American Lung Association.

Delivering Clean Air:

Health Benefits of Zero-Emission Trucks and Electricity

A Zeroing in on Healthy Air Report

About this Report

Heavy-duty trucks deliver major doses of pollution to communities throughout the United States along with their cargo. The transition to zero-emission trucks is a significant opportunity to reduce health impacts and disparities in pollution-burdened communities home to major truck traffic areas. This analysis finds that the transition to zero-emission trucking in the United States will significantly reduce harm to people living in counties with the nation's busiest trucking routes.

This new report builds on the American Lung Association "Zeroing in on Healthy Air" report published in March 2022 by focusing on the health benefits generated by the transition to zero-emission trucks and power generation in counties home to major trucking routes. The March analysis found that a widespread transition to zero-emission cars, trucks, buses and other vehicles, coupled with a transition to non-combustion, renewable electricity, would yield tremendous air quality, public health and climate benefits across the United States.

By highlighting the harms of trucking pollution and the benefits of zero-emission technologies along major US trucking corridors, this new report calls attention to the urgent need for state and federal actions to accelerate the transition to zero-emission trucks to address a major source of regional and local pollution that threatens health and worsens health disparities.

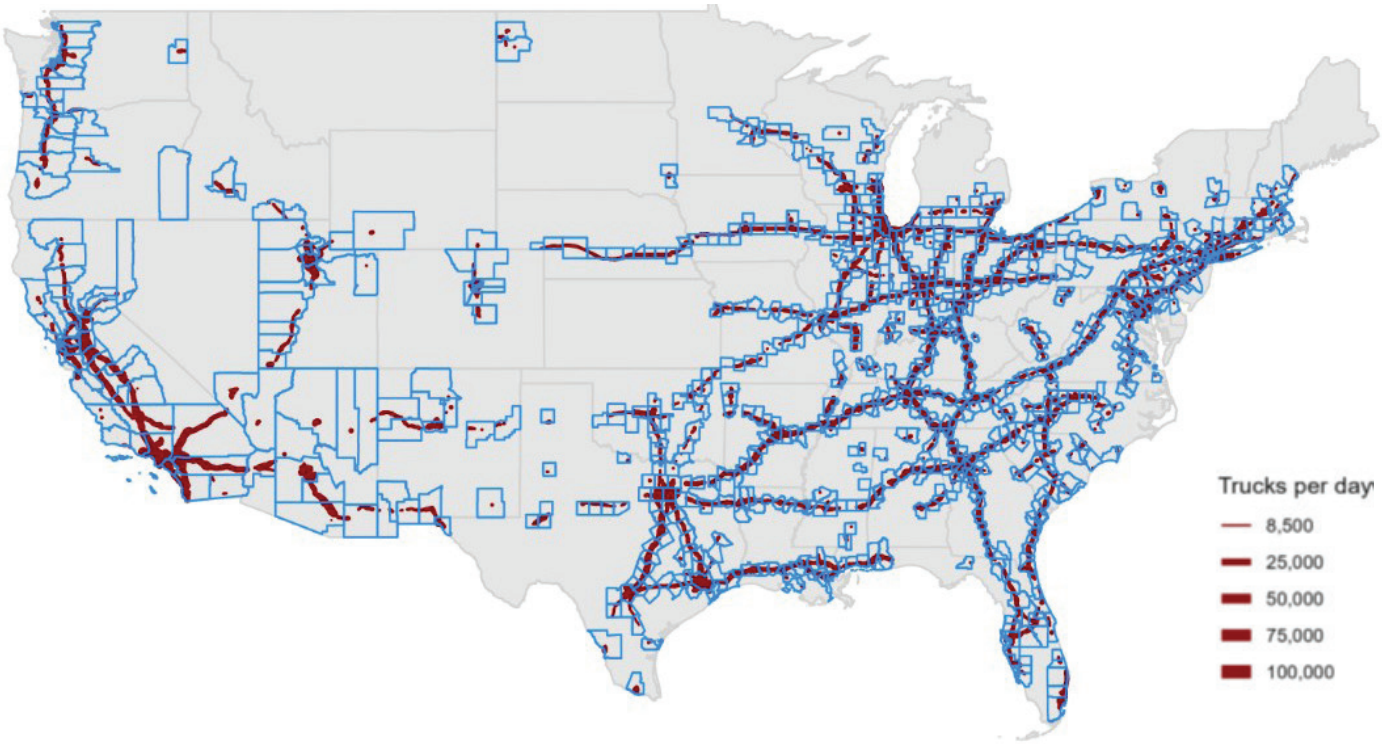
Delivering Clean Air: Health Benefits of Zero-Emission Trucks and Electricity

Key Findings: By 2050, as the nation moves to zero-emission trucks and power, the public health benefits in U.S. counties with major trucking routes could reach:

- $735 billion in public health benefits due to cleaner air
- 66,800 fewer premature deaths
- 1.75 million fewer asthma attacks
- 8.5 million fewer lost workdays

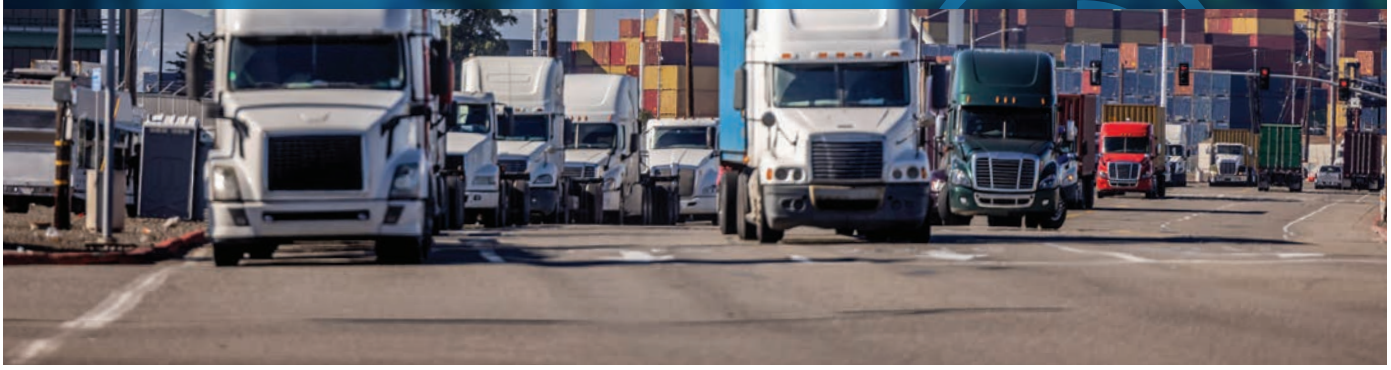
Adopting policies to advance zero-emission trucks will reduce regional air pollution impacts, disparities in pollution burdens and emissions of greenhouse gases that cause climate change.

Trucking Routes Across the United States Carrying 8,500 or More Trucks per Day



Trucking route analysis based on US Department of Transportation/Federal Highway Administration Freight Analysis Framework Version 4 (FAF4).

Warehouse centers, major highways, railyards and ports are major hubs of truck traffic in many communities, bringing thousands of trips per day with major pollution impacts in tow.

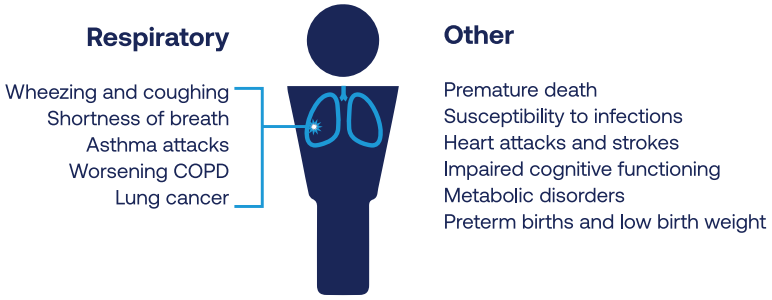


Health and Equity Impacts of Air Pollution from Transportation

The American Lung Association's annual "State of the Air" report notes ongoing progress and challenges in local, state and federal efforts to achieve clean, healthy air for all communities. The 2022 report noted that 41 percent of all Americans— 137 million people— live in communities impacted by unhealthy levels of ozone and/or particle pollution. The report also notes that a person of color is 61 percent more likely than a white person to live in a community impacted by unhealthy air and 3.6 times more likely to live in a community with the most unhealthy air in the United States.[1]

Research demonstrates that the burdens of unhealthy air include increased asthma attacks, heart attacks and strokes, lung cancer and premature death. These poor health outcomes are not shared equally, with many communities of color and lower income communities at greater risk due to increased exposure to transportation pollution. The transportation sector is also the largest source of greenhouse gas emissions that drive climate change, which threatens clean air progress and amplifies a wide range of health risks and disparities.

Air pollution can harm children and adults in many ways



Medium- and heavy-duty vehicles represent approximately six percent of the on-road fleet as of 2020, but generate 59 percent of ozone- and particle-forming NOx emissions and 55 percent of the particle pollution (including brake and tire particles).[2] Medium- and heavy-duty vehicles also produce 26 percent of transportation-based greenhouse gas emissions.[3] These vehicles can include heavier pick-up trucks, delivery and parcel vans, short- and long-haul trucks and tractor trailers that emit harmful pollutants that add to regional air pollution burdens that can affect health far beyond the roadside.

These vehicles also contribute to significant local impacts in the form of carcinogenic diesel particle pollution that can be extremely concentrated in communities nearest major trucking routes. Warehouse centers, major highways, railyards and ports are among the primary hubs of truck traffic in many communities, bringing thousands of trips per day with major pollution impacts in tow. In June 2022, the Health Effects Institute published a review of 353 research

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[1]American Lung Association. *State of the Air* 2022. April 2022. www.lung.org/sota
[2]American Lung Association. *Zeroing in on Healthy Air*. March 2022. www.lung.org/ev
[3]United States Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020*, EPA 430-R-21-005. https://www.epa.gov/system/files/documents/2022-04/us-ghg-inventory-1990-2020-data-highlights.pdf

papers regarding traffic pollution-related health effects and concluded with a moderate to high level of confidence that exposure to traffic pollution is linked with all-cause, circulatory, ischemic heart disease, and lung cancer mortality; asthma onset in both children and adults; and acute lower respiratory infections in children.[4] In March 2022, the United States Environmental Protection Agency (EPA) issued a fact sheet focused on freight trucking routes in the United States and found that 72 million Americans live in close proximity to heavy trucking corridors and "are more likely to be people of color and have lower incomes."[5]

While combustion vehicles (e.g. diesel, gasoline or natural gas) are certified to specific emission levels, the failure of vehicle emission controls, limited warranty protections, varied driving conditions, tampering and other factors can produce harmful doses of pollution far beyond certification levels.[6,7] The transition to zero-emission technologies provides certainty that communities will be protected against direct emissions from trucks.

Analysis

In building this analysis, the American Lung Association contracted with the consulting firm ICF to review our previously reported datasets. This report highlights the potential benefits of moving to zero-emission trucking across the United States with a specific focus on areas near trucking corridors with 8,500 or more trucks trips per day. To achieve this review, the analysis isolates the benefits of the zero-emission truck sector included in the "Zeroing in on Healthy Air" report by extracting county-level health benefit data for those areas containing major trucking routes. (Note: this is not a neighborhood-scale assessment). These health benefits are based on the following scenario and compared against a business-as-usual case, both of which were presented in "Zeroing in on Healthy Air."

- 100% new medium- and heavy-duty vehicle sales are zero-emission no later than 2040
- 100% non-combustion, renewable electricity generation by 2035

Like the previous analysis, this work illustrates national-level health benefits on a cumulative basis between 2020-2050 as well as emission reduction benefits associated with increasing levels of both zero-emission trucks and a non-combustion energy grid powering those vehicles.

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[4]Health Effects Institute. Special Report 23. *A Special Report of the HEI Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution* June 2022. https://www.healtheffects.org/publication/systematic-review-and-meta-analysis-selected-health-effects-long-term-exposure-traffic

[5]United States Environmental Protection Agency. *Fact Sheet: Transportation Pollution and Environmental Justice.* March 2022. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144Y3.pdf

[6]United States Environmental Protection Agency. Proposed Rulemaking for Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. March 2022. "... data indicate that emission levels demonstrated for certification are not achieved under the broad range of real-world operating conditions. In fact, less than ten percent of the data collected during a typical test while the vehicle is operated on the road is subject to EPA's in-use, on-the-road emission standards. These testing data further show that NOX emissions from heavy-duty diesel vehicles are high during many periods of vehicle operation that are not subject to current on-the-road emission standards." https://www.govinfo.gov/content/pkg/FR-2022-03-28/pdf/2022-04934.pdf

[7]California Air Resources Board. *2022 Proposed State Strategy for the State Implementation Plan.* August 2022. "Low mileage natural gas vehicles certified to the optional 0.02 g/bhp-hr NOx emissions standard pollute in the field more than expected..." https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf

Results

Heavy-duty trucks deliver major doses of pollution to communities throughout the United States along with their cargo. The transition to zero-emission trucks is a significant opportunity to reduce health impacts and disparities in pollution-burdened communities adjacent to major truck traffic areas. This analysis finds that the transition to zero-emission trucking in the United States will significantly reduce harm to Americans living in counties with the nation's largest trucking routes.

The shift to zero-emission trucking coupled with an increasingly clean, non-combustion energy mix will not only cut harmful air and climate pollution broadly, it will provide much-needed relief in local communities most impacted by trucking pollution, often low-income communities and communities of color. By 2050, counties with trucking routes of at least 8,500 trips per day could see the following benefits from this transition:

National Scale Benefits to Health (Cumulative: 2020-2050)			
Value of Public Health Benefits (2020-2050)	Premature Deaths Avoided	Asthma Attacks Avoided	Lost Work Days Avoided
$735 Billion	66,800	1.75 Million	8.5 Million

Driving the health benefits noted above are the major reductions in air pollutants achieved by zero-emission trucks running on a cleaner electricity system. The current range of average particle concentrations (9.14 - 9.26 micrograms per cubic meter) present in these counties is well above the most health-protective level being considered by the U.S. EPA in the ongoing reconsideration of the National Ambient Air Quality Standards for annual particle concentrations[8] (8.0 $\mu g/m^3$, the level supported by the American Lung Association and many health and medical organizations). Reducing particles and particle-forming emissions from the trucking sector will provide important improvements in local and regional particle impacts.

These benefits are calculated for the 921 U.S. counties through which pass trucking routes carrying 8,500 or more truck trips per day. These counties represent less than one-third of all US counties but are home to more than three-fourths of the nation's population. Approximately 45 percent of residents in these counties are people of color, compared with approximately 38.4 percent of the total U.S. population.[9] As noted above, the US EPA's March 2022 fact sheet on Transportation and Environmental Justice noted that the 72 million Americans living closest to freight routes – and therefore trucking exhaust – are more likely to be lower-income and people of color. Reducing the impacts of trucking emissions with zero-emission technologies must be a top priority of state and federal policies to ensure communities most impacted by air pollution today benefit from zero-emission technologies.

While not calculated in this report, zero-emission trucks will also provide health benefits to the 25% of the population that does not live in counties with high truck traffic. Pollution from heavy-duty vehicles is harmful even if it occurs from lower volumes of traffic, and combustion vehicles and trucks still contribute to the acceleration of climate change and the health impacts stemming from it. Further, much like trucks and other vehicles travel, harmful emissions can impact health and regional air quality far from the roadways and fueling sites throughout the nation.

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[8]United States Environmental Protection Agency. Final Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. May 2022 https:/www.epa.gov/system/files/documents/2022-05/Final%20Policy%20Assessment%20for%20the%20Reconsideration%20of%20the%20PM%20NAAQS_May2022_0.pdf

[9]United States Census Bureau. Race and Ethnicity in the United States: 2010 Census and 2020 Census. August 2021. https://www.census.gov/library/visualizations/interactive/race-and-ethnicity-in-the-united-state-2010-and-2020-census.html

U.S. Counties with Largest Potential Health Benefits: Cumulative Benefits (2020-2050)

County (With Major Truck Route)	Metropolitan Area (Combined Statistical Area)	Health Benefits (Billions)	Premature Deaths Avoided	Asthma Attacks Avoided	Lost Work Days Avoided
Los Angeles County, CA	Los Angeles-Long Beach, CA	$36.4	3,310	91,700	472,000
Cook County, IL	Chicago-Naperville, IL-IN-WI	$14.3	1,300	37,800	192,000
Harris County, TX	Houston-The Woodlands, TX	$12.9	1,150	56,000	242,000
Orange County, CA	Los Angeles-Long Beach, CA	$11.0	996	25,000	127,000
Palm Beach County, FL	Miami-Port St. Lucie-Fort Lauderdale, FL	$9.3	847	13,400	72,800
Miami-Dade County, FL	Miami-Port St. Lucie-Fort Lauderdale, FL	$8.9	807	18,200	101,000
Broward County, FL	Miami-Port St. Lucie-Fort Lauderdale, FL	$8.6	783	16,300	89,600
San Diego County, CA	San Diego-Chula Vista-Carlsbad, CA	$8.4	748	19,900	103,000
Maricopa County, AZ	Phoenix-Mesa, AZ	$7.6	681	21,300	101,000
Contra Costa County, CA	San Francisco-San Jose-Oakland, CA	$6.8	626	15,900	78,000
Wayne County, MI	Detroit-Warren-Ann Arbor, MI	$6.7	616	15,700	68,700
Hamilton County, OH	Cincinnati-Wilmington-Maysville, OH-KY-IN	$6.4	582	16,600	74,900
Dallas County, TX	Dallas-Fort Worth, TX	$6.2	556	23,400	104,000
Oakland County, MI	Detroit-Warren-Ann Arbor, MI	$5.2	479	8,910	46,300
Tarrant County, TX	Dallas-Fort Worth, TX	$5.2	468	17,600	77,800
Queens County, NY	New York-Newark, NY-NJ-CT-PA	$5.1	458	14,100	80,500
Cuyahoga County, OH	Cleveland-Akron-Canton, OH	$5.1	467	8,520	42,000
Kings County, NY	New York-Newark, NY-NJ-CT-PA	$5.0	445	17,400	83,600
Clark County, NV	Las Vegas-Henderson, NV	$4.9	441	9,700	52,300
Riverside County, CA	Los Angeles-Long Beach, CA	$4.9	438	13,800	62,100
Suffolk County, NY	New York-Newark, NY-NJ-CT-PA	$4.8	437	10,100	51,300
Bexar County, TX	San Antonio-New Braunfels-Pearsall, TX	$4.6	414	14,900	65,500
Alameda County, CA	San Francisco-San Jose-Oakland, CA	$4.4	393	11,500	63,700
Nassau County, NY	New York-Newark, NY-NJ-CT-PA	$4.3	395	8,230	40,700
Macomb County, MI	Detroit-Warren-Ann Arbor, MI	$4.3	395	6,650	36,000
Clermont County, OH	Cincinnati-Wilmington-Maysville, OH-KY-IN	$4.1	378	9,750	43,800
Bucks County, PA	Philadelphia-Reading-Camden, PA-NJ-DE-MD	$4.1	378	5,770	30,500
Montgomery County, PA	Philadelphia-Reading-Camden, PA-NJ-DE-MD	$4.0	363	7,730	38,900
Middlesex County, NJ	New York-Newark, NY-NJ-CT-PA	$3.9	357	9,440	49,800
Santa Clara County, CA	San Francisco-San Jose-Oakland, CA	$3.9	352	11,000	57,400
Philadelphia County, PA	Philadelphia-Reading-Camden, PA-NJ-DE-MD	$3.9	352	11,900	57,700
Erie County, NY	Buffalo-Cheektowaga-Olean, NY	$3.8	353	5,960	30,900
Hillsborough County, FL	Tampa-St. Petersburg-Clearwater, FL	$3.8	341	9,750	49,800
Will County, IL	Chicago-Naperville, IL-IN-WI	$3.8	340	8,790	41,800
Sacramento County, CA	Sacramento-Roseville, CA	$3.6	327	10,000	46,100

Policy Action to Deliver Healthier Air

Federal and State actions to accelerate the transition to zero-emission transportation and electricity will yield major public health benefits across the United States. These actions have the widespread support of the public, with over 70 percent of American voters supporting a full transition to zero-emission truck sales by 2040,[10] and are increasingly in reach thanks to major investments by public and private interests in zero-emission vehicle incentives, manufacturing and infrastructure.

> "Regulatory programs requiring manufacturers to sell increasing percentages of zero-emission trucks and buses, such as California's **Advanced Clean Trucks** (ACT) regulation, are **one of the most effective tools available to rapidly advance the market**"
>
> Northeast States Coordinated Air Use Management (NESCAUM), July 2022
> Multi-State ZEV Action Plan

U.S. EPA: Set Strong National Truck Standards

U.S EPA must finalize the strongest possible heavy-duty vehicle rules by the end of 2022 to significantly reduce smog-forming emissions and climate pollution from trucks, while also accelerating the transition to zero-emission trucks. In 2023, EPA must pivot to longer-term heavy-duty vehicle standards focused on completing the transition to zero-emission technologies to protect health against the impacts of combustion technologies.

Federal Agencies and States: Implement Infrastructure Investments

New federal laws, including the Inflation Reduction Act and the Infrastructure Investment and Jobs Act, provide incentives for the manufacture and purchase of zero-emission vehicles and for fueling infrastructure that will provide important acceleration of zero-emission truck health benefits. These initial investments must serve highly impacted communities, ensure strong emphasis on infrastructure that serves heavy-duty vehicles and ensure a robust shift to non-combustion energy generation in urban and rural settings. Ongoing public and private investment at the local, state and federal levels must follow to ensure continued development of clean vehicle and energy resources across the United States.

[10] American Lung Association. Public Opinion Poll. Seventy Percent of Voters Support Federal Action to Drive the Transition to Zero-Emission Vehicles. June 2021. https://www.lung.org/media/press-releases/seventy-percent-of-voters-support-federal-action

States: Adopt the Advanced Clean Truck (ACT) Standard

States have a clear avenue to accelerate the benefits of zero-emission trucking in communities throughout their states: adopt the Advanced Clean Truck standards, which require increasing sales of zero-emission trucks over time. Adopting regulatory programs like ACT was noted as "one of the most effective tools available" to accelerate zero-emission health benefits in the Multi-State Medium- and Heavy-Duty Action Plan issued by the Northeast States Coordinated Air Use Management (NESCAUM) in July 2022. To date, California, Massachusetts, New Jersey, New York, Oregon, and Washington have adopted the ACT standards, and a total of 17 states and the District of Columbia have signed the Multi-State Zero Emission Medium- and Heavy-Duty Vehicle Initiative - Memorandum of Understanding (MOU)[11] to better coordinate progress on zero-emission trucking. By adopting the ACT regulation, states can ensure the health benefits of zero-emission truck technologies are delivered to local communities. The table below highlights potential benefits in the MOU states and/or states that have adopted the ACT rule.

States Coordinating on ZEV Trucks: Potential Health Benefits in States with Major Trucking Routes (Cumulative 2020-2050)

State	Multi-State ZE MOU	Adopted ACT Rule	Health Benefits (Billions, 2020-2050)	Premature Deaths Avoided (2020-2050)	Asthma Attacks Avoided (2020-2050)	Lost Work Days Avoided (2020-2050)
California	•	2020	$102.7	9,300	270,546	1,320,710
Colorado	•		$5.4	485	18,520	89,000
Connecticut	•		$10.5	963	21,402	111,710
Hawaii	•		See Note Below			
Maine	•		$0.6	54	785	4,180
Maryland	•		$19.8	1,803	46,875	231,260
Massachusetts	•	2021	$11.0	1,005	22,870	126,200
New Jersey	•	2021	$26.4	2,407	58,998	302,190
New York	•	2021	$43.8	3,985	106,833	556,610
Nevada	•		$5.2	474	10,569	56,722
North Carolina	•		$18.8	1,713	45,894	225,565
Oregon	•	2021	$1.1	103	2,553	13,100
Pennsylvania	•		$49.9	4,581	88,010	432,212
Rhode Island	•		$2.3	208	4,378	23,430
Virginia	•		$14.3	1,299	36,673	183,510
Vermont	•		See Note Below			
Washington	•	2021	$2.7	239	7,152	35,682
Washington, DC	•		$1.2	114	3,980	25,600

Note: Data for Alaska and Hawaii are not presented in this report because the US EPA COBRA Model provides health outputs only for the contiguous United States. Further, this report includes only those counties home to major trucking corridors carrying a minimum of 8,500 trips per day and several states (including Vermont) are not represented.

[11] Multi-State Zero Emission Medium- and Heavy-Duty Vehicle Initiative - Memorandum of Understanding. Updated as of March 2022. https://www.nescaum.org/documents/mhdv-zev-mou-20220329.pdf

Conclusion

Major improvements in public health would result from the transition to zero-emission technologies in the transportation and electricity generation sectors. Trucks are a huge driver of air pollution, resulting in illness and premature death in communities adjacent to high truck traffic roadways who are often lower-income communities and people of color. The rapid shift to zero-emission trucks on America's roads is key to achieving pollution reductions and saving lives. State and federal actions to require cleaner, non-combustion trucks must be taken to provide major air quality, health and health equity benefits to residents across the United States. The Advanced Clean Truck rule and stronger federal actions on zero-emission trucks are immediate opportunities to secure major health and health equity benefits across the United States.

About the American Lung Association

The American Lung Association is the leading organization working to save lives by improving lung health and preventing lung disease through research, education and advocacy. The work of the American Lung Association is focused on four strategic imperatives: to defeat lung cancer; to improve the air we breathe; to reduce the burden of lung disease on individuals and their families; and to eliminate tobacco use and tobacco-related diseases. For more information about the American Lung Association, a holder of the Better Business Bureau Wise Giving Guide Seal, or to support the work it does, call 1-800-LUNGUSA (1-800-586-4872) or visit: Lung.org.