March 12, 2024

Submitted via e-mail to: efcomments@epa.gov and Lessard.patrick@epa.gov

Mr. Patrick Lessard
Air Quality Policy Division
U.S. Environmental Protection Agency (EPA)
Office of Air Quality Planning and Standards (C504-05)
Research Triangle Park, NC 27711

RE: Draft Revisions to AP-42 Chapter 2, Section 4-Municipal Solid Waste Landfills

Dear Mr. Lessard:

On behalf of the National Waste & Recycling Association (NWRA) and the Solid Waste Association of North America (SWANA), please accept this letter, which provides comments relating to the U.S. Environmental Protection Agency's (EPA) proposed revisions to *AP-42 Chapter 2, Section 4 – Municipal Solid Waste Landfills* (AP-42). NWRA and SWANA appreciate EPA's decision to grant the requested extension of the comment period to March 12, 2024, and therefore these comments are timely filed.

NWRA is a trade association that represents private-sector waste and recycling companies in the United States, and manufacturers and service providers who do business with those companies. NWRA's members operate in all 50 states and the District of Columbia. NWRA provides leadership, education, research, advocacy, and safety expertise to promote North American waste and recycling industries, serve as their voice, and create a climate where members prosper and provide safe, economically sustainable, and environmentally sound services.

SWANA is a nonprofit professional association. Its membership includes more than 10,000 public and private sector professionals committed to advancing from solid waste management to resource management through their shared emphasis on education, advocacy, and research. For more than 50 years, SWANA has been the leading professional association in the solid waste management field.

Background to Comments

NWRA and SWANA are leading voices for the solid waste industry, having worked closely with EPA and state agencies over several decades in the implementation of regulatory standards and best practices governing municipal solid waste landfills. NWRA and SWANA membership reflects the diversity of the landfill sector, which includes landfills that are private and municipally owned, landfills that vary greatly in size, and landfills that employ active gas collection systems and those that do not. The accurate estimation of landfill gas generation rates, and consequently emissions, is a fundamental aspect of landfill operations and management and therefore is of the utmost importance to the industry. Along with waste type and gas collection practices, the geographic location of municipal solid waste landfills has a significant impact on landfill generation rates because of atmospheric and climate conditions as well as state and local regulations that may affect waste acceptance practices.

Unlike many other sectors, municipal solid waste landfills are subject to presumed or required use of AP-42 for the estimation of emissions. Specifically, both the New Source Performance Standards for Municipal Solid Waste Landfills and its accompanying Emission Guidelines (collectively, "Landfill NSPS"), and the National Emission Standards for Hazardous Air Pollutants for Municipal Solid Waste Landfills ("Landfill NESHAP") refer directly to AP-42 emission factors. In addition, AP-42 may be used in New Source Review and Prevention of Significant Deterioration permitting determinations. The inability to directly measure fugitive landfill gas emissions makes the AP-42 emission factors for this sector extremely important.[1] That said, the ability to develop and utilize site-specific inputs within the AP-42 structure should be preserved to reflect the wide variation in landfill types, sizes, waste acceptance practices, gas collection systems efficiencies, and locations. With all of this in mind, NWRA and SWANA are pleased to offer our comments herein, with the overarching goal of ensuring that AP-42 is the most accurate and flexible tool possible to support and inform agency and permittee decision-making.

Comments Relating to Definitions

NWRA and SWANA ask EPA to consider the following definitions for incorporation into AP-42:

- **Municipal Solid Waste Landfill**: Each municipal solid waste landfill has a solid waste permit issued to it, which specifies the types of waste it can accept and how it must operate. Further, the Landfill NSPS and Landfill NESHAP rules specifically regulate municipal solid waste landfills. Therefore, it is important that AP-42 include a definition of municipal solid waste landfill that reflects the nature of municipal solid waste and prevents confusion with the definition of co-disposal sites. We suggest the following definition, for consistency with the Landfill NSPS and Landfill NESHAP:
    - *Municipal Solid Waste (MSW) Landfill is a landfill that has been permitted by a Local. State, or Federal agency to accept MSW and has MSW in-place. An MSW landfill may also accept other non-hazardous wastes; however, this is not co-disposal. Co-disposal is the acceptance of MSW and hazardous waste. A C&D landfill that is not permitted to accept MSW is not an MSW Landfll.*

- **Treatment system prior to beneficial use**: The definition of gas treatment prior to a beneficial use project should be included in AP-42 and consistent with the definition included in the Landfill NSPS and Landfill NESHAP rules. These treatment systems are considered as a control system for MSW Landfills and are often the first step prior to the gas being processed for the creation of

[1] In offering these comments, NWRA and SWANA are mindful of EPA's recent admonition with respect to reliance on AP-42 emission factors, and note that EPA's enforcement stance in this regard is not appropriate for municipal solid waste landfills, which are often reliant on AP-42 where more representative factors are simply unavailable, or are subject to required usage of AP-42 because of regulatory or agency requirements. *See* https://www.epa.gov/compliance/epa-reminder-about-inappropriate-use-ap-42-emission-factors

renewable natural gas or prior to being used as fuel in engines/turbines/boilers to create energy. The intent of the definition of treatment is to describe the minimum steps for preparation of landfill gas for beneficial use via filtration, de-watering, and compression. While some beneficial use projects may require additional processing, the minimum treatment system criteria are set forth in the Landfill NSPS and Landfill NESHAP, along with an example list of these beneficial uses. We recommend that EPA incorporate the Landfill NSPS and Landfill NESHAP definitions of treated landfill gas into Chapter 2.4 as follows:

  - *Treated landfill gas means landfill gas processed in a treatment system as defined in this subpart.*

  - *Treatment system means a system that filters, de-waters, and compresses landfill gas for further processing, sale, or beneficial use. A treatment system that processes the collected gas for subsequent processing, sale, or beneficial use such as fuel for combustion, production of vehicle fuel, production of high-British thermal unit (Btu) gas for pipeline injection or use as a raw material in a chemical manufacturing process. Venting of treated landfill gas to the ambient air is not allowed. If the treated landfill gas cannot be routed for subsequent processing, sale, or beneficial use, then the treated landfill gas must be controlled according to either enclosed or non-enclosed combustor.*

- Co-Disposal: The concept of co-disposal is discussed in Chapter 2.4, and the section sets forth emission factors associated with co-disposal landfills. However, the definition of co-disposal is not clear and can be misinterpreted to include typical MSW landfills, which may accept wastes other than household wastes, such as C&D materials that clearly are not hazardous wastes and are primarily inert. Since co-disposal only applied to very few MSW landfills that accepted hazardous waste at one time in California,[2] and does not represent the vast majority of MSW landfills, NWRA and SWANA ask EPA to either remove the emission factors for co-disposal, or expressly clarify them as having very limited application within Chapter 2.4. To the extent that EPA determines to maintain emission factors for co-disposal sites, it is critical that "co-disposal" be clearly defined in this AP-42 document. MSW landfills are not allowed to accept hazardous waste and no MSW landfills have been allowed to do so for many years. The limitation of co-disposal factors to those landfills in which hazardous waste was disposed is consistent with directives in EPA's LandGEM Version 3.02.[3]

  - Should EPA determine that the concept of co-disposal must be retained within Chapter 2.4, NWRA and SWANA suggest the following definition of co-disposal:

    Co-disposal, as used within this Chapter 2.4, refers to only those facilities at which hazardous waste, as defined by RCRA, was accepted for disposal along with municipal

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[2] *See,* Emission Factor Document for AP-42, Municipal Solid Waste Landfills (Revised) dated August 1997. Appendix B lists sites with known Co-Disposal – these landfills were sites that accepted hazardous waste and MSW waste, such as BKK Landfill and Palos Verdes. Sites in the list that accepted MSW waste with no hazardous waste were listed as "U" for unknown.

[3] *See,* LandGEM Version 3.02 User's Guide, at p. 17, Section 3.3, Nonmethane Organic Compound Concentration (*The NMOC Concentration for the CAA default is 4,000 ppmv as hexane. The NMOC Concentration for the inventory default is 600 ppmv where co-disposal of hazardous waste has either not occurred or is unknown and 2,400 ppmv where co-disposal of hazardous waste has occurred.)*

solid waste. Only those sites that are known to have accepted hazardous waste should use the co-disposal factors listed in this Chapter.

- In addition, NWRA and SWANA request that the concept of co-disposal be further clarified within the AP-42 section at 2.4.4.1 to refer to *hazardous waste* instead of *non-residential waste*, since non-residential waste is a broad term that could include non-hazardous waste that would not be appropriate for an application of the factors that pertain to co-disposal.

Other Comments

- Fugitive and Uncontrolled emissions - As currently drafted, Chapter 2.4 appears to distinguish between fugitive emissions and uncontrolled emissions, with "fugitive" referring primarily to dust and roadway emissions (*see e.g*. Section 2.4.4) while "uncontrolled" refers to uncollected landfill gas (*see e.g.* Section 2.4.4.1). NWRA and SWANA ask EPA to clarify within Chapter 2.4 that uncollected landfill gas represents fugitive, rather than uncontrolled, emissions. It is important that Chapter 2.4 reflect that not all landfill gas can reasonably be collected within a landfill gas collection system. Indeed, Chapter 2.4 acknowledges this fact by stating that on average, only 75% of the generated landfill gas can be collected. The remaining uncollectable 25% of generated gas would have the potential to be generally released from an area of the landfill. Consequently, the related emissions should be characterized as fugitive rather than uncontrolled. There is a presumption that uncontrolled emissions could be controlled while fugitive emissions are not, which is the case for landfills with landfill gas collection and control systems. This description is consistent with the definition of fugitive emissions as set forth in Parts 51, 52, and 70 (relating to New Source Review and Title V) as those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening.[4] Moreover, as the result of EPA determinations over time, it is well understood for purposes of these programs that uncollected landfill gas would be treated as fugitive in nature, whereas the portion of landfill gas that can be collected would not.[5] Having these emissions correctly classified as fugitive instead of uncontrolled is likewise important within AP-42 Chapter 2.4, to ensure that they are treated consistently across the applicable regulatory programs.

- k and L_0 in AP-42*:* It is unclear why the discussion of k and L_0 values was removed from AP-42 in the current draft. NWRA and SWANA request that EPA retain these values in Chapter 2.4. These values are cross-referenced within the Landfill NSPS and Landfill NESHAP as an alternative to the NSPS/NESHAP default values, which are notably conservative in light of their purpose in that context, which is to determine when gas collection and control systems should be installed.[6]

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[4] *See, e.g.* §40 CFR 70.2.

[5] *See* Memo from John Seitz, OAQPS, to Director, Air Pesticides and Toxics Management Division, Regions I and IV, Director, Air and Waste Management Division, Region II, Director Air, Radiation and Toxics Division, Region III, Director Air and Radiation Division, Region V, Director, Air, Pesticides and Toxics Division, Region VI, Director, Air and Toxics Division, Regions VII, VIII, IX and X entitled *Classification of Emissions from Landfills for NSR Applicability Purposes.*

[6] 40 CFR §60.765(a)(1) and §63.1960(a)(1) states that "... The methane generation rate constant (k) and methane generation potential (L_o) kinetic factors should be those published in the most recent *Compilation of Air Pollutant Emission Factors* (AP-42) or other site-specific values demonstrated to be appropriate and approved by the Administrator; and 40 CFR §60.764(c) states "When calculating emissions for Prevention of Significant Deterioration purposes, the ...MSW landfill...must estimate the NMOC emission rate...using Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP-42) or other approved measurement procedures."

Without these values, regulatory agencies are likely to require the use of the NSPS/NESHAP values that significantly overestimate methane and landfill gas generation from MSW landfills. In particular, the NSPS/NESHAP L_0 value of 170 Mg/m^3 is extremely inflated and is not appropriate for other Clean Air Act (CAA) purposes, such as emission estimation supporting permitting applicability actions for New Source Review or Prevention of Significant Deterioration. Further, as states implement organics diversion programs, L_0 values will decrease, exacerbating the inaccuracy of using 170 Mg/m^3. For example, recent data in California suggests that L_0 values are between 85-90 Mg/m^3 for waste being disposed of today. In addition, under the Landfill NSPS and Landfill NESHAP, the k value increases from 0.02 to 0.05 when annual rainfall reaches 25 inches per year. Data suggests that decay rates do not increase this abruptly at 25 inches of rainfall. For example, the LFG model developed by the California Air Resources Board, based on information from the Intergovernmental Panel on Climate Change, utilizes k values of 0.02 up to 20 inches of rain, 0.037 from 20-40 inches of rain, and 0.057 over 40 inches of rain. Based on these considerations, we request the EPA reinstate the k and L_0 values from the previous version of AP-42 for use in inventories and other CAA purposes outside of the Landfill NSPS and Landfill NESHAP rules.

- **Landfill gas composition:** The draft AP-42 sets out a landfill gas composition of 40% CO2, 55% CH4, 5% N2 and trace amounts of NMOC. These values should instead be represented by ranges to reflect the diversity of landfills rather than single percentages. It should also be clarified that in-situ LFG differs from as-collected LFG because when a vacuum is applied, there can be air intrusion that would alter the gas composition. We recommend changing the language to state that, under static conditions, in-situ LFG typically has a composition of approximately 40% CO_2, 55% CH_4, 5% N_2 and trace amount of NMOC. We further suggest adding the following ranges to describe as-collected LFG: (1) 45-55% methane, (2) 35-45% carbon dioxide, (3) 2-10% nitrogen, and (4) 0-4% oxygen.

- **Table 2.4.1 – Default Concentrations for LFG Constituents:** Carbon Monoxide (CO) is listed as a constituent of landfill gas in Table 2.4.1; however, it contains a footnote stating the following:

  > *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.*

  Since CO is not normally found in landfill gas, it should be removed from this default list of LFG Constituents, and only included the concentration in the footnotes for the case of underground combustion. Many air agencies use AP-42 without examining footnotes, and therefore agencies may require CO emissions to be calculated from the landfill even when there is no underground combustion occurring, simply because it is in the default list. This can impact the air permitting of landfills and when landfills must use this Table 2.4.1 in determining emissions. Therefore, NWRA and SWANA request that EPA remove CO from this list.

- **NMOC vs. VOC:** The draft AP-42 states that VOCs are equivalent to NMOC emissions minus the emissions from compounds with low to no photochemical reactivity (page 2.4-3), noting that "recent data review shows that the contribution of these seven predominant compounds to be less than 0.005% of LFG and less than 0.25% of NMOC." However, EPA presents no supporting data for this change. Further, EPA only cites this equivalency in Tables 2.4-4 and -5 in footnote j for combustion emissions. EPA's own data in Table 2.4-1 and Table 2.4-2 show that certain non-reactive VOCs are commonly present in LFG, and AP-42 includes default concentrations for those chemicals. Lastly, despite this claim of equivalency, EPA is not amending any concentration of the compounds listed in Table 2.4-1 or Table 2.4-2, which affirms the 39% VOC/NMOC ratio, nor is EPA amending footnote "c" of Table 2.4-2. Rather than assuming that VOCs are equal to NMOC, EPA should maintain the 39% value as is set forth in the tables, which can be used as a default VOC concentration in the absence of site-specific data. Because non-reactive VOCs would include, but not be limited to, ethane, acetone, certain halogenated VOCs, siloxanes, and any other non-reactive VOCs, for which high concentrations may be present, the default value continues to be valid. There are landfills that contain much higher concentrations of non-reactive VOCs than the examples cited by EPA; therefore, the assumption that VOCs equals NMOCs is not a conclusion that is appropriate for MSW landfills. EPA can also recommend that site-specific data be developed for this determination.

- Flare emission factors – non-enclosed flares: Table 2.4-5 contains emissions from flares/non-enclosed flares. These emission factors remain the same as in the 1998 version of Section 2.4 of AP-42. These non-enclosed flares are closely related to the Industrial Flares in Section 13.5 of AP-42. In April of 2015, the emission factors for Industrial Flares were updated based on tests of non-enclosed flares. This testing is much newer information than the basis on the non-enclosed flares in Section 2.4, and this represents the most up-to-date data on non-enclosed flares. NWRA and SWANA recommend that EPA use the testing from Section 13.5 and have the emission factors for the non-enclosed flares in Section 13.5 and 2.4 match based on the most recent testing, including emission factors of 0.31 lb/MMBtu for CO and 0.068 lb/MMBtu for NO_x. These factors are already in common use for landfill permitting across the United States, so this change would be consistent with what is already happening in the industry.

- Flare emissions factors – enclosed flares: We have serious concerns with the updated factors being proposed for combustion emissions from enclosed flares. It appears that EPA has combined stack test data from ultra-low emission (ULE) flares with that of conventional enclosed flares to create these factors, particularly with respect to NO_x and CO. This has resulted in emission factors that most conventional enclosed flares cannot meet. Since it is common for regulatory agencies to use AP-42 factors in permitting, these non-representative factors would result in emission limits, which are not attainable and result in flares being in non-compliance with site permits. NWRA and SWANA have reviewed stack test data from conventional enclosed flare across the country and what we have found is a wide range of tested values, many of which would not comply with the proposed factors if they were imposed as permit limit. Furthermore, NO_x and CO emission rates can work counter to each other during combustion of landfill gas in conventional enclosed flares. As such, efforts to meet lower NO_x emission limits can result increased CO (and vise-versa), making it additionally problematic when both NO_x and CO are set at very low level. We request that EPA remove the stack test data from ULE flares from the dataset and recalculate the representative factors for enclosed flares. ULE flares are not in common use across the country and thus do not belong in a dataset being used to create nationally recognized factors. Further, these flares may not be appropriate for all landfills, depending on the quality of the landfill gas and the more limited turndown ratio of ULE flares. Furthermore, we recommend that EPA make it clear in the AP-42 document that vendor supplied emission factors for flares should be ahead of the AP-42 factors in the hierarchy of emission factors for use in permitting.

- IC engines and turbines: The draft AP-42 section still includes factors for combustion emissions from IC engines and gas turbines. Emissions from these devices are highly variable based on the make, model, site conditions where they are deployed, and whether additional controls have been installed on the engines or turbines. Therefore, it is impossible to establish one set of emission factors that will be representative of such units. Therefore, we recommend that no emission factors for LFG-fired IC engines and turbines be listed in AP-42, and that they be removed from Tables 2.4-3, 2.4-4 and 2.4-5. Instead, EPA should direct the use of vendor information for the establishment of emission factors for these sources. Presently, it is vendor information that is most used in permitting of landfill gas-fired engines and turbines across the United States.

- **NMOC emissions from combustion devices:** It is important that AP-42 be consistent with the Landfill NSPS and Landfill NESHAP emission standards in terms of NMOC emissions from LFG combustion devices. NWRA and SWANA members have observed that, at facilities with very high concentrations of inlet NMOCs, combustion devices are not likely able to meet the outlet concentration of 20 parts per million by volume (ppmv) as hexane at 3% oxygen. Similarly, landfills with very low NMOC concentrations in the raw LFG will not be able to demonstrate a 98% destruction efficiency, because laboratories cannot get low enough detection limits to prove this fact. Because of these considerations, which are highly dependent on the site-specific variability in gas quality, NWRA and SWANA requests that NMOC emissions be stated as 98% destruction efficiency *or* 20 ppmv.

- **Specific Comments to Section 2.4.4.1:**

    - EPA notes that Equation (1) is for estimating "methane generation and not methane emissions to the atmosphere" and that the Microsoft Excel Landfill Gas Emissions Model (LandGEM) spreadsheet is used for estimating "emissions rates for total landfill gas, methane, carbon dioxide, NMOCs, and individual air pollutants from municipal solid waste landfills." This distinction, however, is not accurate. Like Equation (1), the LandGEM model calculates methane generation.

    $$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

    In addition, EPA's update of the LandGEM model (Version 3.1) to be consistent with Equation (1) and EPA's statement that LandGEM version 3.03 depicted "methane production" (p. 2.4-3) confirms that these methodologies should be considered consistently. Accordingly, NWRA and SWANA ask that EPA amend the text within AP-42 to state that the LandGEM model is also used to determine "generation rates" of methane, CO_2, NMOC, and individual pollutants. Furthermore, Equation (1) and the LandGEM model represent generation, as noted above, and EPA has made a point that Equation (1) and by association LandGEM is not for determining emissions to the atmosphere. Consequently, the use of the term "uncontrolled emissions" is not appropriate. Therefore, to be consistent with both Equation (1) and the LandGEM model, we recommend that the first paragraph be revised as follows, and all subsequent references to "emissions" in this context, be revised striking "emissions" and replacing it with "generation".

> *To estimate generation rates ~~uncontrolled emissions~~ of the various compounds, present in landfill gas, ~~total landfill gas emissions~~ methane generation must first be estimated. ~~Uncontrolled CH4 emissions~~ Methane generation may be estimated for individual landfills by multiplying the result of Equation HH-1, found at 40 CFR 98.343(a)(1), by 1474.83 to obtain methane generation for the reporting year for ~~which emissions~~ generation rates ~~are~~ calculated in terms of cubic meters per year.*

- EPA presents a method for correcting samples of landfill gas for air infiltration (see p. 2.4-4). While we support the incorporation of such a correction, there are several clarifications that are necessary. First, total pollutant concentrations from EPA Reference Method 25C already have a correction related to air, specifically for nitrogen or oxygen. Correcting an already corrected concentration compounds the calculation, yielding an erroneous result. Therefore, we request that only uncorrected concentrations be corrected for air. Concentrations already corrected should be allowed to skip Equation (2). In addition, the term "infiltration" does not adequately describe the mechanisms put forth by EPA. The dictionary definition is the "permeation of a fluid into something by filtration". Air can be present in a landfill gas sample due to a variety of mechanisms, including leaks in sampling equipment, air pulled into the landfill from applied vacuums, air present in area of a landfill waste with low gas production, etc. As such, it is more accurate to reference air "present" in the sample rather than using the term infiltration. Finally, the correction should not be applicable to samples that do not have air. Instead, we recommend that the phrase "if present" be added to the text. Therefore, we recommend the following changes to page 2.4-4, paragraph 2:

> *If an uncorrected site-specific total pollutant concentration is available ~~(i.e., as measured by EPA Reference Method 25C)~~, it must be corrected for air ~~infiltration~~ in the sample (if present) which can occur by two different mechanisms: LFG sample dilution, and air intrusion into the landfill. Corrected concentrations can skip to Equation (3).*

Further, it is important to dispel any notion that air intrusion or the presence of air in a sample is purely a function of collection system operations. In fact, there are many natural causes including biological and biochemical reactions related to waste age, type, moisture, barometric changes, and other factors that influence oxygen and nitrogen content in a landfill gas sample. These factors are most notable in arid areas. To that end, we recommend that EPA add a precipitation caveat like EPA Reference Method 25C allowing a landfill to skip the correction requirement if annual rainfall is less than 20 inches per year and is not attributed to sample dilution from an air leak.

In addition, we would like to clarify that source test reports don't typically include raw landfill gas concentrations. Therefore, we recommend the following change:

> *Values for CCO2, CCH4, CN2, and CO2, can usually be found in the ~~source~~ laboratory test report or handheld meters for the landfill along with the total pollutant concentration data.*

- Finally, equation (3) utilizes a correction factor that assumes 55% methane and 45% CO_2 and other constituents. As described above, landfill gas compositions vary over a wide range for each constituent. Therefore, including a constant in the formula that is representative of a single composition (1.82) does not provide a mechanism to address the diverse site-specific concentrations. We therefore recommend that EPA adopt a new variable (CF_{LFG}) to replace the 1.82 factor to calculate the pollutant generation rate more accurately: $CF_{LFG} = 1 + (C_{CO2} + C_{N2} + C_{O2})/C_{CH4}$.

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NWRA and SWANA very much appreciate EPA's consideration of this information, and we would be happy to further discuss these comments, or any questions you may have, at your convenience. Should you have any questions about this letter, please contact the undersigned at agermain@wasterecycling.org or koldendorf@swana.org.

Very truly yours,

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