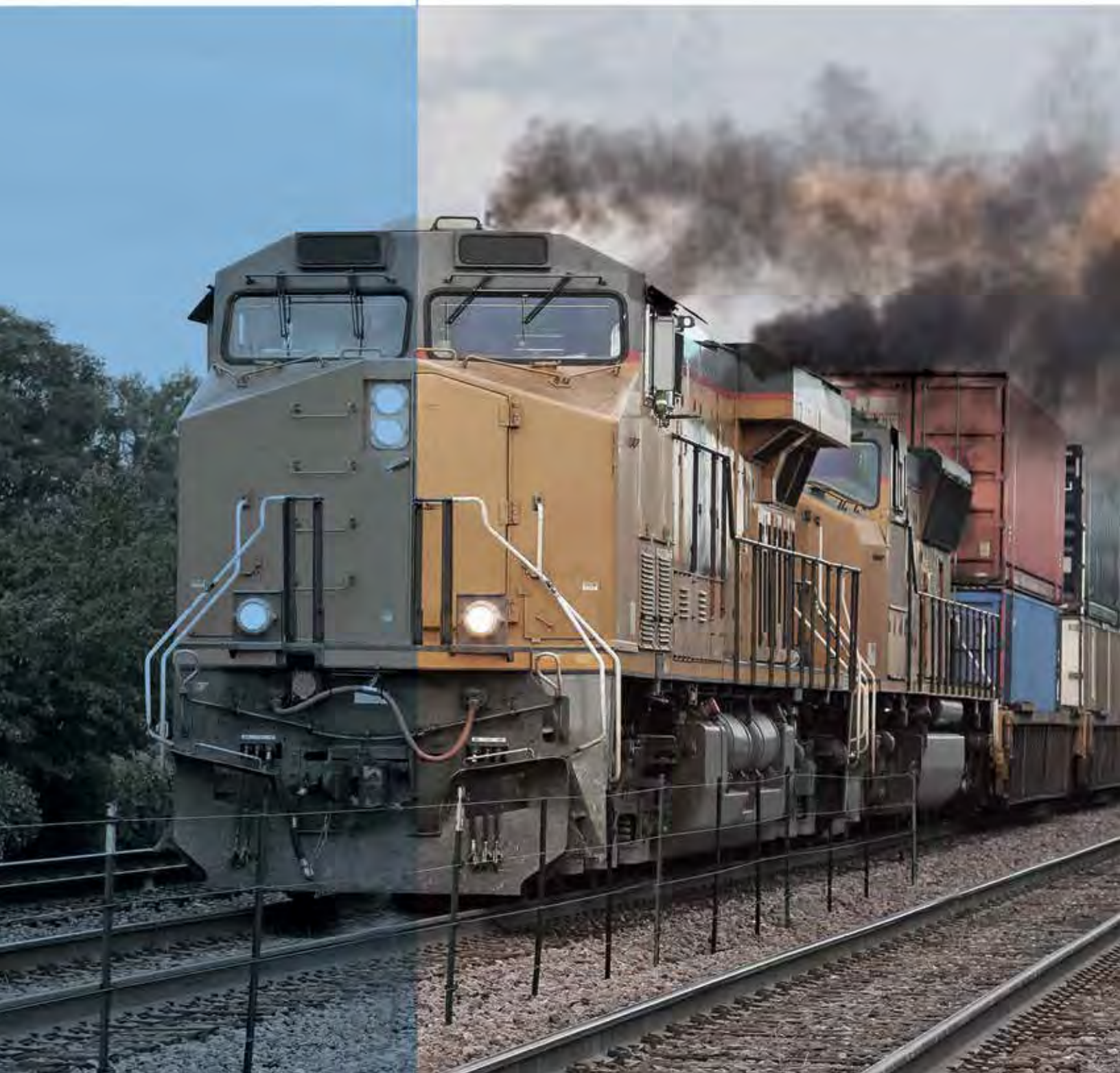
American Lung Association®

Getting Health on Track:
Cleaner Locomotives for Healthy Air

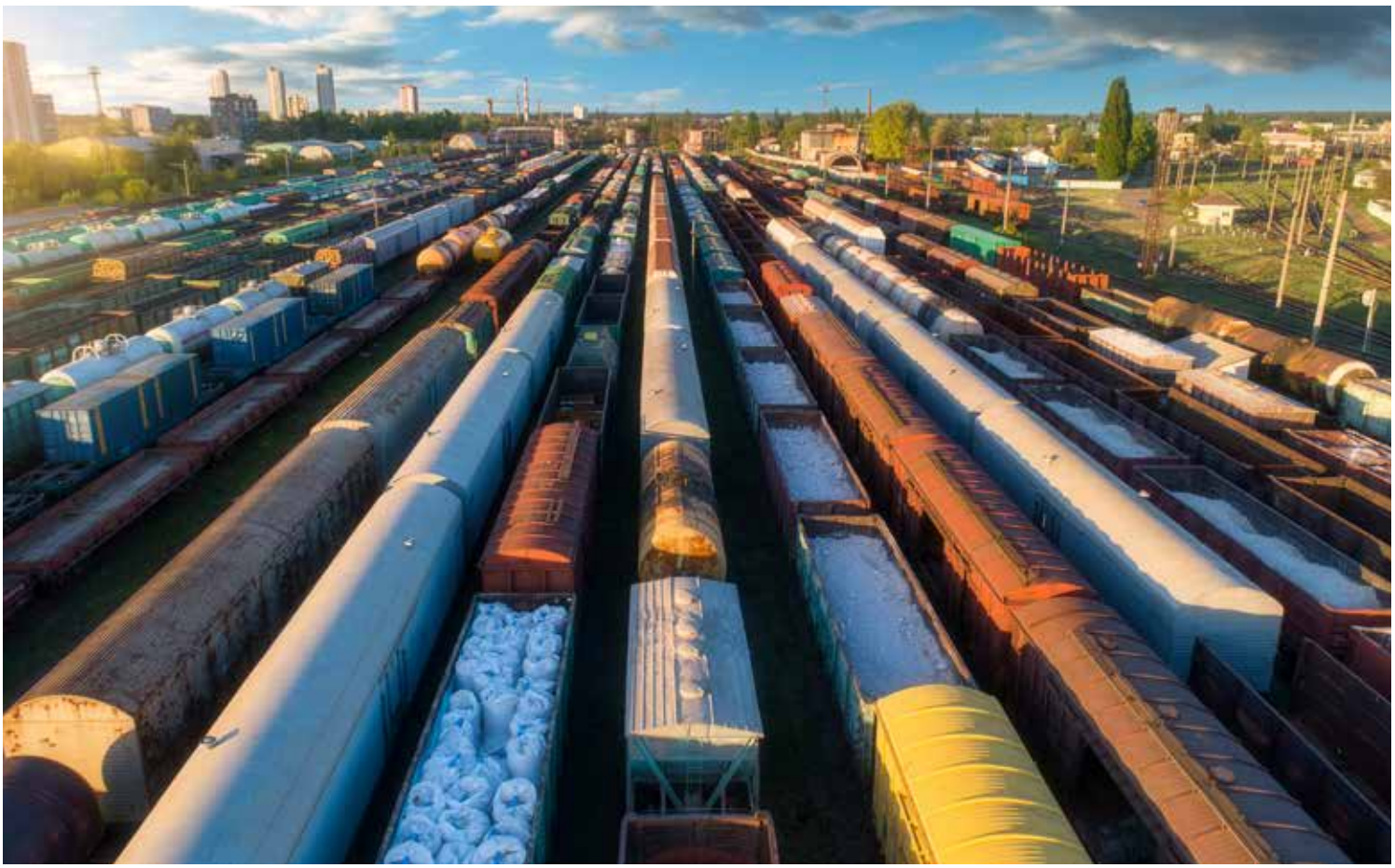


Introduction

The transportation sector is a leading source of harmful, lung-damaging air pollution. While much attention has focused on cars and trucks, the engines that power America's trains – locomotives - remain a major and often overlooked contributor to harmful emissions. Many of these locomotives were built decades ago and continue to operate under outdated standards, releasing high levels of nitrogen oxides (NOx), diesel particulate matter (DPM) and greenhouse gases. Pollutants from locomotives pose a serious threat to public health, especially for railyard workers and the communities living near rail lines, ports and major transit hubs.

America's aging locomotive fleet not only worsens asthma, heart disease and cancer risk, but also disproportionately harms low-income communities and communities who are already overburdened by pollution. At the same time, modern technologies capable of eliminating these emissions are available and cost-effective. Cleaning up locomotives is a critical step to protect human health, decrease health disparities and move the nation toward a cleaner transportation future.

This report examines the health risks of locomotive emissions across the United States, identifies the areas and populations most affected and highlights the solutions that can deliver healthier air for all. By understanding the scale of the problem and the tools at our disposal, we can chart a path toward stronger standards, cleaner technologies and healthier communities.



The Current State of Locomotives in the United States

Today, the majority of passenger and freight-carrying trains in the United States are powered by diesel engines originally constructed decades ago. Currently, operational emissions from just one train are worse than those of hundreds of heavy-duty trucks.[1]

Federal emissions standards for locomotives have seen some strengthening over time, with new "tiers" being assigned for subsequent standards.[2] "Tier 4" locomotives are those certified to meet the cleanest standards of all diesel engine locomotives under regulations of the U.S. Environmental Protection Agency (EPA). EPA estimates Tier 4 locomotives have 90% lower particulate matter emissions, and 80% lower NOx emissions, than Tier 2 locomotives.[3] However, there is no requirement for older trains to be upgraded or replaced. Regulatory loopholes allow the oldest, dirtiest locomotive engines to be rebuilt to meet their original outdated standards instead of upgrading to newer, more efficient technologies. These rebuilds can keep a heavier polluting train on the tracks for decades, without ever upgrading to meet the more health-protective standards. The most recent Tier 4 standards themselves have not been updated since 2008. Line-haul fleets, locomotives transporting passengers or goods long-distances across U.S. rail, remain dominated by engines operating under standards from over 25 years ago.[4]

Tier	Locomotive Manufacture Date	Date Standards Were Finalized
Tier 0	1973-2001	1997
Tier 1	2002-2004	1997
Tier 2	2005-2011	1997
Tier 3	2012-2014	2008
Tier 4	2015 and later	2008

The Health Implications

EPA is long overdue in setting new locomotive emissions standards that can greatly improve air quality, public health and reduce cancer risk. Locomotives are major sources of harmful pollution, emitting nitrogen oxides (NOx) and carcinogenic diesel particulate matter (DPM). These emissions harm millions of people nationwide, especially those living near railyards, ports and transit hubs, where pollution levels are highest.[5] Nearly half of all Americans - 156.1 million people – already live in counties with unhealthy air, as found in the American Lung Association's 2025 "State of the Air" report[6], and locomotive pollution adds a heavy burden to many of these communities.

While rail is an efficient way to move goods and can become an important component of clean transportation, the older, less-efficient locomotive fleets remain a significant source of health harms. DPM can cause lung cancer, trigger asthma attacks and worsen heart and lung disease.[7] Exposure to fine particle pollution, especially at higher concentrations, can trigger illness, hospitalization and is estimated to be responsible for nearly 48,000 premature deaths in the U.S. every year.[8] Other pollutants from locomotives can cause various respiratory, cardiovascular and other health impacts, including asthma attacks, heart attacks, strokes and premature birth.[9] Children, older adults and people with underlying health conditions including asthma, COPD, lung cancer, cardiovascular disease and pregnancy are all at greater risk. Additionally, greenhouse gas emissions from locomotives contribute to climate change.

Occupational Health Risks of Locomotive Emissions

The harmful effects of locomotive emissions extend beyond nearby communities; they also pose serious occupational health risks to the workers who operate and maintain trains every day. Locomotive engineers, conductors, railyard workers, maintenance crews and other railroad employees are frequently exposed to dangerous levels of diesel exhaust and related air pollutants because of their close and continuous proximity to operating diesel engines. For these workers, the air pollution caused by outdated locomotives is not a distant concern, it's an unavoidable and dangerous part of the job that can seriously harm their health over time.

Diesel exhaust is a known human carcinogen, classified by the International Agency for Research on Cancer[10], and long-term exposure is strongly linked to lung cancer, cardiovascular disease and chronic respiratory illness. Repeated exposure to DPM can irritate the eyes, nose and throat, cause persistent coughing and shortness of breath and worsen conditions such as asthma and chronic obstructive pulmonary disease (COPD).[11] For workers who spend hours each day in or around running diesel engines, the cumulative impact can be devastating.

A study conducted by the California Environmental Protection Agency found that railyard workers were among the most highly exposed occupational groups, with some exposed to levels of diesel particulate matter more than 20 times higher than ambient levels in surrounding neighborhoods.[12] Another investigation by the National Institute for Occupational Safety and Health highlighted elevated rates of respiratory illness and heart disease among locomotive crews, further underscoring the occupational hazards of diesel pollution in the rail industry.[13]

The risks are especially concerning given that many rail workers are employed at facilities where outdated, high-emission locomotives are still the norm. The regulatory loopholes that allow locomotives built as far back as the 1970s to remain in

active use put workers in direct contact with pollution levels that would be unacceptable in most other workplace settings. These conditions fail to protect the very workforce that keeps our nation's freight and passenger systems running.

Rail yard workers that are part of the United Electrical, Radio & Machine Workers of America's Green Locomotive Project report respiratory health issues due to pervasive exposure.[14]

> "As an organizer with the United Electrical Radio and Machine Workers (UE), I work for both rail crew drivers and locomotive manufacturing workers. UE members who live near and work in rail yards are among the first people to inhale toxic pollution from locomotives. The concentration of older dirtier locomotives in yards is the result of the railroad industry's unwillingness to make necessary investments in cleaner, more efficient technology. When locomotives get too old to perform long-distance trips, they get demoted to switchers which never leave the yard. Workers describe these locomotives as "maintained just well enough to keep them running." In some cases, there is doubt they would be able to start if they were turned off, so they are left on, spewing emissions 24/7.
>
> The particulate matter from these decades-old switchers that populate this country's yards makes our members and their loved ones more likely to have asthma, COPD and lung cancer. UE members report getting headaches and shortness of breath on the job, as well as high rates of asthma among their kids and grandkids." — Ryan Calbreath, CA

Modernizing federal locomotive standards is not only a matter of addressing community harm, but also a necessary step to safeguard worker health. By accelerating the shift toward zero-emission technologies and requiring the retirement or modernization of the oldest, dirtiest engines, we can protect railroad employees from preventable illness, improve working conditions and save lives. Clean air is a right, not just for the communities trains travel through, but for the people who keep those trains moving.

Health Implications for Communities Near Rail

Across the United States, communities living near railyards, ports and other major rail operations are disproportionately burdened by the health harms of diesel emissions. These areas are often home to low-income families and predominantly African American and Latinx residents, who already face higher rates of pre-existing health conditions such as asthma, heart disease and lung disease. Decades of discriminatory housing policies and land-use decisions have concentrated rail infrastructure in neighborhoods that are least able to bear additional environmental stress. The result is an unjust pattern: the same communities that have historically been excluded from decision-making are now exposed to some of the nation's highest levels of toxic locomotive pollution.[15]

A 2007 U.S. Environmental Protection Agency study found that more than 13 million Americans live near ports and railyards, with a "high percentage of low-income households, African Americans and Hispanics."[16] Communities already facing cumulative environmental and social burdens often lack the resources to relocate or to access quality healthcare to mitigate the harms of pollution. This makes strengthening locomotive standards an urgent priority for health. Cleaning up trains not only reduces greenhouse gas emissions and improves regional air quality but also directly protects the health of those most vulnerable.

EPA's responsibility is clear: ensuring strong, modernized standards for locomotives is not only a matter of reducing emissions, but also a matter of fairness. Transitioning to zero-emission technologies can deliver cleaner air, lower cancer risk and reduce the chronic health disparities that weigh most heavily on historically overburdened communities. By modernizing locomotive policy, the nation can take a meaningful step toward ensuring that everyone has the right to breathe clean, healthy air.

City-by-City Analysis

Pollution from locomotives affects people nationwide. However, some cities host larger rail hubs with more locomotive traffic, increasing their risks of health harms from air pollution, and exposure can vary neighborhood to neighborhood.

Chicago is the nation's busiest rail hub, handling nearly one-quarter of all U.S. freight rail traffic. A study done by the U.S. Department of Transportation Federal Highway Administration found that freight is a large source of NOx and particulate matter at the regional level, and in Chicago, NOx emissions from freight rail are nearly double that of other regions.[17] Neighborhoods on the South and West Sides, home to predominantly Black and Latinx communities, are adjacent to major railyards and intermodal facilities. Residents here face some of the greatest exposure to toxic air pollution in the state.[18] Asthma hospitalization rates in Chicago are twice the national rate, and some neighborhoods see one in every three children affected by asthma.[19] This is a stark indicator of how pollution from locomotives compounds long-standing health inequities.

> "I live on the southwest side of Chicago, and I'm bounded by four rail yards within a two to four mile radius. The polluting diesel locomotives used in Chicago's rail yards are harming railroad workers and drivers like myself, and people that live in these communities."[20]
>
> — Larry Hopklins, UE Local 1177 President

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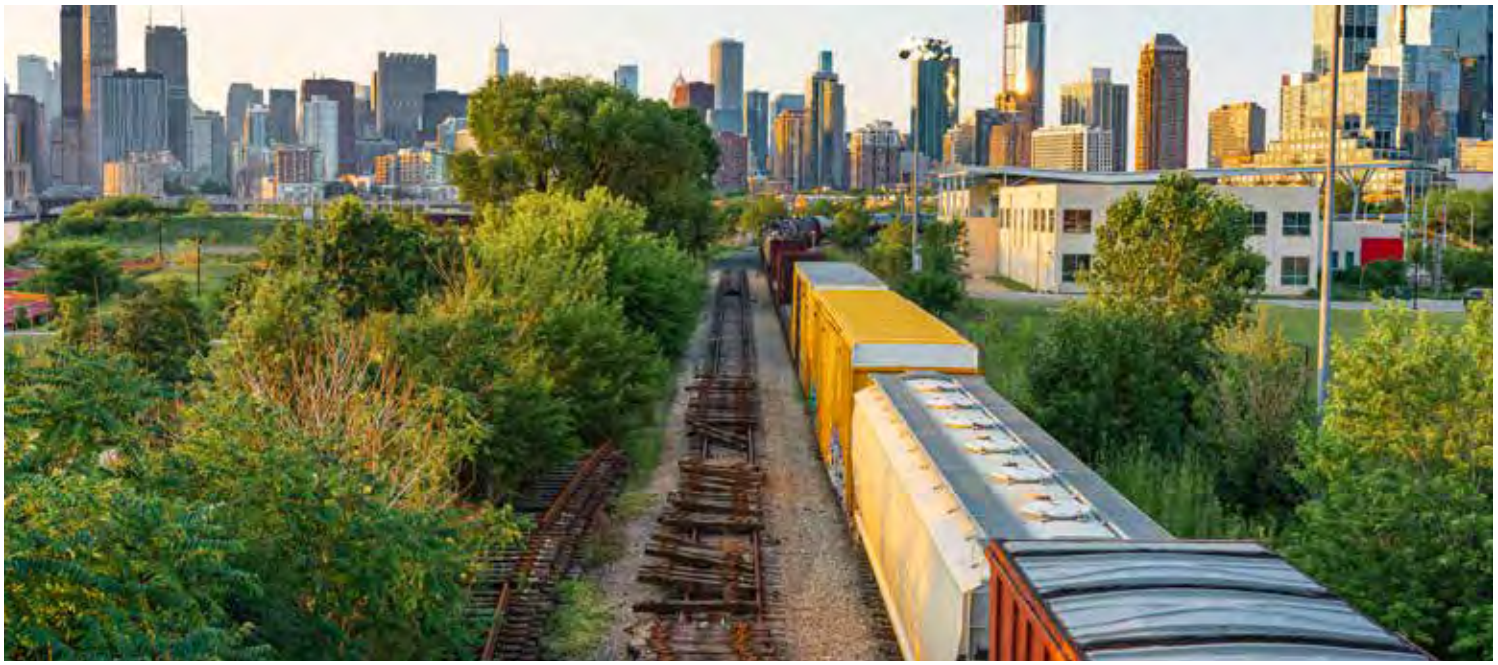
Houston is another major freight hub where multiple Class I – the largest - railroads converge, bringing high levels of diesel locomotive traffic into the city. The city's East End and Fifth Ward neighborhoods, historically African American and Latinx communities, are located next to rail lines and yards. These same neighborhoods already face cumulative burdens from petrochemical facilities and highways, amplifying health risks from locomotive pollution.[21] Elevated cancer risks in these areas underscore how overlapping sources of pollution reinforce patterns of injustice.

> "As a Nurse Practitioner in Houston, I see the heavy burden that diesel emissions place on health. Communities near the rail yards and busy freight corridors face higher rates of asthma and other respiratory illnesses, leading to higher healthcare costs and greater risk for missing work and school. Children are especially vulnerable and I've watched far too many kids struggle to breathe when they should be running, laughing, and learning. No child's potential should be dimmed by the air they breathe. Reducing cancer-causing diesel pollution from locomotives can help provide a healthier future for them and for all of us."
>
> — Traci Gonzales, APRN, PNP-C, AE-C

The ports of Los Angeles and Long Beach form the largest port complex in the Western Hemisphere and are powered in large part by diesel freight rail. The California Air Resources Board has found that railyard-adjacent communities in Southern California are among the state's most heavily impacted by DPM, another clear example of disproportionate environmental and health burdens.[22]



Emerging Technologies

The technology exists to modernize rail in America, and now updated locomotive standards are necessary to push the locomotive industry forward towards a cleaner, healthier and more sustainable future. To protect public health and clean up the air near our nation's railyards, ports and rail lines, we must embrace cleaner and more efficient technologies. As highlighted below, innovative systems like overhead catenary, transmission colocation and discontinuous catenary are ready-to-use examples of technologies that offer practical and powerful solutions to reduce toxic emissions and safeguard community health.

Overhead catenary systems deliver electricity directly to trains through overhead wires, eliminating the need for onboard diesel combustion. Widely used around the world, these continuous overhead catenary systems allow for fully zero-emission train operation which prevents dangerous pollutants like DPM and NOx that contribute to lung disease, cancer and premature death. Furthermore, this is reliable, high-speed technology that lowers operating costs while also supporting grid resilience.[23]

Discontinuous catenary systems offer flexibility in places where full overhead wiring is challenging, such as tunnels, bridges or dense urban areas. These systems allow trains to operate on battery or hybrid power for short distances, then reconnect to overhead wires when possible, preserving zero-emission benefits without compromising reliability.[24]

Transmission colocation takes advantage of existing power infrastructure by placing rail electrification lines alongside high-voltage transmission corridors. This approach can reduce project costs and environmental impacts, while accelerating the transition to electric rail, helping clean the air for communities living near major freight routes.[25]

These modern technologies are already in use or under development globally, and they demonstrate that cleaner, healthier rail is possible today. EPA must begin developing stronger locomotive standards and solutions like these must be considered as the foundation of the path forward. Adopting and enforcing standards that embrace advanced technologies will reduce the cancer risk, asthma burden and other serious health harms caused by outdated diesel engines and deliver cleaner air to millions of Americans. The tools are available; what's missing are stronger policies to ensure their adoption.

Mitigation & Policy Solutions

Protecting public health and advancing cleaner rail requires federal action to hold manufacturers and operators accountable. The last update to locomotive emissions standards occurred more than 17 years ago, leaving EPA far behind technological progress. Stronger standards are urgently needed to close regulatory loopholes that allow decades-old locomotives to remain in service indefinitely, continuing to pollute communities and endanger workers.

A new federal Tier 5 locomotive standard must be established to set ambitious emissions limits that reflect the cleanest available technologies. Tier 5 should include a clear phase-out schedule for the oldest, dirtiest engines and require that rebuilds include modern, cleaner technology, not allow outdated pollution levels to persist.

At the same time, federal and state governments should prioritize policies and investments that accelerate research, development and adoption of zero-emission rail technologies, including battery-electric locomotives and electrification through catenary systems.

These steps will not only reduce diesel emissions but also deliver multiple co-benefits: protecting rail workers, safeguarding overburdened communities and ensuring the rail sector modernizes in ways that protect our health and our climate. By pairing stronger regulatory standards with a bold commitment to zero-emission infrastructure, the U.S. can ensure that trains remain an efficient and sustainable mode of transportation, without sacrificing the health of millions of Americans.

> "I'm a pediatrician practicing in Southern California, where the young patients that I see every day face an increased risk of health harm from the pollution coming out of local railyards. The heavy exposure to pollution – particularly the cancer-causing diesel pollution coming from the trains and equipment – worsens asthma and increases the risk and severity of upper airway illnesses. Cleaning up railyard pollution will help keep these kids in their classrooms and playing with their friends, not in my exam rooms." — Afif El-Hasan, MD, FAAP

Conclusion

Locomotive emissions are a hidden but significant driver of toxic air pollution in the United States, endangering the health of rail workers, nearby communities and millions of Americans already struggling with unhealthy air. The evidence is clear: outdated diesel locomotives contribute to lung disease, cancer, heart disease, asthma and thousands of premature deaths every year. These harms fall disproportionately on low-income communities and communities of color, making locomotive pollution both a public health crisis and a matter of environmental justice.

Fortunately, the solutions are within reach. Proven zero-emission technologies such as battery-electric locomotives, overhead and discontinuous catenary systems and transmission colocation can eliminate harmful emissions while improving efficiency and reducing long-term costs. Stronger federal action is needed to accelerate their adoption.

The U.S. Environmental Protection Agency must close regulatory loopholes, set a bold new Tier 5 standard and require the phase-out of the nation's oldest and dirtiest engines.

Cleaning up locomotives is not only possible, it is necessary. By modernizing standards and embracing zero-emission rail, we can reduce cancer risk, prevent asthma attacks, protect workers and deliver cleaner air to the communities that need it most. Ensuring that every person has the right to breathe clean, healthy air requires decisive action now. The tools exist, it is time to put health first and build a rail system that powers our economy without poisoning our lungs.

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