March 12, 2024

Environmental Protection Agency
Mail Code: 28221T
1200 Pennsylvania Avenue NW
Washington, DC 20460

(*submitted via email to: efcomments@epa.gov*)

Re: Draft Emissions Factors for AP-42 Chapter 2, Section 4 - Municipal Solid Waste Landfills

To Whom It May Concern,

John Zink appreciates the opportunity to provide comments on the proposed draft of AP-42 Chapter 2, Section 4, and draft tables and emission factors as posted in January 2024 on the following sites:

- https://www.epa.gov/air-emissions-factors-and-quantification/draft-emissions-factors-ap-42-chapter-2-section-4;
- https://www.epa.gov/system/files/documents/2024-01/c02s04_1_2024_clean.pdf;
- https://www.epa.gov/system/files/documents/2024-01/ap-42-chapter-2-section-4-tables-and-draft-factors.xlsx

John Zink Company, LLC (John Zink) has supplied equipment for biogas facilities for over 50 years. Over the years, we have continually optimized our systems to improve emission reliability, and unit maintainability. Upon review of the recently proposed regulation changes, we offer the following comments based on our extensive experience with equipment for biogas applications.

Comments to Table 2.4-5. Emission Rates for Secondary Compounds Exiting Control Devices

1. Table 2.4-5 dictates emission factors for enclosed flares to be 0.0375 lobs/MMBtu for Nitrogen Oxides (NOx), 0.00015 lbs/MMBtu for Non-Methane Organic Compounds (NMOC), and 0.0385 lbs/MMBtu for Carbon Monoxide (CO).

    - The current diffusive combustion technology, employed in conventional biogas enclosed flares, is highly unlikely to produce emissions as low as the values proposed in Table 2.4-5, over the complete range of operations that typical enclosed flares experience. Diffusive combustion entails the interaction of the hydrocarbons (typically methane) in landfill gas, with the air (oxygen) required for combustion at the burner tip, facilitated by an ignition source. However, this combustion mechanism presents a limitation regarding the extent of mixing that is achievable at the burner tip, impeding the contact between hydrocarbons (methane) and the necessary amount of oxygen for optimal clean combustion. Consequently, only partial combustion (i.e., sub-stoichiometric) occurs at the burner tip, while the remaining combustion takes place as the gas traverses the stack. Additionally, a substantial portion of thermal NO_X generation occurs at the burner tip itself, at temperatures above 3000°F. During the sub-stoichiometric conditions, at the burner tip during diffusive combustion, a high portion of the flame front reaches temperatures above 2600°F. As partial combustion occurs at the burner tip, achieving the NO_X emissions listed in Table 2.4-5 becomes unattainable with higher methane concentration landfill gas. This theory is supported by a publication authored by John Zink, presented at SWANA's 21st Annual Landfill Gas Symposium and titled "Ultra-Low Emission Enclosed Landfill Gas Flare". (Attachment). The publication contains the results of extensive research done on enclosed flare emissions performance, and its findings show that landfill gas with methane concentrations surpassing 55% produce NOx emissions that exceed the proposed emissions factors. The findings establish that the methane concentration of landfill gas to each unit significantly impacts emission generation, thereby, warranting its consideration when defining emission limits. The source tests included in AP-42 Factor data do not show the inlet landfill gas conditions at each test; without that inclusion, the emissions data points presented are not comparable.

    - Notably, the source tests used in determining the emission factors in Table 2.4-5 solely present emissions data without providing insight into the specific operating conditions and inlet gas conditions of each tested unit. There are several variables that impact the emissions of an enclosed flare such as inlet gas composition, flowrate, ambient air conditions, operating temperature, dimension of the stack, etc. Typically, the inlet gas composition plays a significant role in the emissions performance of the unit; the higher the hydrocarbon (methane) composition in the inlet landfill gas stream the higher the NOx formation. When a landfill gas has lower hydrocarbon (methane) concentrations, it has been found to generate lower NOx. Additionally, as found in the "Ultra-Low Emission Enclosed Landfill Gas Flare" publication, previously referenced, there is also a correlation between the inlet flowrate and the amount of NO_X generated.

- Out of 40 test report data used for emissions values determination, 24 of those were John Zink systems, and 10 of the 24 John Zink Systems were Zink Ultra Low Emission (ZULE®) Flares, a different type of premix combustion technology. Including emissions data from different combustion technologies can skew the emissions averages for conventional enclosed flares.

- The emission of NMOC in biogas enclosed flares exhibits a strong reliance on the concentration of NMOC in the inlet gas. In cases where the inlet NMOC concentration surpasses the typical values found in landfill gas, the destruction efficiency (DRE) requirement may need to be much higher than 98% to achieve the outlet concentration of 20 PPM as hexane at 3% oxygen stated in the draft. The attainment of destruction efficiency exceeding 98% consistently proves to be impractical for conventional enclosed combustors. Conversely, facilities characterized by very low inlet NMOC concentrations face considerable challenges in achieving a DRE of 98%. Hence, John Zink recommends that the NMOC emission limit be as either 98% DRE ***or*** 20 PPM as hexane at 3% oxygen.

2. Table 2.4-5 dictates emission factors for elevated flares to be 0.039 lbs/MMBtu for NOx.

   - Biogas elevated flares typically use diffusive and natural draft technology like industrial flares that do not employ steam assistance. The NO_x emission factor for industrial flares reported in AP-42 Section 13.5 is 0.068 lbs/MMBtu. Because of the similarity between biogas elevated flare and industrial flare, and based on previous discussion on diffusive combustion, achieving the NO_X emissions listed in Table 2.4-5 for an elevated flare becomes impractical and John Zink recommends continue use of AP-42 section 13.5.

The comments are based on our experience with biogas combustion equipment as well as refinery flaring and other applications and technologies.

Sincerely,

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