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Living and Breathing in California: Health Benefits of Clean Air Programs

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Californians have long enjoyed the benefits of strong clean air policies. Ongoing policy efforts remain critical because California is home to the most difficult air pollution burdens in the United States – over 90 percent of people live in an area impacted by unhealthy air. In recent years, the California Air Resources Board (CARB) has approved a suite of policies to cut transportation emissions, including new pollution controls for cars, trucks, ships, and other transportation sources. As these rules are implemented, they will reduce emissions and transition many sources of harmful pollution to cleaner and zero-emission technologies to protect health.

These clean air and zero-emission policies were developed to ensure California maintains progress toward meeting federal clean air standards. California has special authority, under the federal Clean Air Act, to implement stronger clean air policies due to the state's unique air quality challenges. Currently, these policies have been approved by CARB and many are in varying stages of the US Environmental Protection Agency (EPA) process to approve waivers allowing California, and other states that choose to opt in to California's standards, to implement the programs.

Recent clean air policies will generate \$200 billion in public health benefits and save over 20,000 lives in California if fully implemented over the coming decades.

Utilizing health benefits analyses conducted by CARB over the past several years for individual rulemaking processes, this report finds that these recently adopted clean air standards for transportation technologies and operations in California will collectively yield major public health benefits. When totaled, these policies are projected to yield over \$200 billion in public health benefits and save over 20,000 lives over the course of implementation, which ranges from 2020 to 2050. CARB health analyses, including methodologies, assumptions and limitations, are linked in the table at the end of this report.

Achieving these benefits from cleaner cars and trucks on California roads, along with cleaner off-road equipment like locomotives and ships calling on California ports, will take ongoing enforcement, investment, and policymaking.

Pollution Challenges Today in California

According to the 2023 “State of the Air” report, California is home to six of the top ten cities with the worst ozone (smog) in the nation, and six of the ten most impacted by annual particle pollution (soot). California communities dominate the list of metropolitan areas with the worst ozone challenges in the nation:

- Los Angeles-Long Beach (Rank: #1)
- Visalia (Rank: #2)
- Bakersfield (Rank: #3)
- Fresno-Madera-Hanford (Rank: #4)
- Sacramento-Roseville (Rank: #7)
- San Diego-Chula Vista-Carlsbad (Rank: #8)

American Lung Association. State of the Air 2023. April 2023.



98% of California residents live in communities impacted by unhealthy air, and California communities dominate the list of most polluted in the United States.

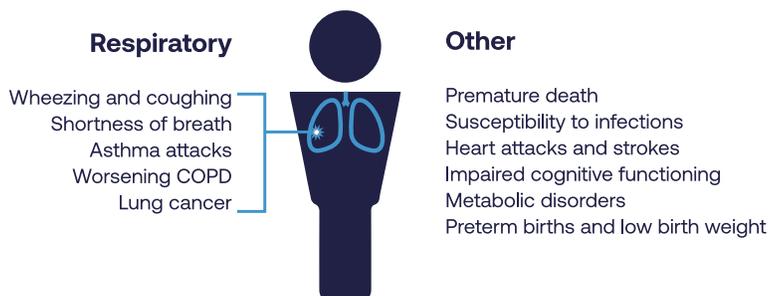
Mobile sources represent approximately 80 percent of smog-forming oxides of nitrogen (NOx) in California and roughly half of greenhouse gas emissions when accounting for transportation fuels.¹

To address these challenges, California has taken great steps to ensure real-world emission reductions and spur the transition to a zero-emission future as broadly and rapidly as possible – including cars and trucks, ports, locomotives, and small off-road equipment.

Health Impacts of Air Pollution

Air pollution impacts the health of everyone, especially seniors, children, and individuals with pre-existing conditions. People with lower incomes, and communities of color in close proximity to major pollution sources are often at higher risk of negative health outcomes due to distance and long-term exposure to the pollutants targeted by California’s clean air regulations.

Air pollution can harm children and adults in many ways



Ozone is an irritant that can react with the delicate lining of our airways, causing inflammation and damaging other body systems.² Long-term and short-term exposure to particle pollution increases the risk of heart disease, stroke, respiratory infections, and early death. These pollutants can cause respiratory and cardiovascular health emergencies and premature deaths. Breathing particle pollution can also cause lung cancer.

Of significant concern is diesel exhaust which contains multiple threats to human health – California has labeled diesel particulate matter, the byproduct from diesel combustion, as a toxic air contaminant based on its potential to cause cancer.³ The clean air policies highlighted in this report are critical to communities bearing the greatest burdens due to nearby railyards, ports, warehouses, loading docks and other high-pollution areas. These policies include reductions in asthma attacks, heart attacks and strokes, lung and other cancers and a wide range of other health emergencies and premature death.

¹California Air Resources Board. Proposed 2022 State Strategy for the State Implementation Plan. 2022 at page 69. August 2022.

²American Lung Association. State of the Air 2023: Health Impact of Air Pollution. April 2023.

³California Air Resources Board. Summary: Diesel Particulate Matter Health Impacts | California Air Resources Board



Health Benefits of California Transportation Policies

California’s clean air rules can provide important health benefits to communities most impacted by major concentrations of pollution, including railyards, ports and harbors and truck routes.

In recent years, CARB has approved clean air and zero-emission policies that will ensure emission reductions from on- and off-road engines, many of which saw implementation begin in 2024. These policies were developed over several years through various public processes, workshops, hearings and community events designed to engage stakeholders and community members. Within each rulemaking process CARB undertakes an analysis of the health benefits associated with proposed rules. These analyses include monetized health benefits in cases of avoided deaths and other negative health impacts.⁴

	Clean Air Policies (Years of Health Benefits Analysis)	Lives Saved	Start Date	Policy Description
Off-Road Policies	Commercial Harbor Craft (2023-2038)	531	2024	Ensure harbor vessels (i.e. ferries, tug boats, and sportfishing vessels) reduce particulate matter and NOx emissions.
	Ocean Going Vessels At-Berth (2021-2031)	237	2024	Shore power to reduce idling of marine engines at California ports, such as cargo and shipping vessels.
	Small Off-Road Engines (2023-2043)	887	2024	Zero-emission and cleaner combustion standards for leaf blowers, lawn mowers and other small engines.
	In-Use Off-Road Diesel-Fueled Fleets (2024-2038)	570	2024	Phases out operation of the oldest, higher emitting off-road engines for various fleets, such as agricultural and construction equipment.
	In-Use Locomotive (2020-2050)	3,233	2024	Cleaner and zero-emission operational standards for locomotives in California
On-Road Policies	Heavy-Duty Inspection and Maintenance (2023-2050)	7,600	2023	Ensure heavy-duty vehicles meet emissions control standards as condition of registration, similar to “Smog Check” program for passenger vehicles.
	Advanced Clean Trucks (2020-2040)	601	2024	Increased zero-emission sales requirements for medium- and heavy-duty trucks.
	Transport Refrigeration Units (2022-2034)	177	2023	Zero-emission transition for truck refrigeration systems.
	Advanced Clean Fleets (2024-2050)	2,526	2024	Increased incorporation of zero-emission vehicles into trucking fleets in California; zero-emission sales standard for 2036.
	Heavy-Duty Low NOx Omnibus (2024-2050)	2,480	2024	Cleaner engine standards and warranty requirements for new heavy-duty vehicles.
	Advanced Clean Cars II (2026-2040)	1,287	2026	Stronger emission standards and increasing zero-emission sales standards for passenger vehicles beginning on model year with 2026 and beyond.

Legend	Off-Road Engines and Equipment			On-Road Engines	
	Marine Engines	Off-Road Engines	Locomotive Operations	Medium- and Heavy-Duty Trucks	Passenger Vehicles

⁴CARB’s economic valuation and health numbers are based on regulatory health analysis calculations using best available tools, any uncertainties associated with those numbers are reflected in the CARB staff reports on each measure. It is important to note that CARB’s analyses are conducted on individual policy proposals and the realization of projected benefits may differ due to future amendments, acceleration or delayed compliance, or other factors impacting individual rules and/or the combined analysis presented in this report.

The full public health benefits are likely to be even greater than those noted in this report. This is especially true for communities living near polluting sources because the analyses included here do not capture the full suite of health impacts avoided, such as preterm birth, fatal and non-fatal cancers for both on and off-road engines.

CARB’s projected health benefits from these regulations cumulatively add up to over \$200 billion in monetary benefits and are estimated to save over twenty thousand lives from 2020 to 2050 (see image below). CARB’s health analyses include cases and values for premature death, hospital admissions for cardiovascular and respiratory illnesses, and emergency room visits for asthma attacks.⁵ These policies benefit all Californians from the transition to cleaner and zero-emission technologies, but especially those communities in close proximity to ports, railyards, harbors, warehouses, and major truck routes. As noted above, children, seniors, and those with pre-existing conditions are more vulnerable to the harmful effects of air pollution. Additional health benefits include reduced number of asthma attacks, heart attacks, strokes, and lost work- or school-days. These health benefits will reduce health costs and emergency room visits and can provide much-needed advancements in health equity.

⁵CARB has recently expanded their health analysis process to include a more comprehensive list of health outcomes.

Health benefits from clean air policies total over \$200 billion.

Approved CARB Regulations in Monetary Health Benefits (in Billion)



Health Benefits from Cleaning Up On-Road Pollution Sources

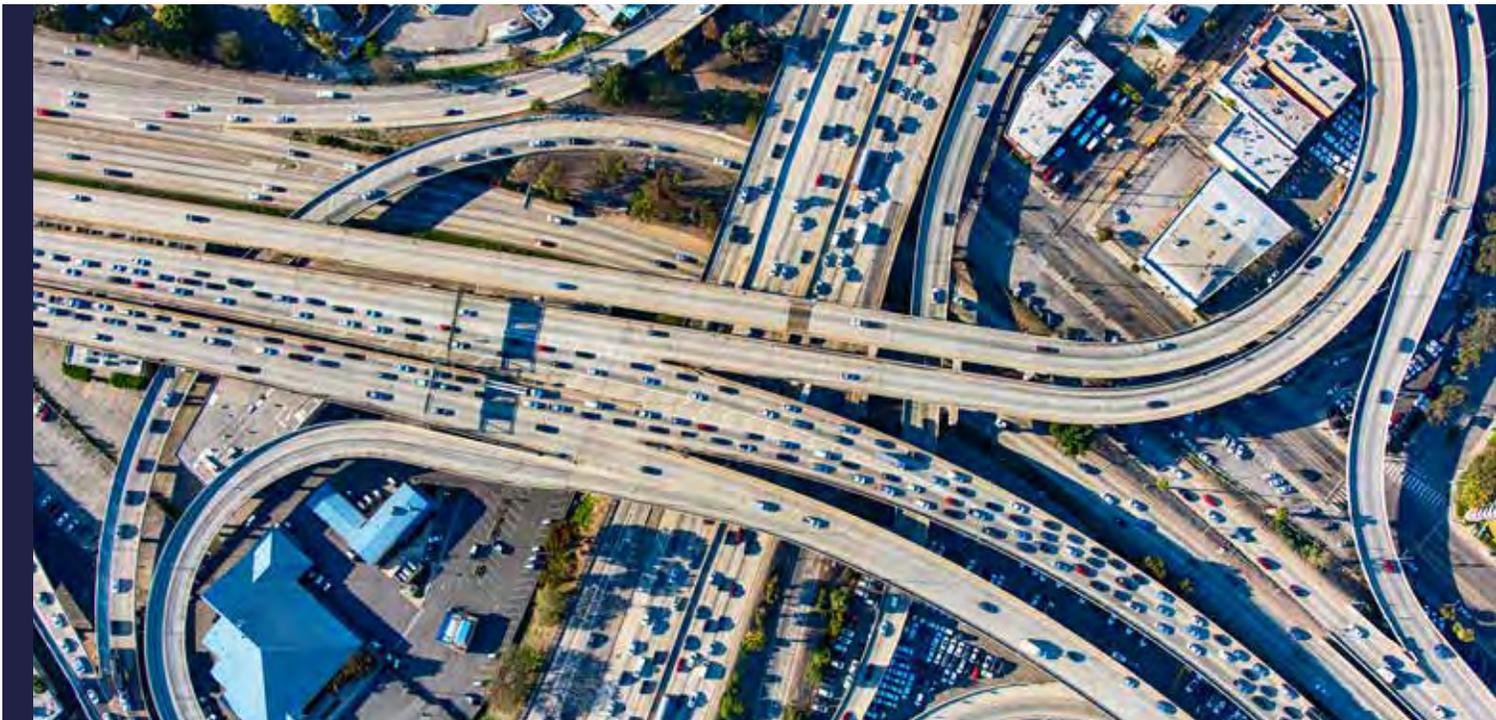
CARB's recently adopted zero-emission and cleaner technology policies for on-road engines add up to an estimated \$150 billion in health benefits and save nearly 15,000 lives by 2050. This includes the Advanced Clean Cars II, Advanced Clean Trucks, Advanced Clean Fleets, Heavy-Duty Inspection and Maintenance, Transport Refrigeration Units, Heavy-Duty Low NOx Omnibus programs.

To improve air quality and meet federal clean air standards, vehicles will have to transition to zero-emission technologies. The Lung Association's "Zeroing in on Healthy Air" report states that California could gain \$164 billion in public health benefits and save over 15,000 lives from 2020 to 2050 by transitioning to zero-emission transportation and a clean, non-combustion electric grid.⁶

Health Benefits from Cleaning Up Off-Road Pollution Sources

CARB has worked for decades to dramatically reduce emissions from on-road engines and must continue to reduce harm from off-road mobile sources. Locomotives, ships operating in California ports and harbors, lawncare and other off-road equipment play a major role in regional and community pollution exposure. Off-road emission reduction policies are estimated to provide \$54 billion in health benefits and save 5,458 lives by 2050. While off-road clean air policies generate a smaller total health benefit, these programs can deliver critical relief in highly-impacted communities.

⁶American Lung Association. Zeroing in on Healthy Air: Health and Climate Benefits of Zero-Emission Transportation and Electricity. March 2022.



In addition to cleaner engines and zero-emission technologies, California needs a more comprehensive approach to reduce transportation pollution. California policymakers must prioritize investment in healthier modes of transportation such as walking, biking, and public transit over continued highway expansion and projects that increase driving and associated pollution. Better alignment of transportation investments with clean air and climate standards is a critical avenue for meeting these challenges.

Recommendation for Action

Achieving the health benefits and lives saved projected from these policies will require strong implementation and investments at the local, state and federal levels. California must ensure that these policies are implemented on schedule and are fully enforced to ensure real-world benefits are realized. California's clean air investment programs must remain robust to deliver equitable distribution of health benefits and ensure ZEV deployments remain ahead of schedule. Critically, investments must prioritize communities most impacted by air pollution today.

Local, state and federal agencies must coordinate to approve, fund and enforce clean air rules to protect health and save lives in California.

As stronger, more health-protective air quality standards are approved by EPA and implemented across the nation, California agencies will be required to develop a plan to meet new standards through ongoing policies to control emissions from all sectors.

For California to continue efforts to meet clean air standards and move to a zero-emission future, it will take a combination of state and federal policies and investments. The policies that have been adopted thus far by CARB will need critical funding for implementation and action from EPA.

- Strong enforcement of existing clean air programs must be a priority for regulators in California to ensure real-world benefits of these programs materialize for Californians.
- EPA must approve all pending and future waivers in a timely matter for California – and other states that opt into California's more health-protective standards - to realize much needed health benefits of clean air standards.
- The governor, California state agencies, local air districts and the legislature must continue to coordinate on ensuring strong investments to accelerate fleet turnover to zero-emissions, building out critical zero-emission infrastructure and ensuring incentive programs are designed to provide a robust and equitable transition to zero-emissions as quickly as possible to meet clean air and climate standards.



- As California works to implement various policies driving cleaner and zero-emission technologies, there must be strong alignment across CARB, the California Energy Commission (CEC), and California’s transportation agencies on funding to increase charging infrastructure and ZEV incentives, while building a more sustainable and equitable transportation system overall.
 - In addition to transitioning to zero-emission vehicles, California must invest in transportation infrastructure to reduce vehicle miles travelled and promote more public transit, walking, and biking.

As new, more health-protective national air quality standards are approved by EPA, CARB will need to continue efforts to improve air quality from sources that are still increasing emissions. California has taken bold action to meet air and climate goals, and we must continue clean up the transportation sector through strong regulations, enforcement, and incentive funding opportunities to build on the state’s decades of progress toward clean, healthy air.



California Air Resources Board health analyses are included in links below.

Off-Road Engines and Equipment			On-Road Engines	
Marine Engines	Off-Road Engines	Locomotive Operations	Medium- and Heavy-Duty Trucks	Passenger Vehicles
Commercial Harbor Craft	Small Off-Road Engines	In-Use Locomotive	Advanced Clean Fleets	Advanced Clean Cars II
Ocean-Going Vessels At Berth	In-Use Off-Road Diesel-Fueled Fleets		Advanced Clean Trucks	
			Heavy-Duty Inspection and Maintenance	
			Heavy-Duty Low NOx Omnibus	
			Transportation Refrigeration Units	