Sunflower Alliance Charles Davidson. Sunflower Alliance & California Environmental Justice Coalition (Charles Davidson)

Reducing methane alone is not enough: The urgent need to reduce reactive landfill VOCs, eliminate toxic ozone and better protect air quality and public health

Charles Davidson, Sunflower Alliance and the California Environmental Justice Coalition (CEJC).
Nov. 2025

Inside the landfill, heat, pressure, moisture, and metal-catalyzed reactions create a toxic chemical stew. Hydroxyl radicals—generated through photolysis of dissolved organic matter, free-radical-driven reactions involving iron in leachate, ozone-driven oxidation, and ammonium sulfate activation—aggressively attack organic material and convert methane and volatile organic compounds (or VOCs) into formaldehyde and other highly reactive compounds. These pollutants migrate upward and escape through the cover, working face, cracks, piping, and settling waste. Many of these chemicals act as direct toxins, such as formaldehyde, while others interact with nitrogen oxides (NOx) in sunlight to form even more ground-level ozone.

Even if methane emissions are reduced by 75–90%, these chemical reactions do not stop. The landfill remains an active reactor, continuously producing carcinogens, ozone precursors, aerosols, and respiratory irritants. Nearby communities—especially low-income residents, children, and elderly adults—continue to face daily exposure to toxic compounds that drive asthma, cardiovascular stress, and cumulative health disparities.

It is also important to clarify that while landfills do not produce nitrogen oxides through decomposition, landfill operations do. Flaring, landfill-gas-to-energy combustion units, backup generators, heavy equipment, and diesel machinery are significant local sources of NOx. These NOx emissions, though external to the waste mass, combine with landfill VOCs and aerosolized aldehydes —and sunlight—to generate ground level ozone, a potent respiratory irritant and a major contributor to asthma attacks, airway inflammation, heart stress, and premature death.

Stronger monitoring, real-time leak detection, improved landfill covers, aggressive landfill leachate recovery, co-pollutant controls, and modern NOx-minimizing engineering technologies are urgently required. Reducing methane alone is not enough to reduce reactive landfill VOCs, eliminate toxic ozone and better protect air quality and public health.

Reducing methane alone is not enough: The urgent need to reduce reactive landfill VOCs, eliminate toxic ozone and better protect air quality and public health

Charles Davidson. Sunflower Alliance and the California Environmental Justice Coalition (CEJC). Nov. 2025

Inside the landfill, heat, pressure, moisture, and metal-catalyzed reactions create a **toxic chemical stew**. Hydroxyl radicals—generated through photolysis of dissolved organic matter, free-radical-driven reactions involving iron in leachate, ozone-driven oxidation, and ammonium sulfate activation—aggressively attack organic material and convert methane and volatile organic compounds (or VOCs) into **formaldehyde and other highly reactive compounds**. These pollutants migrate upward and escape through the cover, working face, cracks, piping, and settling waste. Many of these chemicals act as **direct toxins**, such as formaldehyde, while others interact with nitrogen oxides (NOx) in sunlight to form even more **ground-level ozone**.

Even if methane emissions are reduced by **75–90%**, these chemical reactions **do not stop**. The landfill remains an active reactor, continuously producing carcinogens, ozone precursors, aerosols, and respiratory irritants. Nearby communities—especially low-income residents, children, and elderly adults—continue to face daily exposure to toxic compounds that drive asthma, cardiovascular stress, and cumulative health disparities.

It is also important to clarify that while landfills do not produce nitrogen oxides through decomposition, **landfill operations do**. Flaring, landfill-gas-to-energy combustion units, backup generators, heavy equipment, and diesel machinery are significant **local sources of NOx**. These NOx emissions, though external to the waste mass, combine with landfill VOCs and aerosolized aldehydes —and sunlight—to generate ground level ozone, a potent respiratory irritant and a major contributor to asthma attacks, airway inflammation, heart stress, and premature death.

Stronger monitoring, real-time leak detection, improved landfill covers, aggressive landfill leachate recovery, co-pollutant controls, and modern NOx-minimizing engineering technologies are urgently required. **Reducing methane alone is not enough** to reduce reactive landfill VOCs, eliminate toxic ozone and better protect air quality and public health.