UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

ENVIRONMENTAL INTEGRITY PROJECT,
1000 Vermont Ave, NW, Suite 1100
Washington, DC 20005,

CHESAPEAKE CLIMATE ACTION NETWORK,
6930 Carroll Avenue, Suite 720
Takoma Park, MD 20912, and

SIERRA CLUB,
2101 Webster Street, Suite 1300,
Oakland, CA 94612

Plaintiffs,

v.

MICHAEL REGAN, in his official capacity as Administrator, U.S. Environmental Protection Agency,
Office of the Administrator,
Mail Code 1101A
1200 Pennsylvania Ave, NW
Washington, DC 20460,

Defendant.

Case No. _____

COMPLAINT FOR DECLARATORY AND INJUNCTIVE RELIEF

INTRODUCTION

1. Plaintiffs Chesapeake Climate Action Network, Environmental Integrity Project, and Sierra Club (collectively, "Plaintiffs") bring this action pursuant to section 304(a)(2) of the Clean Air Act, 42 U.S.C. § 7604(a)(2), to compel Defendant Michael Regan, Administrator of the United States Environmental Protection Agency ("EPA" or

"Agency"), to perform the nondiscretionary duties required by Clean Air Act section 130, 42 U.S.C. § 7430. Under this section, the Administrator must review and, if necessary, revise the methods used to estimate emissions of volatile organic compounds ("VOC"), carbon monoxide ("CO"), and oxides of nitrogen ("NOx") for emission sources at least once every three years.

2. In 1998, EPA issued a set of methods for estimating emissions of VOC, CO, NOx, and other pollutants from municipal solid waste landfills. In 2008, the Agency proposed to revise the 1998 methods, expressly acknowledging that they are inaccurate in ways that tend to underestimate emissions. However, EPA never finalized its proposed changes to the 1998 methods for estimating municipal solid waste landfill emissions nor did it make a determination that revision of these methods is not warranted.

3. Under EPA regulations and guidance, these inaccurate methods from 1998 may still be used to develop pollution estimates that are used in important regulatory decisions about whether and how to control emissions. Among other things, these estimates are used in state and regional emission inventories, which are "typically the first part of the development of a regional or national control strategy to reduce area-wide emissions. These inventories are important tools in air quality management because they are used to estimate [levels of pollution in the air that people breathe]; to model pollutant dispersion and transport in the atmosphere; and to develop and assess control strategies." U.S. Env't Prot. Agency, EPA-453/B-21-001, *Recommended Procedures for Development of Emission Factors and Use of the WebFIRE Database*, 4-1 (2021), https://www.epa.gov/system/files/documents/2021-11/final-webfire-procedures-document_nov-2021.pdf [hereinafter Recommended Procedures].

4. The Agency has not reviewed or revised the 1998 methods for estimating landfill emissions of VOC, CO, and NOx in accordance with its duty under Section 130 of the Clean Air Act, which mandates action at least every three years. The current methods for estimating emissions from municipal solid waste landfills are 24 years old, and EPA has acknowledged that they are flawed. In addition, recent scientific studies have shown that these methods tend to underestimate emissions from municipal solid waste landfills.

5. Municipal solid waste landfills emit health-harming pollutants that pose risks to nearby communities as well as greenhouse gases, which warm the planet, disrupting weather patterns and other natural processes in increasingly noticeable ways. EPA's flawed methods for estimating emissions from landfills prevents decision makers and the public from understanding the full magnitude of these emissions and can allow operators of individual landfills to avoid pollution control requirements under the Clean Air Act.

6. Accordingly, Plaintiffs seek a determination that the Administrator's failure to perform the actions required by Section 130 violates the Clean Air Act and an order compelling the Administrator to fulfill its duty and take such action in accordance with an expeditious deadline set by this court.

JURISDICTION AND VENUE

7. This Court has jurisdiction over this action pursuant to 42 U.S.C. § 7604(a)(2) (action arising under the Clean Air Act citizen suit provision), 28 U.S.C. § 1331 (federal question), and 28 U.S.C. § 1361 (mandamus). This Court may order the Administrator to perform the requisite acts and duties, may issue a declaratory judgment, and may grant further relief pursuant to 42 U.S.C. § 7604(a), (d) and 28 U.S.C. §§ 2201-

2202.

8. Pursuant to section 304(a) of the Clean Air Act, 42 U.S.C. § 7604(a), "the district courts shall have jurisdiction . . . to order the Administrator to perform such act or duty [which is not discretionary]."

9. Plaintiffs have a right to bring this action pursuant to section 304(a)(2) of the Clean Air Act, 42 U.S.C. § 7604(a)(2).

10. By certified letter posted December 9, 2021, Plaintiffs sent Administrator Regan written Notice of Intent to Sue ("Notice") and have thereby complied with the notice requirements of section 304(b)(2) of the Clean Air Act, 42 U.S.C. § 7604(b)(2), and 40 C.F.R. pt. 54. More than 60 days have passed since Plaintiffs provided Notice. The Administrator has not remedied the alleged violations. Therefore, an actual controversy exists between the parties. The Notice is attached as Exhibit A.

11. Venue is vested in this Court under 28 U.S.C. § 1391(e) because a substantial part of the events or omissions giving rise to the claim occurred in this district and the Administrator's office is in the District of Columbia.

PARTIES

Chesapeake Climate Action Network

12. Plaintiff Chesapeake Climate Action Network ("CCAN") is a grassroots non-profit organization dedicated to fighting for bold and just solutions to climate change in the mid-Atlantic region, specifically Maryland, Virginia, and Washington, D.C. CCAN's mission is to build a movement powerful enough to put the mid-Atlantic region on the path to climate stability, while inspiring action in neighboring states, around the country, and across the world. This mission includes ensuring that significant sources of

air pollution, like municipal solid waste landfills, do not impact the health and well-being of CCAN's members or the environment by emitting dangerous pollutants. CCAN represents approximately 108,600 members, including 24,300 in Maryland, 24,900 in Virginia, 7,100 in the District of Columbia, and 600 in West Virginia.

13. CCAN has members who live, work, and raise families in close proximity to municipal solid waste landfills. Some of these members farm and raise crops on their properties in close proximity to landfills, including as a primary source of income. These members worry about the effects of landfill emissions of VOC and NOx, as well as ground-level ozone, which forms when VOC and NOx combine in the presence of sunlight. They worry about the effects of these pollutants on their own health and the health of their families. They worry about the effects of ozone, which can damage plant tissue, on their crops. They change their behavior in order to reduce their exposure to air pollution from landfills. Some of these members live in areas that have been classified by the EPA as "nonattainment areas" for ozone, meaning that they do not meet federal air quality standards for this pollutant.

14. These concerns are increased by the knowledge that EPA's methods for estimating municipal solid waste landfill emissions are likely underestimating emissions of VOC and other pollutants, which likely allows some landfills to escape pollution control requirements prescribed under the Clean Air Act. These concerns reduce CCAN's members' enjoyment of their properties and their day-to-day activities.

Environmental Integrity Project

15. Plaintiff Environmental Integrity Project ("EIP") is a national non-profit organization based in Washington, D.C., dedicated to ensuring the effective enforcement of state and federal environmental laws in order to protect public health and the environment. EIP

has three goals: (1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; (2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and (3) to help local communities obtain the protection of environmental laws.

16. EIP has a specific focus on the Clean Air Act and on large stationary sources of air pollution, like municipal solid waste landfills, because of their significant impacts on public health and the environment. EIP has invested significant time and effort through various activities to inform the public about the effects of emissions from large air pollution sources, including municipal solid waste landfills. EIP researches, writes, and publishes detailed reports that include analyses of emissions and other data for the purpose of educating the general public about pollution. EIP also works with community groups and residents living in areas near large air pollution sources, including municipal solid waste landfills, to provide education and information about local sources of pollution.

17. EIP regularly participates in permitting and regulatory processes intended to ensure control of air pollution from large sources like landfills, including processes for issuing permits under the Clean Air Act Prevention of Significant Deterioration Program and regulations to set protective emissions standards and bring areas that do not meet air quality standards for ozone into compliance with these standards. EIP regularly submits written comments of a legal, factual, and technical nature during the public comment periods that regulatory agencies are required to hold as part of these processes.

18. EPA's failure to review and, if necessary, revise its 1998 methods for estimating municipal solid waste landfill emissions in accordance with the schedule mandated under

section 130 of the Clean Air Act deprives EIP of accurate information about emissions from municipal solid waste landfills. This harms EIP's organizational interests and activities by preventing or hindering EIP from informing community-based partners about the air pollution emitted by specific landfills located near their neighborhoods as well as preventing or hindering EIP from informing the general public about emissions from municipal solid waste landfills on a national scale. EIP has expended resources, including staff time, trying to determine the true quantity of emissions from municipal waste landfills because of EPA's failure to update and correct its methods for estimating these emissions.

19. EPA's failure to comply with its statutory duty to review and, if necessary, revise its methods for estimating municipal solid waste landfill emissions every three years also harms EIP's organizational interests and activities by making it more difficult for EIP to analyze whether landfills are meeting legal requirements under the Clean Air Act, including permit and regulatory requirements.

Sierra Club

20. Plaintiff Sierra Club is the oldest and largest grassroots environmental group in the United States, with over 830,000 members nationally. Sierra Club's mission is to explore, enjoy, and protect the wild places of the Earth; to practice and promote the responsible use of the Earth's resources and ecosystems; to educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful meansto carry out these objectives. Sierra Club and its members are greatly concerned about the effects of air pollution on human health and the environment and have a long history of participating in activities related to air quality and permitting of air pollution sources under the Clean Air Act. Sierra Club has members who live and recreate in the vicinity of municipal solid waste landfills and

are harmed by emissions of VOC and other pollutants from these landfills.

21. EPA's failure to review and revise as necessary its methods for estimating municipal solid waste landfill emissions deprives Sierra Club of accurate and reliable information about emissions from municipal solid waste landfills. This harms Sierra Club's organizational interests and activities by reducing Sierra Club's ability to provide information and advice to local activists to assist with efforts to reduce or prevent air pollution from specific facilities. The lack of reliable emissions information also harms Sierra Club by reducing its ability to prioritize among potential advocacy projects. Sierra Club frequently prioritizes projects based on the quantity of air pollution emitted by a type or category of facility and the health risks associated with that pollution.

Plaintiffs Collectively

22. Plaintiffs are "person[s]" within the meaning of 42 U.S.C. § 7602(e), who may commence a civil action pursuant to the Clean Air Act. 42 U.S.C. § 7604(a). Plaintiffs sue on behalf of themselves and their individual members, including their members who live, work, travel, and/or recreate in the vicinity of municipal solid waste landfills.

23. Administrator Regan's acts and omissions injure Plaintiffs and their members by threatening their health and welfare, by diminishing their enjoyment of their property, day-to-day activities, and other interests, and by denying them measures and procedures provided under the Clean Air Act to protect their health and welfare from air pollution in places where they live, work, raise crops, and conduct other activities.

24. EPA's failure to complete a review on the schedule mandated by the Clean Air Act further deprives Plaintiffs of an opportunity to redress this harm by seeking judicial review of a final determination on the final methods. If EPA were to finalize inadequate methods for

estimating landfill emissions or determine that revision of the methods is not warranted, Plaintiffs would have the right to seek judicial review of such a decision under section 307(b)(1) of the Clean Air Act. 42 U.S.C. § 7607(b)(1). EPA's failure to act deprives Plaintiffs of an avenue of redress.

25. As explained by EPA, the Agency notifies members of the public about opportunities to comment on some draft revised methods via an email listserv and provides a 60-day period for the public to review and comment on draft factors. Recommended Procedures, at 11-3.

26. Upon information and belief, EPA has not completed a review of its 1998 methods for estimating landfill emissions, meaning a process that results in revision of the methods or a decision that revision is not warranted, in over two decades. Therefore, EPA's failure to timely complete a review, including, if necessary, revision of the methods for estimating landfill emissions, harms Plaintiffs and their members by depriving them of the opportunity to comment on any proposed revisions or seek judicial review of EPA's determination that revision of the methods is not warranted.

27. The Clean Air Act violations alleged in this Complaint have injured and will continue to injure Plaintiffs and their members, unless and until this Court grants the requested relief. Granting the relief requested in this Complaint would redress these injuries by compelling EPA to perform its mandatory duty to complete a review and, if necessary, revise the 1998 methods for estimating VOC, CO, and NOx emissions from municipal solid waste landfills.

28. EPA has previously found that the methods it finalized in 1998 for estimating landfill emissions are inaccurate in ways that tend to underestimate emissions. In addition,

recent scientific studies show that similar methods underestimate landfill emissions. Given these facts, it is likely that, upon review, EPA would determine that it is necessary to revise the methods for estimating VOC, CO, and NOx emissions from municipal solid waste landfills and then revise them. The revised methods would likely increase estimated emissions for multiple pollutants, including VOC, which would subject some landfills to additional pollution control requirements under the Clean Air Act.

29. In the alternative scenario, EPA would conclude its review by determining that revision is not warranted and Plaintiffs could seek judicial review of that decision.

30. EPA's failure to comply with its mandatory duty under the Clean Air Act prevents Plaintiffs and their members from challenging an unfavorable EPA decision on the methods for estimating landfill emissions or enjoying the air quality and other benefits of a favorable decision.

LEGAL BACKGROUND

31. The Clean Air Act was established "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population" and "to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution." 42 U.S.C. § 7401(b).

32. A "primary goal" of the Clean Air Act is "pollution prevention." 42 U.S.C. § 7401(c).

33. As part of the regulatory framework prescribed by the Clean Air Act to accomplish these objectives, EPA must establish "methods ('emission factors') used…to estimate the quantity of emissions of . . . [VOC, CO, and NOx] . . . from sources of such air pollutants." 42 U.S.C. § 7430.

34. EPA must periodically review and revise these methods. Section 130 provides that "at least every 3 years [after Nov. 15, 1990], the Administrator *shall* review and, if necessary, revise, the methods ('emission factors') used for purposes of [the Clean Air Act] to estimate the quantity of emissions of . . . [VOC, CO, and NOx] . . . from sources of such air pollutants." *Id.* (emphasis added). Section 130 requires that the Administrator complete a review by either making a formal determination that revision is not warranted or revising the methods for estimating VOC, CO, and NOx emissions within the statutory deadline. *See id.*

FACTUAL BACKGROUND

The AP-42 Methods for Estimating Emissions from Municipal Solid Waste Landfills

35. EPA maintains a compendium of methods used to estimate emissions from a variety of sources called the AP-42 Compilation of Air Emission Factors ("AP-42 Compilation"), which the Agency describes as "the principal means by which [EPA's emission factor and inventory group] can document its emission factors." 1 U.S. Env't Prot. Agency, *AP-42 Compilation of Air Pollutant Emissions* 1 (5th ed. 1995), https://www.epa.gov/sites/default/files/2020-09/documents/c00s00.pdf.

36. Within the AP-42 Compilation, the methods for estimating emissions from municipal solid waste landfills are set forth in Section 2.4 (Municipal Solid Waste Landfills) within Chapter 2 (Solid Waste) of Volume I. The final version of this section was issued in 1998. 1 U.S. Env't Prot. Agency, *AP-42 Compilation of Air Pollutant Emissions*, Ch. 2.4 (5th ed. 1998), https://www.epa.gov/sites/default/files/2020-10/documents/c02s04.pdf. The 1998 final version of Section 2.4 of the AP-42 Compilation is hereinafter referred to as the "1998 Methods."

37. The 1998 Methods set forth a series of steps that are used to estimate VOC and CO emissions from landfills. *Id.* at 2.4-3 to 2.4-12. This includes multiple equations as well as values for use in those equations. *Id.*

38. In 2008, EPA issued a draft update to Section 2.4 of the AP-42 Compilation that included several proposed revisions to the methods for estimating emissions from municipal solid waste landfills. 1 U.S. Env't Prot. Agency, *AP-42 Draft Compilation of Air Pollutant Emissions*, Ch. 2.4 (5th ed. 2008), https://www.epa.gov/sites/default/files/2020-10/documents/d02s04_0.pdf [hereinafter Draft 2008 Methods]. The Draft 2008 Methods are attached as Exhibit B.

39. Among the revisions that EPA proposed in the Draft 2008 Methods were changes that, when implemented, result in higher emission estimates for many pollutants, including VOC and CO.

40. One revision proposed by EPA in the Draft 2008 Methods was the addition of a factor of 1.3 to Equation 1, which is the first equation that is used to calculate VOC and CO emissions. *Id.* at 2.4-4 to 2.4-5. In other words, EPA proposed to update this initial equation by adding a multiplier of 1.3.

41. This multiplier was proposed because the 1998 Methods contain a default value for one of the variables in Equation 1 that is based on the incorrect assumption that landfill gas collection systems collect 100% of landfill gas. *Id.* at 2.4-5.

42. EPA's 2008 proposal to add a 1.3 multiplier to Equation 1 was based on the finding that it was more appropriate to treat landfill gas collection systems as collecting 75% of landfill gas. *Id*. The 1.3 multiplier adjusted for the lower collection efficiency. *Id.*

43. Equation 1 is the first step in a series of steps that is used in the 1998

Methods to calculate emissions of many pollutants, including VOC and CO. Therefore, inclusion of a 1.3 multiplier in this equation would increase estimates of VOC, CO, and other emissions from municipal solid waste landfills if all else remained the same.

44. The variable in Equation 1 that incorporates these assumptions about collection efficiency is referred to as L_o in the 1998 Methods. 1998 Methods, at 2.4-3 to 2.4-4. It is referred to hereinafter as the Methane Generation Variable.

45. When following the 1998 Methods, VOC and CO emissions cannot be estimated without using the Methane Generation Variable.

46. In the Draft 2008 Methods, for a subset of landfills, EPA also proposed to increase the default concentration value of VOC in landfill gas. Draft 2008 Methods, at 2.4-13, 2.4-18. For these landfills, use of the higher value that EPA proposed in 2008 would result in significantly increased VOC emission estimates, if all else remained the same, when compared to estimates produced using the 1998 Methods.

47. EPA never finalized the revisions that it proposed in the Draft 2008 Methods, and they remain in draft form. Nor has the Agency withdrawn its proposal and made a determination that revision of the 1998 Methods is not warranted.

48. Based on Plaintiffs' review of publicly available records, EPA has not revised or completed a review of the 1998 Methods for estimating VOC, CO, or NOx from landfills since 1998.

49. EPA has not completed the statutorily mandated review of the methods for estimating VOC, CO, and NOx emissions from municipal solid waste landfills within the last three years, as required, by (1) revising the methods; or (2) determining that revision is not warranted.

How the 1998 Methods are Used

50. EPA allows regulators and landfill operators to use the 1998 Methods to develop emission estimates that are used in official decisions, including decisions about air pollution control strategies and whether new pollution control systems are required.

51. EPA allows state environmental agencies to use the 1998 Methods in the development of state emission inventories. *See, e.g.,* Recommended Procedures, at 4-1.

52. Further, state environmental agencies use the 1998 Methods in the development of state emission inventories. *See, e.g.* Md. Dep't of the Env't, *2015 Ozone [National Ambient Air Quality Standards State Implementation Plan] Emissions Inventory Methodology for Maryland Marginal Nonattainment Areas* 139 (May 26, 2020), https://mde.maryland.gov/programs/air/AirQualityPlanning/Documents/SIPDocuments/Inventories/Washington/AppendixB1b.pdf.

53. "Governments use emission inventories to help determine significant sources of air pollutants and to target regulatory actions. Emissions inventories are an essential input to mathematical models that estimate air quality. The effect on air quality of potential regulatory actions can be predicted by applying estimated emissions reductions to emissions inventory data in air quality models." *Managing Air Quality – Emissions Inventorie*s, U.S. Env't Prot. Agency, https://www.epa.gov/air-quality-management-process/managing-air-quality-emissions-inventories#:~:text=the%20United%20States%3F-,How%20Does%20an%20Emissions%20Inventory%20Contribute%20to%20the%20Air%20Quality,models%20that%20estimate%20air%20quality (last visited July 24, 2022).

54. EPA also allows use of the 1998 Methods in some decisions regarding whether pollution controls must be installed under section 165 of the Clean Air Act (Prevention of Significant Deterioration). *See*, *e.g.*, 40 C.F.R. § 60.764(c) ("When calculating emissions for Prevention of Significant Deterioration purposes, the owner or operator of each . . . landfill subject to the provisions of this subpart must estimate the [Non-Methane Organic Compound] 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.")

55. Upon information and belief, state regulators and landfill operators often, if not always, estimate emissions for purposes of these decisions by using an online EPA calculation tool called the Landfill Gas Emissions Model ("LandGEM").

56. LandGEM allows the user to choose from among two sets of default inputs or, for certain parameters, to enter site-specific inputs. One set of default values is based on the 1998 Methods. Amy Alexander et al., U.S. Env't Prot. Agency, EPA-600/R-05/047, *Landfill Gas Emissions Model (LandGEM) Version 3.02 User's Guide* 1-2 (2005), https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009C8L.PDF?Dockey=P1009C8L.PDF, https://view.officeapps.live.com/op/view.aspx?src=https://www.epa.gov/sites/default/files/2020-06/landgem-v303.xlsm&wdOrigin=BROWSELINK [hereinafter Model Version 3.02 User's Guide]. EPA's instructions state that users may select the defaults based on the 1998 Methods "to generate emission estimates for use in emission inventories and air permits in the absence of site-specific test data." *Id*.

57. For the set of defaults based on the AP-42 Compilation, LandGEM includes the Methane Generation Variable default value from the 1998 Methods despite EPA's

subsequent conclusion that this value is inaccurate. *See id.* at 6-8; U.S. Env't Prot. Agency, *Landfill Gas Emissions Model (LandGEM) Version 3.03* (2020), https://www.epa.gov/catc/clean-air-technology-center-products#software (follow "Landfill Gas Emissions Model (LandGEM)" hyperlink).

58. Use of the 1998 Methods, which likely underestimate emissions, in permitting decisions and the creation of emission inventories likely causes regulators to undercount or under-control emissions from municipal solid waste landfills.

Effects of VOC, CO, and NOx Emissions

59. NOx emissions endanger human health and the environment. NOx emissions contribute to the formation of other pollutants in the ambient (outdoor) air, including ozone and fine particles, that can have harmful effects on human health. Fine particles have been linked to premature death from heart and lung disease. *See generally* U.S. Env't Prot. Agency, *Expert Opinions on the Existence of a Threshold in the Concentration Response Function for PM2.5-related Mortality: Technical Support Document* (2010), http://www3.epa.gov/ttnecas1/regdata/Benefits/thresholdstsd.pdf.

60. VOC are substances that readily vaporize into the air, and include gaseous hydrocarbons and partially oxidized hydrocarbons. Some VOCs are toxic pollutants, such as benzene, a known carcinogen that is emitted by municipal solid waste landfills. Agency for Toxic Substances & Disease Registry, *Landfill Gas Primer: An Overview for Environmental Health Professionals* 3 (2001), https://www.atsdr.cdc.gov/HAC/landfill/PDFs/Landfill_2001_ch2mod.pdf.

61. VOC and NOx also combine in a light-induced chemical reaction to produce ground-level ozone. Ozone is a criteria pollutant known to endanger public health and the

environment. Ozone can "[i]nflame and damage the airways[,] [m]ake the lungs more susceptible to infection[,] [a]ggravate lung diseases such as asthma, emphysema, and chronic bronchitis[,[[and] [i]ncrease the frequency of asthma attacks." *Ground-level Ozone Pollution, Health Effects of Ozone Pollution*, U.S. Env't Prot. Agency, https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution. "Long-term exposure to ozone . . . is likely to be one of many causes of asthma development. Studies in locations with elevated concentrations also report associations of ozone with deaths from respiratory causes." *Id*.

62. Ozone can also damage plant tissue. "Ozone causes considerable damage to plants around the world, including agricultural crops and plants in natural ecosystems." *Ozone Effects on Plants*, Nat'l Park Serv., https://www.nps.gov/subjects/air/nature-ozone.htm#:~:text=Ozone%20causes%20considerable%20damage%20to,leaves%20and%20causes%20reduced%20survival (last visited July 24, 2022).

63. CO is a gas that, at elevated concentrations in the outdoor air, can pose risks to people with some types of heart disease by exacerbating reduced blood flow to the heart and causing chest pain. *Basic Information about Carbon Monoxide (CO) Outdoor Air Pollution*, U.S. Env't Prot. Agency, https://www.epa.gov/c o-pollution/basic-information-about-carbon-monoxide-co-outdoor-air-pollution#Effects (last visited July 24, 2022).

64. As EPA itself has acknowledged, estimates derived from the 1998 Methods likely significantly undercount emissions, potentially exposing communities to excess levels of VOC, CO, and NOx that are prohibited by law and causing significant adverse health effects and other grave risks. These effects are the result of EPA's failure to comply with its mandatory duty under section 130 of the Clean Air Act to review and, if necessary, revise

these methods at least every three years.

65. As part of this review, EPA must review the value it finalized in the 1998 Methods for the Methane Generation Variable. As explained above in paragraphs 40 to 45, it is not possible to estimate VOC or CO emissions following the 1998 Methods without using the Methane Generation Variable. But the default value set forth in the 1998 Methods for this variable underestimates emissions because it is based on an assumption that EPA has acknowledged is incorrect: that landfill gas collection systems collect 100% of landfill gas.

66. In addition, several recent scientific studies based on direct measurement of landfill emissions show that the 1998 Methods and similar methods tend to underestimate emissions, as explained on pages 5-8 of Plaintiffs' December 9, 2021 Notice. Ex. A.

67. Notwithstanding the poor quality of the 1998 Methods for estimating emissions from municipal solid waste landfills, the Administrator has failed to complete a review and make necessary revisions of these methods since 1998. The Clean Air Act requires the Administrator to do so at least once every three years for emissions of VOC, CO, and NOx. In light of EPA's longstanding failure to act, Plaintiffs issued a notice of intent to sue EPA for failure to comply with its statutory duties under section 130 of the Clean Air Act on December 9, 2021. *See* Ex. A.

CAUSE OF ACTION

68. Plaintiffs re-allege and incorporate the allegations of all foregoing paragraphs.

69. Pursuant to section 130 of the Clean Air Act, the Administrator has a nondiscretionary and continuing duty to review and, if necessary, revise methods for

estimating emissions of VOC, CO, and NOx at least every three years. 42 U.S.C. § 7430.

70. This statutory duty applies to each and every method set forth in the 1998 Methods for estimating VOC, CO, or NOx emissions from landfills, including but not limited to the default value for the Methane Generation Variable. *Id.*

71. The Administrator has not completed the statutorily mandated review of the 1998 Methods for estimating VOC, CO, and NOx emissions from landfills, including but not limited to the default value for the Methane Generation Variable, within the last three years by either revising those methods or determining that revision is not warranted.

72. The Administrator's ongoing failure to complete this mandatory review within the three-year statutory deadline constitutes a "failure of the Administrator to perform any act or duty under this chapter which is not discretionary with the Administrator." 42 U.S.C. § 7604(a)(2).

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs respectfully request that this Court:

A. Declare that the Administrator's failure to complete a review of the 1998 Methods for estimating landfill emissions of VOC, CO, and NOx - including but not limited to the default value for the Methane Generation Variable – and revise the methods if necessary within the required time frame constitutes a "failure of the Administrator to perform any act or duty under this chapter which is not discretionary with the Administrator" within the meaning of section 304(a)(2) of the Clean Air Act, 42 U.S.C. § 7604(a)(2);

B. Order the Administrator to complete the required review of the 1998 Methods for estimating landfill emissions of VOC, CO, and NOx in their entirety, including but not limited to the default value for the Methane Generation Variable, by either revising those

methods or making a final determination that such revision is not warranted, pursuant to section 130 of the Clean Air Act, 42 U.S.C. § 7430, in accordance with an expeditious deadline specified by this Court;

D. Retain jurisdiction of this action to ensure compliance with this Court's decree;

D. Award Plaintiffs the costs of this action, including reasonable attorneys' fees; and

E. Grant such other relief as the Court deems just and proper.

DATED: July 29, 2022

ATTORNEY OF RECORD

/s/ Jennifer Duggan
Jennifer Duggan
D.C. Bar No. 978352
Environmental Integrity Project
1000 Vermont Ave. N.W., Suite 1100
Washington, D.C. 20005
Phone: (202) 263-4446
jduggan@environmentalintegrity.org

Attorney for Plaintiffs

EXHIBIT A

Plaintiffs' December 9, 2021 Notice of Intent to Sue

ENVIRONMENTAL INTEGRITY PROJECT

1000 Vermont Avenue NW
Suite 1100
Washington, DC 20005
T 202 296 8800
F 202 296 8822
environmentalintegrity.org

December 9, 2021

Via certified mail and e-mail
Michael Regan, Administrator
U.S. Environmental Protection Agency
Office of the Administrator, Mail Code 1101A
1200 Pennsylvania Avenue NW
Washington, DC 20460
regan.michael@epa.gov

RE: Notice of Intent to Sue for Violation of Nondiscretionary Duties to Review and Revise the Emission Factors for Municipal Solid Waste Landfills under Section 130 of the Clean Air Act

Dear Administrator Regan:

The Environmental Integrity Project, Chesapeake Climate Action Network, and Sierra Club (collectively, "Citizen Groups") write to provide you with notice of our intent to commence a civil action against the U.S. Environmental Protection Agency and you, in your official capacity as Administrator (collectively, "EPA" or "the Agency"), for failing to perform nondiscretionary duties required by the Clean Air Act. 42 U.S.C. § 7604(a)(2).

EPA has failed to review and, if necessary, revise the methods—emission factors—that are used to quantify emissions of volatile organic compounds ("VOCs"), oxides of nitrogen ("NOx"), and carbon monoxide ("CO") from municipal solid waste ("MSW") landfills at least every three years. 42 U.S.C. § 7430. EPA has not revised the emission factors for MSW landfills in Chapter 2.4 of the Agency's "AP-42" compendium of emission factors since 1998—more than twenty years ago—despite acknowledging that the current emission factors are flawed. Several research studies show that these emission factors are inaccurate and tend to underestimate air pollution from MSW landfills. Among other problems, the current emission factors: (1) underestimate emissions of almost all pollutants by about 25 percent; (2) underestimate VOC emissions from a significant number of landfills in the U.S. by approximately 60 percent; and (3) do not address emissions of nitrous oxide, a nitrogen oxide compound that is also a potent greenhouse gas with a global warming potential up to 298 times greater than carbon dioxide.

This letter serves as notice of our intent to file suit against EPA under the Clean Air Act for failure to perform these nondiscretionary duties. The Citizen Groups may commence suit in federal district court any time after sixty days from the postmarked date of this notice. 40 C.F.R. § 54.3.

I. EPA has not fulfilled its nondiscretionary duty to review and, if needed, revise the emission factors for VOCs, NOx, and CO pollution from MSW landfills at least once every three years.

The Clean Air Act requires the Agency to "review and, if necessary, revise" the emission factors that are used to quantify emissions of VOCs, NOx, and CO from sources of these pollutants, including MSW landfills, at least once every three years.[1] In order to complete the required review and thereby fulfill its mandatory duties under the Clean Air Act, EPA must review these emission factors every three years and either (1) make a determination that revision is not appropriate or (2) make a determination that revision is appropriate and revise the emission factors.[2]

EPA has failed to perform these nondiscretionary duties for MSW landfills. The Agency has not revised any of the emission factors for MSW landfills in Chapter 2.4 of the AP-42 compilation of emission factors since 1998 ("1998 Factors").[3] In 2008, EPA acknowledged the deficiency of the 1998 Factors and proposed updated emission factors for Chapter 2.4 of AP-42 ("2008 Draft Factors").[4] However, the Agency never finalized the proposed revisions and they remain in draft form.[5] Nor did EPA retract its proposal and make a determination that revision of the 1998 Factors is unnecessary.

According to EPA, "[t]here are currently no draft [AP-42] sections under review" for any sources.[6] Based on the information available to the Citizen Groups, EPA has not completed the required reviews of the VOC, NOx, or CO emission factors for MSW landfills for at least three years.

II. EPA's mandatory duty to complete a review of the VOCs, NOx, and CO emission factors includes a review of emission factors for methane, non-methane organic compounds, nitrous oxide, and the Agency's Landfill Gas Emissions Model.

As part of EPA's mandatory review of the VOCs, NOx, and CO emission factors, EPA must review the emission factors for methane, a class of pollutants called "non-methane organic compounds," and nitrous oxide, which is among the class of nitrogen oxides subject to review under Section 130. EPA must also include a review of the VOCs, NOx, and CO emission estimation methods in EPA's Landfill Gas Emissions Model, commonly referred to as "LandGEM."

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[1] 42 U.S.C. § 7430.

[2] *See, e.g.*, *Envtl. Def. Fund v. Thomas*, 870 F.2d 892, 898–900 (2d Cir. 1989).

[3] *See* EPA, *AP 42, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal* (Nov. 1998), *available at* https://www.epa.gov/sites/default/files/2020-10/documents/c02s04.pdf [hereinafter "1998 Factors"].

[4] *See* EPA, *Draft AP 42, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal* (Oct. 2008), *available at* https://www.epa.gov/sites/default/files/2020-10/documents/d02s04_0.pdf [hereinafter "2008 Draft Factors"].

[5] EPA, Measurement Policy Group, *What is a draft section?* (Sept. 2013), https://www3.epa.gov/ttn/chief/ap42/whatisadraft.txt.

[6] EPA, Air Emissions Factors and Quantification, *AP-42: Compilation of Air Emissions Factors* (Aug. 5, 2021), *available at* https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors.

A. Methane and non-methane organic compounds

VOCs and CO emissions estimates are based, in large part, on methane generation estimates under the 1998 Factors. Determining the amount of methane generated by the landfill is the crucial first step to estimate VOCs and CO emissions.[7] In addition, while EPA has not yet established an emission factor for nitrous oxide, any factor that it does develop will likely follow the same approach.

Similarly, non-methane organic compounds ("NMOC") emissions estimates are used to estimate VOC emissions under the 1998 Factors. NMOC is a category of compounds that includes VOCs, but also includes other organic pollutants that are not as volatile as a VOC.[8] EPA uses the NMOC emission factor to estimate VOC emissions by subtracting pollutants with negligible chemical photoreactivity from the NMOC factor.[9] Thus, any review of the emission factors for VOCs and CO must necessarily include a review of the methods used to quantify methane generation and NMOC.

B. Nitrous oxide

The 1998 Factors contain an emission factor for NOx emitted from control devices at landfills, like flares, but do not contain an emission factor for estimating nitrous oxide pollution from landfills. Nitrous oxide is an oxide of nitrogen[10] and falls within the scope of EPA's review duties under Section 130 of the Clean Air Act. Nitrous oxide is a recognized landfill pollutant[11] and a potent greenhouse gas.[12] As part of its review of the NOx emission factors for landfills, EPA must review methods for estimating nitrous oxide emissions from MSW landfills.

C. LandGEM

Landfill operators and state and federal regulators use EPA's Landfill Gas Emissions Model ("LandGEM") to estimate landfill pollution for inventorying, permitting, and regulatory compliance. LandGEM incorporates the 1998 Factors and is used to estimate emissions of VOCs,

[7] 1998 Factors at 1, 5–8, 12.
[8] *Id.* at 2–6.
[9] EPA, *Emission Factor Documentation for AP-42 Section 2.4 Municipal Solid Waste Landfills Revised*, at 4-18, 4-21, App. C (Aug. 1997), *available at* https://www.epa.gov/sites/default/files/2020-10/documents/b02s04_0.pdf; EPA, *Background Information Document for Updating AP42 Section 2.4 for Estimating Emissions from Municipal Solid Waste Landfills*, at 14–16, App. D (Sept. 2008), *available at* https://www.epa.gov/sites/default/files/2020-10/documents/d02s04.pdf.
[10] EPA, *Technical Bulletin: Nitrogen Oxides (NOx), Why and How They are Controlled*, at 1–4 (Nov. 1999), *available at* https://www3.epa.gov/ttncatc1/cica/files/fnoxdoc.pdf.
[11] Intergovernmental Panel on Climate Change, *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 5, Ch. 3, at 23, Appendix 3A.1 *Information on Nitrous Oxide Emission from Solid Waste Disposal Sites* (2019), *available at* https://www.ipccnggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_3_Ch03_SWDS.pdf.
[12] EPA, *Greenhouse Gas Emissions, Understanding Global Warming Potentials* (Sept. 9, 2020), *available at* https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

NOx, and CO, along with methane, NMOC, and other landfill pollutants.[13] Accordingly, EPA must review the LandGEM methods for quantifying VOCs, NOx, and CO as part of its review under Section 130 of the Clean Air Act.[14]

III. The current VOCs, NOx, and CO emission factors for MSW landfills are inaccurate and incomplete.

The 1998 Factors for VOCs, NOx, and CO underestimate landfill pollution and should be revised. First, EPA has already acknowledged the need to revise the 1998 Factors because the current factors rely on an inaccurate methane generation equation and outdated information about landfill waste composition. Second, scientific studies using direct monitoring of landfills show the current emission factors undercount landfill emissions. Finally, the current emission factors are incomplete because they do not include a method for estimating emissions of nitrous oxide. As EPA itself acknowledged more than fourteen years ago, the 1998 Factors should be revised to ensure that pollution from landfills is accurately accounted for.

A. EPA's own analyses show that the 1998 Factors rely upon an inaccurate methane generation equation and outdated waste composition information.

EPA has already conceded that the methane generation equation in the 1998 Factors underestimates VOCs and CO emissions but did not take action to revise those factors. As discussed above, the equation used to estimate the total amount of methane generated by a landfill is the foundation for the VOCs and CO emission factors. Among other potential problems,[15] EPA itself has determined that the methane generation equation in the 1998 Factors does not account for the fact that gas collection systems at landfills do not recover all of the gas that is generated.[16] The 2008 Draft Factors include a significant revision to address this issue, adding a constant of 1.3 to the methane generation equation.[17] EPA noted:

> This constant is included to compensate for L_O which is typically determined by the amount of gas collected by [landfill gas] collection systems. The design of these systems will typically result in a gas capture efficiency of only 75%. Therefore, 25% of the gas generated by the landfill is not captured and included in the development of L_O. The ratio of total gas to captured gas is a ratio of 100/75 or equivalent to 1.3.[18]

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[13] EPA released LandGEM version 3.03 in June 2020. EPA, *Landfill Methane Outreach Program (LMOP), List of Tools Related to Landfill Gas and Waste Management: Other EPA LFG Tools* (July 14, 2021), *available at* https://www.epa.gov/lmop/list-tools-related-landfill-gas-and-waste-management.

[14] *See Kansas v. EPA*, 638 Fed.Appx. 11 (Mem.) (D.C. Cir. 2016) (citing Section 130 when referencing EPA's computer model for estimating motor vehicle emission, the Motor Vehicle Emissions Simulator for 2014).

[15] *See, e.g.*, SCS Engineers, *New and Improved Implementation of the First Order Model for Landfill Gas Generation or Collection* (Mar. 2015), *available at* https://scsengineers.com/wp-content/uploads/2015/03/Dillah-Panesar-Gornto-Dieleman_New_and_Improved_Implementation_of_First_Order_Model_for_LFG_Generation_or_Collection.pdf.

[16] 2008 Draft Factors at 5.

[17] *Id.*

[18] 2008 Draft Factors at 5. "L_O" is a variable that represents the potential amount of methane that a given amount of waste will produce and is expressed in units of cubic meters of methane per metric ton of waste.

This means that the 1998 Factors underestimate methane generation by at least 25 percent, which translates directly into a 25 percent underestimate of emissions of methane and other pollutants. Accordingly, VOC and CO emissions are likely underestimated by at least 25 percent using the current emission factors.

In addition, the 1998 Factors significantly underestimate VOCs because they rely on outdated waste composition information. EPA has acknowledged that the 1998 Factors' reliance on old waste composition data can result in a 60.7 percent underestimate of VOC emissions when compared with the 2008 Draft Factors. The 1998 Factors are based on data from landfills that received a majority of their waste prior to 1992, when MSW landfills were allowed to accept hazardous waste regulated under Subtitle C of the Resource Conservation and Recovery Act ("RCRA").[19] The 2008 Draft Factors, however, include emission factors for landfills that received all or a majority of their waste after 1992.[20] This distinction is important because landfill operators began to implement changes to meet the requirements of Subtitle D of RCRA around this time, which means the composition of the waste disposed of at MSW landfills changed after 1992.[21] For example, the 1998 Factors provide the following:

- VOCs make up 39 percent of NMOC by weight for MSW landfills that received the majority of their waste before 1992 and do not have a known history of accepting a mix of MSW and hazardous waste.[22]

- VOCs constitute 85 percent of NMOC by weight for MSW landfills that received the majority of their waste before 1992 and *did* accept a mix of MSW and hazardous waste.[23]

In contrast, the 2008 Draft Factors state that VOCs make up 99.7 percent of NMOC for MSW landfills that received most of their waste after 1992.[24] If operators of MSW landfills that received the majority of their waste after 1992 use the default concentrations in the 1998 Factors to estimate VOC emissions, they could underestimate those emissions by approximately 60 percent.

B. Scientific studies show that the 1998 Factors underestimate landfill emissions.

Numerous recent scientific studies involving direct monitoring of landfills and other methods show that the 1998 Factors tend to undercount pollution. These studies conclude that the

[19] *Id.* at 8, 12; EPA, *Background Information Document for Updating AP-42 Section 2.4 for Estimating Emissions from Municipal Solid Waste Landfills*, at iii, 1, 31 (Sept. 2008), *available at* https://www3.epa.gov/ttn/chief/ap42/ch02/draft/db02s04.pdf.
[20] 2008 Draft Factors at 12.
[21] EPA, *Solid Waste Disposal Facility Criteria*, 56 Fed. Reg. 50,978 (Oct. 9, 1991); EPA, *Background Information Document for Updating AP-42 Section 2.4 for Estimating Emissions from Municipal Solid Waste Landfills*, at 1 (Sept. 2008), *available at* https://www3.epa.gov/ttn/chief/ap42/ch02/draft/db02s04.pdf; *see also* EPA, *Solid Waste Disposal Facility Criteria*, 56 Fed. Reg. 50,978 (Oct. 9, 1991).
[22] 1998 Factors at 12.
[23] *Id*.
[24] 2008 Draft Factors at 13, 18.

current emission factors for MSW landfills and LandGEM underestimate methane emissions, which indicates that VOC and CO emissions are also likely underestimated.

Direct measurement data, while limited due to infrequent monitoring at landfills,[25] tends to show that actual emissions from landfills are higher than estimates produced using the 1998 Factors or similar methods, like those used in EPA's Greenhouse Gas Reporting Program. For example:

1. Researchers who conducted the California Methane Survey, which relied on aircraft to measure methane emissions, concluded that methane emissions from MSW landfills were the largest point sources of methane in the state and that emissions from these facilities were greatly underestimated using emission factors that closely resemble the 1998 Factors.[26]

2. A study of California landfills used direct measurement to identify sources of emissions at landfills that models have difficulty capturing, including emissions from the active faces of landfills and emissions that result from changes in landfill infrastructure. The researchers concluded that models like LandGEM that apply the 1998 Factors may not account for these emissions.[27]

3. A Baltimore and Washington, DC area study that used aircraft to measure methane emissions demonstrated that emissions from landfills were nearly double the emissions estimates from EPA's Greenhouse Gas Reporting Program, which uses methods that are closely related to the 1998 Factors.[28] Emissions from one of the largest landfills in Maryland were nine times greater than the Greenhouse Gas Reporting Program estimated.[29]

4. Researchers who used aircraft to measure methane emissions from landfills in the San Francisco area concluded that landfills were the most under-reported methane source in the study area and that emissions were likely double the estimates from the Greenhouse Gas Reporting Program.[30]

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[25] *Id*. at 4, 9, 13.

[26] Riley Duran, et al., *California's methane super-emitters*,nNature, at 180–84 (Nov. 7, 2019); *see also* California Air Resources Board, *California's 2000–2014 Greenhouse Gas Emission Inventory, Technical Support Document*, 2016 Ed., at 126–33, 135–36 (Sept. 2016), *available at* https://www.arb.ca.gov/cc/inventory/doc/methods_00-14/ghg_inventory_00-14_technical_support_document.pdf.

[27] Daniel Cusworth, et al., *Using remote sensing to detect, validate, and quantify methane emissions from California solid waste operations*, Environmental Research Letters, at 1–2, 4–7, 9 (Apr. 29, 2020), *available at* https://iopscience.iop.org/article/10.1088/1748-9326/ab7b99/pdf.

[28] Xinrong Ren, et al., *Methane Emissions from the Baltimore-Washington Area Based on Airborne Observations: Comparison to Emissions Inventories*, Journal of Geophysical Research: Atmospheres, at 8,876 (Aug. 20, 2018).

[29] *Id*. at 8,874–76.

[30] Abhinav Guha, et al., *Assessment of Regional Methane Emissions Inventories through Airborne Quantification in the San Francisco Bay Area*, Environmental Science and Technology, at 2, 20 (July 7, 2020), *available at* https://authors.library.caltech.edu/104257/1/acs.est.0c01212.pdf.

Other studies focused specifically on LandGEM, which incorporates the 1998 Factors, have shown that LandGEM can underestimate landfill gas generation by as much as 80 percent.[31] For example:

1. A Canada-based study compared LandGEM to other models used around the world and found that LandGEM was the only one to consistently underestimate methane generation from landfills.[32]

2. Researchers who evaluated 5 to 8 years of annual methane collection data from 114 closed landfills nationwide determined that "MSW landfills are emitting more methane than estimated . . ." using the methods employed by the 1998 Factors, as well as the closely related methods employed by EPA's Greenhouse Gas Reporting Program.[33]

These studies demonstrate that the current emission factors for MSW landfills should be revised.

C. The 1998 Factors underestimate landfill pollution because the factors do not include a method for estimating nitrous oxide emissions.

While the 1998 Factors include emission factors to estimate nitrogen dioxide emissions from control devices that combust landfill gas,[34] they do not contain an emission factor for estimating emissions of nitrous oxide, a type of NOx that is generated in the waste heap and emitted directly from landfills. Nitrous oxide is a potent greenhouse gas that is up to 298 times more effective at warming the globe than carbon dioxide on a per weight basis.[35]

According to the Intergovernmental Panel on Climate Change's ("IPCC") *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*, "[s]ignificant generation of [nitrous oxide] from [Solid Waste Disposal Sites, which include landfills] was indicated by the IPCC Fourth Assessment Report (2007)" and the anaerobic generation of nitrous oxide is

[31] Hamid Amini, et al., *Comparison of first-order-decay modeled and actual field measured municipal solid waste landfill methane data*, Waste Management, at 2720–28 (Dec. 2013), *available at* https://www.sciencedirect.com/science/article/abs/pii/S0956053X1300353X?via%3Dihub; Daniel Cusworth, et al., *Using remote sensing to detect, validate, and quantify methane emissions from California solid waste operations*, Environmental Research Letters, at 2 (Apr. 29, 2020), *available at* https://iopscience.iop.org/article/10.1088/1748-9326/ab7b99/pdf.

[32] Shirley Thompson, et al., *Building a better methane generation model: Validating models with methane recovery rates from 35 Canadian landfills*, Waste Management, at 2085–86, 2088–90 (Apr. 2009), *available at* https://www.researchgate.net/publication/24241186_Building_a_better_methane_generation_model_Validating_models_with_methane_recovery_rates_from_35_Canadian_landfills.

[33] Pradeep Jain, et al., *Greenhouse gas reporting data improves understanding of regional climate impact on landfill methane production and collection*, PLoS ONE, at 1–3, 10–11 (Feb. 26, 2021), *available at* https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0246334.

[34] 1998 Factors at 14–15.

[35] EPA, *Greenhouse Gas Emissions, Understanding Global Warming Potentials* (Sept. 9, 2020), *available at* https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

"common" in landfills.[36] EPA has also acknowledged that MSW landfills emit nitrous oxide.[37] California tracks nitrous oxide emissions from MSW landfills in its state greenhouse gas inventory.[38] Further, a number of studies show that nitrous oxide is generated and emitted by MSW landfills, including from the active faces of landfills.[39] Thus, the 1998 Factors are incomplete and underestimate landfill pollution.

IV. Citizen Groups Giving Notice.

As required by 40 C.F.R. § 54.3, the names, addresses, and telephone numbers of the Citizen Groups giving notice are:

Environmental Integrity Project
1000 Vermont Avenue NW, Suite 1100
Washington, DC 20005
(202) 469-3150

Sierra Club
National Clean Air Team
P.O. Box 845
Rosamund, CA
(661) 256-2101

Chesapeake Climate Action Network
6930 Carroll Avenue, Suite 720
Takoma Park, MD 20912
(240) 630-2146

Ryan Maher and Jennifer Duggan are the attorneys representing the Environmental Integrity Project, Chesapeake Climate Action Network, and Sierra Club, with contact information provided in the signature block below.

V. Conclusion

MSW landfills are significant sources of air pollution in the United States, but the methods that are used to estimate emissions from these facilities are inaccurate and incomplete. EPA is

[36] Vol. 5, Ch. 3, at 23, Appendix 3A.1 *Information on Nitrous Oxide Emission from Solid Waste Disposal Sites*, https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_3_Ch03_SWDS.pdf.

[37] *See, e.g.*, EPA, *Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Municipal Solid Waste Landfills*, at 21, 26 (June 2011), *available at* https://www.epa.gov/sites/default/files/2015-12/documents/landfills.pdf.

[38] *See* California Air Resources Board, *Current California GHG Emission Inventory Data* (July 28, 2021), *available at* https://ww2.arb.ca.gov/ghg-inventory-data.

[39] *See, e.g.*, Jean Bogner, et al., *Seasonal greenhouse gas emissions (methane, carbon dioxide, nitrous oxide) from engineered landfills: Daily, intermediate, and final California soil covers*, Journal of Environmental Quality, at 1010–20 (2011); Houhu Zhang, et al., *N2O emissions at municipal solid waste landfill sites: Effects of CH4 emissions and cover soil*, Atmospheric Environment, at 2623–31 (May 2009), *available at* https://www.researchgate.net/publication/223658901_N2O_emissions_at_municipal_solid_waste_landfill_sites_Effects_of_CH4_emissions_and_cover_soil.

subject to a statutory mandate to complete a review of the emission factors that are used to estimate VOC, NOx, and CO pollution from MSW landfills at least once every three years. For at least the past three years, EPA has failed to complete these reviews and either (1) make a determination that revision of the emission factors is not necessary or (2) make a determination that revision is appropriate and revise the emission factors. The Citizen Groups intend to sue EPA to compel compliance with its mandatory duties to review and revise, as necessary, the VOC, NOx, and CO emission factors for MSW landfills.

If you have any questions regarding the allegations in this notice or would like to discuss resolution of this matter, please contact Ryan Maher using the information provided below.

Thank you for your attention to this matter.

Respectfully submitted,

Ryan Maher
Attorney
Environmental Integrity Project
1000 Vermont Ave. NW, Suite 1100
Washington, DC 20005
(202) 469-3150
rmaher@environmentalintegrity.org

Jennifer Duggan
Deputy Director
Environmental Integrity Project
1000 Vermont Ave. NW, Suite 1100
Washington, DC 20005
jduggan@environmentalintegrity.org

cc:

Via certified mail and e-mail

Jeffrey Prieto
General Counsel
EPA Office of the General Counsel, Mail Code: 2310A
1200 Pennsylvania Ave., NW
Washington, DC 20460
Prieto.Jeffrey@epa.gov

Peter Tsirigotis
Director
EPA Office of Air Quality Planning and Standards, Mail Code: C404-04
109 T.W. Alexander Drive
Research Triangle Park, NC 27711
Tsirigotis.Peter@epa.gov

Barry Breen
Acting Assistant Administrator
EPA Office of Land and Emergency Management, Mail Code: 5101T
1301 Constitution Ave., NW
Washington, DC 20460
Breen.Barry@epa.gov

Via certified mail

Merrick Garland
Attorney General of the United States
U.S. Department of Justice
950 Pennsylvania Avenue NW
Washington, DC 20530

EXHIBIT B

U.S. Environmental Protection Agency, AP-42 Draft Compilation of Air Pollutant Emissions, Ch. 2.4 (5th ed. 2008) (Draft 2008 Methods)

2.4 Municipal Solid Waste Landfills

2.4.1 General [1-4]

A municipal solid waste (MSW) landfill unit is a discrete area of land or an excavation that receives household waste, and that is not a land application unit, surface impoundment, injection well, or waste pile. An MSW landfill unit may also receive other types of wastes, such as commercial solid waste, nonhazardous sludge, and industrial solid waste. In addition to household and commercial wastes, the other waste types potentially accepted by MSW landfills include (most landfills accept only a few of the following categories):

- Municipal sludge,
- Municipal waste combustion ash,
- Infectious waste,
- Small-quantity generated hazardous waste;
- Waste tires,
- Industrial non-hazardous waste,
- Conditionally exempt small quantity generator (CESQG) hazardous waste,
- Construction and demolition waste,
- Agricultural wastes,
- Oil and gas wastes, and
- Mining wastes.

The information presented in this section applies only to landfills which receive primarily MSW. This information is not intended to be used to estimate emissions from landfills which receive large quantities of other waste types such as industrial waste, or construction and demolition wastes. These other wastes exhibit emissions unique to the waste being landfilled.

In the United States in 2006, approximately 55 percent of solid waste was landfilled, 13 percent was incinerated, and 32 percent was recycled or composted. There were an estimated 1,754 active MSW landfills in the United States in 2006. These landfills were estimated to receive 138 million tons of waste annually, with 55 to 60 percent reported as household waste, and 35 to 45 percent reported as commercial waste.[79]

2.4.2 Process Description [2,5]

The majority of landfills currently use the "area fill" method which involves placing waste on a landfill liner, spreading it in layers, and compacting it with heavy equipment. A daily soil cover is spread over the compacted waste to prevent wind-blown trash and to protect the trash from scavengers and vectors. The landfill liners are constructed of soil (i.e., recompacted clay) and synthetics (i.e., high density polyethylene) to provide an impermeable barrier to leachate (i.e., water that has passed through the landfill) and gas migration from the landfill. Once an area of the landfill is completed, it is covered with a "cap" or "final cover" composed of various combinations of clay, synthetics, soil and cover vegetation to control the incursion of precipitation, the erosion of the cover, and the release of gases and odors from the landfill.

2.4.3 Control Technology [2,5,6]

The New Source Performance Standards (NSPS) and Emission Guidelines for air emissions from MSW landfills for certain new and existing landfills were published in the Federal Register on March 1, 1996. Current versions of the NSPS and Emission Guidelines can

be found at 40 CFR 60 subparts WWW and Cb, respectively. The regulation requires that Best Demonstrated Technology (BDT) be used to reduce MSW landfill emissions from affected new and existing MSW landfills if (1) the landfill has a design capacity of 2.5 million Mg (2.75 million tons) and 2.5 million cubic meters or more, and (2) the calculated uncontrolled emissions from the landfill are greater than or equal to 50 Mg/yr (55 tons/yr) of nonmethane organic compounds (NMOCs). The MSW landfills that are affected by the NSPS/Emission Guidelines are each new MSW landfill, and each existing MSW landfill that has accepted waste since November 8, 1987 or that has capacity available for future use. Control systems require: (1) a well-designed and well-operated gas collection system, and (2) a control device capable of reducing non-methane organic compounds (NMOCs) in the collected gas by 98 weight-percent (or to 20 ppmv, dry basis as hexane at 3% oxygen for an enclosed combustion device). Other compliance options include use of a flare that meets specified design and operating requirements or treatment of landfill gas (LFG) for use as a fuel. The National Emission Standards for Hazardous Air Pollutants (NESHAP) for MSW landfills was published in the Federal Register on January 16, 2003. It requires control of the same landfills, and the same types of gas collection and control systems as the NSPS. The NESHAP also requires earlier control of bioreactor landfills and contains a few additional reporting requirements for MSW landfills.

Landfill gas collection systems consist of a series of vertical or horizontal perforated pipes that penetrate the waste mass and collect the gases produced by the decaying waste. These collection systems are classified as either active or passive systems. Active collection systems use mechanical blowers or compressors to create a vacuum in the collection piping to optimize the collection of LFG. Passive systems use the natural pressure gradient established between the encapsulated waste and the atmosphere to move the gas through the collection system.

LFG control and treatment options include: (1) combustion of the LFG, and (2) treatment of the LFG for subsequent sale or use. Combustion techniques include techniques that do not recover energy (i.e., flares and thermal incinerators), and techniques that recover energy and generate electricity from the combustion of the LFG (i.e., gas turbines and reciprocating engines). Boilers can also be employed to recover energy from LFG in the form of steam. Flares combust the LFG without the recovery of energy, and are classified by their burner design as being either open or enclosed. Purification techniques are used to process raw LFG to either a medium-BTU gas using dehydration and filtration or as a higher-BTU gas by removal of inert constituents using adsorption, absorption, and membranes.

2.4.4 Emissions[2,7]

Methane (CH_4) and carbon dioxide (CO_2) are the primary constituents of LFG, and are produced by microorganisms within the landfill under anaerobic conditions. Transformations of CH_4 and CO_2 are mediated by microbial populations that are adapted to the cycling of materials in anaerobic environments. Landfill gas generation proceeds through four phases. The first phase is aerobic [i.e., with oxygen (O_2) available from air trapped in the waste] and the primary gas produced is CO_2. The second phase is characterized by O_2 depletion, resulting in an anaerobic environment, where large amounts of CO_2 and some hydrogen (H_2) are produced. In the third phase, CH_4 production begins, with an accompanying reduction in the amount of CO_2 produced. Nitrogen (N_2) content is initially high in LFG in the first phase, and declines sharply as the landfill proceeds through the second and third phases. In the fourth phase, gas production of CH_4, CO_2, and N_2 becomes fairly steady. The duration of each phase and the total time of gas generation vary with landfill conditions (i.e., waste composition, design management, and anaerobic state).

Typically, LFG also contains NMOC and volatile organic compounds (VOC). NMOC result from either decomposition by-products or volatilization of biodegradable wastes. Although NMOC are considered trace constituents in LFG, the NMOC and VOC emission rates could be "major" with respect to Prevention of Significant Deterioration (PSD) and New Source Review (NSR) requirements. This NMOC fraction often contains various organic hazardous air pollutants (HAP), greenhouse gases (GHG), compounds associated with stratospheric ozone depletion and volatile organic compounds (VOC). However, in MSW landfills where contaminated soils from storage tank cleanups are used as daily cover, much higher levels of NMOC have been observed. As LFG migrates through the contaminated soil, it adsorbs the organics, resulting in the higher concentrations of NMOC and any other contaminant in the soil. In one landfill where contaminated soil was used as daily cover, the NMOC concentration in the LFG was 5,870 ppm as compared to the AP-42 average value of 838 ppm. While there is insufficient data to develop a factor or algorithm for estimating NMOC from contaminated daily cover, the emissions inventory developer should be aware to expect elevated NMOC concentrations from these landfills.

Other emissions associated with MSW landfills include combustion products from LFG control and utilization equipment (i.e., flares, engines, turbines, and boilers). These include carbon monoxide (CO), oxides of nitrogen (NO_X), sulfur dioxide (SO_2), hydrogen chloride (HCl), particulate matter (PM) and other combustion products (including HAPs). PM emissions can also be generated in the form of fugitive dust created by mobile sources (i.e., garbage trucks) traveling along paved and unpaved surfaces. The reader should consult AP-42 Volume I Sections 13.2.1 and 13.2.2 for information on estimating fugitive dust emissions from paved and unpaved roads.

One pollutant that can very greatly between landfills is hydrogen sulfide (H_2S). H_2S is normally present in LFG at levels ranging from 0 to 90 ppm, with an average concentration of 33 ppm. However, a recent trend at some landfills has been the use of construction and demolition waste (C&D) as daily cover. Under certain conditions that are not well understood, some microorganisms will convert the sulfur in the wall-board of C&D waste to H_2S. At these landfills, H_2S concentrations can be significantly higher than at landfills that do not use C&D waste as daily cover. While H_2S measurements are not available for landfills using C&D for daily cover, the State of New Hampshire among others have noted elevated H_2S odor problems at these landfills and have assumed that H_2S concentrations have increased, similarly. In a series of studies at 10 landfills in Florida where a majority of the waste is composed of C&D material, the concentration of H_2S concentration spanned a range from less than the detection limit of the instrument (0.003 ppmv) up to 12,000 ppmv.[8] Another study that was conducted used flux boxes to measure uncontrolled emissions of H_2S at five landfills in Florida. This study reported a range of H_2S emissions between 0.192 and 1.76 mg/(m^2-d).[9] At any MSW landfill where C&D waste was used as daily cover or was comingled with the MSW, it is recommended that direct H_2S measurements be used to develop specific H_2S emissions for the landfill.

The rate of emissions from a landfill is governed by gas production and transport mechanisms. Production mechanisms involve the production of the emission constituent in its vapor phase through vaporization, biological decomposition, or chemical reaction. Transport mechanisms involve the transportation of a volatile constituent in its vapor phase to the surface of the landfill, through the air boundary layer above the landfill, and into the atmosphere. The three major transport mechanisms that enable transport of a volatile constituent in its vapor phase are diffusion, convection, and displacement.

Although relatively uncommon, fires can occur on the surface of the landfill or underground. The smoke from a landfill fire frequently contains many dangerous chemical

compounds, including: carbon monoxide, particulate matter and hazardous gases that are the products of incomplete combustion, and very elevated concentrations of the many gaseous constituents normally occurring in LFG. Of particular concern in landfill fires is the emission of dioxins/furans. Accidental fires at landfills and the uncontrolled burning of residential waste are considered the largest sources of dioxin emissions in the United States.[10] The composition of the gases from landfill fires is highly variable and dependent on numerous site specific factors, including: the composition of the material burning, the composition of the surrounding waste, the temperature of the burning waste, and the presence of oxygen. The only reliable method for estimating the emissions from a landfill fire involves testing the emissions directly. More information is available on landfill fires and their emissions from reference 11.

2.4.4.1 Uncontrolled Emissions –

Several methods have been developed by EPA to determine the uncontrolled emissions of the various compounds present in LFG. The newest measurement method is optical remote sensing with radial plume mapping (ORS-RPM). This method uses an optical emission detector such as open-path Fourier transform infrared spectroscopy (FTIR), ultraviolet differential absorption spectroscopy (UV-DOAS), or open-path tunable diode laser absorption spectroscopy (OP-TDLAS); coupled with radial plume mapping software that processes path-integrated emission concentration data and meteorological data to yield an estimate of uncontrolled emissions. More information on this newest method is described in *Evaluation of Fugitive Emissions Using Ground-Based Optical Remote Sensing Technology* (EPA/600/R-07/032).[12] Additional research is ongoing to provide additional guidance on the use of optical remote sensing for application at landfills. Evaluating uncontrolled emissions from landfills can be a challenge. This is due to the changing nature of landfills, scale and complexity of the site, topography, and spatial and temporal variability in emissions. Additional guidance is being developed for application of EPA's test method for area sources emissions. This is expected to be released by the spring of 2009. For more information, refer to the Emission Measurement Center of EPA's Technology Transfer Network (http://www.epa.gov/ttn/emc/tmethods.html). Additional information on ORS technology can also be found on EPA's website for Measurement and Monitoring Technologies for 21st Century ($21M^2$) which provided funding to identify improved technologies for quantifying area source emissions (http://www.clu-in.org/programs/21m2/openpath/).

Often flux data are used to evaluate LFG collection efficiency. The concern with the use of this data is that it does not capture emission losses from header pipes or extraction wells. The other concern is that depending upon the design of the study, the emission variability across a landfill surface is not captured. Emission losses can occur from cracks and fissures or difference in landfill cover material. Often, alternative cover material is used to help promote infiltration, particularly for wet landfill operation. This can result in larger loss of fugitive emissions. Another loss of landfill gas is through the leachate collection pumps and wells. For many of these potential losses, a flux box is not considered adequate to capture the total loss of fugitive gas. The use of ORS technology is considered more reliable.

When direct measurement data are not available, the most commonly used EPA method to estimate the uncontrolled emissions associated with LFG is based on a biological decay model. In this method, the generation of CH_4 must first be estimated by using a theoretical first-order kinetic model of CH_4 production developed by the EPA[13]:

$$Q_{CH_4} = 1.3 L_o \, R \, (e^{-kc} - e^{-kt}) \quad (1)$$

where:

Q_{CH_4} = Methane generation rate at time t, m^3/yr;
L_o = Methane generation potential, m^3 CH_4/Mg of "wet" or "as received" refuse;
R = Average annual refuse acceptance rate during active life, Mg of "wet" or "as received" refuse /yr;
e = Base log, unitless;
k = Methane generation rate constant, yr^{-1};
c = Time since landfill closure, yrs (c = 0 for active landfills); and
t = Time since the initial refuse placement, yrs.

When annual refuse acceptance data is available, the following form of Equation (1) is used. This is the general form of the equation that is used in EPA's Landfill Gas Emissions Model (LandGEM). Due to the complexity of the double summation, Equation (1alt) is normally implemented within a computer model. Equation (1 alt.) is more accurate because it accounts for the varying annual refuse flows and it calculates each year's gas flow in $^1/_{10th}$ year increments.

$$Q_{CH_4} = 1.3 \sum_{i=1}^{n} \sum_{j=0.1}^{1} k \, L_o \frac{R_i}{10} e^{-kt_{ij}} \quad \text{(1 alternate)}$$

where:

Q_{CH_4} = Methane generation rate at time t, m^3/yr;
L_o = Methane generation potential, m^3 CH_4/Mg of "wet" or "as received" refuse;
R_i = Annual refuse acceptance rate for year i, Mg of "wet" or "as received" refuse /yr;
e = Base log, unitless;
k = Methane generation rate constant, yr^{-1};
c = Time since landfill closure, yrs (c = 0 for active landfills); and
t = Time since the initial refuse placement, yrs.
i = year in life of the landfill
j = $^1/_{10th}$ year increment in the calculation.

It should be noted that Equation (1) is provided for estimating CH_4 emissions to the atmosphere. Other fates may exist for the gas generated in a landfill, including capture and subsequent microbial degradation within the landfill's surface layer. Currently, there are no data that adequately address this fate. It is generally accepted that the bulk of the CH_4 generated will be emitted through cracks or other openings in the landfill surface and that Equation (1) can be used to approximate CH_4 emissions from an uncontrolled landfill. It should also be noted that Equation (1) is different from the equation used in other models such as LandGEM by the addition of the constant 1.3 at the front of the equation. This constant is included to compensate for L_O which is typically determined by the amount of gas collected by LFG collection systems. The design of these systems will typically result in a gas capture efficiency of only 75%. Therefore, 25% of the gas generated by the landfill is not captured and included in the development of L_O. The ratio of total gas to captured gas is a ratio of 100/75 or equivalent to 1.3.

Site-specific landfill information is generally available for variables R, c, and t. When refuse acceptance rate information is scant or unknown, R can be determined by dividing the refuse in place by the age of the landfill. If a facility has documentation that a certain segment

(cell) of a landfill received *only* nondegradable refuse, then the waste from this segment of the landfill can be excluded from the calculation of R. Nondegradable refuse includes concrete, brick, stone, glass, plaster, wallboard, piping, plastics, and metal objects. The average annual acceptance rate should only be estimated by this method when there is inadequate information available on the actual average acceptance rate. The time variable, t, includes the total number of years that the refuse has been in place (including the number of years that the landfill has accepted waste and, if applicable, has been closed).

Values for variables L_o and k are normally estimated. Estimation of the potential CH_4 generation capacity of refuse (L_o) is generally treated as a function of the moisture and organic content of the refuse. Estimation of the CH_4 generation constant (k) is a function of a variety of factors, including moisture, pH, temperature, and other environmental factors, and landfill operating conditions.

Recommended AP-42 defaults for k are:

k Value	Landfill Conditions
0.02	**Areas receiving <25 inches/yr rainfall**
0.04	**Areas receiving >25 inches/yr rainfall**
0.3	**Wet landfills[14]**

For the purpose of the above table, wet landfills are defined as landfills which add large amounts of water to the waste. This added water may be recycled landfill leachates and condensates, or may be other sources of water such as treated wastewater.

The CH_4 generation potential, L_o, has been observed to vary from 6 to 270 m^3/Mg (200 to 8670 ft3/ton), depending on the organic content of the waste material. A higher organic content results in a higher L_o. Food, textiles, paper, wood, and horticultural waste have the highest L_o value on a dry basis, while inert materials such as glass, metal and plastic have no L_o value.[2] Since moisture does not contribute to the value of L_o, a high moisture content waste, such as food or organic sludge, will have a lower L_o on an "as received" basis. When using Equation 1 to estimate emissions for typical MSW landfills in the U.S., a mean L_o value of 100 m^3/Mg refuse (3,530 ft^3 /ton, "as received" basis) is recommended.

There is a significant level of uncertainty in Equation 2 and its recommended defaults values for k and L_o. The recommended defaults k and L_o for conventional landfills, based upon the best fit to 40 different landfills, yielded predicted CH_4 emissions that ranged from ~30 to 400% of measured values and had a relative standard deviation of 0.73 (Table 2-2). The default values for wet landfills were based on a more limited set of data and are expected to contain even greater uncertainty.

When gas generation reaches steady state conditions, LFG consists of approximately equal volumes of CO_2 and CH_4. LFG also typically contains as much as five percent N_2 and other gases, and trace amounts of NMOCs. Since the flow of CO_2 is approximately equal to the flow of CH_4, the estimate derived for CH_4 generation using Equation (1) can also be used to estimate CO_2 generation. Addition of the CH_4 and CO_2 emissions will yield an estimate of total LFG emissions. If site-specific information is available on the actual CH_4 and CO_2 contents of the LFG, then the site-specific information should be used.

Most of the NMOC emissions from landfills result from the volatilization of organic compounds contained in the landfilled waste. Small amounts may also be created by biological

processes and chemical reactions within the landfill. Available data show that the range of values for total NMOC in LFG is from 31 ppmv to over 5,387 ppmv, and averages 838 ppmv. The proposed regulatory default of 4,000 ppmv for NMOC concentration was developed for regulatory compliance purposes and is considered more conservative. For emissions inventory purposes, site-specific information should be taken into account when determining the total NMOC concentration, whenever available. Measured pollutant concentrations (i.e., as measured by EPA Reference Method 25C), must be corrected for air infiltration which can occur by two different mechanisms: LFG sample dilution and air intrusion into the landfill. These corrections require site-specific data for the LFG CH_4, CO_2, N_2, and O_2 content. If the ratio of N_2 to O_2 is less than or equal to 4.0 (as found in ambient air), then the total pollutant concentration is adjusted for sample dilution by assuming that CO_2 and CH_2 are the primary constituents of LFG (assumed to account for 100% of the LGF), and the following equation is used:

$$C_P \text{ (corrected for air infiltration)} = \frac{C_P \text{ x } (1 \text{x} 10^6)}{C_{CO_2} + C_{CH_4}} \quad (2)$$

where:

C_P = Concentration of pollutant P in LFG (i.e., NMOC as hexane), ppmv;
C_{CO_2} = CO_2 concentration in LFG, ppmv;
Q_{CH_4} = CH_4 Concentration in LFG, ppmv; and
$1 \text{ x } 10^6$ = Constant used to correct concentration of P to units of ppmv.

If the ratio of N_2 to O_2 concentrations (i.e., C_{N2}, C_{O2}) is greater than 4.0, then the total pollutant concentration should be adjusted for air intrusion into the landfill by using Equation (2) and adding the concentration of N_2 (i.e., C_{N2}) to the denominator. Values for C_{CO2}, C_{CH4}, C_{N2}, C_{O2}, can usually be found in the source test report for the particular landfill along with the total pollutant concentration data.

To estimate uncontrolled emissions of NMOC or other LFG constituents, the following equation should be used:

$$Q_P = \frac{Q_{CH4} \text{ x } C_P}{C_{CH_4} \text{ x } (1 \text{x} 10^6)} \quad (3)$$

where:

Q_P = Emission rate of pollutant P (i.e., NMOC), m^3/yr;
Q_{CH_4} = CH_4 generation rate, m^3/yr (from Equation 1);
C_P = Concentration of pollutant P in LFG, ppmv; and
C_{CH_4} = Concentration of CH_4 in the LFG (assumed to be 50% expressed as 0.5)

Uncontrolled mass emissions per year of total NMOC (as hexane) and speciated organic and inorganic compounds can be estimated by the following equation:

$$UM_P = Q_P \text{ x } \frac{MW_P \text{ x } 1 \text{ atm}}{(8.205 \text{x} 10^{-5} \text{ m}^3 - \text{atm/gmol} - {}^\circ\text{K}) \text{ x } (1000 \text{g/kg}) \text{ x } (273 + T)} \quad (4)$$

where:

UM_P = Uncontrolled mass emissions of pollutant P (i.e., NMOC), kg/yr;
MW_P = Molecular weight of P, g/gmol (i.e., 86.18 for NMOC as hexane);
Q_P = Emission rate of pollutant P, m^3/yr; and
T = Temperature of LFG, °C.

This equation assumes that the operating pressure of the system is approximately 1 atmosphere. If the temperature of the LFG is not known, a temperature of 25 °C (77 °F) is recommended.

Uncontrolled default concentrations of VOC, NMOC and speciated compounds are presented in Table 2.4-1 for landfills having a majority of the waste in place on or after 1992 and in Table 2.4-2 for landfills having a majority of the waste in place before 1992. These default concentrations have already been corrected for air infiltration and can be used as input parameters to Equation (3) for estimating emissions from landfills when site-specific data are not available. An analysis of the data, based on the co-disposal history (with non-residential wastes) of the individual landfills from which the concentration data were derived, indicates that for benzene, NMOC, and toluene, there is a difference in the uncontrolled concentrations.

It is important to note that the compounds listed in Tables 2.4-1 and 2.4-2 are not the only compounds likely to be present in LFG. The listed compounds are those that were identified through a review of the available landfill test reports. The reader should be aware that additional compounds are likely present, such as those associated with consumer or industrial products. Given this information, extreme caution should be exercised in the use of the default emission concentrations given in Tables 2.4-1 and 2.4-2. Available data have shown that there is a range of over two orders of magnitude in many of the pollutant concentrations among gases from various MSW landfills.

2.4.4.2 Controlled Emissions —

Emissions from landfills are typically controlled by installing a gas collection system, and either combusting the collected gas through the use of internal combustion engines, flares, or turbines, or by purifying the gas for direct use in place of a fuel such as natural gas. Gas collection systems are not 100% efficient in collecting LFG, so emissions of CH_4 and NMOC at a landfill with a gas recovery system still occur. To estimate controlled emissions of CH_4, NMOC, and other constituents in LFG, the collection efficiency of the system must first be estimated. Reported collection efficiencies typically range from 50 to 95%, with a default efficiency of 75% recommended by EPA for inventory purposes. The lower collection efficiencies are experienced at landfills with a large number of open cells, no liners, shallow soil covers, poor collection system and cap maintenance programs and/or a large number of cells without gas collection. The higher collection efficiencies may be achieved at closed sites employing good liners, extensive geomembrane-clay composite caps in conjunction with well engineered gas collection systems, and aggressive operation and maintenance of the cap and collection system. If documented site-specific collection efficiencies are available (i.e., through a comprehensive surface sampling program), then they may be used instead of the 75% average. An analysis showing a range in the gas collection system taking into account delays from gas collection from initial waste placement is provided in Section 2.0.

Estimates of controlled emissions may also need to account for the control efficiency of the control device. Control efficiencies for NMOC and VOC based on test data for the combustion of LFG with differing control devices are presented in Table 2.4-3. As noted in the table, these control efficiencies may also be applied to other LFG constituents. Emissions from

the control devices need to be added to the uncollected emissions to estimate total controlled emissions.

Controlled CH_4, NMOC, VOC, and speciated emissions can be determined by either of two methods developed by EPA. The newest method is the optical remote sensing with radial plume mapping (ORS-RPM). This method uses an optical emission detector such as open-path Fourier transform infrared spectroscopy (FTIR), ultraviolet differential absorption spectroscopy (UV-DOAS), or open-path tunable diode laser absorption spectroscopy (OP-TDLAS); coupled with radial plume mapping software that processes path-integrated emission concentration data and meteorological data to yield an estimate of uncontrolled emissions. More information on this newest method is described in *Evaluation of Fugitive Emissions Using Ground-Based Optical Remote Sensing Technology* (EPA/600/R-07/032).[12]

Historically, controlled emissions have been calculated with Equation 5. In this equation it is assumed that the LFG collection and control system operates 100 percent of the time. Minor durations of system downtime associated with routine maintenance and repair (i.e., 5 to 7 percent) will not appreciably effect emission estimates. The first term in Equation 5 accounts for emissions from uncollected LFG, while the second term accounts for emissions of the pollutant that were collected but not fully combusted in the control or utilization device:

$$CM_P = \left[UM_P \times \left(1 - \frac{\eta_{col}}{100} \right) \right] + \left[UM_P \times \frac{\eta_{col}}{100} \times \left(1 - \frac{\eta_{cnt}}{100} \right) \right] \quad (5)$$

where:

CM_P = Controlled mass emissions of pollutant P, kg/yr;
UM_P = Uncontrolled mass emissions of P, kg/yr (from Equation 4);
η_{col} = Efficiency of the LFG collection system, % (recommended default is 75%); and
η_{cnt} = Efficiency of the LFG control or utilization device, %.

Emission factors for the secondary compounds, CO, PM, NO_x and dioxins/furans exiting the control device are presented in Table 2.4-4. These emission factors should be used when equipment vendor emission guarantees are not available.

Controlled emissions of CO_2 and sulfur dioxide (SO_2) are best estimated using site-specific LFG constituent concentrations and mass balance methods.[15] If site-specific data are not available, the data in Tables 2.4-1 and 2.4-2 can be used with the mass balance methods that follow.

Controlled CO_2 emissions include emissions from the CO_2 component of LFG and additional CO_2 formed during the combustion of LFG. The bulk of the CO_2 formed during LFG combustion comes from the combustion of the CH_4 fraction. Small quantities will be formed during the combustion of the NMOC fraction. However, this typically amounts to less than 1 percent of total CO_2 emissions by weight. Also, the formation of CO through incomplete combustion of LFG will result in small quantities of CO_2 not being formed. This contribution to the overall mass balance picture is also very small and does not have a significant impact on overall CO_2 emissions.[15]

The following equation which assumes a 100% combustion efficiency for CH_4 can be used to estimate CO_2 emissions from controlled landfills:

$$CM_{CO2} = UM_{CO2} + \left(UM_{CH4} \text{ x } \frac{\eta_{col}}{100} \text{ x } 2.75 \right) \quad (6)$$

where:

CM_{CO_2} = Controlled mass emissions of CO_2, kg/yr;
UM_{CO_2} = Uncontrolled mass emissions of CO_2, kg/yr (from Equation 4);
UM_{CH_4} = Uncontrolled mass emissions of CH_4, kg/yr (from Equation 4);
η_{col} = Efficiency of the LFG collection system, % (recommended default is 75%); and
2.75 = Ratio of the molecular weight of CO_2 to the molecular weight of CH_4.

To prepare estimates of SO_2 emissions, data on the concentration of reduced sulfur compounds within the LFG are needed. The best way to prepare this estimate is with site-specific information on the total reduced sulfur content of the LFG. Often these data are expressed in ppmv as sulfur (S). Equations 3 and 4 should be used first to determine the uncontrolled mass emission rate of reduced sulfur compounds as sulfur. Then, the following equation can be used to estimate SO_2 emissions:

$$CM_{SO2} = UM_S \text{ x } \frac{\eta_{col}}{100} \text{ x } 2.0 \quad (7)$$

where:

CM_{SO_2} = Controlled mass emissions of SO_2, kg/yr;
UM_S = Uncontrolled emissions of reduced sulfur compounds as sulfur, kg/yr (from Equations 3 and 4);
η_{col} = Efficiency of the LFG collection system, %; and
2.0 = Ratio of the molecular weight of SO_2 to the molecular weight of S.

The next best method to estimate SO_2 concentrations, if site-specific data for total reduced sulfur compounds as sulfur are not available, is to use site-specific data for speciated reduced sulfur compound concentrations. These data can be converted to ppmv as S with Equation 8. After the total reduced sulfur as S has been obtained from Equation 8, then Equations 3, 4, and 7 can be used to derive SO_2 emissions.

$$C_S = \sum_{i=1}^{n} C_P \text{ x } S_P \quad (8)$$

where:

C_S = Concentration of total reduced sulfur compounds, ppmv as S (for use in Equation 3);
C_P = Concentration of each reduced sulfur compound, ppmv;
S_P = Number of moles of S produced from the combustion of each reduced sulfur compound (i.e., 1 for sulfides, 2 for disulfides); and
n = Number of reduced sulfur compounds available for summation.

If no site-specific data are available, values of 47 and 33 ppmv can be used for C_S in the gas from landfills having a majority of the waste in place before 1992 and from landfills having a majority of the waste in place after 1992, respectively. These values were obtained by using the default concentrations presented in Tables 2.4-1 and 2.4-2 for reduced sulfur compounds and Equation 8.

Hydrochloric acid [Hydrogen Chloride (HCl)] emissions are formed when chlorinated compounds in LFG are combusted in control equipment. The best methods to estimate HCl emissions are mass balance methods that are analogous to those presented above for estimating SO_2 emissions. Hence, the best source of data to estimate HCl emissions is site-specific LFG data on total chloride [expressed in ppmv as the chloride ion (Cl^-)]. However, emission estimates may be underestimated, since not every chlorinated compound in the LFG will be represented in the site test report (i.e., only those that the analytical method specifies). If these data are not available, then total chloride can be estimated from data on individual chlorinated species using Equation 9 below.

$$C_{Cl} = \sum_{i=1}^{n} C_P \times Cl_P \qquad (9)$$

where:

C_{Cl} = Concentration of total chloride, ppmv as Cl^- (for use in Equation 3);
C_P = Concentration of each chlorinated compound, ppmv;
Cl_P = Number of moles of Cl^- produced from the combustion of each mole of chlorinated compound (i.e., 3 for 1,1,1-trichloroethane); and
n = Number of chlorinated compounds available for summation.

After the total chloride concentration (C_{Cl}) has been estimated, Equations 3 and 4 should be used to determine the total uncontrolled mass emission rate of chlorinated compounds as chloride ion (UM_{Cl}). This value is then used in Equation 10, below, to derive HCl emission estimates:

$$CM_{HCl} = UM_{Cl} \times \frac{\eta_{col}}{100} \times 1.03 \times \frac{\eta_{cnt}}{100} \qquad (10)$$

where:

CM_{HCl} = Controlled mass emissions of HCl, kg/yr;
UM_{Cl} = Uncontrolled mass emissions of chlorinated compounds as chloride, kg/yr (from Equations 3 and 4);
η_{col} = Efficiency of the LFG collection system, percent;
1.03 = Ratio of the molecular weight of HCl to the molecular weight of Cl^-; and
η_{cnt} = Control efficiency of the LFG control or utilization device, percent.

In estimating HCl emissions, it is assumed that all of the chloride ion from the combustion of chlorinated LFG constituents is converted to HCl. If an estimate of the control efficiency, η_{cnt}, is not available, then the control efficiency for the equipment listed in Table 2.4-3 should be used. This assumption is recommended to assume that HCl emissions are not under-estimated.

If site-specific data on total chloride or speciated chlorinated compounds are not available, then default values of 42 and 74 ppmv can be used for C_{Cl} in the gas from landfills having a majority of the waste in place before 1992 and from landfills having a majority of the

waste in place after 1992, respectively. These values were derived from the default LFG constituent concentrations presented in Tables 2.4-1 and 2.4-2. As mentioned above, use of this default may produce underestimates of HCl emissions since it is based only on those compounds for which analyses have been performed. The constituents listed in Table 2.4-1 and 2.4-2 are likely not all of the chlorinated compounds present in LFG.

The reader is referred to AP-42 Volume I, Sections 13.2.1 and 13.2.2 for information on estimating fugitive dust emissions from paved and unpaved roads, and to Section 13.2.3 for information on estimating fugitive dust emissions from heavy construction operations; and to AP-42 Volume II Section II-7 for estimating exhaust emissions from construction equipment.

2.4.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. The November 1998 revision includes major revisions of the text and recommended emission factors contained in the section. The most significant revisions to this section since publication in the Fifth Edition are summarized below.

- The equations to calculate the CH_4, CO_2 and other constituents were simplified.
- The default L_0 and k were revised based upon an expanded base of gas generation data.
- The default ratio of CO_2 to CH_4 was revised based upon averages observed in available source test reports.
- The default concentrations of LFG constituents were revised based upon additional data. References 16-148 are the emission test reports from which data were obtained for this section.
- Additional control efficiencies were included and existing efficiencies were revised based upon additional emission test data.
- Revised and expanded the recommended emission factors for secondary compounds emitted from typical control devices.

The current (i.e., 2008) update includes text revisions and additional discussion, as well as revised recommended emission factors contained within the section. The more significant revisions are summarized below:

- Default concentrations of LFG constituents were developed for landfills with the majority of their waste in place on or after 1992 (proposal of RCRA Subtitle D). The LFG constituent list from the last update reflects data from landfills with waste in place prior to 1992, so Table 2.4-2 was renamed to reflect this.
- Control efficiencies were updated to incorporate additional emission test data and the table was revised to show the NMOC and VOC control efficiencies.
- Revised and expanded the recommended emission factors for secondary compounds emitted from typical control devices.
- The description of modern landfills and statistics about waste disposition in the U.S. were updated with 2006 information.

- EPA's newest measurement method for determining landfill emissions, Optical Remote Sensing with Radial Plume Mapping (ORS-RPM), was added to the discussion of available options for measuring landfill emissions.

- A factor of 1.3 was added to Equation (1) to account for the fact that L_0 is typically determined by the amount of CH_4 collected at landfills using equipment that typically has a capture efficiency of only 75%.

- A k value of 0.3 was added to the list of recommended k values for use in Equation (1).

Table 2.4-1. DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE ON OR AFTER 1992

Compound	CAS Number	Molecular Weight	Default Concentration (ppmv)	Recommended Emission Factor Rating
NMOC (as hexane)[a]		86.18	8.38E+02	A
VOC[b]		NA	8.35E+02	A
1,1,1-Trichloroethane[c]	71556	133.40	2.43E-01	A
1,1,2,2-Tetrachloroethane[c]	79345	167.85	5.35E-01	E
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)[c]	87683	260.76	3.49E-03	D
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	76131	187.37	6.72E-02	C
1,1,2-Trichloroethane[c]	79005	133.40	1.58E-01	D
1,1-Dichloroethane[c]	75343	98.96	2.08E+00	A
1,1-Dichloroethene (1,1-Dichloroethylene)[c]	75354	96.94	1.60E-01	A
1,2,3-Trimethylbenzene	526738	120.19	3.59E-01	D
1,2,4-Trichlorobenzene[c]	120821	181.45	5.51E-03	C
1,2,4-Trimethylbenzene	95636	120.19	1.37E+00	B
1,2-Dibromoethane (Ethylene dibromide)[c]	106934	187.86	4.80E-03	B
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	76142	170.92	1.06E-01	B
1,2-Dichloroethane (Ethylene dichloride)[c]	107062	98.96	1.59E-01	A
1,2-Dichloroethene	540590	96.94	1.14E+01	E
1,2-Dichloropropane[c]	78875	112.99	5.20E-02	D
1,2-Diethylbenzene	135013	134.22	1.99E-02	D
1,3,5-Trimethylbenzene	108678	120.19	6.23E-01	C
1,3-Butadiene (Vinyl ethylene)[c]	106990	54.09	1.66E-01	C
1,3-Diethylbenzene	141935	134.22	6.55E-02	D
1,4-Diethylbenzene	105055	134.22	2.62E-01	D
1,4-Dioxane (1,4-Diethylene dioxide)[c]	123911	88.11	8.29E-03	D
1-Butene / 2-Methylbutene	106989 / 513359	56.11 / 70.13	1.22E+00	D
1-Butene / 2-Methylpropene	106989 / 115117	56.11	1.10E+00	E

Table 2.4-1 (CONTINUED). DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE ON OR AFTER 1992

Compound	CAS Number	Molecular Weight	Default Concentration (ppmv)	Recommended Emission Factor Rating
1-Ethyl-4-methylbenzene (4-Ethyl toluene)	622968	120.19	9.89E-01	C
1-Ethyl-4-methylbenzene (4-Ethyl toluene) + 1,3,5-Trimethylbenzene	622968 / 108678	120.19	5.79E-01	D
1-Heptene	592767	98.19	6.25E-01	E
1-Hexene / 2-Methyl-1-pentene	592416 / 763291	84.16	8.88E-02	D
1-Methylcyclohexene	591491	96.17	2.27E-02	D
1-Methylcyclopentene	693890	82.14	2.52E-02	D
1-Pentene	109671	70.13	2.20E-01	D
1-Propanethiol (n-Propyl mercaptan)	107039	76.16	1.25E-01	A
2,2,3-Trimethylbutane	464062	100.20	9.19E-03	D
2,2,4-Trimethylpentane[c]	540841	114.23	6.14E-01	D
2,2,5-Trimethylhexane	3522949	128.26	1.56E-01	D
2,2-Dimethylbutane	75832	86.18	1.56E-01	D
2,2-Dimethylpentane	590352	100.20	6.08E-02	D
2,2-Dimethylpropane	463821	72.15	2.74E-02	E
2,3,4-Trimethylpentane	565753	114.23	3.12E-01	D
2,3-Dimethylbutane	79298	86.18	1.67E-01	D
2,3-Dimethylpentane	565593	100.20	3.10E-01	D
2,4-Dimethylhexane	589435	114.23	2.22E-01	D
2,4-Dimethylpentane	108087	100.20	1.00E-01	D
2,5-Dimethylhexane	592132	114.23	1.66E-01	D
2,5-Dimethylthiophene	638028	112.19	6.44E-02	E
2-Butanone (Methyl ethyl ketone)[c]	78933	72.11	4.01E+00	C
2-Ethyl-1-butene	760214	84.16	1.77E-02	D
2-Ethylthiophene	872559	112.19	6.29E-02	E
2-Ethyltoluene	611143	120.19	3.23E-01	D
2-Hexanone (Methyl butyl ketone)	591786	100.16	6.13E-01	E
2-Methyl-1-butene	563462	70.13	1.79E-01	D
2-Methyl-1-propanethiol (Isobutyl mercaptan)	513440	90.19	1.70E-01	E
2-Methyl-2-butene	513359	70.13	3.03E-01	D
2-Methyl-2-propanethiol (tert-Butylmercaptan)	75661	90.19	3.25E-01	E
2-Methylbutane	78784	72.15	2.26E+00	D
2-Methylheptane	592278	114.23	7.16E-01	D
2-Methylhexane	591764	100.20	8.16E-01	D
2-Methylpentane	107835	86.18	6.88E-01	D
2-Propanol (Isopropyl alcohol)	67630	60.10	1.80E+00	C

Table 2.4-1 (CONTINUED). DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE ON OR AFTER 1992

Compound	CAS Number	Molecular Weight	Default Concentration (ppmv)	Recommended Emission Factor Rating
3,6-Dimethyloctane	15869940	142.28	7.85E-01	D
3-Ethyltoluene	620144	120.19	7.80E-01	D
3-Methyl-1-pentene	760203	84.16	6.99E-03	D
3-Methylheptane	589811	114.23	7.63E-01	D
3-Methylhexane	589344	100.20	1.13E+00	D
3-Methylpentane	96140	86.18	7.40E-01	D
3-Methylthiophene	616444	98.17	9.25E-02	E
4-Methyl-1-pentene	691372	84.16	2.33E-02	E
4-Methyl-2-pentanone (MIBK)[c]	108101	100.16	8.83E-01	C
4-Methylheptane	589537	114.23	2.49E-01	D
Acetaldehyde[c]	75070	44.05	7.74E-02	D
Acetone	67641	58.08	6.70E+00	C
Acetonitrile[c]	75058	41.05	5.56E-01	A
Acrylonitrile[c,d]	107131	53.06	BDL	
Benzene[c]	71432	78.11	2.40E+00	A
Benzyl chloride[c]	100447	126.58	1.81E-02	A
Bromodichloromethane	75274	163.83	8.78E-03	E
Bromomethane (Methyl bromide)[c]	74839	94.94	2.10E-02	C
Butane	106978	58.12	6.22E+00	C
Carbon disulfide[c]	75150	76.14	1.47E-01	A
Carbon monoxide	630080	28.01	2.44E+01	C
Carbon tetrachloride[c]	56235	153.82	7.98E-03	A
Carbon tetrafluoride (Freon 14)	75730	88.00	1.51E-01	E
Carbonyl sulfide (Carbon oxysulfide)[c]	463581	60.08	1.22E-01	A
Chlorobenzene	108907	112.56	4.84E-01	A
Chlorodifluoromethane (Freon 22)[c]	75456	86.47	7.96E-01	D
Chloroethane (Ethyl chloride)[c]	75003	64.51	3.95E+00	B
Chloromethane (Methyl chloride)[c]	74873	50.49	2.44E-01	B
cis-1,2-Dichloroethene	156592	96.94	1.24E+00	B
cis-1,2-Dimethylcyclohexane	2207014	112.21	8.10E-02	D
cis-1,3-Dichloropropene	10061015	110.97	3.03E-03	D
cis-1,3-Dimethylcyclohexane	638040	112.21	5.01E-01	D
cis-1,4-Dimethylcyclohexane / trans-1,3-Dimethylcyclohexane	624293 / 2207036	112.21	2.48E-01	D
cis-2-Butene	590181	56.11	1.05E-01	D
cis-2-Heptene	6443921	98.19	2.45E-02	E
cis-2-Hexene	7688213	84.16	1.72E-02	D
cis-2-Octene	7642048	112.21	2.20E-01	D
cis-2-Pentene	627203	70.13	4.79E-02	D

Table 2.4-1 (CONTINUED). DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE ON OR AFTER 1992

Compound	CAS Number	Molecular Weight	Default Concentration (ppmv)	Recommended Emission Factor Rating
cis-3-Methyl-2-pentene	922623	84.16	1.79E-02	D
Cyclohexane	110827	84.16	1.01E+00	B
Cyclohexene	110838	82.14	1.84E-02	D
Cyclopentane	287923	70.13	2.21E-02	D
Cyclopentene	142290	68.12	1.21E-02	D
Decane	124185	142.28	3.80E+00	D
Dibromochloromethane	124481	208.28	1.51E-02	D
Dibromomethane (Methylene dibromide)	74953	173.84	8.35E-04	E
Dichlorobenzene[c,e]	106467	147.00	9.40E-01	A
Dichlorodifluoromethane (Freon 12)	75718	120.91	1.18E+00	B
Dichloromethane (Methylene chloride)[c]	75092	84.93	6.15E+00	A
Diethyl sulfide	352932	90.19	8.62E-02	E
Dimethyl disulfide	624920	94.20	1.37E-01	A
Dimethyl sulfide	75183	62.14	5.66E+00	A
Dodecane (n-Dodecane)	112403	170.33	2.21E-01	D
Ethane	74840	30.07	9.05E+00	D
Ethanol	64175	46.07	2.30E-01	D
Ethyl acetate	141786	88.11	1.88E+00	C
Ethyl mercaptan (Ethanediol)	75081	62.14	1.98E-01	A
Ethyl methyl sulfide	624895	76.16	3.67E-02	E
Ethylbenzene[c]	100414	106.17	4.86E+00	B
Formaldehyde[c]	50000	30.03	1.17E-02	D
Heptane	142825	100.20	1.34E+00	B
Hexanec	110543	86.18	3.10E+00	B
Hydrogen sulfide	7783064	34.08	3.20E+01	A
Indane (2,3-Dihydroindene)	496117	34.08	6.66E-02	D
Isobutane (2-Methylpropane)	75285	58.12	8.16E+00	D
Isobutylbenzene	538932	134.22	4.07E-02	D
Isoprene (2-Methyl-1,3-butadiene)	78795	68.12	1.65E-02	D
Isopropyl mercaptan	75332	76.16	1.75E-01	A
Isopropylbenzene (Cumene)[c]	98828	120.19	4.30E-01	D
Mercury (total)[c]	7439976	200.59	1.22E-04	B
Mercury (elemental)[c]	7439976	200.59	7.70E-05	C
Mercury (monomethyl)[c]	51176126	216.63	3.84E-07	C
Mercury (dimethyl)[c]	627441	258.71	2.53E-06	B
Methanethiol (Methyl mercaptan)	74931	48.11	1.37E+00	A
Methyl tert-butyl ether (MTBE)[c]	1634044	88.15	1.18E-01	D
Methylcyclohexane	108872	98.19	1.29E+00	D

Table 2.4-1 (CONTINUED). DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE ON OR AFTER 1992

Compound	CAS Number	Molecular Weight	Default Concentration (ppmv)	Recommended Emission Factor Rating
Methylcyclopentane	96377	84.16	6.50E-01	D
Naphthalene[c]	91203	128.17	1.07E-01	D
n-Butylbenzene	104518	134.22	6.80E-02	D
Nonane	111842	128.26	2.37E+00	D
n-Propylbenzene (Propylbenzene)	103651	120.19	4.13E-01	D
Octane	111659	114.23	1.08E+00	D
p-Cymene (1-Methyl-4-lsopropylbenzene)	99876	134.22	3.58E+00	D
Pentane	109660	72.15	4.46E+00	C
Propane	74986	44.10	1.55E+01	C
Propene	115071	42.08	3.32E+00	D
Propyne	74997	40.06	3.80E-02	E
sec-Butylbenzene	135988	134.22	6.75E-02	D
Styrene (Vinylbenzene)[c]	100425	104.15	4.11E-01	B
Tetrachloroethylene (Perchloroethylene)[c]	127184	165.83	2.03E+00	A
Tetrahydrofuran (Diethylene oxide)	109999	72.11	9.69E-01	C
Thiophene	110021	84.14	3.49E-01	E
Toluene (Methyl benzene)[c]	108883	92.14	2.95E+01	A
trans-1,2-Dichloroethene	156605	96.94	2.87E-02	C
trans-1,2-Dimethylcyclohexane	6876239	112.21	4.04E-01	D
trans-1,3-Dichloropropene	10061026	110.97	9.43E-03	D
trans-1,4-Dimethylcyclohexane	2207047	112.21	2.05E-01	D
trans-2-Butene	624646	56.11	1.04E-01	D
trans-2-Heptene	14686136	98.19	2.50E-03	E
trans-2-Hexene	4050457	84.16	2.06E-02	D
trans-2-Octene	13389429	112.21	2.41E-01	D
trans-2-Pentene	646048	70.13	3.47E-02	D
trans-3-Methyl-2-pentene	616126	84.16	1.55E-02	D
Tribromomethane (Bromoform)[c]	75252	252.73	1.24E-02	D
Trichloroethylene (Trichloroethene)[c]	79016	131.39	8.28E-01	A
Trichlorofluoromethane (Freon 11)	91315616	137.37	2.48E-01	B
Trichloromethane (Chloroform)[c]	8013545	119.38	7.08E-02	A
Undecane	1120214	156.31	1.67E+00	D
Vinyl acetate[c]	85306269	86.09	2.48E-01	C
Vinyl chloride (Chloroethene)[c]	75014	62.50	1.42E+00	A
Xylenes (o-, m-, p-, mixtures)	8026093	106.17	9.23E+00	A

NOTE: This is not an all-inclusive list of potential LFG constituents, only those for which test data were available at multiple sites. References 83-148.

[a] For NSPS/Emission Guideline compliance purposes, the default concentration for NMOC as specified in the final rule must be used.

[b] Calculated as 99.7% of NMOC, based on speciated emission test data.

[c] Hazardous Air Pollutant listed in Title III of the 1990 Clean Air Act Amendments.

[d] All tests below detection limit. Method detection limits are available for three tests, and are as follows: MDL = 2.00E-04, 4.00E-03, and 2.00E-02 ppm

[e] Many source tests did not indicate whether this compound was the ortho-, meta-, or para- isomer. The para isomer is a Title III listed HAP.

Table 2.4-2. DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE PRIOR TO 1992

Compound	Molecular Weight	Default Concentration (ppmv)	Emission Factor Rating
NMOC (as hexane)[e]	86.18		
Co-disposal (SCC 50300603)		2,420	D
No or Unknown co-disposal (SCC 50100402)		595	B
1,1,1-Trichloroethane (methyl chloroform)[a]	133.42	0.48	B
1,1,2,2-Tetrachloroethane[a]	167.85	1.11	C
1,1-Dichloroethane (ethylidene dichloride)[a]	98.95	2.35	B
1,1-Dichloroethene (vinylidene chloride)[a]	96.94	0.20	B
1,2-Dichloroethane (ethylene dichloride)[a]	98.96	0.41	B
1,2-Dichloropropane (propylene dichloride)[a]	112.98	0.18	D
2-Propanol (isopropyl alcohol)	60.11	50.1	E
Acetone	58.08	7.01	B
Acrylonitrile[a]	53.06	6.33	D
Benzene[a]	78.11		
Co-disposal (SCC 50300603)		11.1	D
No or Unknown co-disposal (SCC 50100402)		1.91	B
Bromodichloromethane	163.83	3.13	C
Butane	58.12	5.03	C
Carbon disulfide[a]	76.13	0.58	C
Carbon monoxide[b]	28.01	141	E
Carbon tetrachloride[a]	153.84	0.004	B
Carbonyl sulfide[a]	60.07	0.49	D
Chlorobenzene[a]	112.56	0.25	C
Chlorodifluoromethane	86.47	1.30	C
Chloroethane (ethyl chloride)[a]	64.52	1.25	B
Chloroform[a]	119.39	0.03	B
Chloromethane	50.49	1.21	B
Dichlorobenzene[c]	147	0.21	E
Dichlorodifluoromethane	120.91	15.7	A
Dichlorofluoromethane	102.92	2.62	D
Dichloromethane (methylene chloride)[a]	84.94	14.3	A
Dimethyl sulfide (methyl sulfide)	62.13	7.82	C
Ethane	30.07	889	C

Table 2.4-2 (CONTINUED). DEFAULT CONCENTRATIONS FOR LFG CONSTITUENTS FOR LANDFILLS WITH WASTE IN PLACE PRIOR TO 1992

Compound	Molecular Weight	Default Concentration (ppmv)	Emission Factor Rating
Ethanol	46.08	27.2	E
Ethyl mercaptan (ethanethiol)	62.13	2.28	D
Ethylbenzene[a]	106.16	4.61	B
Ethylene dibromide	187.88	0.001	E
Fluorotrichloromethane	137.38	0.76	B
Hexane[a]	86.18	6.57	B
Hydrogen sulfide	34.08	35.5	B
Mercury (total)[a,d]	200.61	2.92×10^{-4}	E
Methyl ethyl ketone[a]	72.11	7.09	A
Methyl isobutyl ketone[a]	100.16	1.87	B
Methyl mercaptan	48.11	2.49	C
Pentane	72.15	3.29	C
Perchloroethylene (tetrachloroethylene)[a]	165.83	3.73	B
Propane	44.09	11.1	B
t-1,2-dichloroethene	96.94	2.84	B
Toluene[a]	92.13		
Co-disposal (SCC 50300603)		165	D
No or Unknown co-disposal (SCC 50100402)		39.3	A
Trichloroethylene (trichloroethene)[a]	131.38	2.82	B
Vinyl chloride[a]	62.50	7.34	B
Xylenes[a]	106.16	12.1	B

NOTE: This is not an all-inclusive list of potential LFG constituents, only those for which test data were available at multiple sites. References 16-82. Source Classification Codes in parentheses.

[a] Hazardous Air Pollutants listed in Title III of the 1990 Clean Air Act Amendments.

[b] Carbon monoxide is not a typical constituent of LFG, but does exist in instances involving landfill (underground) combustion. Therefore, this default value should be used with caution. Of 18 sites where CO was measured, only 2 showed detectable levels of CO.

[c] Source tests did not indicate whether this compound was the para- or ortho- isomer. The para isomer is a Title III-listed HAP.

[d] No data were available to speciate total Hg into the elemental and organic forms.

[e] For NSPS/Emission Guideline compliance purposes, the default concentration for NMOC as specified in the final rule must be used. For purposes not associated with NSPS/Emission Guideline compliance, the default VOC content at co-disposal sites can be estimated by 85 percent by weight (2,060 ppmv as hexane); at No or Unknown sites can be estimated by 39 percent by weight 235 ppmv as hexane).

Table 2.4-3. CONTROL EFFICIENCIES FOR LFG NMOC and VOC[a]

Control Device	Control Efficiency (%)[b]		
	Typical	Range	Rating
Boiler/Steam Turbine (50100423)	98.6	96-99+	D
Flare[c] (50100410) (50300601)	97.7	86-99+	A
Gas Turbine (50100420)	94.4	92-97	E
IC Engine (50100421)	97.2	95-99+	D

[a] References 16-148. Source Classification Codes in parentheses.
[b] Control efficiency may also be applied to LFG constituents in Tables 2-4.1 and 2.4-2, except for mercury. For any combustion equipment, the control efficiency for mercury should be assumed to be 0.
[c] Where information on equipment was given in the reference, test data were taken from enclosed flares. Control efficiencies are assumed to be equally representative of open flares.

Table 2.4-4. EMISSION FACTORS FOR SECONDARY COMPOUNDS EXITING CONTROL DEVICES[a]

Control Device	Pollutant[b]	Typical Rate, kg/10^6 dscm CH_4	Typical Rate, lb/10^6 dscf CH_4	Emission Factor Rating
Flare[c] (50100410) (50300601)	Nitrogen dioxide	631	39	A
	Carbon monoxide	737	46	A
	Particulate matter	238	15	A
	Dioxin/Furan	6.7×10^{-6}	4.2×10^{-7}	E
IC Engine (50100421)	Nitrogen dioxide	11,620	725	C
	Carbon monoxide	8,462	528	C
	Particulate matter	232	15	D
Boiler/Steam Turbine[d] (50100423)	Nitrogen dioxide	677	42	D
	Carbon monoxide	116	7	D
	Particulate matter	41	3	D
	Dioxin/Furan	5.1×10^{-6}	3.2×10^{-7}	D
Gas Turbine (50100420)	Nitrogen dioxide	1,400	87	D
	Carbon monoxide	3,600	230	E
	Particulate matter	350	22	E

[a] Source Classification Codes in parentheses.
[b] No data on PM size distributions were available, however for other gas-fired combustion sources, most of the particulate matter is less than 2.5 microns in diameter. Hence, this emission factor can be used to provide estimates of PM-10 or PM-2.5 emissions. See section 2.4.4.2 for methods to estimate CO_2, SO_2, and HCl.
[c] Where information on equipment was given in the reference, test data were taken from enclosed flares. Control efficiencies are assumed to be equally representative of open flares.
[d] All source tests were conducted on boilers, however emission factors should also be representative of steam turbines. Emission factors are representative of boilers equipped with low-NO_x burners and flue gas recirculation. No data were available for uncontrolled NO_x emissions.

References for Section 2.4

1. "Criteria for Municipal Solid Waste Landfills," 40 CFR Part 258, Volume 56, No. 196, October 9, 1991.

2. *Air Emissions from Municipal Solid Waste Landfills - Background Information for Proposed Standards and Guidelines,* Office of Air Quality Planning and Standards, EPA-450/3-90-011a, Chapters 3 and 4, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1991.

3. *Municipal Solid Waste in the United States: 2006 Facts and Figures*, Office of Solid Waste, U. S. Environmental Protection Agency, Washington, DC, December 2007. http://www.epa.gov/osw/nonhaz/municipal/msw99.htm

4. Eastern Research Group, Inc., *List of Municipal Solid Waste Landfills*, Prepared for the U. S. Environmental Protection Agency, Office of Solid Waste, Municipal and Industrial Solid Waste Division, Washington, DC, September 1992.

5. *Suggested Control Measures for Landfill Gas Emissions,* State of California Air Resources Board, Stationary Source Division, Sacramento, CA, August 1990.

6. "Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills; Proposed Rule, Guideline, and Notice of Public Hearing," 40 CFR Parts 51, 52, and 60, Vol. 56, No. 104, May 30, 1991.

7. U.S. DOE, National Renewable Energy Laboratory, Comparison of Models for Predicting Landfill Methane Recovery, March 1997, Available online: http://www.nrel.gov/docs/legosti/fy97/26041.pdf

8. Eun, Sangho, Debra R. Reinhart, C. David Cooper, Timothy G. Townsend, Ayman Faour. Hydrogen sulfide flux measurements from construction and demolition debris (C&D) landfills. Waste Management 27 (2007) 220-227. Available online: http://www.sciencedirect.com

9. Lee, Sue, Qiyong Xu, Matthew Booth, Timothy G. Townsend, Paul Chadik and Gabriel Bitton. *Reduced sulfur compounds in gas from construction and demolition debris landfills.* Department of Environmental Engineering Sciences, University of Florida, P.O. Box 116450, Gainesville, FL 32611-6450, United States. October 2005. Available online: http://www.sciencedirect.com

10. Gullett, B.K., P.M. Lemieux, C.C. Lutes, C.K.. Winterrowd and D.L. Winters, 2001. Emissions of PCDD/F from uncontrolled, domestic waste burning , *Chemosphere, Volume 43, Issues 4-7, May 2001, Pages 721-725*

11. *Landfill Fires, Their Magnitude, Characteristics, and Mitigation*, prepared by TriData Corporation, 1000 Wilson Boulevard Arlington, Virginia 22209, for Federal Emergency Management Agency, United States Fire Administration, National Fire Data Center, May 2002, http://www.usfa.dhs.gov/downloads/pdf/publications/fa-225.pdf

12. *Evaluation of Fugitive Emissions Using Ground-Based Optical Remote Sensing Technology,* Office of Research and Development, U. S. Environmental Protection Agency, Washington, DC, (EPA/600/R-07/032), February 2007.

13. R.L. Peer, et al., Memorandum *Methodology Used to Revise the Model Inputs in the Municipal Solid Waste Landfills Input Data Bases (Revised)*, to the Municipal Solid Waste Landfills Docket No. A-88-09, April 28, 1993.

14. Debra R. Reinhart, Ayman A. Faour, and Huaxin You, *First-Order Kinetic Gas Generation Model Parameters for Wet Landfills*, U. S. Environmental Protection Agency, (EPA-600/R-05/072), June 2005.

15. Letter and attached documents from C. Nesbitt, Los Angeles County Sanitation Districts, to K. Brust, E.H. Pechan and Associates, Inc., December 6, 1996.

16. A.R. Chowdhury, *Emissions from a Landfill Gas-Fired Turbine/Generator Set, Source Test Report C-84-33*, Los Angeles County Sanitation District, South Coast Air Quality Management District, June 28, 1984.

17. Engineering-Science, Inc., *Report of Stack Testing at County Sanitation District Los Angeles Puente Hills Landfill*, Los Angeles County Sanitation District, August 15, 1984.

18. J.R. Manker, *Vinyl Chloride (and Other Organic Compounds) Content of Landfill Gas Vented to an Inoperative Flare, Source Test Report 84-496*, David Price Company, South Coast Air Quality Management District, November 30, 1984.

19. S. Mainoff, *Landfill Gas Composition, Source Test Report 85-102*, Bradley Pit Landfill, South Coast Air Quality Management District, May 22, 1985.

20. J. Littman, *Vinyl Chloride and Other Selected Compounds Present in A Landfill Gas Collection System Prior to and after Flaring, Source Test Report 85-369*, Los Angeles County Sanitation District, South Coast Air Quality Management District, October 9, 1985.

21. W.A. Nakagawa, *Emissions from a Landfill Exhausting Through a Flare System, Source Test Report 85-461*, Operating Industries, South Coast Air Quality Management District, October 14, 1985.

22. S. Marinoff, *Emissions from a Landfill Gas Collection System, Source Test Report 85-511*. Sheldon Street Landfill, South Coast Air Quality Management District, December 9, 1985.

23. W.A. Nakagawa, *Vinyl Chloride and Other Selected Compounds Present in a Landfill Gas Collection System Prior to and after Flaring, Source Test Report 85-592*, Mission Canyon Landfill, Los Angeles County Sanitation District, South Coast Air Quality Management District, January 16, 1986.

24. California Air Resources Board, *Evaluation Test on a Landfill Gas-Fired Flare at the BKK Landfill Facility*, West Covina, CA, ARB-SS-87-09, July 1986.

25. S. Marinoff, *Gaseous Composition from a Landfill Gas Collection System and Flare, Source Test Report 86-0342*, Syufy Enterprises, South Coast Air Quality Management District, August 21, 1986.

26. *Analytical Laboratory Report for Source Test*, Azusa Land Reclamation, June 30, 1983, South Coast Air Quality Management District.

27. J.R. Manker, *Source Test Report C-84-202*, Bradley Pit Landfill, South Coast Air Quality Management District, May 25, 1984.

28. S. Marinoff, *Source Test Report 84-315*, Puente Hills Landfill, South Coast Air Quality Management District, February 6, 1985.

29. P.P. Chavez, *Source Test Report 84-596*, Bradley Pit Landfill, South Coast Air Quality Management District, March 11, 1985.

30. S. Marinoff, *Source Test Report 84-373*, Los Angeles By-Products, South Coast air Quality Management District, March 27, 1985.

31. J. Littman, *Source Test Report 85-403*, Palos Verdes Landfill, South Coast Air Quality Management District, September 25, 1985.

32. S. Marinoff, *Source Test Report 86-0234*, Pacific Lighting Energy Systems, South Coast Air Quality Management District, July 16, 1986.

33. South Coast Air Quality Management District, *Evaluation Test on a Landfill Gas-Fired Flare at the Los Angeles County Sanitation District's Puente Hills Landfill Facility*, [ARB/SS-87-06], Sacramento, CA, July 1986.

34. D.L. Campbell, et al., *Analysis of Factors Affecting Methane Gas Recovery from Six Landfills*, Air and Energy Engineering Research Laboratory, EPA-600/2-91-055, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1991.

35. Browning-Ferris Industries, Source Test Report, Lyon Development Landfill, August 21, 1990.

36. X.V. Via, *Source Test Report*, Browning-Ferris Industries, Azusa Landfill.

37. M. Nourot, *Gaseous Composition from a Landfill Gas Collection System and Flare Outlet*. Laidlaw Gas Recovery Systems, to J.R. Farmer, OAQPS:ESD, December 8, 1987.

38. D.A. Stringham and W.H. Wolfe, *Waste Management of North America, Inc.*, to J.R. Farmer, OAQPS:ESD, January 29, 1988, Response to Section 114 questionnaire.

39. V. Espinosa, *Source Test Report 87-0318*, Los Angeles County Sanitation District Calabasas Landfill, South Coast Air Quality Management District, December 16, 1987.

40. C.S. Bhatt, *Source Test Report 87-0329*, Los Angeles County Sanitation District, Scholl Canyon Landfill, South Coast Air Quality Management District, December 4, 1987.

41. V. Espinosa, *Source Test Report 87-0391*, Puente Hills Landfill, South Coast Air Quality Management District, February 5, 1988.

42. V. Espinosa, *Source Test Report 87-0376*, Palos Verdes Landfill, South Coast Air Quality Management District, February 9, 1987.

43. Bay Area Air Quality Management District, *Landfill Gas Characterization*, Oakland, CA, 1988.

44. Steiner Environmental, Inc., *Emission Testing at BFI's Arbor Hills Landfill, Northville, Michigan*, September 22 through 25, 1992, Bakersfield, CA, December 1992.

45. PEI Associates, Inc., *Emission Test Report - Performance Evaluation Landfill-Gas Enclosed Flare, Browning Ferris Industries*, Chicopee, MA, 1990.

46. Kleinfelder Inc., *Source Test Report Boiler and Flare Systems*, Prepared for Laidlaw Gas Recovery Systems, Coyote Canyon Landfill, Diamond Bar, CA, 1991.

47. Bay Area Air Quality Management District, *McGill Flare Destruction Efficiency Test Report for Landfill Gas at the Durham Road Landfill*, Oakland, CA, 1988.

48. San Diego Air Pollution Control District, *Solid Waste Assessment for Otay Valley/Annex Landfill*. San Diego, CA, December 1988.

49. PEI Associates, Inc., *Emission Test Report - Performance Evaluation Landfill Gas Enclosed Flare*, Rockingham, VT, September 1990.

50. Browning-Ferris Industries, *Gas Flare Emissions Source Test for Sunshine Canyon Landfill.* Sylmar, CA, 1991.

51. Scott Environmental Technology, *Methane and Nonmethane Organic Destruction Efficiency Tests of an Enclosed Landfill Gas Flare*, April 1992.

52. BCM Engineers, Planners, Scientists and Laboratory Services, *Air Pollution Emission Evaluation Report for Ground Flare at Browning Ferris Industries Greentree Landfill, Kersey, Pennsylvania*. Pittsburgh, PA, May 1992.

53. EnvironMETeo Services Inc., *Stack Emissions Test Report for Ameron Kapaa Quarry,* Waipahu, HI, January 1994.

54. Waukesha Pearce Industries, Inc., *Report of Emission Levels and Fuel Economies for Eight Waukesha 12V-AT25GL Units Located at the Johnston, Rhode Island Central Landfill,* Houston TX, July 19, 1991.

55. Mostardi-Platt Associates, Inc., *Gaseous Emission Study Performed for Waste Management of North America, Inc., CID Environmental Complex Gas Recovery Facility, August 8, 1989.* Chicago, IL, August 1989.

56. Mostardi-Platt Associates, Inc., *Gaseous Emission Study Performed for Waste Management of North America, Inc., at the CID Environmental Complex Gas Recovery Facility, July 12-14, 1989.* Chicago, IL, July 1989.

57. Browning-Ferris Gas Services, Inc., *Final Report for Emissions Compliance Testing of One Waukesha Engine Generator*, Chicopee, MA, February 1994.

58. Browning-Ferris Gas Services, Inc., *Final Report for Emissions Compliance Testing of Three Waukesha Engine Generators*, Richmond, VA, February 1994.

59. South Coast Environmental Company (SCEC), *Emission Factors for Landfill Gas Flares at the Arizona Street Landfill*, Prepared for the San Diego Air Pollution Control District, San Diego, CA, November 1992.

60. Carnot, *Emission Tests on the Puente Hills Energy from Landfill Gas (PERG) Facility - Unit 400, September 1993*, Prepared for County Sanitation Districts of Los Angeles County, Tustin, CA, November 1993.

61. Pape & Steiner Environmental Services, *Compliance Testing for Spadra Landfill Gas-to-Energy Plant, July 25 and 26, 1990*, Bakersfield, CA, November 1990.

62. AB2588 Source Test Report for Oxnard Landfill, July 23-27, 1990, by Petro Chem Environmental Services, Inc., for Pacific Energy Systems, Commerce, CA, October 1990.

63. AB2588 Source Test Report for Oxnard Landfill, October 16, 1990, by Petro Chem Environmental Services, Inc., for Pacific Energy Systems, Commerce, CA, November 1990.

64. Engineering Source Test Report for Oxnard Landfill, December 20, 1990, by Petro Chem Environmental Services, Inc., for Pacific Energy Systems, Commerce, CA, January 1991.

65. AB2588 Emissions Inventory Report for the Salinas Crazy Horse Canyon Landfill, Pacific Energy, Commerce, CA, October 1990.

66. Newby Island Plant 2 Site IC Engine's Emission Test, February 7-8, 1990, Laidlaw Gas Recovery Systems, Newark, CA, February 1990.

67. Landfill Methane Recovery Part II: Gas Characterization, Final Report, Gas Research Institute, December 1982.

68. Letter from J.D. Thornton, Minnesota Pollution Control Agency, to R. Myers, U.S. EPA, February 1, 1996.

69. Letter and attached documents from M. Sauers, GSF Energy, to S. Thorneloe, U.S. EPA, May 29, 1996.

70. Landfill Gas Particulate and Metals Concentration and Flow Rate, Mountaingate Landfill Gas Recovery Plant, Horizon Air Measurement Services, prepared for GSF Energy, Inc., May 1992.

71. Landfill Gas Engine Exhaust Emissions Test Report in Support of Modification to Existing IC Engine Permit at Bakersfield Landfill Unit #1, Pacific Energy Services, December 4, 1990.

72. Addendum to Source Test Report for Superior Engine #1 at Otay Landfill, Pacific Energy Services, April 2, 1991.

73. Source Test Report 88-0075 of Emissions from an Internal Combustion Engine Fueled by Landfill Gas, Penrose Landfill, Pacific Energy Lighting Systems, South Coast Air Quality Management District, February 24, 1988.

74. Source Test Report 88-0096 of Emissions from an Internal Combustion Engine Fueled by Landfill Gas, Toyon Canyon Landfill, Pacific Energy Lighting Systems, March 8, 1988.

75. Determination of Landfill Gas Composition and Pollutant Emission Rates at Fresh Kills Landfill, revised Final Report, Radian Corporation, prepared for U.S. EPA, November 10, 1995.

76. Advanced Technology Systems, Inc., *Report on Determination of Enclosed Landfill Gas Flare Performance*, Prepared for Y & S Maintenance, Inc., February 1995.

77. Chester Environmental, *Report on Ground Flare Emissions Test Results*, Prepared for Seneca Landfill, Inc., October 1993.

78. Smith Environmental Technologies Corporation, *Compliance Emission Determination of the Enclosed Landfill Gas Flare and Leachate Treatment Process Vents*, Prepared for Clinton County Solid Waste Authority, April 1996.

79. AirRecon®, Division of RECON Environmental Corp., *Compliance Stack Test Report for the Landfill Gas FLare Inlet & Outlet at Bethlehem Landfill*, Prepared for LFG Specialties Inc., December 3, 1996.

80. ROJAC Environmental Services, Inc., *Compliance Test Report, Hartford Landfill Flare Emissions Test Program*, November 19, 1993.

81. Normandeau Associates, Inc., *Emissions Testing of a Landfill Gas Flare at Contra Costa Landfill, Antioch, California, March 22, 1994 and April 22, 1994*, May 17, 1994.

82. Roe, S.M., et. al., *Methodologies for Quantifying Pollution Prevention Benefits from Landfill Gas Control and Utilization*, Prepared for U.S. EPA, Office of Air and Radiation, Air and Energy Engineering Laboratory, EPA-600/R-95-089, July 1995.

83. TR-076. New Source Performance Standards Tier 2 Sampling and Analysis for the Flying Cloud Landfill, Browning-Ferris Industries, 6/30/98.

84. TR-084. Tier 2 NMOC Emission Rate Report for the Buncombe County Landfill, Buncombe County Solid Waste Services, 5/12/99.

85. TR-086. Tier 2 NMOC Emission Rate Report for the White Street Landfill, Duke Engineering and Services, City of Greensboro Solid Waste Management Division, 5/18/99.

86. TR-114. Summary Report of Tier 2 Sampling, Analysis, and Landfill Emissions Estimates for Non-Methane Organic Compounds Chrin Brothers Landfill, Chrin Brothers Sanitary Landfill, 4/24/98.

87. TR-115. Seneca Landfill - Revised Tier 2 NMOC Emission Rate Report, Seneca Landfill, Inc., 12/5/96.

88. TR-134. New Source Performance Standards Tier 2 Sampling, Analysis, and Landfill NMOC Emission Estimates for the Fort Worth Landfill, Laidlaw Waste Systems, Inc., 4/15/97.

89. TR-141. Tier 2 NMOC Emission Rate Report for the SPSA Regional Landfill, Southeastern Public Service Authority, MSA Consulting Engineers, 6/10/97.

90. TR-145. Compliance Testing of a Landfill Flare at Browning-Ferris Gas Services, Inc.'s Facility in Halifax, Massachusetts, BFI Waste Systems of North America, Inc., May 1996.

91. TR-146. Compliance Source Testing of a Landfill Flare at Northern Disposal, Inc. East Bridgewater Landfill, Northern Disposal, Inc., June 1994.

92. TR-147. Compliance Emissions Test Program for BFI of Ohio, Inc., BFI of Ohio, Inc., 6/26/98.

93. TR-148. Compliance Testing of Landfill Flare at Browning-Ferris Gas Services, Inc.'s Fall River Landfill Flare, BFI Waste Systems of North America, Inc., March 1995.

94. TR-153. Results of the Emission Compliance Test on the Enclosed Flare System at the Carbon Limestone Landfill, Browning-Ferris Industrial Gas Services, Inc., 8/8/96.

95. TR-156. Results of the Emission Compliance Test on the Enclosed Flare System at the Lorain County Landfill No. 2, Browning-Ferris Industrial Gas Services, Inc., 9/5/96.

96. TR-157. Emission Compliance Testing Browning-Ferris Gas Services, Inc. Willowcreek Landfill, BFI-Willowcreek, 2/2/98.

97. TR-159. Compliance Stack Sampling Report, Monmouth County Reclamation Center, SCS Engineers (Reston, VA), 9/8/95.

98. TR-160. Source Emission Testing of an Enclosed Landfill Gas Ground Flare, SCS Engineers (Reston, VA), September 1997.

99. TR-163. Compliance Testing for SPADRA Landfill Gas-to-Energy Plant, Ebasco Constructors, Inc., November 1990.

100. TR-165. 1997 Annual Compliance Source Testing Results for the Coyote Canyon Landfill Gas Recovery Facility Flare No. 1, Laidlaw Gas Recovery Systems, January 1998.

101. TR-167. 1997 Annual Compliance Source Testing Results for the Coyote Canyon Landfill Gas Recovery Facility Boiler, Laidlaw Gas Recovery Systems, January 1998.

102. TR-168. Colton Sanitary Landfill Gas Flare No. 2 (John Zink) 1998 Source Tests Results, Bryan A. Stirrat & Associates, 9/29/98.

103. TR-169. Colton Sanitary Landfill Gas Flare No. 1 (McGill) 1998 Source Tests Results, Bryan A. Stirrat & Associates, 9/29/98.

104. TR-171. High Landfill Gas Flow Rate Source Test Results from One Landfill Gas Flare at FRB Landfill in Orange County, California, Bryan A. Stirrat & Associates, July 1997.

105. TR-173. Annual Emissions Test of Landfill Gas Flare #3 Bradley Landfill, Waste Management Recycling and Disposal Services of California, Inc., 4/12/99.

106. TR-175. Emissions Tests on Flares #2, #4 and #6 at the Lopez Canyon Landfill, City of Los Angeles, August 1997.

107. TR-176. Emissions Test Results on Flares #1, #4 and #9 Calabasas Landfill, County Sanitation Districts of Los Angeles County, February 1998.

108. TR-178. Annual Emission Test of Landfill Gas Flare #3 Bradley Landfill, Waste Management Recycling and Disposal Services of California, Inc., 5/21/98.

109. TR-179. Annual Emissions Test of Landfill Gas Flare #1 Bradley Landfill, Waste Management Recycling and Disposal Services of California, Inc., 4/13/99.

110. TR-181. The Mid-Valley Sanitary Landfill Gas Flare No.1 (McGill) 1998 Source Test Results, Bryan A. Stirrat & Associates, 9/29/98.

111. TR-182. The Mid-Valley Sanitary Landfill Gas Flare No.2 (SurLite) 1998 Source Test Results, Bryan A. Stirrat & Associates, 9/29/98.

112. TR-183. Annual Emissions Test of Landfill Gas Flare #2 Bradley Landfill, Waste Management Recycling and Disposal Services of California, Inc., 4/13/99.

113. TR-187. Emissions Test of a Landfill Gas Flare - Lowry Landfill/Denver-Arapohoe Disposal Site, Sur-Lite Corporation, February 1997.

114. TR-188. Characterization of Emissions from a Power Boiler Fired with Landfill Gas, Environment Canada Emissions Research and Measurement Division, March 2000.

115. TR-189. Characterization of Emissions from 925 kWe Reciprocating Engine Fired with Landfill Gas, Environment Canada Emissions Research and Measurement Division, December 2000.

116. TR-190. Characterization of Emissions from 812 kWe Reciprocating Engine Fired with Landfill Gas, Environment Canada Emissions Research and Measurement Division, December 1999.

117. TR-191. Characterization of Emissions from Enclosed Flare - Trail Road Landfill, Environment Canada Emissions Research and Measurement Division, August 2000.

118. TR-194. Characterization of Emissions from 1 MWe Reciprocating Engine Fired with Landfill Gas, Environment Canada Emissions Research and Measurement Division, January 2002.

119. TR-195. Characteristics of Semi-volatile Organic Compounds from Vented Landfills, Environment Canada Environmental Technology Advancement Directorate, August 1996.

120. TR-196. Results of the Biennial Criteria and AB 2588 Air Toxics Source Test on the Simi Valley Landfill Flare, Simi Valley Landfill and Recycling Center, April 1997.

121. TR-199. Emission Compliance Test on a Landfill Flare, City of Los Angeles, January 1999.

122. TR-205. The Mid-Valley Sanitary Landfill Gas Flare No. 3 (John Zink) 1998 Source Test Results, Bryan A. Stirrat & Associates, 9/29/98.

123. TR-207. Compliance Source Test Report Landfill Gas-fired Flare Stations I-4 and F-2, BKK Landfill, 12/12/97.

124. TR-209. Emission Test Report Volumes I and II - Source/Compliance Emissions Testing for Cedar Hills Landfill, King County Solid Waste Division, 1/20/05.

125. TR-211. Determination of Total and Dimethyl Mercury in Raw Landfill Gas with Site Screening for Elemental Mercury at Eight Washington State Landfills, Washington State Department of Ecology, July 2003.

126. TR-212. Determination of Total, and Monomethyl Mercury in Raw Landfill Gas at the Central Solid Waste Management Center, Delaware Solid Waste Authority, February 2003.

127. TR-220. SCAQMD Performance Tests on the Spadra Energy Recovery from Landfill Gas (SPERG) Facility, County Sanitation Districts of Los Angeles County, April 1992.

128. TR-226. Methane and Nonmethane Organic Destruction Efficiency Tests of an Enclosed Landfill Gas Flare, Newco Waste Systems, April 1992.

129. TR-229. Scholl Canyon Landfill Gas Flares No. 9, 10 11 and 12 Emission Source Testing April 1999, South Coast Air Quality Management District, April 1999.

130. TR-236. Landfill Gas Flare Hydrogen Chloride Emissons Atascocita Landfill, Waste Management of Houston, 4/20/99.

131. TR-241. Performance Evaluation, Enclosed Landfill Gas Flare, Valley Landfill, Waste Energy Technology, November 1991.

132. TR-251. Emission Compliance Test on a Landfill Gas Flare - Flare #1, Frank R. Bowerman Landfill, Orange County, 1/25/99.

133. TR-253. Emission Source Testing on Two Flares (Nos. 3 and 6) at the Spadra Landfill, Los Angeles County Sanitation Districts, 7/21/98.

134. TR-255. Emission Compliance Test on a Landfill Gas Flare -Olinda Alpha Landfill, Orange County Integrated Waste Management Department, No Report Date Given.

135. TR-258. Source Test Report, City of Sacramento Landfill Gas Flare, City of Sacramento, 6/26/96.

136. TR-259. The Millikan Sanitary Landfill Gas Flare No. 1 (Surlite) 1998 Source Test Results, South Coast Air Quality Management District, 9/29/98.

137. TR-260. The Millikan Sanitary Landfill Gas Flare No. 2 (John Zink) 1998 Source Test Results, South Coast Air Quality Management District, 9/29/98.

138. TR-261. The Millikan Sanitary Landfill Gas Flare No. 3 (John Zink) 1998 Source Test Results, South Coast Air Quality Management District, 9/29/98.

139. TR-264. Emission Compliance Test on a Landfill Gas Flare, Orange County Integrated Waste Management Department, No Report Date Given.

140. TR-266. Compliance Source Test Report - Landfill Gas-Fired Engine, Minnesota Methane, 3/3/98.

141. TR-268. Emission Testing at PERG - Maximum Boiler Load, County Sanitation Districts of Los Angeles County, December 1986.

142. TR-272. Source Testing Final Report - Landfill A, US EPA Air Pollution Prevention and Control Division, 10/6/05.

143. TR-273. Source Testing Final Report - Landfill B, US EPA Air Pollution Prevention and Control Division, 10/6/05.

144. TR-284. Source Testing Final Report - Landfill C, US EPA Air Pollution Prevention and Control Division, 10/6/05.

145. TR-287. Source Testing Final Report - Landfill D, US EPA Air Pollution Prevention and Control Division, 10/6/05.

146. TR-290. San Timoteo Sanitary Landfill 1998 Source Test Results, San Bernandino County Solid Waste Management, 9/29/98.TR-291. PCDD/PCDF Emissions Tests on the Palos Verdes Energy Recovery from Landfill Gas (PVERG) Facility, Unit 2, County Sanitation Districts of Los Angeles County, February 1994.

147. TR-292. Source Testing Final Report - Landfill E, US EPA Air Pollution Prevention and Control Division, October 2005

148. TR-293. *Quantifying Uncontrolled Air Emissions From Two Florida Landfills* – Draft Final Report. U.S. EPA Air Pollution Prevention and Control Division, March 26, 2008.

CIVIL COVER SHEET

JS-44 (Rev. 11/2020 DC)

I. (a) PLAINTIFFS

Environmental Integrity Project
Chesapeake Climate Action Network
Sierra Club

(b) COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF 11001
(EXCEPT IN U.S. PLAINTIFF CASES)

DEFENDANTS

Michael Regan, in his official capacity as the Administrator for the United States Environmental Protection Agency

COUNTY OF RESIDENCE OF FIRST LISTED DEFENDANT 11001
(IN U.S. PLAINTIFF CASES ONLY)
NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF LAND INVOLVED

(c) ATTORNEYS (FIRM NAME, ADDRESS, AND TELEPHONE NUMBER)

Jennifer Duggan, Environmental Integrity Project
1000 Vermont Ave. N.W., Suite 1100
Washington, D.C. 20005
(202) 263-4446

ATTORNEYS (IF KNOWN)

Bryan Harrison
U.S Department of Justice

II. BASIS OF JURISDICTION
(PLACE AN x IN ONE BOX ONLY)

- ○ 1 U.S. Government Plaintiff
- ○ 3 Federal Question (U.S. Government Not a Party)
- ◉ 2 U.S. Government Defendant
- ○ 4 Diversity (Indicate Citizenship of Parties in item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (PLACE AN x IN ONE BOX FOR PLAINTIFF AND ONE BOX FOR DEFENDANT) **FOR DIVERSITY CASES ONLY!**

	PTF	DFT		PTF	DFT
Citizen of this State	○ 1	○ 1	Incorporated or Principal Place of Business in This State	○ 4	○ 4
Citizen of Another State	○ 2	○ 2	Incorporated and Principal Place of Business in Another State	○ 5	○ 5
Citizen or Subject of a Foreign Country	○ 3	○ 3	Foreign Nation	○ 6	○ 6

IV. CASE ASSIGNMENT AND NATURE OF SUIT

(Place an X in one category, A-N, that best represents your Cause of Action and one in a corresponding Nature of Suit)

○ A. *Antitrust*

- ☐ 410 Antitrust

○ B. *Personal Injury/ Malpractice*

- ☐ 310 Airplane
- ☐ 315 Airplane Product Liability
- ☐ 320 Assault, Libel & Slander
- ☐ 330 Federal Employers Liability
- ☐ 340 Marine
- ☐ 345 Marine Product Liability
- ☐ 350 Motor Vehicle
- ☐ 355 Motor Vehicle Product Liability
- ☐ 360 Other Personal Injury
- ☐ 362 Medical Malpractice
- ☐ 365 Product Liability
- ☐ 367 Health Care/Pharmaceutical Personal Injury Product Liability
- ☐ 368 Asbestos Product Liability

◉ C. *Administrative Agency Review*

- ☐ 151 Medicare Act

Social Security
- ☐ 861 HIA (1395ff)
- ☐ 862 Black Lung (923)
- ☐ 863 DIWC/DIWW (405(g))
- ☐ 864 SSID Title XVI
- ☐ 865 RSI (405(g))

Other Statutes
- ☐ 891 Agricultural Acts
- ☒ 893 Environmental Matters
- ☐ 890 Other Statutory Actions (If Administrative Agency is Involved)

○ D. *Temporary Restraining Order/Preliminary Injunction*

Any nature of suit from any category may be selected for this category of case assignment.

(If Antitrust, then A governs)

○ E. *General Civil (Other)* OR **○ F. *Pro Se General Civil***

Real Property
- ☐ 210 Land Condemnation
- ☐ 220 Foreclosure
- ☐ 230 Rent, Lease & Ejectment
- ☐ 240 Torts to Land
- ☐ 245 Tort Product Liability
- ☐ 290 All Other Real Property

Personal Property
- ☐ 370 Other Fraud
- ☐ 371 Truth in Lending
- ☐ 380 Other Personal Property Damage
- ☐ 385 Property Damage Product Liability

Bankruptcy
- ☐ 422 Appeal 27 USC 158
- ☐ 423 Withdrawal 28 USC 157

Prisoner Petitions
- ☐ 535 Death Penalty
- ☐ 540 Mandamus & Other
- ☐ 550 Civil Rights
- ☐ 555 Prison Conditions
- ☐ 560 Civil Detainee – Conditions of Confinement

Property Rights
- ☐ 820 Copyrights
- ☐ 830 Patent
- ☐ 835 Patent – Abbreviated New Drug Application
- ☐ 840 Trademark
- ☐ 880 Defend Trade Secrets Act of 2016 (DTSA)

Federal Tax Suits
- ☐ 870 Taxes (US plaintiff or defendant)
- ☐ 871 IRS-Third Party 26 USC 7609

Forfeiture/Penalty
- ☐ 625 Drug Related Seizure of Property 21 USC 881
- ☐ 690 Other

Other Statutes
- ☐ 375 False Claims Act
- ☐ 376 Qui Tam (31 USC 3729(a))
- ☐ 400 State Reapportionment
- ☐ 430 Banks & Banking
- ☐ 450 Commerce/ICC Rates/etc
- ☐ 460 Deportation
- ☐ 462 Naturalization Application
- ☐ 465 Other Immigration Actions
- ☐ 470 Racketeer Influenced & Corrupt Organization
- ☐ 480 Consumer Credit
- ☐ 485 Telephone Consumer Protection Act (TCPA)
- ☐ 490 Cable/Satellite TV
- ☐ 850 Securities/Commodities/ Exchange
- ☐ 896 Arbitration
- ☐ 899 Administrative Procedure Act/Review or Appeal of Agency Decision
- ☐ 950 Constitutionality of State Statutes
- ☐ 890 Other Statutory Actions (if not administrative agency review or Privacy Act)

○ **G. *Habeas Corpus/ 2255***	○ **H. *Employment Discrimination***	○ **I. *FOIA/Privacy Act***	○ **J. *Student Loan***
☐ 530 Habeas Corpus – General ☐ 510 Motion/Vacate Sentence ☐ 463 Habeas Corpus – Alien Detainee	☐ 442 Civil Rights – Employment (criteria: race, gender/sex, national origin, discrimination, disability, age, religion, retaliation) *(If pro se, select this deck)*	☐ 895 Freedom of Information Act ☐ 890 Other Statutory Actions (if Privacy Act) *(If pro se, select this deck)*	☐ 152 Recovery of Defaulted Student Loan (excluding veterans)
○ **K. *Labor/ERISA (non-employment)***	○ **L. *Other Civil Rights (non-employment)***	○ **M. *Contract***	○ **N. *Three-Judge Court***
☐ 710 Fair Labor Standards Act ☐ 720 Labor/Mgmt. Relations ☐ 740 Labor Railway Act ☐ 751 Family and Medical Leave Act ☐ 790 Other Labor Litigation ☐ 791 Empl. Ret. Inc. Security Act	☐ 441 Voting (if not Voting Rights Act) ☐ 443 Housing/Accommodations ☐ 440 Other Civil Rights ☐ 445 Americans w/Disabilities – Employment ☐ 446 Americans w/Disabilities – Other ☐ 448 Education	☐ 110 Insurance ☐ 120 Marine ☐ 130 Miller Act ☐ 140 Negotiable Instrument ☐ 150 Recovery of Overpayment & Enforcement of Judgment ☐ 153 Recovery of Overpayment of Veteran's Benefits ☐ 160 Stockholder's Suits ☐ 190 Other Contracts ☐ 195 Contract Product Liability ☐ 196 Franchise	☐ 441 Civil Rights – Voting (if Voting Rights Act)

V. ORIGIN

◉ 1 Original Proceeding ○ 2 Removed from State Court ○ 3 Remanded from Appellate Court ○ 4 Reinstated or Reopened ○ 5 Transferred from another district (specify) ○ 6 Multi-district Litigation ○ 7 Appeal to District Judge from Mag. Judge ○ 8 Multi-district Litigation – Direct File

VI. CAUSE OF ACTION (CITE THE U.S. CIVIL STATUTE UNDER WHICH YOU ARE FILING AND WRITE A BRIEF STATEMENT OF CAUSE.)

42 U.S.C. 7604(a)(2) Falure to perform non-discretionary action

VII. REQUESTED IN COMPLAINT ☐ CHECK IF THIS IS A **CLASS ACTION** UNDER F.R.C.P. 23 **DEMAND $** **JURY DEMAND:** Check YES only if demanded in complaint **YES** ☐ **NO** ☒

VIII. RELATED CASE(S) IF ANY (See instruction) **YES** ☐ **NO** ☒ If yes, please complete related case form

DATE: July 29, 2022 **SIGNATURE OF ATTORNEY OF RECORD** /s/ Jennifer Duggan

INSTRUCTIONS FOR COMPLETING CIVIL COVER SHEET JS-44
Authority for Civil Cover Sheet

The JS-44 civil cover sheet and the information contained herein neither replaces nor supplements the filings and services of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. Consequently, a civil cover sheet is submitted to the Clerk of Court for each civil complaint filed. Listed below are tips for completing the civil cover sheet. These tips coincide with the Roman Numerals on the cover sheet.

I. COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF/DEFENDANT (b) County of residence: Use 11001 to indicate plaintiff if resident of Washington, DC, 88888 if plaintiff is resident of United States but not Washington, DC, and 99999 if plaintiff is outside the United States.

III. CITIZENSHIP OF PRINCIPAL PARTIES: This section is completed only if diversity of citizenship was selected as the Basis of Jurisdiction under Section II.

IV. CASE ASSIGNMENT AND NATURE OF SUIT: The assignment of a judge to your case will depend on the category you select that best represents the primary cause of action found in your complaint. You may select only one category. You must also select one corresponding nature of suit found under the category of the case.

VI. CAUSE OF ACTION: Cite the U.S. Civil Statute under which you are filing and write a brief statement of the primary cause.

VIII. RELATED CASE(S), IF ANY: If you indicated that there is a related case, you must complete a related case form, which may be obtained from the Clerk's Office.

Because of the need for accurate and complete information, you should ensure the accuracy of the information provided prior to signing the form.

AO 440 (Rev. 06/12; DC 3/15) Summons in a Civil Action

UNITED STATES DISTRICT COURT

for the

District of Columbia

ENVIRONMENTAL INTEGRITY PROJECT, CHESAPEAKE CLIMATE ACTION NETWORK, and SIERRA CLUB

Plaintiff(s)

v.

MICHAEL REGAN, in his official capacity as the Administrator for the United States Environmental Protection Agency

Defendant(s)

Civil Action No.

SUMMONS IN A CIVIL ACTION

To: *(Defendant's name and address)* Michael Regan, Administrator
U.S. Environmental Protection Agency
Office of the Administrator, Mail Code 1101A
1200 Pennsylvania Avenue NW
Washington, DC 20460

A lawsuit has been filed against you.

Within 21 days after service of this summons on you (not counting the day you received it) — or 60 days if you are the United States or a United States agency, or an officer or employee of the United States described in Fed. R. Civ. P. 12 (a)(2) or (3) — you must serve on the plaintiff an answer to the attached complaint or a motion under Rule 12 of the Federal Rules of Civil Procedure. The answer or motion must be served on the plaintiff or plaintiff's attorney, whose name and address are: Jennifer Duggan
Environmental Integrity Project
1000 Vermont Ave. N.W., Suite 1100
Washington, D.C. 20005

If you fail to respond, judgment by default will be entered against you for the relief demanded in the complaint. You also must file your answer or motion with the court.

ANGELA D. CAESAR, CLERK OF COURT

Date: _____

_____
Signature of Clerk or Deputy Clerk

Civil Action No.

PROOF OF SERVICE

(This section should not be filed with the court unless required by Fed. R. Civ. P. 4 (l))

This summons for *(name of individual and title, if any)* _____ was received by me on *(date)* _____ .

❒ I personally served the summons on the individual at *(place)* _____ on *(date)* _____ ; or

❒ I left the summons at the individual's residence or usual place of abode with *(name)* _____ , a person of suitable age and discretion who resides there, on *(date)* _____ , and mailed a copy to the individual's last known address; or

❒ I served the summons on *(name of individual)* _____ , who is designated by law to accept service of process on behalf of *(name of organization)* _____ on *(date)* _____ ; or

❒ I returned the summons unexecuted because _____ ; or

❒ Other *(specify):*

My fees are $ _____ for travel and $ _____ for services, for a total of $ 0.00 .

I declare under penalty of perjury that this information is true.

Date: _____

_____
Server's signature

_____
Printed name and title

_____
Server's address

Additional information regarding attempted service, etc:

Print Save As... Reset

AO 440 (Rev. 06/12; DC 3/15) Summons in a Civil Action

UNITED STATES DISTRICT COURT

for the

District of Columbia

ENVIRONMENTAL INTEGRITY PROJECT, CHESAPEAKE CLIMATE ACTION NETWORK, and SIERRA CLUB

Plaintiff(s)

v.

MICHAEL REGAN, in his official capacity as the Administrator for the United States Environmental Protection Agency

Defendant(s)

Civil Action No.

SUMMONS IN A CIVIL ACTION

To: *(Defendant's name and address)* Merrick Garland
Attorney General of the United States
U.S. Department of Justice
950 Pennsylvania Avenue NW
Washington, DC 20530-0001

A lawsuit has been filed against you.

Within 21 days after service of this summons on you (not counting the day you received it) — or 60 days if you are the United States or a United States agency, or an officer or employee of the United States described in Fed. R. Civ. P. 12 (a)(2) or (3) — you must serve on the plaintiff an answer to the attached complaint or a motion under Rule 12 of the Federal Rules of Civil Procedure. The answer or motion must be served on the plaintiff or plaintiff's attorney, whose name and address are: Jennifer Duggan
Environmental Integrity Project
1000 Vermont Ave. N.W., Suite 1100
Washington, D.C. 20005

If you fail to respond, judgment by default will be entered against you for the relief demanded in the complaint. You also must file your answer or motion with the court.

ANGELA D. CAESAR, CLERK OF COURT

Date: _____

_____
Signature of Clerk or Deputy Clerk

Civil Action No.

PROOF OF SERVICE

(This section should not be filed with the court unless required by Fed. R. Civ. P. 4 (l))

This summons for *(name of individual and title, if any)* _____ was received by me on *(date)* _____ .

❒ I personally served the summons on the individual at *(place)* _____ on *(date)* _____ ; or

❒ I left the summons at the individual's residence or usual place of abode with *(name)* _____ , a person of suitable age and discretion who resides there, on *(date)* _____ , and mailed a copy to the individual's last known address; or

❒ I served the summons on *(name of individual)* _____ , who is designated by law to accept service of process on behalf of *(name of organization)* _____ on *(date)* _____ ; or

❒ I returned the summons unexecuted because _____ ; or

❒ Other *(specify):*

My fees are $ _____ for travel and $ _____ for services, for a total of $ 0.00 .

I declare under penalty of perjury that this information is true.

Date: _____

_____
Server's signature

_____
Printed name and title

_____
Server's address

Additional information regarding attempted service, etc:

Print Save As... Reset

AO 440 (Rev. 06/12; DC 3/15) Summons in a Civil Action

UNITED STATES DISTRICT COURT

for the

District of Columbia

ENVIRONMENTAL INTEGRITY PROJECT, CHESAPEAKE CLIMATE ACTION NETWORK, and SIERRA CLUB

Plaintiff(s)

v.

MICHAEL REGAN, in his official capacity as the Administrator for the United States Environmental Protection Agency

Defendant(s)

Civil Action No.

SUMMONS IN A CIVIL ACTION

To: *(Defendant's name and address)* Matthew M. Graves
c/o Civil Process Clerk
U.S. Attorney's Office for D.C.
601 D Street, NW
Washington, DC 20530

A lawsuit has been filed against you.

Within 21 days after service of this summons on you (not counting the day you received it) — or 60 days if you are the United States or a United States agency, or an officer or employee of the United States described in Fed. R. Civ. P. 12 (a)(2) or (3) — you must serve on the plaintiff an answer to the attached complaint or a motion under Rule 12 of the Federal Rules of Civil Procedure. The answer or motion must be served on the plaintiff or plaintiff's attorney, whose name and address are: Jennifer Duggan
Environmental Integrity Project
1000 Vermont Ave. N.W., Suite 1100
Washington, D.C. 20005

If you fail to respond, judgment by default will be entered against you for the relief demanded in the complaint. You also must file your answer or motion with the court.

ANGELA D. CAESAR, CLERK OF COURT

Date: _____

_____
Signature of Clerk or Deputy Clerk

Civil Action No.

PROOF OF SERVICE

(This section should not be filed with the court unless required by Fed. R. Civ. P. 4 (l))

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❒ I personally served the summons on the individual at *(place)* _____ on *(date)* _____ ; or

❒ I left the summons at the individual's residence or usual place of abode with *(name)* _____ , a person of suitable age and discretion who resides there, on *(date)* _____ , and mailed a copy to the individual's last known address; or

❒ I served the summons on *(name of individual)* _____ , who is designated by law to accept service of process on behalf of *(name of organization)* _____ on *(date)* _____ ; or

❒ I returned the summons unexecuted because _____ ; or

❒ Other *(specify):*

My fees are $ _____ for travel and $ _____ for services, for a total of $ 0.00 .

I declare under penalty of perjury that this information is true.

Date: _____

_____
Server's signature

_____
Printed name and title

_____
Server's address

Additional information regarding attempted service, etc:

Print Save As... Reset