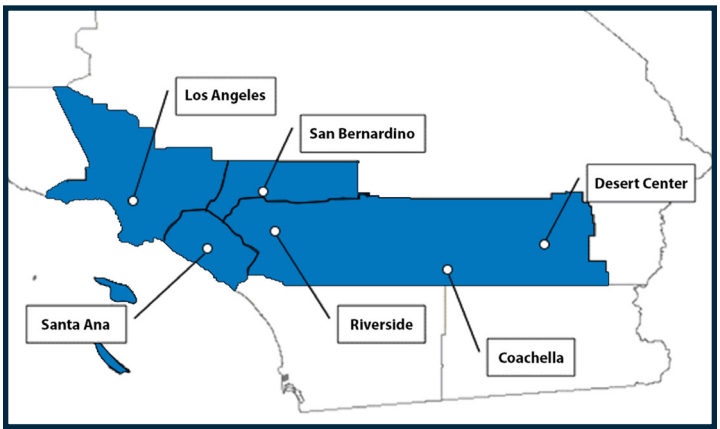
Southern California's Hidden Air Pollution Problem: Gas Furnaces & Water Heaters

The vast Southern California region encompassed by the South Coast Air Quality Management District (AQMD) suffers from some of the most polluted air in the country and has consistently failed to meet federal and state air quality standards for more than 30 years.[1, 2, 3] Under federal law, regions that fail to meet these standards must develop comprehensive plans to cut pollution.

Gas-burning equipment in residential and commercial buildings is a significant – but often overlooked – contributor to this air quality crisis. Burning gas in household appliances like furnaces and water heaters generates a range of pollutants that harm health, including nitrogen oxides (NOx) and fine particle ($PM_{2.5}$) pollution. In addition to harming health in its own right, NOx emissions from gas-burning equipment are also a precursor to ozone pollution – a major component of smog – and "secondary" $PM_{2.5}$ pollution.[4, 5] These pollutants are responsible for significant health harms including respiratory and cardiovascular diseases, cognitive impairment, and premature death, with particularly severe impacts on communities of color.

To address these significant health-harming emissions, the South Coast AQMD has proposed strengthening pollution limits for some residential and commercial HVAC and water heating equipment. These healthy air standards would ensure that when polluting equipment reaches the end of its lifespan, it is replaced with clean equipment like highly efficient electric heat pumps, which emit zero onsite pollution. These regulations would take effect in 2026 for new construction and phase in between 2028 and 2035 for existing homes and businesses.

If adopted, these health-protective standards would deliver the greatest emissions reductions of any air quality regulation the agency has issued in three decades.[6]



South Coast Air Quality Management District

The Scale of the Problem:

Methane gas-burning equipment in residential and commercial buildings in the South Coast Air Basin generates significant levels of smog and other air pollution:

- Gas-burning equipment in residential and commercial buildings produces nearly half of the health-harming NOx emissions that fall under the South Coast AQMD's direct authority and responsibility to control.[7, 8]
- Gas-burning equipment in residential and commercial buildings emits more NOx pollution than regional oil and gas production, refining, cement manufacturing, and power generation combined.[9]
- Gas-burning equipment in residential and commercial buildings releases seven times more NOx pollution than the region's power plants.[10]

- Gas-burning equipment in residential and commercial buildings releases over three times more fine particulate matter ($PM_{2.5}$) than the region's power plants.[11]
- Residential gas-burning equipment alone emits more NOx pollution than all the region's cement production and power generation combined.[12]

This pollution leads to $2 billion annually in negative health impacts like lost school days, asthma attacks, and premature deaths.[13]

The Air Quality Crisis in the South Coast

Poor air quality results in serious health impacts for more than 17 million residents of Southern California:

- The Los Angeles-Long Beach metropolitan area has ranked first in the nation for high ozone days for 24 of the last 25 years.[14]
- From 2020 to 2022, the region saw an average of 175 unhealthy ozone days each year, exceeding federal pollution limits more than one-third of the time.[15, 16]

Disadvantaged communities, specifically those with larger populations of color, suffer a disproportionate burden of this harmful pollution in the Los Angeles region:

- People of color in the Los Angeles metro area are almost twice as likely as white residents to live in an area with a high risk for respiratory illness.[17]
- Black residents in Los Angeles County seek emergency care for asthma-related health issues more than twice as often as the county average and nearly five times as often as white residents.[18]

The federal Clean Air Act requires areas that are failing to meet National Ambient Air Quality Standards (NAAQS) to develop comprehensive plans for how they will attain those pollution limits. The South Coast AQMD's most recent plan – the culmination of a multi-year public process – highlights that the "only way to achieve the required NOx reductions is through extensive use of zero emission technologies across all stationary and mobile sources."[19]

Gas-Burning Furnaces & Water Heaters Release Health-Harming Air Pollution

Burning methane gas in building equipment like furnaces and water heaters generates a range of outdoor air pollutants that harm health.

Analysis using EPA's Co-Benefits Risk Assessment (COBRA) health impacts tool demonstrates that methane gas-burning equipment in residential and commercial buildings in the South Coast Air Basin is responsible for:

- Approximately 76,000 asthma attacks per year.[20]
- About 30,000 lost school days annually.[21]
- 130 premature deaths each year.[22]
- Annual health impacts valued at $2 billion.[23]

Compounding existing environmental and social inequities, $PM_{2.5}$ pollution from residential gas combustion disproportionately harms people of color in California:

- 30% higher exposure for people of color compared to white residents.[24]
- 50% higher exposure for Black residents compared to white residents.[25]

Nitrogen oxides (NOx)	• Short-term exposure to NOx is causal of asthma attacks and long-term exposure is "likely causal" of the development of asthma.[26] • The EPA cites a causal link between short- and long-term exposure to nitrogen dioxide (NO_2, a component of NOx) and a variety of other health harms, such as heart rate variability, systemic inflammation of other organs, adverse birth outcomes, cancer, and premature death.[27, 28] • Short-term exposure to NO_2, as well as long-term exposure to low levels of NO_2, is correlated with higher overall mortality rates among older adults.[29]
Ozone	• Short-term exposure to ozone is associated with shortness of breath, wheezing and coughing, asthma attacks, increased risk of respiratory infections, increased risk of emergency room visits and hospitalizations, and premature death. • Long-term ozone exposure is associated with increased cardiovascular mortality, respiratory illnesses, metabolic disorders, nervous system issues, reproductive problems (including reduced fertility and poor birth outcomes), and cancer.
Fine Particle Pollution ($PM_{2.5}$)	• Short- and long-term exposure to $PM_{2.5}$ contributes to premature death, infant mortality, lung cancer, heart attacks and strokes, new and worsening asthma in children and adults, slowed lung development, incidence of diabetes, reduced brain volume, and increased risk of dementia, among other negative outcomes. • No safe level of $PM_{2.5}$ exposure has been identified.[30, 31]

A Critical Step Towards Healthier Air: South Coast AQMD's Proposed Rules for Furnaces & Water Heaters

Since 1978, the South Coast AQMD has limited NOx pollution from gas furnaces and water heaters through two key regulations – Rules 1111 and 1121 – with emissions declining over time.
The agency's Governing Board is proposing to strengthen these standards by lowering the permissible NOx emission limit to zero. These zero-pollution standards would ensure that when polluting equipment reaches the end of its lifespan, it is replaced with clean equipment like highly efficient electric heat pumps, which emit zero onsite pollution.

Together, these rules target more than 10 million methane-burning furnaces and water heaters.[32] Along with the zero-NOx rule the agency adopted in June 2024, covering more than 1 million pool heaters, tankless water heaters, and commercial water heaters, the AQMD's adoption of these rules will address about 75% of the NOx emissions that come from gas combustion in the region's residential and commercial buildings.[33] The remaining pollution comes from other gas appliances like stoves, ovens, dryers, and commercial cooking equipment, which are not in the scope of the proposed rule updates.

Proposed Updates to Rule 1111 - Furnaces

- Scope: Affects 5.35 million residential and commercial furnaces up to 2 million Btu/hr
- Zero-NOx Compliance Timeline:
  - 2026: New construction
  - 2029: Most existing homes and some commercial buildings
  - 2030: Existing mobile homes
  - 2035: High-altitude – existing homes and some commercial buildings
  - 2035: Existing homes without AC – or AC under 10 years old
- Extensions when electrical upgrades or other construction necessary to comply, with added flexibility for multifamily properties
- Exemption for master-metered mobile homes

Proposed Updates to Rule 1121 - Water Heaters

- Scope: Affects 5.13 million residential water heaters up to 75,000 Btu/hr
- Zero-NOx Compliance Timeline:
  - 2026: New construction
  - 2028: Most existing homes
  - 2030: Existing mobile homes
  - 2035: High-altitude – existing homes
- Extensions when electrical upgrades or other construction necessary to comply, with added flexibility for multifamily properties
- Exemption for master-metered mobile homes

Clean Technology Solutions

What Is a Heat Pump?

A heat pump is like a super-efficient air conditioner that can run in reverse, so it is able to both cool and heat buildings. Instead of burning fuel like a methane gas furnace, it moves heat from one place to another using electricity. In winter, an air-source heat pump extracts heat from the outside air and moves it inside your home, even in below-freezing temperatures.[45] In summer, it works like a highly efficient air conditioner. Ground-source heat pumps use the relatively stable temperature of the ground or groundwater as a heat source in the winter and a heat sink in the summer and provide the most efficient form of heating available today. Whatever the source of heat, because heat pumps move heat rather than generate it, they are two to four times more efficient than traditional gas furnaces.[46]

What Is a Heat Pump Water Heater?

A heat pump water heater uses the same technology to heat water for your home. Rather than burning methane gas, it pulls heat from the surrounding air and transfers it into the water in the tank, saving energy by being much more efficient.

National Context: South Coast AQMD Is Not Acting Alone

The federal Clean Air Act grants states broad authority to identify and enact regulations that limit pollution from stationary sources. Several states have already exercised this authority to limit pollution from space and water heaters. For example, Texas adopted a low-NOx standard requiring some space and water heating equipment over two decades ago – a regulation that limits but does not fully exclude NOx pollution from heating equipment.[34] Other states and the South Coast AQMD have taken similar action.

The South Coast AQMD's proposed healthy air standards for furnaces and water heaters align with a growing national trend to strengthen these standards as states and regions across the country take decisive action to further address air pollution and greenhouse gas emissions from buildings.

- The Bay Area Air Quality Management District adopted the nation's first zero-pollution standard for space and water heating in 2023.[35] This standard will prevent 15,000 asthma attacks and up to 85 premature deaths every year.[36]
- California commited to zero-pollution space and water heater standards by 2030 in its 2022 plan for meeting federal air quality standards.[37, 38] In May of 2023, the California Air Resources Board kicked off development of statewide zero-emission standards.[39]
- Maryland is developing statewide zero-pollution HVAC and water heating standards as well. Regulators are expected to introduce the draft rules in early 2025.[40]
- Eight additional states – Connecticut, Hawaii, Massachusetts, New York, Oregon, Pennsylvania, Rhode Island, and Washington – joined California and Maryland in committing in 2023 to explore the adoption of zero-emission standards for

space and water heating equipment, and all are participating in an Equipment Emissions Standards Cohort co-convened by NESCAUM and the U.S. Climate Alliance.[41, 42]

- Building on this commitment, nine states – California, Colorado, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, and Rhode Island – plus DC signed an agreement in February 2024 to ensure at least 65% of collective sales of residential HVAC and water heating equipment are heat pumps by 2030 – and 90% by 2040.[43]
- NESCAUM has now published a model rule that sets zero-emission standards for furnaces and water heaters, which states may use to accelerate achievement of their heat pump goals.[44]

A Cleaner, Healthier Future for the South Coast

These new standards represent a crucial step toward cleaner air in Southern California. These healthy air standards will be the largest single pollution reduction the agency has completed in three decades. By transitioning from methane gas equipment to efficient, clean technologies like heat pumps, the South Coast region can significantly improve health outcomes for all residents, especially in its most vulnerable communities.

Endnotes

1 U.S. Environmental Protection Agency (EPA), "Criteria Pollutant Nonattainment Summary Report," October 2024.

2 EPA, "California Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants," October 2024.

3 California Air Resources Board (CARB), "Ambient Air Quality Standards Designation Tool."

4 American Lung Association (ALA), "Ozone."

5 CARB, "Inhalable Particulate Matter and Health (PM2.5 and PM10)."

6 Based on a review of South Coast Air Quality Management District rules adopted since the RECLAIM (Regional Clean Air Incentives Market) rules (Regulation XX) in October 1993.

7 The South Coast Air Quality Management District includes large portions of Los Angeles, Orange, Riverside, and San Bernardino Counties. While approximately 5% of the four-county population resides in other Air Districts, full county data are used throughout this document.

8 South Coast Air Quality Management District (SCAQMD), *2022 Air Quality Management Plan*, December 2022 (Figs. 3-3 and 3-4, Table III-1-7).

9 EPA, 2020 National Emissions Inventory, March 2023. Appliance emission estimates include residential & commercial emissions for the gas, oil, & other fuel categories, with commercial emissions adjusted to exclude certain non-appliance sources.

10 Ibid.

11 Ibid.

12 Ibid.

13 EPA, CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA), June 2024. Analysis used commercial and residential gas subsectors.

14 ALA, "State of the Air 2024: Key Findings."

15 ALA, "State of the Air 2024: Ozone Pollution Trends."

16 SCAQMD, "Historical Data By Year," 2024.

17 ABC7/KABC (Ashley Mackey and Grace Manthey), "Neighborhoods of color east of LAX have some of the highest health risks, data shows," October 2021.

18 Jason A. Douglas et al., "Ecological determinants of respiratory health: Examining associations between asthma emergency department visits, diesel particulate matter, and public parks and open space in Los Angeles, California," *Preventive Medicine Reports* 14:100855, June 2019.

19 SCAQMD, *2022 Air Quality Management Plan*, December 2022 (Executive Summary).

20 EPA, CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA), June 2024. Analysis used commercial and residential gas subsectors.

21 Ibid.

22 Ibid.

23 Ibid.

24 Christopher W. Tessum et al., "$PM_{2.5}$ polluters disproportionately and systemically affect people of color in the United States," *Science Advances* 7(18), April 2021 (Supplementary Data File S2).

25 Ibid.

26 EPA, *Integrated Science Assessment (ISA) for Oxides of Nitrogen – Health Criteria*, January 2016.

27 Ibid.

28 Health Canada, *Human Health Risk Assessment for Ambient Nitrogen Dioxide*, May 2016.

29 Yaoyao Qian et al., "Long-Term Exposure to Low-Level NO^2 and Mortality Among the Elderly Population in the Southeastern United States," *Environmental Health Perspectives* 129(12):127009, December 2021.

30 Yuantong Sun et al., "Short term exposure to low level ambient fine particulate matter and natural cause, cardiovascular, and respiratory morbidity among US adults with health insurance: case time series study," *BMJ* 2024;384:e076322, February 2024.

31 Yaguang Wei et al., "Exposure-response associations between chronic exposure to fine particulate matter and risks of hospital admission for major cardiovascular diseases: population based cohort study," *BMJ* 2024;384:e076939, February 2024.

32 SCAQMD, *Preliminary Draft Staff Report for: Proposed Amended Rule 1111 & Proposed Amended Rule 1121*, September 2024.

33 SCAQMD, *2022 Air Quality Management Plan*, December 2022 (Table III-1-7).

34 Texas Commission on Environmental Quality, *Chapter 117 - Control of Air Pollution from Nitrogen Compounds: Rule Project Number 2004-076-117-AI*, August 2004.

35 Bay Area Air Quality Management District (BAAQMD), "Rules 9-4 and 9-6 Building Appliances."

36 BAAQMD, *Final Staff Report: Proposed Amendments to Building Appliance Rules – Regulation 9, Rule 4 and Rule 6*, March 2023.

37 CARB, *2022 State Strategy for the State Implementation Plan*, September 2022.

38 NPR (Caleigh Wells), "California plans to phase out new gas heaters by 2030," September 2022.

39 CARB, "Zero-Emission Space and Water Heater Standards."

40 Maryland Department of the Environment, "Clean Heat Rules."

41 U.S. Climate Alliance, "U.S. Climate Alliance Announces New Commitments to Decarbonize Buildings Across America, Quadruple Heat Pump Installations by 2030," September 2023.

42 NESCAUM, "Zero-Emission Heating Equipment Standards."

43 NESCAUM, "Building Electrification."

44 NESCAUM, "Zero-Emission Heating Equipment Standards."

45 RMI, "Heat Pumps: A Practical Solution for Cold Climates," December 2020.

46 RMI, "Clean Energy 101: Heat Pumps," July 2022.