelines for Existing Sources and the New Source Performance Standards in the Municipal Solid Waste Landfills Sector" (hereafter "2016 RIA") included in the docket. There is also insufficient information to quantify the effect increased gas control costs might have on the amount of solid waste disposed in landfills versus other disposal mechanisms such as recycling, waste-to-energy, or composting. Note that elements of this final rule—notably lowering the NMOC threshold to 34 Mg/yr—provide additional incentives to separate waste.

C. What are the secondary air impacts?

Secondary air impacts may include grid emissions from purchasing electricity to operate the GCCS

[48] USEPA. Global Mitigation of Non-CO_2 Greenhouse Gases: 2010–2030. EPA–430–R–13–011.

[49] See the docketed 2016 RIA for additional discussion of changes made to electricity pricing assumptions.

[50] To map existing landfill sites to EIA's Electricity Market Module regions, the sites' geospatial coordinates were overlayed on a map of the EMM regions. The AEO Electricity Market Module regions are commensurate with the eGRID2012 primary regions for which a shapefile is available at *https://www.epa.gov/energy/download-egrid2012-shapefiles.* For expected new landfills within a state the specific location is unknown, therefore the landfill is located at the state's centroid for purposes of mapping the site to an EMM region.

components, by-product emissions from combustion of LFG in flares or energy recovery devices, and offsets to conventional grid emissions from new LFG energy supply.

The secondary air impacts are presented as net impacts, considering both the energy demand and energy supply resulting from the final rule. The methodology used to prepare the estimated secondary impacts for this preamble is discussed in the docketed memorandum "Revised Estimates of Secondary Impacts of the Landfills NSPS Review, 2016."

While we do expect NO_X and sulfur dioxide (SO_2) emission changes as a result of these guidelines, we expect these changes to be small and these changes have not been estimated. The net impacts were computed for CO_2e. After considering the offsets from LFG electricity, the impacts of the final rule are expected to reduce CO_2 emissions by 26,000 metric tons per year. These CO_2 emission reductions are in addition to the methane emission reductions achieved from the direct destruction of methane in flares or engines presented in Table 2 of this preamble.

D. What are the energy impacts?

The final rule is expected to have a very minimal impact on energy supply and consumption. Active gas collection systems require energy to operate the blowers and pumps and the final rule will increase the volume of LFG collected. When the least cost control is a flare, energy may be purchased from the grid to operate the blowers of the LFG collection system. However, when the least cost control option is an engine, the engine may provide this energy to the gas control system and then sell the excess to the grid. Considering the balance of energy generated and demanded from the estimated least cost controls, the final rule is estimated to supply 0.07 million megawatt hours (MWh) of additional energy per year.

E. What are the cost impacts?

To meet the final rule emission thresholds, a landfill is expected to install the least cost control for combusting the LFG. The cost estimates evaluated each landfill to determine whether a gas collection and flare or a gas collection with flare and engine equipment would be least cost, after considering local power buyback rates and whether the quantity of LFG was sufficient to generate electricity. The control costs include the costs to install and operate gas collection infrastructure such as wells, header pipes, blowers, and an enclosed flare. For landfills for which the least cost control option is an engine, the costs also include the cost to install and operate one or more reciprocating internal combustion engines to convert the LFG into electricity. Revenue from electricity sales was incorporated into the net control costs using forecasted electricity generation price data from EIA Electricity Market Module regions. Testing and monitoring costs at controlled landfills include the cost to conduct initial performance tests on the enclosed flare or engine control equipment, quarterly surface monitoring, continuous combustion monitoring, and monthly wellhead monitoring. At uncontrolled landfills, the testing and monitoring costs include calculation and reporting of NMOC emission rates.

The nationwide incremental annualized net cost for the final rule is $6 million, when using a 7 percent discount rate (2012$). The annualized costs represent the costs compared to no changes to the current NSPS (*i.e.,* baseline) and include $11 million to install and operate a GCCS, as well as $0.08 million to complete the corresponding testing and monitoring. These control costs are offset by $5.1 million in revenue from electricity sales, which is incorporated into the net control costs for certain landfills that are expected to generate revenue by using the LFG to produce electricity.

F. What are the economic impacts?

Because of the relatively low net cost of the final rule compared to the overall size of the MSW industry, as well as the lack of appropriate economic parameters or model, the EPA is unable to estimate the impacts on the supply and demand for MSW landfill services. However, because of the relatively low incremental costs, the EPA does not believe the final rule would lead to substantial changes in supply and demand for landfill services or waste disposal costs, tipping fees, or the amount of waste disposed in landfills. Hence, the overall economic impact of the final rule should be minimal on the affected industries and their consumers.

G. What are the benefits?

This final action is expected to result in significant emissions reductions from new, reconstructed, or modified MSW landfills. By lowering the NMOC emissions threshold to 34 Mg/yr, the final NSPS would achieve reductions of 281 Mg/yr NMOC and 44,300 Mg/yr methane (1.1 million metric tons CO_2–Eq./yr). In addition, the final rulemaking is expected to result in the net reduction of 26,000 metric tons CO_2, due to reduced demand for electricity from the grid as landfills generate electricity from LFG.

This rule is expected to result in significant health and welfare benefits resulting from the climate benefits due to anticipated methane and CO_2 reductions. Methane is a potent GHG that, once emitted into the atmosphere, absorbs terrestrial infrared radiation that contributes to increased global warming and continuing climate change. Methane reacts in the atmosphere to form tropospheric ozone and stratospheric water vapor, both of which also contribute to global warming. When accounting for the impacts of changing methane, tropospheric ozone, and stratospheric water vapor concentrations, the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (2013) found that historical emissions of methane accounted for about 30 percent of the total current warming influence (radiative forcing) due to historical emissions of greenhouse gases. Methane is therefore a major contributor to the climate change impacts described in section III.B of this preamble. The remainder of this section discusses the methane reductions expected from this proposed rule and the associated monetized benefits.

As discussed in section IV of this preamble, this rulemaking includes several changes to the NSPS for MSW landfills that will decrease methane emissions from this sector. Specifically, the final NSPS are expected to reduce methane emissions from all landfills annually by about 44,300 metric tons of methane.

We calculated the global social benefits of these methane emission reductions using estimates of the social cost of methane (SC-CH_4), a metric that estimates the monetary value of impacts associated with marginal changes in methane emissions in a given year. The SC-CH_4 estimates applied in this analysis were developed by Marten et al. (2014) and are discussed in greater detail below.

A similar metric, the social cost of CO_2 (SC-CO_2), provides important context for understanding the Marten et al. SC-CH_4 estimates.[51] The SC-CO_2 is a metric that estimates the monetary value of impacts associated with marginal changes in CO_2 emissions in a given year. It includes a wide range of

[51] Previous analyses have commonly referred to the social cost of carbon dioxide emissions as the social cost of carbon or SCC. To more easily facilitate the inclusion of non-CO_2 GHGs in the discussion and analysis the more specific SC-CO_2 nomenclature is used to refer to the social cost of CO_2 emissions.

anticipated climate impacts, such as net changes in agricultural productivity and human health, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. Estimates of the SC-CO_2 have been used by the EPA and other federal agencies to value the impacts of CO_2 emissions changes in benefit cost analysis for GHG-related rulemakings since 2008.

The SC-CO_2 estimates were developed over many years, using the best science available, and with input from the public. Specifically, an interagency working group (IWG) that included the EPA and other executive branch agencies and offices used three integrated assessment models (IAMs) to develop the SC-CO_2 estimates and recommended four global values for use in regulatory analyses. The SC-CO_2 estimates were first released in February 2010 and updated in 2013 using new versions of each IAM.

The 2010 SC-CO_2 Technical Support Document (TSD) provides a complete discussion of the methods used to develop these estimates and the current SC-CO_2 TSD presents and discusses the 2013 update (including recent minor technical corrections to the estimates).[52]

The SC-CO_2 TSDs discuss a number of limitations to the SC-CO_2 analysis, including the incomplete way in which the IAMs capture catastrophic and non-catastrophic impacts, their incomplete treatment of adaptation and technological change, uncertainty in the extrapolation of damages to high temperatures, and assumptions regarding risk aversion. Currently, IAMs do not assign value to all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature due to a lack of precise information on the nature of damages and because the science incorporated into these models understandably lags behind the most recent research. Nonetheless, these estimates and the discussion of their limitations represent the best available information about the social benefits of CO_2 reductions to inform benefit-cost analysis. The EPA and other agencies continue to engage in research on modeling and valuation of climate impacts with the goal to improve these estimates, and continue to consider feedback on the SC-CO_2 estimates from stakeholders through a range of channels, including public comments received on Agency rulemakings, a separate Office of Management and Budget (OMB) public comment solicitation, and through regular interactions with stakeholders and research analysts implementing the SC-CO_2 methodology. See the docketed 2016 RIA for additional details.

A challenge particularly relevant to this rule is that the IWG did not estimate the social costs of non-CO_2 GHG emissions at the time the SC-CO_2 estimates were developed. In addition, the directly modeled estimates of the social costs of non-CO_2 GHG emissions previously found in the published literature were few in number and varied considerably in terms of the models and input assumptions they employed.[53] In the past, EPA has sought to understand the potential importance of monetizing non-CO_2 GHG emissions changes through sensitivity analysis using an estimate of the GWP of methane to convert emission impacts to CO_2 equivalents, which can then be valued using the SC-CO_2 estimates. This approach approximates the social cost of methane (SC-CH_4) using estimates of the SC-CO_2 and the GWP of methane.

The published literature documents a variety of reasons that directly modeled estimates of SC-CH_4 are an analytical improvement over the estimates from the GWP approximation approach. Specifically, several recent studies found that GWP-weighted benefit estimates for CH_4 are likely to be lower than the estimates derived using directly modeled social cost estimates for these gases.[54] The GWP reflects only the relative integrated radiative forcing of a gas over 100 years in comparison to CO_2. The directly modeled social cost estimates differ from the GWP-scaled SC-CO_2 because the relative differences in timing and magnitude of the warming between gases are explicitly modeled, the non-linear effects of temperature change on economic damages are included, and rather than treating all impacts over a hundred years equally, the modeled damages over the time horizon considered (300 years in this case) are discounted to present value terms. A detailed discussion of the limitations of the GWP approach can be found in the RIA.

In general, the commenters on previous rulemakings strongly encouraged the EPA to incorporate the monetized value of non-CO_2 GHG impacts into the benefit cost analysis. However, they noted the challenges associated with the GWP approach, as discussed above, and encouraged the use of directly modeled estimates of the SC-CH_4 to overcome those challenges.

Since then, a paper by Marten et al. (2014) has provided the first set of published SC-CH_4 estimates in the peer-reviewed literature that are consistent with the modeling assumptions underlying the SC-CO_2 estimates.[55 56] Specifically, the estimation approach of Marten et al. used the same set of three IAMs, five socioeconomic-emissions scenarios, equilibrium climate sensitivity distribution, three constant discount rates, and aggregation approach used by the IWG to develop the SC-CO_2 estimates.

The SC-CH_4 estimates from Marten, et al. (2014) are presented in Table 3 of this preamble. More detailed discussion of the methodology, results, and a comparison to other published estimates can be found in the RIA and in Marten, et al.

TABLE 3—SOCIAL COST OF CH_4, 2012–2050 [a]

[In 2012$ per metric ton (Source: Marten et al., 2014 [b])]

Year	SC-CH_4			
	5% Average	3% Average	2.5% Average	3% 95th percentile
2012	$430	$1000	$1400	$2800

[52] Both the 2010 SC-CO_2 TSD and the current TSD are available at: *https://www.whitehouse.gov/omb/oira/social-cost-of-carbon.*

[53] U.S. EPA. 2012. Regulatory Impact Analysis Final New Source Performance Standards and Amendments to the National Emissions Standards for Hazardous Air Pollutants for the Oil and Natural Gas Industry. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division. April. *http://www.epa.gov/ttn/ecas/regdata/RIAs/oil_natural_gas_final_neshap_nsps_ria.pdf.* Accessed April 7, 2016.

[54] See Waldhoff et al (2011); Marten and Newbold (2012); and Marten et al. (2014).

[55] Marten et al. (2014) also provided the first set of SC-N_2O estimates that are consistent with the assumptions underlying the IWG SC-CO_2 estimates.

[56] Marten, A.L., E.A. Kopits, C.W. Griffiths, S.C. Newbold & A. Wolverton (2014). Incremental CH_4 and N_2O mitigation benefits consistent with the U.S. Government's SC-CO_2 estimates, Climate Policy, DOI: 10.1080/14693062.2014.912981.

TABLE 3—SOCIAL COST OF CH_4, 2012–2050 [a]—Continued

[In 2012$ per metric ton (Source: Marten et al., 2014 [b])]

Year	SC-CH_4			
	5% Average	3% Average	2.5% Average	3% 95th percentile
2015	490	1100	1500	3000
2020	580	1300	1700	3500
2025	700	1500	1900	4000
2030	820	1700	2200	4500
2035	970	1900	2500	5300
2040	1100	2200	2800	5900
2045	1300	2500	3000	6600
2050	1400	2700	3300	7200

[a] The values are emissions-year specific. Estimates using several discount rates are included because the literature shows that estimates of the SC-CO_2 (and SC-CH_4) are sensitive to assumptions about the discount rate, and because no consensus exists on the appropriate rate to use in an intergenerational context (where costs and benefits are incurred by different generations). The fourth value is the 95th percentile of the SC-CH_4 estimates across three models using a 3 percent discount rate. It is included to represent higher-than-expected impacts from temperature change further out in the tails of the SC-CH_4 distribution.

[b] The estimates in this table have been adjusted to reflect recent minor technical corrections to the SC-CO_2 estimates. See the Corrigendum to Marten et al. (2014), *http://www.tandfonline.com/doi/abs/10.1080/14693062.2015.1070550.*

The application of these directly modeled SC-CH_4 estimates from Marten et al. (2014) in a benefit-cost analysis of a regulatory action is analogous to the use of the SC-CO_2 estimates. In addition, the limitations for the SC-CO_2 estimates discussed above likewise apply to the SC-CH_4 estimates, given the consistency in the methodology.

In early 2015, the EPA conducted a peer review of the application of the Marten, et al. (2014) non-CO_2 social cost estimates in regulatory analysis and received responses that supported this application. See the 2016 RIA for a detailed discussion.

The EPA also carefully considered the full range of public comments and associated technical issues on the Marten et al. SC-CH_4 estimates received through this rulemaking. The comments addressed the technical details of the SC-CO_2 estimates and the Marten et al. SC-CH_4 estimates as well as their application to this rulemaking analysis. One comment letter also provided constructive recommendations to improve the SC-CO_2 and SC-CH_4 estimates in the future. Based on the evaluation of the public comments on this rulemaking, the favorable peer review of the Marten et al. application, and past comments urging the EPA to value non-CO_2 GHG impacts in its rulemakings, the agency has concluded that the estimates represent the best scientific information on the impacts of climate change available in a form appropriate for incorporating the damages from incremental CH_4 emissions changes into regulatory analysis. The EPA has included those benefits in the main benefits analysis. See the Response to Comments document for the complete response to comments received on the SC-CH_4 as part of this rulemaking.

The CH_4 benefits based on Marten et al. (2014) are presented for the year 2025. Applying this approach to the methane reductions estimated for these NSPS, the 2025 methane benefits vary by discount rate and range from about $31 million to approximately $180 million; the mean SC-CH_4 at the 3-percent discount rate results in an estimate of about $67 million in 2025, as presented in Table 4 of this preamble.

TABLE 4—ESTIMATED GLOBAL BENEFITS OF CH_4 REDUCTIONS IN 2025

[In millions, 2012$]

Million metric tons CH_4	Discount rate and statistic			
	5% Average	3% Average	2.5% Average	3% 95th percentile
0.044	$31	$67	$86	$180

The vast majority of this action's climate-related benefits are associated with methane reductions. Additional climate-related benefits are expected from the NSPS secondary air impacts, specifically, a net reduction in CO_2 emissions. Monetizing the net CO_2 reductions with the SC-CO_2 estimates described in this section yields benefits of $1.3 million in the year 2025 (average SC-CO_2, 3 percent discount rate, 2012$). See the 2016 RIA for more details. The climate-related benefits associated with methane reductions plus the benefits from the secondary air impact CO_2 reductions amount to about $68 million in 2025 (average SC-CH_4 and average SC-CO_2, each at a 3 percent discount rate, 2012$).

In addition to the limitation discussed above, and the referenced documents, there are additional impacts of individual GHGs that are not currently captured in the IAMs used in the directly modeled approach of Marten et al. (2014), and therefore are not quantified for the rule. For example, the NMOC portion of LFG can contain a variety of air pollutants, including VOC and various organic HAP. VOC emissions are precursors to both $PM_{2.5}$ and ozone formation, while methane is a GHG and a precursor to global ozone formation. These pollutants are associated with substantial health effects, welfare effects, and climate effects, which are discussed in section III.B of this preamble. The ozone generated by methane has important non-climate impacts on agriculture, ecosystems, and human health. The RIA describes the specific impacts of

methane as an ozone precursor in more detail and discusses studies that have estimated monetized benefits of these methane generated ozone effects. The EPA continues to monitor developments in this area of research.

Finally, these final NSPS will yield benefits from reductions in VOC and HAP emissions and from reductions in methane as a precursor to global background concentrations of tropospheric ozone.

Based on the monetized benefits and costs, the annual net benefits of the rule are estimated to be approximately $62 million ($2012) in 2025, based on the average SC-CH_4 at a 3 percent discount rate, average SC-CO_2 at a 3 percent discount rate, and costs at a 7 percent discount rate.

VIII. Statutory and Executive Order Reviews

Additional information about these statutes and Executive Orders can be found at *http://www2.epa.gov/laws-regulations/laws-and-executive-orders.*

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is an economically significant regulatory action that was submitted to OMB for review. Any changes made in response to OMB recommendations have been documented in the docket. The EPA prepared an analysis of the potential costs and benefits associated with this action. This analysis is documented in the 2016 RIA, which is available in docket EPA–HQ–OAR–2003–0215 and is briefly summarized in section VII of this preamble.

B. Paperwork Reduction Act (PRA)

The Office of Management and Budget (OMB) has approved the information collection activities contained in this rule under the PRA and has assigned OMB control number 2060–0697. The Information Collection Request (ICR) document that the EPA prepared for the final NSPS has been assigned EPA ICR number 2498.03. You can find a copy of the ICR in the docket for this rule, and it is briefly summarized here.

The information required to be collected is necessary to identify the regulated entities subject to the final rule and to ensure their compliance with the final NSPS. The recordkeeping and reporting requirements are mandatory and are being established under authority of CAA section 114 (42 U.S.C. 7414). All information other than emissions data submitted as part of a report to the agency for which a claim of confidentiality is made will be safeguarded according to CAA section 111(c) and the EPA's implementing regulations at 40 CFR part 2, subpart B.

Respondents/affected entities: MSW landfills that commence construction, reconstruction, or modification after July 17, 2014.

Respondent's obligation to respond: Mandatory (40 CFR part 60, subpart XXX).

Estimated number of respondents: 133 MSW landfills (per year) that commence construction, reconstruction, or modification after July 17, 2014.

Frequency of response: Initially, occasionally, and annually.

Total estimated burden: 91,087 hours (per year) for the responding facilities and 2,634 hours (per year) for the agency. These are estimates for the average annual burden for the first 3 years after the rule is final. Burden is defined at 5 CCFR 1320.3(b).

Total estimated cost: $6,130,652 (per year), which includes annualized capital or operation and maintenance costs, for the responding facilities and $169,978 (per year) for the agency. These are estimates for the average annual cost for the first 3 years after the rule is final.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for the EPA's regulations in 40 CFR are listed in 40 CFR part 9.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. The small entities subject to the requirements of this final rule may include private small businesses and small governmental jurisdictions that own or operate landfills. Although it is unknown how many new landfills will be owned or operated by small entities, recent trends in the waste industry have been towards consolidated ownership among larger companies. The EPA has determined that approximately 10 percent of existing landfills subject to similar regulations (40 CFR part 60, subparts WWW and Cc or the corresponding state or federal plan) are small entities. It was determined that the July 2014 proposed NSPS and August 2015 supplemental to the proposed NSPS subpart would not have a significant economic impact on a substantial number of small entities. Given the changes in the number of landfills anticipated to become subject to the new NSPS, the potential impact on small entities has been reanalyzed. The EPA has determined that, with a size threshold of 2.5 million Mg and 2.5 million m^3 and an NMOC emission rate of 34 Mg/yr, no small entities are expected to experience an impact of greater than 1 percent of revenues in 2025. Details of the analysis are presented in the 2016 RIA, located in Docket ID No. EPA–HQ–OAR–2003–0215.

Although not required by the RFA to convene a Small Business Advocacy Review Panel because the EPA has now determined that the final NSPS would not have a significant economic impact on a substantial number of small entities, the EPA originally convened a panel to obtain advice and recommendations from small entity representatives potentially subject to this rule's requirements. A copy of the "Summary of Small Entity Outreach" is included in Docket ID No. EPA–HQ–OAR–2003–0215.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate of $100 million or more as described in UMRA, 2 U.S.C. 1531–1538. This final NSPS applies to landfills that commence construction, reconstruction, or modification after July 17, 2014. Impacts resulting from the final NSPS are far below the applicable threshold. Thus, the final NSPS is not subject to the requirements of sections 202 or 205 of the UMRA. However, in developing the final NSPS, the EPA consulted with small governments pursuant to a plan established under section 203 of the UMRA to address impacts of regulatory requirements in the rule that might significantly or uniquely affect small governments. The EPA held meetings as discussed in section VIII.E of this preamble under Federalism consultations.

E. Executive Order 13132: Federalism

The EPA has concluded that the final NSPS does not have Federalism implications. The final NSPS does not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. The final rule does not have impacts of $25 million or more in any one year. Thus, Executive Order 13132 does not apply to the final NSPS.

Although section 6 of Executive Order 13132 does not apply to the final NSPS, the EPA consulted with state and local officials and representatives of state and local governments early in the process

of developing the final rules for MSW landfills (both the NSPS and Emission Guidelines) to permit them to have meaningful and timely input into its development.

The EPA conducted a Federalism Consultation Outreach Meeting on September 10, 2013. Due to interest in that meeting, additional outreach meetings were held on November 7, 2013, and November 14, 2014. An additional Federalism outreach meeting was conducted on April 15, 2015. Participants included the National Governors' Association, the National Conference of State Legislatures, the Council of State Governments, the National League of Cities, the U.S. Conference of Mayors, the National Association of Counties, the International City/County Management Association, the National Association of Towns and Townships, the County Executives of America, the Environmental Council of States, the National Association of Clean Air Agencies, Association of State and Territorial Solid Waste Management Officials, environmental agency representatives from 43 states, and approximately 60 representatives from city and county governments. Concerns raised during the consultations include: implementation concerns associated with shortening of gas collection system installation and/or expansion timeframes, concerns regarding significant lowering of the design capacity or emission thresholds, the need for clarifications associated with wellhead operating parameters, and the need for consistent, clear, and rigorous surface monitoring requirements. The EPA has addressed many of these concerns in the final rule.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 13175. Based on methodology used to predict future landfills as outlined in the docketed memorandum "Summary of Updated Landfill Dataset Used in the Cost and Emission Reduction Analysis of Landfills Regulations, 2016," future tribal landfills are not anticipated to be large enough to become subject to the rulemaking. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

This action is subject to Executive Order 13045 (62 FR 19885, April 23, 1997) because it is a significant regulatory action as defined by Executive Order 12866, and the EPA believes that the environmental health or safety risk addressed by this action has a disproportionate effect on children. Accordingly, the EPA has evaluated the environmental health and welfare effects of climate change on children.

Greenhouse gases including methane contribute to climate change and are emitted in significant quantities by the landfill sector. The EPA believes that the GHG emission reductions resulting from implementation of this final rule will further improve children's health.

The assessment literature cited in the EPA's 2009 Endangerment Finding concluded that certain populations and life stages, including children, the elderly, and the poor, are most vulnerable to climate-related health effects. The assessment literature since 2009 strengthens these conclusions by providing more detailed findings regarding these groups' vulnerabilities and the projected impacts they may experience.

These assessments describe how children's unique physiological and developmental factors contribute to making them particularly vulnerable to climate change. Impacts to children are expected from heat waves, air pollution, infectious and waterborne illnesses, and mental health effects resulting from extreme weather events. In addition, children are among those especially susceptible to most allergic diseases, as well as health effects associated with heat waves, storms, and floods. Additional health concerns may arise in low income households, especially those with children, if climate change reduces food availability and increases prices, leading to food insecurity within households.

More detailed information on the impacts of climate change to human health and welfare is provided in section III.B of this preamble.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This action is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Further, we have concluded that this rule is not likely to have any adverse energy effects because there are a small number of new or modified landfills expected to be subject to control requirements under 40 CFR part 60, subpart XXX in 2025. Further, the energy demanded to operate these control systems will be offset by additional energy supply from LFG energy projects.

I. National Technology Transfer and Advancement Act (NTTAA) and 1 CFR Part 51

The final NSPS involves technical standards. For the final NSPS, the EPA has decided to use EPA Methods 2, 2E, 3, 3A, 3C, 18, 21, 25, 25A, and 25C of 40 CFR part 60, appendix A.

The EPA identified 15 voluntary consensus standards (VCS) as being potentially applicable (ASTM D3154–00 (2006), ASTM D3464–96 (2007), ASTM D3796–90 (2001), ANSI/ASME PTC 19–10–1981 Part 10, ASME B133.9–1994 (2001), ISO 10396:1993 (2007), ISO 12039:2001, ISO 10780:1994, ASTM D5835–95 (2013), ASTM D6522–11, ASTM D6420–99 (2010), CAN/CSA Z223.2–M86 (1999), ASTM D6060–96 (2009), ISO 14965:2000(E), EN 12619 (1999)). The EPA determined that 14 of the 15 candidate VCS identified for measuring emissions of pollutants or their surrogates subject to emission standards in the rule would not be practical due to lack of equivalency, documentation, validation data, and other important technical and policy considerations. The agency identified no equivalent standards for Methods 2E, 21, and 25C. However, one voluntary consensus standard was identified as an acceptable alternative to EPA test method for the purposes of this rule.

The voluntary consensus standard ASTM D6522–11, "Standard Test Method for the Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers" is an acceptable alternative to Method 3A when used at the wellhead before combustion. It is advisable to know the flammability and check the Lower Explosive Limit of the flue gas constituents, prior to sampling, in order to avoid undesired ignition of the gas.

The EPA's review, including review of comments for these 15 methods, is documented in the memorandum, "Voluntary Consensus Standard Results for Standards of Performance for Municipal Solid Waste Landfills, 2016" in the docket for this rulemaking (EPA–HQ–OAR–2003–0215).

In this rule, the EPA is finalizing regulatory text for 40 CFR part 60, subpart XXX that includes incorporation by reference in accordance with requirements of 1 CFR 51.5. Specifically, the EPA is incorporating by reference ASTM D6522–11. You may obtain a copy from

American Society for Testing and Materials, 100 Barr Harbor Drive, Post Office Box C700, West Conshohocken, PA 19428–2959 or *http://www.astm.org.*

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes the human health or environmental risk addressed by this action will not have potential disproportionately high and adverse human health or environmental effects on minority, low-income, or indigenous populations. The EPA has determined this because the rulemaking increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority, low-income, or indigenous populations. To the extent that any minority, low-income, or indigenous subpopulation is disproportionately impacted by hazardous air emissions due to the proximity of their homes to sources of these emissions, that subpopulation also stands to see increased environmental and health benefit from the emission reductions called for by this rule.

The EPA has provided meaningful participation opportunities for minority, low-income, indigenous populations and tribes during the rulemaking process by conducting and participating in community calls and webinars. Documentation of these activities can be found in the document titled, ''2016 Environmental Justice Screening Report for Municipal Solid Waste Landfills,'' a copy of which is available in the docket for this action (EPA–HQ–OAR–2003–0215).

K. Congressional Review Act (CRA)

This rule is subject to the CRA, and the EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is a ''major rule'' as defined by 5 U.S.C. 804(2).

List of Subjects in 40 CFR Part 60

Environmental protection, Administrative practice and procedure, Air pollution control, Incorporation by reference, Reporting and recordkeeping requirements.

Dated: July 14, 2016.

Gina McCarthy,

Administrator.

For the reasons stated in the preamble, the Environmental Protection Agency amends title 40, chapter I of the Code of Federal Regulations as follows:

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

■ 1. The authority citation for part 60 continues to read as follows:

Authority: 42 U.S.C. 7401 *et seq.*

■ 2. Amend § 60.17(h)(185) by removing the period at the end of the paragraph and adding in its place ", 60.766(a)."

■ 3. Add subpart XXX to read as follows:

Subpart XXX—Standards of Performance for Municipal Solid Waste Landfills That Commenced Construction, Reconstruction, or Modification After July 17, 2014

Sec.
60.760 Applicability, designation of affected source, and delegation of authority.
60.761 Definitions.
60.762 Standards for air emissions from municipal solid waste landfills.
60.763 Operational standards for collection and control systems.
60.764 Test methods and procedures.
60.765 Compliance provisions.
60.766 Monitoring of operations.
60.767 Reporting requirements.
60.768 Recordkeeping requirements.
60.769 Specifications for active collection systems.

Subpart XXX—Standards of Performance for Municipal Solid Waste Landfills That Commenced Construction, Reconstruction, or Modification After July 17, 2014

§ 60.760 Applicability, designation of affected source, and delegation of authority.

(a) The provisions of this subpart apply to each municipal solid waste landfill that commenced construction, reconstruction, or modification after July 17, 2014. Physical or operational changes made to an MSW landfill solely to comply with subparts Cc, Cf, or WWW of this part are not considered construction, reconstruction, or modification for the purposes of this section.

(b) The following authorities are retained by the Administrator and are not transferred to the state: § 60.764(a)(5).

(c) Activities required by or conducted pursuant to a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), or state remedial action are not considered construction, reconstruction, or modification for purposes of this subpart.

§ 60.761 Definitions.

As used in this subpart, all terms not defined herein have the meaning given them in the Act or in subpart A of this part.

Active collection system means a gas collection system that uses gas mover equipment.

Active landfill means a landfill in which solid waste is being placed or a landfill that is planned to accept waste in the future.

Closed area means a separately lined area of an MSW landfill in which solid waste is no longer being placed. If additional solid waste is placed in that area of the landfill, that landfill area is no longer closed. The area must be separately lined to ensure that the landfill gas does not migrate between open and closed areas.

Closed landfill means a landfill in which solid waste is no longer being placed, and in which no additional solid wastes will be placed without first filing a notification of modification as prescribed under § 60.7(a)(4). Once a notification of modification has been filed, and additional solid waste is placed in the landfill, the landfill is no longer closed.

Closure means that point in time when a landfill becomes a closed landfill.

Commercial solid waste means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

Controlled landfill means any landfill at which collection and control systems are required under this subpart as a result of the nonmethane organic compounds emission rate. The landfill is considered controlled at the time a collection and control system design plan is submitted in compliance with § 60.762(b)(2)(i).

Corrective action analysis means a description of all reasonable interim and long-term measures, if any, that are available, and an explanation of why the selected corrective action(s) is/are the best alternative(s), including, but not limited to, considerations of cost effectiveness, technical feasibility, safety, and secondary impacts.

Design capacity means the maximum amount of solid waste a landfill can accept, as indicated in terms of volume or mass in the most recent permit issued by the state, local, or tribal agency responsible for regulating the landfill, plus any in-place waste not accounted for in the most recent permit. If the owner or operator chooses to convert the design capacity from volume to mass or from mass to volume to demonstrate its design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, the calculation

must include a site-specific density, which must be recalculated annually.

Disposal facility means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

Emission rate cutoff means the threshold annual emission rate to which a landfill compares its estimated emission rate to determine if control under the regulation is required.

Enclosed combustor means an enclosed firebox which maintains a relatively constant limited peak temperature generally using a limited supply of combustion air. An enclosed flare is considered an enclosed combustor.

Flare means an open combustor without enclosure or shroud.

Gas mover equipment means the equipment (*i.e.,* fan, blower, compressor) used to transport landfill gas through the header system.

Gust means the highest instantaneous wind speed that occurs over a 3-second running average.

Household waste means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including, but not limited to, single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas). Household waste does not include fully segregated yard waste. Segregated yard waste means vegetative matter resulting exclusively from the cutting of grass, the pruning and/or removal of bushes, shrubs, and trees, the weeding of gardens, and other landscaping maintenance activities. Household waste does not include construction, renovation, or demolition wastes, even if originating from a household.

Industrial solid waste means solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of the Resource Conservation and Recovery Act, parts 264 and 265 of this chapter. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: Electric power generation; fertilizer/agricultural chemicals; food and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

Interior well means any well or similar collection component located inside the perimeter of the landfill waste. A perimeter well located outside the landfilled waste is not an interior well.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile as those terms are defined under § 257.2 of this title.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing MSW landfill. A lateral expansion is not a modification unless it results in an increase in the design capacity of the landfill.

Leachate recirculation means the practice of taking the leachate collected from the landfill and reapplying it to the landfill by any of one of a variety of methods, including pre-wetting of the waste, direct discharge into the working face, spraying, infiltration ponds, vertical injection wells, horizontal gravity distribution systems, and pressure distribution systems.

Modification means an increase in the permitted volume design capacity of the landfill by either lateral or vertical expansion based on its permitted design capacity as of July 17, 2014. Modification does not occur until the owner or operator commences construction on the lateral or vertical expansion.

Municipal solid waste landfill or *MSW landfill* means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land. An MSW landfill may also receive other types of RCRA Subtitle D wastes (§ 257.2 of this title) such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste. Portions of an MSW landfill may be separated by access roads. An MSW landfill may be publicly or privately owned. An MSW landfill may be a new MSW landfill, an existing MSW landfill, or a lateral expansion.

Municipal solid waste landfill emissions or *MSW landfill emissions* means gas generated by the decomposition of organic waste deposited in an MSW landfill or derived from the evolution of organic compounds in the waste.

NMOC means nonmethane organic compounds, as measured according to the provisions of § 60.764.

Nondegradable waste means any waste that does not decompose through chemical breakdown or microbiological activity. Examples are, but are not limited to, concrete, municipal waste combustor ash, and metals.

Passive collection system means a gas collection system that solely uses positive pressure within the landfill to move the gas rather than using gas mover equipment.

Root cause analysis means an assessment conducted through a process of investigation to determine the primary cause, and any other contributing causes, of positive pressure at a wellhead.

Segregated yard waste means vegetative matter resulting exclusively from the cutting of grass, the pruning and/or removal of bushes, shrubs, and trees, the weeding of gardens, and other landscaping maintenance activities.

Sludge means the term sludge as defined in 40 CFR 258.2.

Solid waste means the term solid waste as defined in 40 CFR 258.2.

Sufficient density means any number, spacing, and combination of collection system components, including vertical wells, horizontal collectors, and surface collectors, necessary to maintain emission and migration control as determined by measures of performance set forth in this part.

Sufficient extraction rate means a rate sufficient to maintain a negative pressure at all wellheads in the collection system without causing air infiltration, including any wellheads connected to the system as a result of expansion or excess surface emissions, for the life of the blower.

Treated landfill gas means landfill gas processed in a treatment system as defined in this subpart.

Treatment system means a system that filters, de-waters, and compresses landfill gas for sale or beneficial use.

Untreated landfill gas means any landfill gas that is not treated landfill gas.

§ 60.762 Standards for air emissions from municipal solid waste landfills.

(a) Each owner or operator of an MSW landfill having a design capacity less than 2.5 million megagrams by mass or 2.5 million cubic meters by volume must submit an initial design capacity report to the Administrator as provided in § 60.767(a). The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. Any density conversions must be documented and submitted with the report. Submittal of the initial design capacity report fulfills the requirements

of this subpart except as provided for in paragraphs (a)(1) and (2) of this section.

(1) The owner or operator must submit to the Administrator an amended design capacity report, as provided for in § 60.767(a)(3).

(2) When an increase in the maximum design capacity of a landfill exempted from the provisions of § 60.762(b) through § 60.769 on the basis of the design capacity exemption in paragraph (a) of this section results in a revised maximum design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the owner or operator must comply with the provisions of paragraph (b) of this section.

(b) Each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, must either comply with paragraph (b)(2) of this section or calculate an NMOC emission rate for the landfill using the procedures specified in § 60.764. The NMOC emission rate must be recalculated annually, except as provided in § 60.767(b)(1)(ii). The owner or operator of an MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters is subject to part 70 or 71 permitting requirements.

(1) If the calculated NMOC emission rate is less than 34 megagrams per year, the owner or operator must:

(i) Submit an annual NMOC emission rate emission report to the Administrator, except as provided for in § 60.767(b)(1)(ii); and

(ii) Recalculate the NMOC emission rate annually using the procedures specified in § 60.764(a)(1) until such time as the calculated NMOC emission rate is equal to or greater than 34 megagrams per year, or the landfill is closed.

(A) If the calculated NMOC emission rate, upon initial calculation or annual recalculation required in paragraph (b) of this section, is equal to or greater than 34 megagrams per year, the owner or operator must either: Comply with paragraph (b)(2) of this section; calculate NMOC emissions using the next higher tier in § 60.764; or conduct a surface emission monitoring demonstration using the procedures specified in § 60.764(a)(6).

(B) If the landfill is permanently closed, a closure report must be submitted to the Administrator as provided for in § 60.767(e).

(2) If the calculated NMOC emission rate is equal to or greater than 34 megagrams per year using Tier 1, 2, or 3 procedures, the owner or operator must either:

(i) Calculated *NMOC Emission Rate.* Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year as specified in § 60.767(c); calculate NMOC emissions using the next higher tier in § 60.764; or conduct a surface emission monitoring demonstration using the procedures specified in § 60.764(a)(6). The collection and control system must meet the requirements in paragraphs (b)(2)(ii) and (iii) of this section.

(ii) *Collection system.* Install and start up a collection and control system that captures the gas generated within the landfill as required by paragraphs (b)(2)(ii)(C) or (D) and (b)(2)(iii) of this section within 30 months after:

(A) The first annual report in which the NMOC emission rate equals or exceeds 34 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the NMOC emission rate is less than 34 megagrams per year, as specified in § 60.767(c)(4); or

(B) The most recent NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year based on Tier 2, if the Tier 4 surface emissions monitoring shows a surface methane emission concentration of 500 parts per million methane or greater as specified in § 60.767(c)(4)(iii).

(C) An active collection system must:

(*1*) Be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control system equipment;

(*2*) Collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade.

(*3*) Collect gas at a sufficient extraction rate;

(*4*) Be designed to minimize off-site migration of subsurface gas.

(D) A passive collection system must:

(*1*) Comply with the provisions specified in paragraphs (b)(2)(ii)(C)(*1*), (*2*), and (*3*) of this section.

(*2*) Be installed with liners on the bottom and all sides in all areas in which gas is to be collected. The liners must be installed as required under 40 CFR 258.40.

(iii) *Control system.* Route all the collected gas to a control system that complies with the requirements in either paragraph (b)(2)(iii)(A), (B), or (C) of this section.

(A) A non-enclosed flare designed and operated in accordance with the parameters established in § 60.18 except as noted in § 60.764(e); or

(B) A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen. The reduction efficiency or parts per million by volume must be established by an initial performance test to be completed no later than 180 days after the initial startup of the approved control system using the test methods specified in § 60.764(d). The performance test is not required for boilers and process heaters with design heat input capacities equal to or greater than 44 megawatts that burn landfill gas for compliance with this subpart.

(*1*) If a boiler or process heater is used as the control device, the landfill gas stream must be introduced into the flame zone.

(*2*) The control device must be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in § 60.766;

(C) Route the collected gas to a treatment system that processes the collected gas for subsequent sale or beneficial use such as fuel for combustion, production of vehicle fuel, production of high-Btu gas for pipeline injection, or use as a raw material in a chemical manufacturing process. Venting of treated landfill gas to the ambient air is not allowed. If the treated landfill gas cannot be routed for subsequent sale or beneficial use, then the treated landfill gas must be controlled according to either paragraph (b)(2)(iii)(A) or (B) of this section.

(D) All emissions from any atmospheric vent from the gas treatment system are subject to the requirements of paragraph (b)(2)(iii)(A) or (B) of this section. For purposes of this subpart, atmospheric vents located on the condensate storage tank are not part of the treatment system and are exempt from the requirements of paragraph (b)(2)(iii)(A) or (B) of this section.

(iv) *Operation.* Operate the collection and control device installed to comply with this subpart in accordance with the provisions of §§ 60.763, 60.765 and 60.766.

(v) *Removal criteria.* The collection and control system may be capped, removed, or decommissioned if the following criteria are met:

(A) The landfill is a closed landfill (as defined in § 60.761). A closure report must be submitted to the Administrator as provided in § 60.767(e).

(B) The collection and control system has been in operation a minimum of 15 years or the landfill owner or operator demonstrates that the GCCS will be unable to operate for 15 years due to declining gas flow.

(C) Following the procedures specified in § 60.764(b), the calculated NMOC emission rate at the landfill is less than 34 megagrams per year on three successive test dates. The test dates must be no less than 90 days apart, and no more than 180 days apart.

(c) For purposes of obtaining an operating permit under title V of the Clean Air Act, the owner or operator of an MSW landfill subject to this subpart with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters is not subject to the requirement to obtain an operating permit for the landfill under part 70 or 71 of this chapter, unless the landfill is otherwise subject to either part 70 or 71. For purposes of submitting a timely application for an operating permit under part 70 or 71, the owner or operator of an MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters, and not otherwise subject to either part 70 or 71, becomes subject to the requirements of § 70.5(a)(1)(i) or § 71.5(a)(1)(i) of this chapter, regardless of when the design capacity report is actually submitted, no later than:

(1) November 28, 2016 for MSW landfills that commenced construction, modification, or reconstruction after July 17, 2014 but before August 29, 2016;

(2) Ninety days after the date of commenced construction, modification, or reconstruction for MSW landfills that commence construction, modification, or reconstruction after August 29, 2016.

(d) When an MSW landfill subject to this subpart is closed as defined in this subpart, the owner or operator is no longer subject to the requirement to maintain an operating permit under part 70 or 71 of this chapter for the landfill if the landfill is not otherwise subject to the requirements of either part 70 or 71 and if either of the following conditions are met:

(1) The landfill was never subject to the requirement for a control system under paragraph (b)(2) of this section; or

(2) The owner or operator meets the conditions for control system removal specified in paragraph (b)(2)(v) of this section.

§ 60.763 Operational standards for collection and control systems.

Each owner or operator of an MSW landfill with a gas collection and control system used to comply with the provisions of § 60.762(b)(2) must:

(a) Operate the collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for:

(1) 5 years or more if active; or

(2) 2 years or more if closed or at final grade;

(b) Operate the collection system with negative pressure at each wellhead except under the following conditions:

(1) A fire or increased well temperature. The owner or operator must record instances when positive pressure occurs in efforts to avoid a fire. These records must be submitted with the annual reports as provided in § 60.767(g)(1);

(2) Use of a geomembrane or synthetic cover. The owner or operator must develop acceptable pressure limits in the design plan;

(3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes must be approved by the Administrator as specified in § 60.767(c);

(c) Operate each interior wellhead in the collection system with a landfill gas temperature less than 55 degrees Celsius (131 degrees Fahrenheit). The owner or operator may establish a higher operating temperature value at a particular well. A higher operating value demonstration must be submitted to the Administrator for approval and must include supporting data demonstrating that the elevated parameter neither causes fires nor significantly inhibits anaerobic decomposition by killing methanogens. The demonstration must satisfy both criteria in order to be approved (*i.e.,* neither causing fires nor killing methanogens is acceptable).

(d) Operate the collection system so that the methane concentration is less than 500 parts per million above background at the surface of the landfill. To determine if this level is exceeded, the owner or operator must conduct surface testing using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in § 60.765(d). The owner or operator must conduct surface testing around the perimeter of the collection area and along a pattern that traverses the landfill at no more than 30-meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover and all cover penetrations. Thus, the owner or operator must monitor any openings that are within an area of the landfill where waste has been placed and a gas collection system is required. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan must be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30-meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing.

(e) Operate the system such that all collected gases are vented to a control system designed and operated in compliance with § 60.762(b)(2)(iii). In the event the collection or control system is not operating, the gas mover system must be shut down and all valves in the collection and control system contributing to venting of the gas to the atmosphere must be closed within 1 hour of the collection or control system not operating; and

(f) Operate the control system at all times when the collected gas is routed to the system.

(g) If monitoring demonstrates that the operational requirements in paragraphs (b), (c), or (d) of this section are not met, corrective action must be taken as specified in § 60.765(a)(3) and (5) or (c). If corrective actions are taken as specified in § 60.765, the monitored exceedance is not a violation of the operational requirements in this section.

§ 60.764 Test methods and procedures.

(a)(1) *NMOC Emission Rate.* The landfill owner or operator must calculate the NMOC emission rate using either Equation 1 provided in paragraph (a)(1)(i) of this section or Equation 2 provided in paragraph (a)(1)(ii) of this section. Both Equation 1 and Equation 2 may be used if the actual year-to-year solid waste acceptance rate is known, as specified in paragraph (a)(1)(i) of this section, for part of the life of the landfill and the actual year-to-year solid waste acceptance rate is unknown, as specified in paragraph (a)(1)(ii) of this section, for part of the life of the landfill. The values to be used in both Equation 1 and Equation 2 are 0.05 per year for k, 170 cubic meters per megagram for L_o, and 4,000 parts per million by volume as hexane for the C_{NMOC}. For landfills located in geographical areas with a 30-year annual average precipitation of less than 25 inches, as measured at the nearest

representative official meteorologic site, the k value to be used is 0.02 per year.

(i)(A) Equation 1 must be used if the actual year-to-year solid waste acceptance rate is known.

$$M_{NMOC} = \sum_{i=1}^{n} 2\,k\,L_o M_i \left(e^{-kt_i}\right)\left(C_{NMOC}\right)\left(3.6\times10^{-9}\right) \qquad \text{(Eq. 1)}$$

Where:

M_{NMOC} = Total NMOC emission rate from the landfill, megagrams per year.
k = Methane generation rate constant, year^{-1}.
L_o = Methane generation potential, cubic meters per megagram solid waste.
M_i = Mass of solid waste in the ith section, megagrams.
t_i = Age of the ith section, years.
C_{NMOC} = Concentration of NMOC, parts per million by volume as hexane.
3.6×10^{-9} = Conversion factor.

(B) The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value for M_i if documentation of the nature and amount of such wastes is maintained.

(ii)(A) Equation 2 must be used if the actual year-to-year solid waste acceptance rate is unknown.

$$M_{NMOC} = 2L_oR\,(e^{-kc}-e^{-kt})\,C_{NMOC}(3.6 \times 10^{-9}) \qquad \text{(Eq.2)}$$

Where:

M_{NMOC} = Mass emission rate of NMOC, megagrams per year.
L_o = Methane generation potential, cubic meters per megagram solid waste.
R = Average annual acceptance rate, megagrams per year.
k = Methane generation rate constant, year^{-1}.
t = Age of landfill, years.
C_{NMOC} = Concentration of NMOC, parts per million by volume as hexane.
c = Time since closure, years; for active landfill c = 0 and $e^{-kc} = 1$.
3.6×10^{-9} = Conversion factor.

(B) The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value of R, if documentation of the nature and amount of such wastes is maintained.

(2) *Tier 1.* The owner or operator must compare the calculated NMOC mass emission rate to the standard of 34 megagrams per year.

(i) If the NMOC emission rate calculated in paragraph (a)(1) of this section is less than 34 megagrams per year, then the landfill owner or operator must submit an NMOC emission rate report according to § 60.767(b), and must recalculate the NMOC mass emission rate annually as required under § 60.762(b).

(ii) If the calculated NMOC emission rate as calculated in paragraph (a)(1) of this section is equal to or greater than 34 megagrams per year, then the landfill owner must either:

(A) Submit a gas collection and control system design plan within 1 year as specified in § 60.767(c) and install and operate a gas collection and control system within 30 months according to § 60.762(b)(2)(ii) and (iii);

(B) Determine a site-specific NMOC concentration and recalculate the NMOC emission rate using the Tier 2 procedures provided in paragraph (a)(3) of this section; or

(C) Determine a site-specific methane generation rate constant and recalculate the NMOC emission rate using the Tier 3 procedures provided in paragraph (a)(4) of this section.

(3) *Tier 2.* The landfill owner or operator must determine the site-specific NMOC concentration using the following sampling procedure. The landfill owner or operator must install at least two sample probes per hectare, evenly distributed over the landfill surface that has retained waste for at least 2 years. If the landfill is larger than 25 hectares in area, only 50 samples are required. The probes should be evenly distributed across the sample area. The sample probes should be located to avoid known areas of nondegradable solid waste. The owner or operator must collect and analyze one sample of landfill gas from each probe to determine the NMOC concentration using Method 25 or 25C of appendix A of this part. Taking composite samples from different probes into a single cylinder is allowed; however, equal sample volumes must be taken from each probe. For each composite, the sampling rate, collection times, beginning and ending cylinder vacuums, or alternative volume measurements must be recorded to verify that composite volumes are equal. Composite sample volumes should not be less than one liter unless evidence can be provided to substantiate the accuracy of smaller volumes. Terminate compositing before the cylinder approaches ambient pressure where measurement accuracy diminishes. If more than the required number of samples are taken, all samples must be used in the analysis. The landfill owner or operator must divide the NMOC concentration from Method 25 or 25C of appendix A of this part by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane. If the landfill has an active or passive gas removal system in place, Method 25 or 25C samples may be collected from these systems instead of surface probes provided the removal system can be shown to provide sampling as representative as the two sampling probe per hectare requirement. For active collection systems, samples may be collected from the common header pipe. The sample location on the common header pipe must be before any gas moving, condensate removal, or treatment system equipment. For active collection systems, a minimum of three samples must be collected from the header pipe.

(i) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results according to § 60.767(i)(1).

(ii) The landfill owner or operator must recalculate the NMOC mass emission rate using Equation 1 or Equation 2 provided in paragraph (a)(1)(i) or (a)(1)(ii) of this section and using the average site-specific NMOC concentration from the collected samples instead of the default value provided in paragraph (a)(1) of this section.

(iii) If the resulting NMOC mass emission rate is less than 34 megagrams per year, then the owner or operator must submit a periodic estimate of NMOC emissions in an NMOC emission rate report according to § 60.767(b)(1), and must recalculate the NMOC mass emission rate annually as required under § 60.762(b). The site-specific

NMOC concentration must be retested every 5 years using the methods specified in this section.

(iv) If the NMOC mass emission rate as calculated using the Tier 2 site-specific NMOC concentration is equal to or greater than 34 megagrams per year, the landfill owner or operator must either:

(A) Submit a gas collection and control system design plan within 1 year as specified in § 60.767(c) and install and operate a gas collection and control system within 30 months according to § 60.762(b)(2)(ii) and (iii);

(B) Determine a site-specific methane generation rate constant and recalculate the NMOC emission rate using the site-specific methane generation rate using the Tier 3 procedures specified in paragraph (a)(4) of this section; or

(C) Conduct a surface emission monitoring demonstration using the Tier 4 procedures specified in paragraph (a)(6) of this section.

(4) *Tier 3.* The site-specific methane generation rate constant must be determined using the procedures provided in Method 2E of appendix A of this part. The landfill owner or operator must estimate the NMOC mass emission rate using Equation 1 or Equation 2 in paragraph (a)(1)(i) or (ii) of this section and using a site-specific methane generation rate constant, and the site-specific NMOC concentration as determined in paragraph (a)(3) of this section instead of the default values provided in paragraph (a)(1) of this section. The landfill owner or operator must compare the resulting NMOC mass emission rate to the standard of 34 megagrams per year.

(i) If the NMOC mass emission rate as calculated using the Tier 2 site-specific NMOC concentration and Tier 3 site-specific methane generation rate is equal to or greater than 34 megagrams per year, the owner or operator must either:

(A) Submit a gas collection and control system design plan within 1 year as specified in § 60.767(c) and install and operate a gas collection and control system within 30 months according to § 60.762(b)(2)(ii) and (iii); or

(B) Conduct a surface emission monitoring demonstration using the Tier 4 procedures specified in paragraph (a)(6) of this section.

(ii) If the NMOC mass emission rate is less than 34 megagrams per year, then the owner or operator must recalculate the NMOC mass emission rate annually using Equation 1 or Equation 2 in paragraph (a)(1) of this section and using the site-specific Tier 2 NMOC concentration and Tier 3 methane generation rate constant and submit a periodic NMOC emission rate report as provided in § 60.767(b)(1). The calculation of the methane generation rate constant is performed only once, and the value obtained from this test must be used in all subsequent annual NMOC emission rate calculations.

(5) *Other methods.* The owner or operator may use other methods to determine the NMOC concentration or a site-specific methane generation rate constant as an alternative to the methods required in paragraphs (a)(3) and (4) of this section if the method has been approved by the Administrator.

(6) *Tier 4.* The landfill owner or operator must demonstrate that surface methane emissions are below 500 parts per million. Surface emission monitoring must be conducted on a quarterly basis using the following procedures. Tier 4 is allowed only if the landfill owner or operator can demonstrate that NMOC emissions are greater than or equal to 34 Mg/yr but less than 50 Mg/yr using Tier 1 or Tier 2. If both Tier 1 and Tier 2 indicate NMOC emissions are 50 Mg/yr or greater, then Tier 4 cannot be used. In addition, the landfill must meet the criteria in paragraph (a)(6)(viii) of this section.

(i) The owner or operator must measure surface concentrations of methane along the entire perimeter of the landfill and along a pattern that traverses the landfill at no more than 30-meter intervals using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in § 60.765(d).

(ii) The background concentration must be determined by moving the probe inlet upwind and downwind at least 30 meters from the waste mass boundary of the landfill.

(iii) Surface emission monitoring must be performed in accordance with section 8.3.1 of Method 21 of appendix A of this part, except that the probe inlet must be placed no more than 5 centimeters above the landfill surface; the constant measurement of distance above the surface should be based on a mechanical device such as with a wheel on a pole, except as described in paragraph (a)(6)(iii)(A) of this section.

(A) The owner or operator must use a wind barrier, similar to a funnel, when onsite average wind speed exceeds 4 miles per hour or 2 meters per second or gust exceeding 10 miles per hour. Average on-site wind speed must also be determined in an open area at 5-minute intervals using an on-site anemometer with a continuous recorder and data logger for the entire duration of the monitoring event. The wind barrier must surround the SEM monitor, and must be placed on the ground, to ensure wind turbulence is blocked. SEM cannot be conducted if average wind speed exceeds 25 miles per hour.

(B) Landfill surface areas where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover, and all cover penetrations must also be monitored using a device meeting the specifications provided in § 60.765(d).

(iv) Each owner or operator seeking to comply with the Tier 4 provisions in paragraph (a)(6) of this section must maintain records of surface emission monitoring as provided in § 60.768(g) and submit a Tier 4 surface emissions report as provided in § 60.767(c)(4)(iii).

(v) If there is any measured concentration of methane of 500 parts per million or greater from the surface of the landfill, the owner or operator must submit a gas collection and control system design plan within 1 year of the first measured concentration of methane of 500 parts per million or greater from the surface of the landfill according to § 60.767(c) and install and operate a gas collection and control system according to § 60.762(b)(2)(ii) and (iii) within 30 months of the most recent NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year based on Tier 2.

(vi) If after four consecutive quarterly monitoring periods at a landfill, other than a closed landfill, there is no measured concentration of methane of 500 parts per million or greater from the surface of the landfill, the owner or operator must continue quarterly surface emission monitoring using the methods specified in this section.

(vii) If after four consecutive quarterly monitoring periods at a closed landfill there is no measured concentration of methane of 500 parts per million or greater from the surface of the landfill, the owner or operator must conduct annual surface emission monitoring using the methods specified in this section.

(viii) If a landfill has installed and operates a collection and control system that is not required by this subpart, then the collection and control system must meet the following criteria:

(A) The gas collection and control system must have operated for 6,570 out of 8,760 hours preceding the Tier 4 surface emissions monitoring demonstration.

(B) During the Tier 4 surface emissions monitoring demonstration, the gas collection and control system must operate as it normally would to

collect and control as much landfill gas as possible.

(b) After the installation and startup of a collection and control system in compliance with this subpart, the owner or operator must calculate the NMOC emission rate for purposes of determining when the system can be capped, removed or decommissioned as provided in § 60.762(b)(2)(v), using Equation 3:

$$M_{NMOC} = 1.89 \times 10^{-3} Q_{LFG} C_{NMOC} \qquad \text{(Eq. 3)}$$

Where:

M_{NMOC} = Mass emission rate of NMOC, megagrams per year.

Q_{LFG} = Flow rate of landfill gas, cubic meters per minute.

C_{NMOC} = NMOC concentration, parts per million by volume as hexane.

(1) The flow rate of landfill gas, Q_{LFG}, must be determined by measuring the total landfill gas flow rate at the common header pipe that leads to the control system using a gas flow measuring device calibrated according to the provisions of section 10 of Method 2E of appendix A of this part.

(2) The average NMOC concentration, C_{NMOC}, must be determined by collecting and analyzing landfill gas sampled from the common header pipe before the gas moving or condensate removal equipment using the procedures in Method 25 or Method 25C. The sample location on the common header pipe must be before any condensate removal or other gas refining units. The landfill owner or operator must divide the NMOC concentration from Method 25 or Method 25C of appendix A of this part by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane.

(3) The owner or operator may use another method to determine landfill gas flow rate and NMOC concentration if the method has been approved by the Administrator.

(i) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results of the performance test, including any associated fuel analyses, according to § 60.767(i)(1).

(ii) [Reserved]

(c) When calculating emissions for Prevention of Significant Deterioration purposes, the owner or operator of each MSW landfill subject to the provisions of this subpart must estimate the NMOC emission rate for comparison to the Prevention of Significant Deterioration major source and significance levels in §§ 51.166 or 52.21 of this chapter using Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP–42) or other approved measurement procedures.

(d) For the performance test required in § 60.762(b)(2)(iii)(B), Method 25 or 25C (Method 25C may be used at the inlet only) of appendix A of this part must be used to determine compliance with the 98 weight-percent efficiency or the 20 parts per million by volume outlet concentration level, unless another method to demonstrate compliance has been approved by the Administrator as provided by § 60.767(c)(2). Method 3, 3A, or 3C must be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8 ppm NMOC as hexane), Method 25A should be used in place of Method 25. Method 18 may be used in conjunction with Method 25A on a limited basis (compound specific, *e.g.*, methane) or Method 3C may be used to determine methane. The methane as carbon should be subtracted from the Method 25A total hydrocarbon value as carbon to give NMOC concentration as carbon. The landowner or operator must divide the NMOC concentration as carbon by 6 to convert from the CNMOC as carbon to CNMOC as hexane. Equation 4 must be used to calculate efficiency:

$$\text{Control Efficiency} = (NMOC_{in} - NMOC_{out})/(NMOC_{in}) \qquad \text{(Eq. 4)}$$

Where:

$NMOC_{in}$ = Mass of NMOC entering control device.

$NMOC_{out}$ = Mass of NMOC exiting control device.

(e) For the performance test required in § 60.762(b)(2)(iii)(A), the net heating value of the combusted landfill gas as determined in § 60.18(f)(3) is calculated from the concentration of methane in the landfill gas as measured by Method 3C. A minimum of three 30-minute Method 3C samples are determined. The measurement of other organic components, hydrogen, and carbon monoxide is not applicable. Method 3C may be used to determine the landfill gas molecular weight for calculating the flare gas exit velocity under § 60.18(f)(4).

(1) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results of the performance tests, including any associated fuel analyses, required by § 60.764(b) or (d) according to § 60.767(i)(1).

(2) [Reserved]

§ 60.765 Compliance provisions.

(a) Except as provided in § 60.767(c)(2), the specified methods in paragraphs (a)(1) through (6) of this section must be used to determine whether the gas collection system is in compliance with § 60.762(b)(2)(ii).

(1) For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with § 60.762(b)(2)(ii)(C)(*1*), either Equation 5 or Equation 6 must be used. The methane generation rate constant (k) and methane generation potential (L_o) kinetic factors should be those published in the most recent Compilation of Air Pollutant Emission Factors (AP–42) or other site specific values demonstrated to be appropriate and approved by the Administrator. If k has been determined as specified in § 60.764(a)(4), the value of k determined from the test must be used. A value of no more than 15 years must be used for the intended use period of the gas mover equipment. The active life of the landfill is the age of the landfill plus the estimated number of years until closure.

(i) For sites with unknown year-to-year solid waste acceptance rate:

$$Q_m = 2L_oR\ (e^{-kc} - e^{-kt}) \qquad \text{(Eq. 5)}$$

Where:

Q_m = Maximum expected gas generation flow rate, cubic meters per year.

L_o = Methane generation potential, cubic meters per megagram solid waste.

R = Average annual acceptance rate, megagrams per year.

k = Methane generation rate constant, year^{-1}.

t = Age of the landfill at equipment installation plus the time the owner or operator intends to use the gas mover equipment or active life of the landfill, whichever is less. If the equipment is installed after closure, t is the age of the landfill at installation, years.

c = Time since closure, years (for an active landfill c = 0 and e^{-kc} = 1).

(ii) For sites with known year-to-year solid waste acceptance rate:

$$Q_M = \sum_{i=1}^{n} 2kL_oM_i(e^{-kt_i}) \qquad \text{(Eq. 6)}$$

Where:

Q_M = Maximum expected gas generation flow rate, cubic meters per year.

k = Methane generation rate constant, year^{-1}.

L_o = Methane generation potential, cubic meters per megagram solid waste.

M_i = Mass of solid waste in the ith section, megagrams.

t_i = Age of the ith section, years.

(iii) If a collection and control system has been installed, actual flow data may be used to project the maximum expected gas generation flow rate instead of, or in conjunction with, Equation 5 or Equation 6 in paragraphs (a)(1)(i) and (ii) of this section. If the landfill is still accepting waste, the actual measured flow data will not equal the maximum expected gas generation rate, so calculations using Equation 5 or Equation 6 in paragraphs (a)(1)(i) or (ii) of this section or other methods must be used to predict the maximum expected gas generation rate over the intended period of use of the gas control system equipment.

(2) For the purposes of determining sufficient density of gas collectors for compliance with § 60.762(b)(2)(ii)(C)(*2*), the owner or operator must design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the Administrator, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards.

(3) For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with § 60.762(b)(2)(ii)(C)(*3*), the owner or operator must measure gauge pressure in the gas collection header applied to each individual well, monthly. If a positive pressure exists, action must be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under § 60.763(b). Any attempted corrective measure must not cause exceedances of other operational or performance standards.

(i) If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement of positive pressure, the owner or operator must conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after positive pressure was first measured. The owner or operator must keep records according to § 60.768(e)(3).

(ii) If corrective actions cannot be fully implemented within 60 days following the positive pressure measurement for which the root cause analysis was required, the owner or operator must also conduct a corrective action analysis and develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the positive pressure measurement. The owner or operator must submit the items listed in § 60.767(g)(7) as part of the next annual report. The owner or operator must keep records according to § 60.768(e)(4).

(iii) If corrective action is expected to take longer than 120 days to complete after the initial exceedance, the owner or operator must submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Administrator, according to § 60.767(g)(7) and § 60.767(j). The owner or operator must keep records according to § 60.768(e)(5).

(4) [Reserved]

(5) For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator must monitor each well monthly for temperature as provided in § 60.763(c). If a well exceeds the operating parameter for temperature, action must be initiated to correct the exceedance within 5 calendar days. Any attempted corrective measure must not cause exceedances of other operational or performance standards.

(i) If a landfill gas temperature less than 55 degrees Celsius (131 degrees Fahrenheit) cannot be achieved within 15 calendar days of the first measurement of landfill gas temperature greater than 55 degrees Celsius (131 degrees Fahrenheit), the owner or operator must conduct a root cause analysis and correct the exceedance as soon as practicable, but no later than 60 days after a landfill gas temperature greater than 55 degrees Celsius (131 degrees Fahrenheit) was first measured. The owner or operator must keep records according to § 60.768(e)(3).

(ii) If corrective actions cannot be fully implemented within 60 days following the positive pressure measurement for which the root cause analysis was required, the owner or operator must also conduct a corrective action analysis and develop an implementation schedule to complete the corrective action(s) as soon as practicable, but no more than 120 days following the measurement of landfill gas temperature greater than 55 degrees Celsius (131 degrees Fahrenheit). The owner or operator must submit the items listed in § 60.767(g)(7) as part of the next annual report. The owner or operator must keep records according to § 60.768(e)(4).

(iii) If corrective action is expected to take longer than 120 days to complete after the initial exceedance, the owner or operator must submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Administrator, according to § 60.767(g)(7) and § 60.767(j). The owner or operator must keep records according to § 60.768(e)(5).

(6) An owner or operator seeking to demonstrate compliance with § 60.762(b)(2)(ii)(C)(*4*) through the use of a collection system not conforming to the specifications provided in § 60.769 must provide information satisfactory to the Administrator as specified in § 60.767(c)(3) demonstrating that off-site migration is being controlled.

(b) For purposes of compliance with § 60.763(a), each owner or operator of a controlled landfill must place each well or design component as specified in the approved design plan as provided in § 60.767(c). Each well must be installed

no later than 60 days after the date on which the initial solid waste has been in place for a period of:

(1) Five (5) years or more if active; or

(2) Two (2) years or more if closed or at final grade.

(c) The following procedures must be used for compliance with the surface methane operational standard as provided in § 60.763(d).

(1) After installation and startup of the gas collection system, the owner or operator must monitor surface concentrations of methane along the entire perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals (or a site-specific established spacing) for each collection area on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in paragraph (d) of this section.

(2) The background concentration must be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells.

(3) Surface emission monitoring must be performed in accordance with section 8.3.1 of Method 21 of appendix A of this part, except that the probe inlet must be placed within 5 to 10 centimeters of the ground. Monitoring must be performed during typical meteorological conditions.

(4) Any reading of 500 parts per million or more above background at any location must be recorded as a monitored exceedance and the actions specified in paragraphs (c)(4)(i) through (v) of this section must be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of § 60.763(d).

(i) The location of each monitored exceedance must be marked and the location and concentration recorded.

(ii) Cover maintenance or adjustments to the vacuum of the adjacent wells to increase the gas collection in the vicinity of each exceedance must be made and the location must be re-monitored within 10 calendar days of detecting the exceedance.

(iii) If the re-monitoring of the location shows a second exceedance, additional corrective action must be taken and the location must be monitored again within 10 days of the second exceedance. If the re-monitoring shows a third exceedance for the same location, the action specified in paragraph (c)(4)(v) of this section must be taken, and no further monitoring of that location is required until the action specified in paragraph (c)(4)(v) of this section has been taken.

(iv) Any location that initially showed an exceedance but has a methane concentration less than 500 ppm methane above background at the 10-day re-monitoring specified in paragraph (c)(4)(ii) or (iii) of this section must be re-monitored 1 month from the initial exceedance. If the 1-month re-monitoring shows a concentration less than 500 parts per million above background, no further monitoring of that location is required until the next quarterly monitoring period. If the 1-month re-monitoring shows an exceedance, the actions specified in paragraph (c)(4)(iii) or (v) of this section must be taken.

(v) For any location where monitored methane concentration equals or exceeds 500 parts per million above background three times within a quarterly period, a new well or other collection device must be installed within 120 calendar days of the initial exceedance. An alternative remedy to the exceedance, such as upgrading the blower, header pipes or control device, and a corresponding timeline for installation may be submitted to the Administrator for approval.

(5) The owner or operator must implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis.

(d) Each owner or operator seeking to comply with the provisions in paragraph (c) of this section or § 60.764(a)(6) must comply with the following instrumentation specifications and procedures for surface emission monitoring devices:

(1) The portable analyzer must meet the instrument specifications provided in section 6 of Method 21 of appendix A of this part, except that "methane" replaces all references to "VOC".

(2) The calibration gas must be methane, diluted to a nominal concentration of 500 parts per million in air.

(3) To meet the performance evaluation requirements in section 8.1 of Method 21 of appendix A of this part, the instrument evaluation procedures of section 8.1 of Method 21 of appendix A of this part must be used.

(4) The calibration procedures provided in sections 8 and 10 of Method 21 of appendix A of this part must be followed immediately before commencing a surface monitoring survey.

(e) The provisions of this subpart apply at all times, including periods of startup, shutdown or malfunction. During periods of startup, shutdown, and malfunction, you must comply with the work practice specified in § 60.763(e) in lieu of the compliance provisions in § 60.765.

§ 60.766 Monitoring of operations.

Except as provided in § 60.767(c)(2):

(a) Each owner or operator seeking to comply with § 60.762(b)(2)(ii)(C) for an active gas collection system must install a sampling port and a thermometer, other temperature measuring device, or an access port for temperature measurements at each wellhead and:

(1) Measure the gauge pressure in the gas collection header on a monthly basis as provided in § 60.765(a)(3); and

(2) Monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as follows:

(i) The nitrogen level must be determined using Method 3C, unless an alternative test method is established as allowed by § 60.767(c)(2).

(ii) Unless an alternative test method is established as allowed by § 60.767(c)(2), the oxygen level must be determined by an oxygen meter using Method 3A, 3C, or ASTM D6522–11 (incorporated by reference, see § 60.17). Determine the oxygen level by an oxygen meter using Method 3A, 3C, or ASTM D6522–11 (if sample location is prior to combustion) except that:

(A) The span must be set between 10 and 12 percent oxygen;

(B) A data recorder is not required;

(C) Only two calibration gases are required, a zero and span;

(D) A calibration error check is not required;

(E) The allowable sample bias, zero drift, and calibration drift are ±10 percent.

(iii) A portable gas composition analyzer may be used to monitor the oxygen levels provided:

(A) The analyzer is calibrated; and

(B) The analyzer meets all quality assurance and quality control requirements for Method 3A or ASTM D6522–11 (incorporated by reference, see § 60.17).

(3) Monitor temperature of the landfill gas on a monthly basis as provided in § 60.765(a)(5). The temperature measuring device must be calibrated annually using the procedure in 40 CFR part 60, appendix A–1, Method 2, Section 10.3.

(b) Each owner or operator seeking to comply with § 60.762(b)(2)(iii) using an enclosed combustor must calibrate, maintain, and operate according to the manufacturer's specifications, the following equipment:

(1) A temperature monitoring device equipped with a continuous recorder and having a minimum accuracy of ±1 percent of the temperature being

measured expressed in degrees Celsius or ±0.5 degrees Celsius, whichever is greater. A temperature monitoring device is not required for boilers or process heaters with design heat input capacity equal to or greater than 44 megawatts.

(2) A device that records flow to the control device and bypass of the control device (if applicable). The owner or operator must:

(i) Install, calibrate, and maintain a gas flow rate measuring device that must record the flow to the control device at least every 15 minutes; and

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism must be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(c) Each owner or operator seeking to comply with § 60.762(b)(2)(iii) using a non-enclosed flare must install, calibrate, maintain, and operate according to the manufacturer's specifications the following equipment:

(1) A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame.

(2) A device that records flow to the flare and bypass of the flare (if applicable). The owner or operator must:

(i) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the control device at least every 15 minutes; and

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism must be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(d) Each owner or operator seeking to demonstrate compliance with § 60.762(b)(2)(iii) using a device other than a non-enclosed flare or an enclosed combustor or a treatment system must provide information satisfactory to the Administrator as provided in § 60.767(c)(2) describing the operation of the control device, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The Administrator must review the information and either approve it, or request that additional information be submitted. The Administrator may specify additional appropriate monitoring procedures.

(e) Each owner or operator seeking to install a collection system that does not meet the specifications in § 60.769 or seeking to monitor alternative parameters to those required by §§ 60.763 through 60.766 must provide information satisfactory to the Administrator as provided in § 60.767(c)(2) and (3) describing the design and operation of the collection system, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The Administrator may specify additional appropriate monitoring procedures.

(f) Each owner or operator seeking to demonstrate compliance with the 500 parts per million surface methane operational standard in § 60.763(d) must monitor surface concentrations of methane according to the procedures in § 60.765(c) and the instrument specifications in § 60.765(d). Any closed landfill that has no monitored exceedances of the operational standard in three consecutive quarterly monitoring periods may skip to annual monitoring. Any methane reading of 500 ppm or more above background detected during the annual monitoring returns the frequency for that landfill to quarterly monitoring.

(g) Each owner or operator seeking to demonstrate compliance with § 60.762(b)(2)(iii) using a landfill gas treatment system must maintain and operate all monitoring systems associated with the treatment system in accordance with the site-specific treatment system monitoring plan required in § 60.768(b)(5)(ii) and must calibrate, maintain, and operate according to the manufacturer's specifications a device that records flow to the treatment system and bypass of the treatment system (if applicable). The owner or operator must:

(1) Install, calibrate, and maintain a gas flow rate measuring device that records the flow to the treatment system at least every 15 minutes; and

(2) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism must be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(h) The monitoring requirements of paragraphs (b), (c) (d) and (g) of this section apply at all times the affected source is operating, except for periods of monitoring system malfunctions, repairs associated with monitoring system malfunctions, and required monitoring system quality assurance or quality control activities. A monitoring system malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data. Monitoring system failures that are caused in part by poor maintenance or careless operation are not malfunctions. You are required to complete monitoring system repairs in response to monitoring system malfunctions and to return the monitoring system to operation as expeditiously as practicable.

§ 60.767 Reporting requirements.

(a) *Design capacity report.* Each owner or operator subject to the requirements of this subpart must submit an initial design capacity report to the Administrator.

(1) *Submission.* The initial design capacity report fulfills the requirements of the notification of the date construction is commenced as required by § 60.7(a)(1) and must be submitted no later than:

(i) November 28, 2016, for landfills that commenced construction, modification, or reconstruction after July 17, 2014 but before August 29, 2016; or

(ii) Ninety days after the date of commenced construction, modification, or reconstruction for landfills that commence construction, modification, or reconstruction after August 29, 2016.

(2) *Initial design capacity report.* The initial design capacity report must contain the following information:

(i) A map or plot of the landfill, providing the size and location of the landfill, and identifying all areas where solid waste may be landfilled according to the permit issued by the state, local, or tribal agency responsible for regulating the landfill.

(ii) The maximum design capacity of the landfill. Where the maximum design capacity is specified in the permit issued by the state, local, or tribal agency responsible for regulating the landfill, a copy of the permit specifying the maximum design capacity may be submitted as part of the report. If the maximum design capacity of the landfill is not specified in the permit, the maximum design capacity must be calculated using good engineering practices. The calculations must be provided, along with the relevant parameters as part of the report. The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. If the owner or operator chooses to convert the design capacity from volume to mass or from mass to volume to demonstrate its design capacity is less

than 2.5 million megagrams or 2.5 million cubic meters, the calculation must include a site-specific density, which must be recalculated annually. Any density conversions must be documented and submitted with the design capacity report. The state, tribal, local agency or Administrator may request other reasonable information as may be necessary to verify the maximum design capacity of the landfill.

(3) *Amended design capacity report.* An amended design capacity report must be submitted to the Administrator providing notification of an increase in the design capacity of the landfill, within 90 days of an increase in the maximum design capacity of the landfill to meet or exceed 2.5 million megagrams and 2.5 million cubic meters. This increase in design capacity may result from an increase in the permitted volume of the landfill or an increase in the density as documented in the annual recalculation required in § 60.768(f).

(b) *NMOC emission rate report.* Each owner or operator subject to the requirements of this subpart must submit an NMOC emission rate report following the procedure specified in paragraph (i)(2) of this section to the Administrator initially and annually thereafter, except as provided for in paragraph (b)(1)(ii) of this section. The Administrator may request such additional information as may be necessary to verify the reported NMOC emission rate.

(1) The NMOC emission rate report must contain an annual or 5-year estimate of the NMOC emission rate calculated using the formula and procedures provided in § 60.764(a) or (b), as applicable.

(i) The initial NMOC emission rate report may be combined with the initial design capacity report required in paragraph (a) of this section and must be submitted no later than indicated in paragraphs (b)(1)(i)(A) and (B) of this section. Subsequent NMOC emission rate reports must be submitted annually thereafter, except as provided for in paragraph (b)(1)(ii) of this section.

(A) November 28, 2016, for landfills that commenced construction, modification, or reconstruction after July 17, 2014, but before August 29, 2016, or

(B) Ninety days after the date of commenced construction, modification, or reconstruction for landfills that commence construction, modification, or reconstruction after August 29, 2016.

(ii) If the estimated NMOC emission rate as reported in the annual report to the Administrator is less than 34 megagrams per year in each of the next 5 consecutive years, the owner or operator may elect to submit, following the procedure specified in paragraph (i)(2) of this section, an estimate of the NMOC emission rate for the next 5-year period in lieu of the annual report. This estimate must include the current amount of solid waste-in-place and the estimated waste acceptance rate for each year of the 5 years for which an NMOC emission rate is estimated. All data and calculations upon which this estimate is based must be provided to the Administrator. This estimate must be revised at least once every 5 years. If the actual waste acceptance rate exceeds the estimated waste acceptance rate in any year reported in the 5-year estimate, a revised 5-year estimate must be submitted to the Administrator. The revised estimate must cover the 5-year period beginning with the year in which the actual waste acceptance rate exceeded the estimated waste acceptance rate.

(2) The NMOC emission rate report must include all the data, calculations, sample reports and measurements used to estimate the annual or 5-year emissions.

(3) Each owner or operator subject to the requirements of this subpart is exempted from the requirements to submit an NMOC emission rate report, after installing a collection and control system that complies with § 60.762(b)(2), during such time as the collection and control system is in operation and in compliance with §§ 60.763 and 60.765.

(c) *Collection and control system design plan.* Each owner or operator subject to the provisions of § 60.762(b)(2) must submit a collection and control system design plan to the Administrator for approval according to the schedule in paragraph (c)(4) of this section. The collection and control system design plan must be prepared and approved by a professional engineer and must meet the following requirements:

(1) The collection and control system as described in the design plan must meet the design requirements in § 60.762(b)(2).

(2) The collection and control system design plan must include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, recordkeeping or reporting provisions of §§ 60.763 through 60.768 proposed by the owner or operator.

(3) The collection and control system design plan must either conform with specifications for active collection systems in § 60.769 or include a demonstration to the Administrator's satisfaction of the sufficiency of the alternative provisions to § 60.769.

(4) Each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters must submit a collection and control system design plan to the Administrator for approval within 1 year of the first NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year, except as follows:

(i) If the owner or operator elects to recalculate the NMOC emission rate after Tier 2 NMOC sampling and analysis as provided in § 60.764(a)(3) and the resulting rate is less than 34 megagrams per year, annual periodic reporting must be resumed, using the Tier 2 determined site-specific NMOC concentration, until the calculated emission rate is equal to or greater than 34 megagrams per year or the landfill is closed. The revised NMOC emission rate report, with the recalculated emission rate based on NMOC sampling and analysis, must be submitted, following the procedures in paragraph (i)(2) of this section, within 180 days of the first calculated exceedance of 34 megagrams per year.

(ii) If the owner or operator elects to recalculate the NMOC emission rate after determining a site-specific methane generation rate constant k, as provided in Tier 3 in § 60.764(a)(4), and the resulting NMOC emission rate is less than 34 Mg/yr, annual periodic reporting must be resumed. The resulting site-specific methane generation rate constant k must be used in the emission rate calculation until such time as the emissions rate calculation results in an exceedance. The revised NMOC emission rate report based on the provisions of § 60.764(a)(4) and the resulting site-specific methane generation rate constant k must be submitted, following the procedure specified in paragraph (i)(2) of this section, to the Administrator within 1 year of the first calculated emission rate equaling or exceeding 34 megagrams per year.

(iii) If the owner or operator elects to demonstrate that site-specific surface methane emissions are below 500 parts per million methane, based on the provisions of § 60.764(a)(6), then the owner or operator must submit annually a Tier 4 surface emissions report as specified in this paragraph following the procedure specified in paragraph (i)(2) of this section until a surface emissions readings of 500 parts per million methane or greater is found. If the Tier 4 surface emissions report shows no

surface emissions readings of 500 parts per million methane or greater for four consecutive quarters at a closed landfill, then the landfill owner or operator may reduce Tier 4 monitoring from a quarterly to an annual frequency. The Administrator may request such additional information as may be necessary to verify the reported instantaneous surface emission readings. The Tier 4 surface emissions report must clearly identify the location, date and time (to nearest second), average wind speeds including wind gusts, and reading (in parts per million) of any value 500 parts per million methane or greater, other than non-repeatable, momentary readings. For location, you must determine the latitude and longitude coordinates using an instrument with an accuracy of at least 4 meters. The coordinates must be in decimal degrees with at least five decimal places. The Tier 4 surface emission report must also include the results of the most recent Tier 1 and Tier 2 results in order to verify that the landfill does not exceed 50 Mg/yr of NMOC.

(A) The initial Tier 4 surface emissions report must be submitted annually, starting within 30 days of completing the fourth quarter of Tier 4 surface emissions monitoring that demonstrates that site-specific surface methane emissions are below 500 parts per million methane, and following the procedure specified in paragraph (i)(2) of this section.

(B) The Tier 4 surface emissions report must be submitted within 1 year of the first measured surface exceedance of 500 parts per million methane, following the procedure specified in paragraph (i)(2) of this section.

(5) The landfill owner or operator must notify the Administrator that the design plan is completed and submit a copy of the plan's signature page. The Administrator has 90 days to decide whether the design plan should be submitted for review. If the Administrator chooses to review the plan, the approval process continues as described in paragraph (c)(6) of this section. However, if the Administrator indicates that submission is not required or does not respond within 90 days, the landfill owner or operator can continue to implement the plan with the recognition that the owner or operator is proceeding at their own risk. In the event that the design plan is required to be modified to obtain approval, the owner or operator must take any steps necessary to conform any prior actions to the approved design plan and any failure to do so could result in an enforcement action.

(6) Upon receipt of an initial or revised design plan, the Administrator must review the information submitted under paragraphs (c)(1) through (3) of this section and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with landfill gas system design, alternative systems may be necessary. A wide variety of system designs are possible, such as vertical wells, combination horizontal and vertical collection systems, or horizontal trenches only, leachate collection components, and passive systems. If the Administrator does not approve or disapprove the design plan, or does not request that additional information be submitted within 90 days of receipt, then the owner or operator may continue with implementation of the design plan, recognizing they would be proceeding at their own risk.

(7) If the owner or operator chooses to demonstrate compliance with the emission control requirements of this subpart using a treatment system as defined in this subpart, then the owner or operator must prepare a site-specific treatment system monitoring plan as specified in § 60.768(b)(5).

(d) *Revised design plan.* The owner or operator who has already been required to submit a design plan under paragraph (c) of this section must submit a revised design plan to the Administrator for approval as follows:

(1) At least 90 days before expanding operations to an area not covered by the previously approved design plan.

(2) Prior to installing or expanding the gas collection system in a way that is not consistent with the design plan that was submitted to the Administrator according to paragraph (c) of this section.

(e) *Closure report.* Each owner or operator of a controlled landfill must submit a closure report to the Administrator within 30 days of waste acceptance cessation. The Administrator may request additional information as may be necessary to verify that permanent closure has taken place in accordance with the requirements of 40 CFR 258.60. If a closure report has been submitted to the Administrator, no additional wastes may be placed into the landfill without filing a notification of modification as described under § 60.7(a)(4).

(f) *Equipment removal report.* Each owner or operator of a controlled landfill must submit an equipment removal report to the Administrator 30 days prior to removal or cessation of operation of the control equipment.

(1) The equipment removal report must contain all of the following items:

(i) A copy of the closure report submitted in accordance with paragraph (e) of this section;

(ii) A copy of the initial performance test report demonstrating that the 15-year minimum control period has expired, unless the report of the results of the performance test has been submitted to the EPA via the EPA's CDX, or information that demonstrates that the GCCS will be unable to operate for 15 years due to declining gas flows. In the equipment removal report, the process unit(s) tested, the pollutant(s) tested, and the date that such performance test was conducted may be submitted in lieu of the performance test report if the report has been previously submitted to the EPA's CDX; and

(iii) Dated copies of three successive NMOC emission rate reports demonstrating that the landfill is no longer producing 34 megagrams or greater of NMOC per year, unless the NMOC emission rate reports have been submitted to the EPA via the EPA's CDX. If the NMOC emission rate reports have been previously submitted to the EPA's CDX, a statement that the NMOC emission rate reports have been submitted electronically and the dates that the reports were submitted to the EPA's CDX may be submitted in the equipment removal report in lieu of the NMOC emission rate reports.

(2) The Administrator may request such additional information as may be necessary to verify that all of the conditions for removal in § 60.762(b)(2)(v) have been met.

(g) *Annual report.* The owner or operator of a landfill seeking to comply with § 60.762(b)(2) using an active collection system designed in accordance with § 60.762(b)(2)(ii) must submit to the Administrator, following the procedure specified in paragraph (i)(2) of this section, annual reports of the recorded information in paragraphs (g)(1) through (7) of this section. The initial annual report must be submitted within 180 days of installation and startup of the collection and control system, and must include the initial performance test report required under § 60.8, as applicable, unless the report of the results of the performance test has been submitted to the EPA via the EPA's CDX. In the initial annual report, the process unit(s) tested, the pollutant(s) tested, and the date that such performance test was conducted may be submitted in lieu of the performance test report if the report has been previously submitted to the EPA's CDX. For enclosed combustion devices and

flares, reportable exceedances are defined under § 60.768(c).

(1) Value and length of time for exceedance of applicable parameters monitored under § 60.766(a), (b), (c), (d), and (g).

(2) Description and duration of all periods when the gas stream was diverted from the control device or treatment system through a bypass line or the indication of bypass flow as specified under § 60.766.

(3) Description and duration of all periods when the control device or treatment system was not operating and length of time the control device or treatment system was not operating.

(4) All periods when the collection system was not operating.

(5) The location of each exceedance of the 500 parts per million methane concentration as provided in § 60.763(d) and the concentration recorded at each location for which an exceedance was recorded in the previous month. For location, you must determine the latitude and longitude coordinates using an instrument with an accuracy of at least 4 meters. The coordinates must be in decimal degrees with at least five decimal places.

(6) The date of installation and the location of each well or collection system expansion added pursuant to § 60.765(a)(3), (a)(5), (b), and (c)(4).

(7) For any corrective action analysis for which corrective actions are required in § 60.765(a)(3) or (5) and that take more than 60 days to correct the exceedance, the root cause analysis conducted, including a description of the recommended corrective action(s), the date for corrective action(s) already completed following the positive pressure reading, and, for action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates.

(h) *Initial performance test report.* Each owner or operator seeking to comply with § 60.762(b)(2)(iii) must include the following information with the initial performance test report required under § 60.8:

(1) A diagram of the collection system showing collection system positioning including all wells, horizontal collectors, surface collectors, or other gas extraction devices, including the locations of any areas excluded from collection and the proposed sites for the future collection system expansion;

(2) The data upon which the sufficient density of wells, horizontal collectors, surface collectors, or other gas extraction devices and the gas mover equipment sizing are based;

(3) The documentation of the presence of asbestos or nondegradable material for each area from which collection wells have been excluded based on the presence of asbestos or nondegradable material;

(4) The sum of the gas generation flow rates for all areas from which collection wells have been excluded based on nonproductivity and the calculations of gas generation flow rate for each excluded area; and

(5) The provisions for increasing gas mover equipment capacity with increased gas generation flow rate, if the present gas mover equipment is inadequate to move the maximum flow rate expected over the life of the landfill; and

(6) The provisions for the control of off-site migration.

(i) *Electronic reporting.* The owner or operator must submit reports electronically according to paragraphs (i)(1) and (2) of this section.

(1) Within 60 days after the date of completing each performance test (as defined in § 60.8), the owner or operator must submit the results of each performance test according to the following procedures:

(i) For data collected using test methods supported by the EPA's Electronic Reporting Tool (ERT) as listed on the EPA's ERT Web site (*https://www3.epa.gov/ttn/chief/ert/ert_info.html*) at the time of the test, you must submit the results of the performance test to the EPA via the Compliance and Emissions Data Reporting Interface (CEDRI). CEDRI can be accessed through the EPA's Central Data Exchange (CDX) (*https://cdx.epa.gov/*). Performance test data must be submitted in a file format generated through the use of the EPA's ERT or an alternative file format consistent with the extensible markup language (XML) schema listed on the EPA's ERT Web site, once the XML schema is available. If you claim that some of the performance test information being submitted is confidential business information (CBI), you must submit a complete file generated through the use of the EPA's ERT or an alternate electronic file consistent with the XML schema listed on the EPA's ERT Web site, including information claimed to be CBI, on a compact disc, flash drive or other commonly used electronic storage media to the EPA. The electronic media must be clearly marked as CBI and mailed to U.S. EPA/OAQPS/CORE CBI Office, Attention: Group Leader, Measurement Policy Group, MD C404–02, 4930 Old Page Rd., Durham, NC 27703. The same ERT or alternate file with the CBI omitted must be submitted to the EPA via the EPA's CDX as described earlier in this paragraph.

(ii) For data collected using test methods that are not supported by the EPA's ERT as listed on the EPA's ERT Web site at the time of the test, you must submit the results of the performance test to the Administrator at the appropriate address listed in § 60.4.

(2) Each owner or operator required to submit reports following the procedure specified in this paragraph must submit reports to the EPA via the CEDRI. (CEDRI can be accessed through the EPA's CDX.) The owner or operator must use the appropriate electronic report in CEDRI for this subpart or an alternate electronic file format consistent with the XML schema listed on the CEDRI Web site (*https://www3.epa.gov/ttn/chief/cedri/index.html*). If the reporting form specific to this subpart is not available in CEDRI at the time that the report is due, the owner or operator must submit the report to the Administrator at the appropriate address listed in § 60.4. Once the form has been available in CEDRI for 90 calendar days, the owner or operator must begin submitting all subsequent reports via CEDRI. The reports must be submitted by the deadlines specified in this subpart, regardless of the method in which the reports are submitted.

(j) *Corrective action and the corresponding timeline.* The owner or operator must submit according to paragraphs (j)(1) and (j)(2) of this section.

(1) For corrective action that is required according to § 60.765(a)(3)(iii) or (a)(5)(iii) and is expected to take longer than 120 days after the initial exceedance to complete, you must submit the root cause analysis, corrective action analysis, and corresponding implementation timeline to the Administrator as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature monitoring value of 55 degrees Celsius (131 degrees Fahrenheit). The Administrator must approve the plan for corrective action and the corresponding timeline.

(2) For corrective action that is required according to § 60.765(a)(3)(iii) or (a)(5)(iii) and is not completed within 60 days after the initial exceedance, you must submit a notification to the Administrator as soon as practicable but no later than 75 days after the first measurement of positive pressure or temperature exceedance.

(k) *Liquids addition.* The owner or operator of an affected landfill with a design capacity equal to or greater than 2.5 million megagrams and 2.5 million

cubic meters that has employed leachate recirculation or added liquids based on a Research, Development, and Demonstration permit (issued through Resource Conservation and Recovery Act, subtitle D, part 258) within the last 10 years must submit to the Administrator, annually, following the procedure specified in paragraph (i)(2) of this section, the following information:

(1) Volume of leachate recirculated (gallons per year) and the reported basis of those estimates (records or engineering estimates).

(2) Total volume of all other liquids added (gallons per year) and the reported basis of those estimates (records or engineering estimates).

(3) Surface area (acres) over which the leachate is recirculated (or otherwise applied).

(4) Surface area (acres) over which any other liquids are applied.

(5) The total waste disposed (megagrams) in the areas with recirculated leachate and/or added liquids based on on-site records to the extent data are available, or engineering estimates and the reported basis of those estimates.

(6) The annual waste acceptance rates (megagrams per year) in the areas with recirculated leachate and/or added liquids, based on on-site records to the extent data are available, or engineering estimates.

(7) The initial report must contain items in paragraph (k)(1) through (6) of this section per year for the initial annual reporting period as well as for each of the previous 10 years, to the extent historical data are available in on-site records, and the report must be submitted no later than:

(i) September 27, 2017, for landfills that commenced construction, modification, or reconstruction after July 17, 2014 but before August 29, 2016 containing data for the first 12 months after August 29, 2016; or

(ii) Thirteen (13) months after the date of commenced construction, modification, or reconstruction for landfills that commence construction, modification, or reconstruction after August 29, 2016 containing data for the first 12 months after August 29, 2016.

(8) Subsequent annual reports must contain items in paragraph (k)(1) through (6) of this section for the 365-day period following the 365-day period included in the previous annual report, and the report must be submitted no later than 365 days after the date the previous report was submitted.

(9) Landfills may cease annual reporting of items in paragraphs (k)(1) through (7) of this section once they have submitted the closure report in paragraph (e) of this section.

(l) *Tier 4 notification.* (1) The owner or operator of an affected landfill with a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters must provide a notification of the date(s) upon which it intends to demonstrate site-specific surface methane emissions are below 500 parts per million methane, based on the Tier 4 provisions of § 60.764(a)(6). The landfill must also include a description of the wind barrier to be used during the SEM in the notification. Notification must be postmarked not less than 30 days prior to such date.

(2) If there is a delay to the scheduled Tier 4 SEM date due to weather conditions, including not meeting the wind requirements in § 60.764(a)(6)(iii)(A), the owner or operator of a landfill shall notify the Administrator by email or telephone no later than 48 hours before any delay or cancellation in the original test date, and arrange an updated date with the Administrator by mutual agreement.

§ 60.768 Recordkeeping requirements.

(a) Except as provided in § 60.767(c)(2), each owner or operator of an MSW landfill subject to the provisions of § 60.762(b)(2)(ii) and (iii) must keep for at least 5 years up-to-date, readily accessible, on-site records of the design capacity report that triggered § 60.762(b), the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable.

(b) Except as provided in § 60.767(c)(2), each owner or operator of a controlled landfill must keep up-to-date, readily accessible records for the life of the control system equipment of the data listed in paragraphs (b)(1) through (5) of this section as measured during the initial performance test or compliance determination. Records of subsequent tests or monitoring must be maintained for a minimum of 5 years. Records of the control device vendor specifications must be maintained until removal.

(1) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.762(b)(2)(ii):

(i) The maximum expected gas generation flow rate as calculated in § 60.765(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the Administrator.

(ii) The density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in § 60.769(a)(1).

(2) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.762(b)(2)(iii) through use of an enclosed combustion device other than a boiler or process heater with a design heat input capacity equal to or greater than 44 megawatts:

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

(ii) The percent reduction of NMOC determined as specified in § 60.762(b)(2)(iii)(B) achieved by the control device.

(3) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.762(b)(2)(iii)(B)(*1*) through use of a boiler or process heater of any size: A 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 testing.

(4) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.762(b)(2)(iii)(A) through use of a non-enclosed flare, the flare type (*i.e.,* steam-assisted, air-assisted, or nonassisted), 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 § 60.18; continuous records of the flare pilot flame or flare flame monitoring and records of all periods of operations during which the pilot flame of the flare flame is absent.

(5) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.762(b)(2)(iii) through use of a landfill gas treatment system:

(i) *Bypass records.* Records of the flow of landfill gas to, and bypass of, the treatment system.

(ii) *Site-specific treatment monitoring plan,* to include:

(A) Monitoring records of parameters that are identified in the treatment system monitoring plan and that ensure the treatment system is operating properly for each intended end use of the treated landfill gas. At a minimum, records should include records of filtration, de-watering, and compression parameters that ensure the treatment system is operating properly for each

intended end use of the treated landfill gas.

(B) Monitoring methods, frequencies, and operating ranges for each monitored operating parameter based on manufacturer's recommendations or engineering analysis for each intended end use of the treated landfill gas.

(C) Documentation of the monitoring methods and ranges, along with justification for their use.

(D) Identify who is responsible (by job title) for data collection.

(E) Processes and methods used to collect the necessary data.

(F) Description of the procedures and methods that are used for quality assurance, maintenance, and repair of all continuous monitoring systems.

(c) Except as provided in § 60.767(c)(2), each owner or operator of a controlled landfill subject to the provisions of this subpart must keep for 5 years up-to-date, readily accessible continuous records of the equipment operating parameters specified to be monitored in § 60.766 as well as up-to-date, readily accessible records for periods of operation during which the parameter boundaries established during the most recent performance test are exceeded.

(1) The following constitute exceedances that must be recorded and reported under § 60.767(g):

(i) For enclosed combustors except for boilers and process heaters with design heat input capacity of 44 megawatts (150 million British thermal units per hour) or greater, all 3-hour periods of operation during which the average temperature was more than 28 degrees Celsius (82 degrees Fahrenheit) below the average combustion temperature during the most recent performance test at which compliance with § 60.762(b)(2)(iii) was determined.

(ii) For boilers or process heaters, whenever there is a change in the location at which the vent stream is introduced into the flame zone as required under paragraph (b)(3) of this section.

(2) Each owner or operator subject to the provisions of this subpart must keep up-to-date, readily accessible continuous records of the indication of flow to the control system and the indication of bypass flow or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines, specified under § 60.766.

(3) Each owner or operator subject to the provisions of this subpart who uses a boiler or process heater with a design heat input capacity of 44 megawatts or greater to comply with § 60.762(b)(2)(iii) must keep an up-to-date, readily accessible record of all periods of operation of the boiler or process heater. (Examples of such records could include records of steam use, fuel use, or monitoring data collected pursuant to other state, local, tribal, or federal regulatory requirements.)

(4) Each owner or operator seeking to comply with the provisions of this subpart by use of a non-enclosed flare must keep up-to-date, readily accessible continuous records of the flame or flare pilot flame monitoring specified under § 60.766(c), and up-to-date, readily accessible records of all periods of operation in which the flame or flare pilot flame is absent.

(5) Each owner or operator of a landfill seeking to comply with § 60.762(b)(2) using an active collection system designed in accordance with § 60.762(b)(2)(ii) must keep records of periods when the collection system or control device is not operating.

(d) Except as provided in § 60.767(c)(2), each owner or operator subject to the provisions of this subpart must keep for the life of the collection system an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector.

(1) Each owner or operator subject to the provisions of this subpart must keep up-to-date, readily accessible records of the installation date and location of all newly installed collectors as specified under § 60.765(b).

(2) Each owner or operator subject to the provisions of this subpart must keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as provided in § 60.769(a)(3)(i) as well as any nonproductive areas excluded from collection as provided in § 60.769(a)(3)(ii).

(e) Except as provided in § 60.767(c)(2), each owner or operator subject to the provisions of this subpart must keep for at least 5 years up-to-date, readily accessible records of the following:

(1) All collection and control system exceedances of the operational standards in § 60.763, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance.

(2) Each owner or operator subject to the provisions of this subpart must also keep records of each wellhead temperature monitoring value of 55 degrees Celsius (131 degrees Fahrenheit) or above, each wellhead nitrogen level at or above 20 percent, and each wellhead oxygen level at or above 5 percent.

(3) For any root cause analysis for which corrective actions are required in § 60.765(a)(3)(i) or (a)(5)(i), keep a record of the root cause analysis conducted, including a description of the recommended corrective action(s) taken, and the date(s) the corrective action(s) were completed.

(4) For any root cause analysis for which corrective actions are required in § 60.765(a)(3)(ii) or (a)(5)(ii), keep a record of the root cause analysis conducted, the corrective action analysis, the date for corrective action(s) already completed following the positive pressure reading or high temperature reading, and, for action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates.

(5) For any root cause analysis for which corrective actions are required in § 60.765(a)(3)(iii) or (a)(5)(iii), keep a record of the root cause analysis conducted, the corrective action analysis, the date for corrective action(s) already completed following the positive pressure reading or high temperature reading, for action(s) not already completed, a schedule for implementation, including proposed commencement and completion dates, and a copy of any comments or final approval on the corrective action analysis or schedule from the regulatory agency.

(f) Landfill owners or operators who convert design capacity from volume to mass or mass to volume to demonstrate that landfill design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, as provided in the definition of "design capacity", must keep readily accessible, on-site records of the annual recalculation of site-specific density, design capacity, and the supporting documentation. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable.

(g) Landfill owners or operators seeking to demonstrate that site-specific surface methane emissions are below 500 parts per million by conducting surface emission monitoring under the Tier 4 procedures specified in § 60.764(a)(6) must keep for at least 5 years up-to-date, readily accessible records of all surface emissions monitoring and information related to monitoring instrument calibrations conducted according to sections 8 and 10 of Method 21 of appendix A of this part, including all of the following items:

(1) Calibration records:

(i) Date of calibration and initials of operator performing the calibration.

(ii) Calibration gas cylinder identification, certification date, and certified concentration.

(iii) Instrument scale(s) used.

(iv) A description of any corrective action taken if the meter readout could not be adjusted to correspond to the calibration gas value.

(v) If an owner or operator makes their own calibration gas, a description of the procedure used.

(2) Digital photographs of the instrument setup, including the wind barrier. The photographs must be time and date-stamped and taken at the first sampling location prior to sampling and at the last sampling location after sampling at the end of each sampling day, for the duration of the Tier 4 monitoring demonstration.

(3) Timestamp of each surface scan reading:

(i) Timestamp should be detailed to the nearest second, based on when the sample collection begins.

(ii) A log for the length of time each sample was taken using a stopwatch (*e.g.,* the time the probe was held over the area).

(4) Location of each surface scan reading. The owner or operator must determine the coordinates using an instrument with an accuracy of at least 4 meters. Coordinates must be in decimal degrees with at least five decimal places.

(5) Monitored methane concentration (parts per million) of each reading.

(6) Background methane concentration (parts per million) after each instrument calibration test.

(7) Adjusted methane concentration using most recent calibration (parts per million).

(8) For readings taken at each surface penetration, the unique identification location label matching the label specified in paragraph (d) of this section.

(9) Records of the operating hours of the gas collection system for each destruction device.

(h) Except as provided in § 60.767(c)(2), each owner or operator subject to the provisions of this subpart must keep for at least 5 years up-to-date, readily accessible records of all collection and control system monitoring data for parameters measured in § 60.766(a)(1), (2), and (3).

(i) Any records required to be maintained by this subpart that are submitted electronically via the EPA's CDX may be maintained in electronic format.

(j) For each owner or operator reporting leachate or other liquids addition under § 60.767(k), keep records of any engineering calculations or company records used to estimate the quantities of leachate or liquids added, the surface areas for which the leachate or liquids were applied, and the estimates of annual waste acceptance or total waste in place in the areas where leachate or liquids were applied.

§ 60.769 Specifications for active collection systems.

(a) Each owner or operator seeking to comply with § 60.762(b)(2)(i) must site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the following procedures unless alternative procedures have been approved by the Administrator as provided in § 60.767(c)(2) and (3):

(1) The collection devices within the interior must be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues must be addressed in the design: Depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, resistance to the refuse decomposition heat, and ability to isolate individual components or sections for repair or troubleshooting without shutting down entire collection system.

(2) The sufficient density of gas collection devices determined in paragraph (a)(1) of this section must address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior.

(3) The placement of gas collection devices determined in paragraph (a)(1) of this section must control all gas producing areas, except as provided by paragraphs (a)(3)(i) and (ii) of this section.

(i) Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under § 60.768(d). The documentation must provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and must be provided to the Administrator upon request.

(ii) Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material must be documented and provided to the Administrator upon request. A separate NMOC emissions estimate must be made for each section proposed for exclusion, and the sum of all such sections must be compared to the NMOC emissions estimate for the entire landfill.

(A) The NMOC emissions from each section proposed for exclusion must be computed using Equation 7:

$$Q_i = 2\ k\ L_o M_i (e^{-kt_i})\ (C_{NMOC})\ (3.6 \times 10^{-9}) \qquad \text{(Eq. 7)}$$

Where:

Q_i = NMOC emission rate from the ith section, megagrams per year.

k = Methane generation rate constant, $year^{-1}$.

L_o = Methane generation potential, cubic meters per megagram solid waste.

M_i = Mass of the degradable solid waste in the ith section, megagram.

t_i = Age of the solid waste in the ith section, years.

C_{NMOC} = Concentration of nonmethane organic compounds, parts per million by volume.

3.6×10^{-9} = Conversion factor.

(B) If the owner/operator is proposing to exclude, or cease gas collection and control from, nonproductive physically separated (*e.g.,* separately lined) closed areas that already have gas collection systems, NMOC emissions from each physically separated closed area must be computed using either Equation 3 in § 60.764(b) or Equation 7 in paragraph (a)(3)(ii)(A) of this section.

(iii) The values for k and C_{NMOC} determined in field testing must be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (this distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, L_o and C_{NMOC} provided in § 60.764(a)(1) or the alternative values from § 60.764(a)(5) must be used. The mass of nondegradable solid waste contained

within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph (a)(3)(i) of this section.

(b) Each owner or operator seeking to comply with § 60.762(b)(2)(ii)(A) construct the gas collection devices using the following equipment or procedures:

(1) The landfill gas extraction components must be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: Convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system must extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors must be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations must be situated with regard to the need to prevent excessive air infiltration.

(2) Vertical wells must be placed so as not to endanger underlying liners and must address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors must be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices must be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.

(3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly must include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices must be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.

(c) Each owner or operator seeking to comply with § 60.762(b)(2)(iii) must convey the landfill gas to a control system in compliance with § 60.762(b)(2)(iii) through the collection header pipe(s). The gas mover equipment must be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:

(1) For existing collection systems, the flow data must be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph (c)(2) of this section must be used.

(2) For new collection systems, the maximum flow rate must be in accordance with § 60.765(a)(1).

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