The Air We Breathe, Part 4

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1. Introduction

This is a needed update of Parts 1 through 3 of this series that was originally posted in late 2022. This update was triggered by an editorial in the March 7 issue of Science Magazine. The article dealt with the shortcomings in the US Air Quality Index (AQI) a standard that is used world-wide to measure air quality.

As I normally do, when considering a potential new paper, I spent a few hours researching this subject. I started by reading the Science Editorial sited in the above paragraph, and found it detailed and impressive. Also, it's two authors have impressive credentials: one (Kimberly Prather) is a professor at Scripps Institution of Oceanography with a joint appointment in the Department of Chemistry and Biochemistry at the University of California San Diego, and the other (Kelley Barsanti) a scientist in the Atmospheric Chemistry Observations and Modeling Laboratory at the NSF National Center for Atmospheric Research, Boulder, CO.

In doing additional research on-line, I found several interesting recent developments:

- The previous (Biden) administration was attempting update the current AQI
- The current (Trump) administration was attempting to make the current AQI "more flexible" by:
    - *Reconsideration of regulations on power plants (Clean Power Plan 2.0)*
    - *Reconsideration of regulations throttling the oil and gas industry*
    - *Reconsideration of Mercury and Air Toxics Standards that improperly targeted coal-fired power plants (MATS)*
    - *Reconsideration of mandatory Greenhouse Gas Reporting Program that imposed significant costs on the American energy supply (GHG Reporting Program)*
    - *Reconsideration of limitations, guidelines and standards (ELG) for the Steam Electric Power Generating Industry to ensure low-cost electricity while protecting water resources (Steam Electric ELG)*
    - *Reconsideration of wastewater regulations for oil and gas development to help unleash American energy (Oil and Gas ELG)*
    - *Reconsideration of Biden-Harris Administration Risk Management Program rule that made America's oil and natural gas refineries and chemical facilities less safe (Risk Management Program Rule)…*[1]

    In other words, "a death by a thousand cuts."

    Your author didn't faint dead away, when I saw the above.

[1] EPA Press Office, "EPA Launches Biggest Deregulatory Action in U.S. History," March 12, 2025, https://www.epa.gov/newsreleases/epa-launches-biggest-deregulatory-action-us-history

Fortunately, I live in California where we have the power to set our own air quality standards (at least for the moment). However, the future updated Air Quality Index will probably have a new acronym: CAQI.

1.1. Prior Parts of The Air We Breathe

Below are summaries and links for this subsection. Part 1 preceded the other two parts by about a month, so it has a separate summary.

The Air We Breathe: *I have said in the past that energy and water are tightly linked. Energy is required to process water, pump water and otherwise make it suitable for use. Also, guess which sector is the largest user of water? The power sector.*

But this post is not about water, it is about an even more important resource for energy, as well as every living thing on our planet. The title of this post might help you guess what this resource is.

My home state (California) has an interesting relationship with air. We have more vehicles than any other state, and also drive more miles. Many of these miles are driven in very long daily commutes in four of the largest metropolitan areas in the US.[2] *Our air quality problems date back to the 1950s. Since then, we have had the most aggressive pollution control measures in the U.S. In fact, in recent years a group of states with similar issues have adopted our solutions. One other thing, the governmental body that defines the rules to remedy our air quality issues is the California Air Resources Board (CARB).*

This post is about current and future CARB rules, especially as they impact various energy users.

https://energycentral.com/c/cp/air-we-breathe

The Air We Breathe, Parts 2 & 3: *The impacts of climate change are no longer a distant threat on the horizon—they are right here, right now, with a growing intensity that is adversely affecting our communities and our environment, here in California and across the globe. The science that, decades ago, predicted the impacts we are currently experiencing is even stronger today and unambiguously tells us what we must do to limit irreversible damage: we must act with renewed commitment and focus to do more and do it sooner…*

In mid-November I came across a just-released scoping plan by CARB which was very good and thorough. It also clearly defined how CARB will lead us (California) to Carbon Neutrality by 2045. As I got well into the source document (and this paper) I looked at my word-count and saw I was well over my preferred length, and not near covering all of the plan that I needed to, thus this paper is now parts 2-and 3.

This paper is a summary of CARB's Scoping Plan. Part 2 of this paper describes

- High level goals of California's greenhouse gas (GHG) reduction efforts, and methods we intend to use to achieve these goals:
- The severity of climate change impacts

[2] Los Angeles Metropolitan Statistical Area (MSA) at population appx. 20 million (2nd largest); SF Bay Area ECSA (4th largest), 9.2 million pop; San Diego MSA (18th largest), 3.3 million pop; Sacramento-Roseville MSA, (27th largest), 2.5 million pop.

- Innovative steps we intend to take to control GHG

Part 3 of this paper (posted two days after Part 2) describes:

- *Scenarios used to develop this plan*
- *Action Plans for each Sector in the Scoping Plan Scenario*
- *Carbon Removal and Sequestration Methods and Roles*

https://energycentral.com/c/ec/air-we-breathe-part-2
https://energycentral.com/c/ec/air-we-breathe-part-3

2. Issues with the Current AQI

As I mentioned in the Intro, the editorial in Science was very good, so we will start there.

2.1. Is the Air We Breathe Safe?

Is the air we breathe safe? This seemingly straightforward question is often unanswerable because regulations, monitoring approaches, and reporting structures cannot keep up with the rapid human-induced shifts to the planet and atmosphere. The air is becoming more burdened by pollutants from new sources such as intense fires at the wildland-urban interface, an ever-expanding area where human development meets natural habitats. Air pollution is the second leading cause of human death worldwide, a statistic that excludes numerous indoor and acute outdoor exposures. To protect public health everywhere, air quality standards must be modernized, advanced instrumentation mobilized, and collaborative networks established to move air quality assessment into the 21st century.[3]

A major challenge is updating the Air Quality Index (AQI). The AQI was developed by the United States Environmental Protection Agency and is a key global metric for communicating air quality. However, it only accounts for a handful of pollutants targeted in the 1970s, leaving out thousands of more recently identified like volatile organic compounds and other airborne toxins that originate from contemporary building materials, industrial processes & accidents, and urban fires. This includes the burning of homes, cars, plastics, batteries, and other matter at burgeoning urban-wild-land boundaries. Consider the 2025 fires in Los Angeles, California, where AQI readings reported "good" air quality once visible smoke blew offshore. This misleadingly suggested that the air was safe even though invisible toxins were still being released. In its current form, the AQI cannot accurately convey the toxins released from urban fires.

Airborne bioparticles, such as bacteria, fungi, and viruses, also affect human health, yet remain understudied. Although respiratory viruses such as influenza and severe acute respiratory syndrome coronavirus 2 have drawn attention, other microbes—particularly those released outdoors by fires—are often overlooked. Inconsistent sampling and analysis protocols make it difficult to compare their prevalence over time and space and to assess overall health impacts. A coordinated global mapping system that draws on contributions from government, academic, private, and community scientists could merge bioparticle and chemical pollutant data from a given location with a time-linked event map. This would provide a comprehensive view of atmospheric composition and air quality and substantially improve predictive models.

[3] Kimberly Prather and Kelley Barsanti, Science Magazine, "Is the Air We Breathe Safe?" March 7, 2025, https://www.science.org/doi/10.1126/science.adx1128

Existing air quality metrics, monitoring networks, and pollutant databases are insufficient to quantify the extent to which urban fires increase harmful air pollutants. Furthermore, standards for human exposures based on the effects of a growing multitude of air pollutants on health are needed. The gap between research and regulations is reminiscent of the aftermath of 9/11, when first responders were wrongly assured of safe air, only to face serious health issues later. Sadly, responses to episodic and evolving air pollution threats remain inadequate.

Although indoor air pollutants pose health risks – particularly in urban settings where people spend about 90% of their time indoors – the problem is more manageable with specialized filters for fine particles and activated carbon filters for harmful gases. Such interventions are inexpensive and can reduce daily exposure, but are unfortunately limited to major pollution events such as wildfires. Increasing accessibility to these filtration methods for indoor air management would substantially improve global public health.

Meanwhile, although technology exists to characterize air pollutants, epidemiological studies are hindered by fragmented data collection methods, inconsistent analysis protocols, and siloed data storage. Transformative progress requires coordinated measurement efforts, standardized protocols, and open-access global frameworks that link pollutant levels with location-specific variables. By integrating meteorological data, health data, computational systems biology, and artificial intelligence into a global mapping system, baselines can be established, anomalies identified, and the pollutant mixtures posing great risks to health identified.

People everywhere face air quality challenges that demand equitable solutions. In the United States, concern over air pollutants is surging at a moment when federal support for environmental protections is under threat. Yet, with adequate funding from diverse sources, scientists can tackle this solvable problem. By harnessing existing technologies, developing a global mapping system, forming strong inclusive partnerships, and establishing health-based metrics for emerging airborne pollutants, the ubiquitous and challenging question of whether the air is safe to breathe could well be answered.

3. Specific Regulatory Requirements

Your author will attempt to parse out some specific requirements from the above text, and research any existing regulations that might apply. I expect there may be some state regulation that are applicable, and I will look at my state (California) for examples of these, as my state's government is probably the most aggressive when it comes to air quality requirements.

3.1. Indoor Air

Let's start with the largest category of air quality not covered by the AQI, indoor air:

The U.S. Air Quality Index (AQI) is EPA's tool for communicating about outdoor air quality and health.[4]

[4] AirNow.gov - Home of the U.S. Air Quality, Air Quality Index (AQI) Basics, https://www.airnow.gov/aqi/aqi-basics/

The good news is that the EPA actually has an indoor air quality site,[5] and acronym (IAQ). I spent some time on the site, and could not find any regulations, just information. The good news is, it had information on state agencies, which led me to the California agencies (eventually).

Once I reached the right California Agencies, I spent an hour or two exploring, and found not a trace of regulations. The good news is that they produced a comprehensive report. The bad news is that the report was published in 2005. The abstract for this report is below with a reference linking the whole report.

Indoor air pollution causes significant health effects – including respiratory illness and disease, asthma attacks, cancer, and premature death. This costs Californians at least $45 billion each year. These impacts are avoidable: preventive measures and alternatives are available, many at little added cost. Many agencies, professional groups, and organizations have taken actions to reduce indoor pollution, but these have been limited and are not sufficiently effective in preventing indoor air pollution.[6]

The other good news is that it has a section called "EXISTING REGULATIONS, GUIDELINES AND PRACTICES." There are some excerpts from this below.

Despite the significant health effects and potential economic impacts caused by indoor sources of pollution, there are few government standards restricting emissions from common sources of indoor pollutants, and there is no comprehensive program to protect air quality within residences, schools, or public and private buildings. A variety of agencies and organizations have established standards and guidelines that can be applied to limited aspects of indoor environments to assist in the assessment and control of health hazards from air pollutants. Foremost among these are workplace standards; however, those standards are designed for 8-hour exposures of healthy adults, are not as protective as standards set for ambient air, and are not designed to protect the more sensitive subgroups of the population, such as children. Other standards are applicable to indoor air quality, but only in a limited way. For example, ambient (outdoor) *air quality standards and emission control regulations indirectly improve IAQ by improving ambient air quality, and California Assembly Bill 13 (1995) prohibits cigarette smoking in workplaces. Many of these programs have resulted directly or indirectly in improvements in indoor air quality, but they are not adequate to ensure healthful indoor air quality.*

Workplace Standards. *The California Occupational Safety and Health Program (Cal/OSHA) in the Department of Industrial Relations (DIR) has authority to develop, promulgate, and enforce air pollutant exposure limits, ventilation regulations, and other standards for the workplace that directly impact indoor air quality. The California Occupational Safety and Health Standards Board is the unit within the Cal/OSHA program with authority to adopt standards and regulations to protect workers. Some of the Cal/OSHA standards and regulations that impact indoor air quality are the following:*

- *Permissible Exposure Limits. The Standards Board sets permissible exposure limits (PELs) and other limits for airborne contaminants. The PELs are 8-hour exposure limits generally protective of the health of most workers. However, they are not designed to protect vulnerable members of the population such as infants, the elderly, or individuals with pre-existing heart or respiratory disease.*

[5] https://www.epa.gov/indoor-air-quality-iaq

[6] Report to the California Legislature, Indoor Air Pollution in California, https://ww2.arb.ca.gov/sites/default/files/2020-05/rpt0705.pdf

Additionally, they are not intended to be protective for exposures greater than eight hours per day, five days a week, and PELs are not available for all indoor air contaminants.

- *Ventilation. Cal/OSHA requires employers to maintain and operate mechanical ventilation systems to provide at least the quantity of outdoor air required by the State Building Code at the time the building permit was issued.*
- *Mold, moisture. Cal/OSHA requires that workplaces be maintained in a sanitary condition, and that employers correct all types of water intrusion or leakage, to reduce the potential for mold growth.*

Ventilation design requirements. *Minimum ventilation levels for the design quantity of outdoor air in new non-residential buildings, such as offices and public buildings, have been established by the California Energy Commission for different types of buildings and different types of rooms (e.g., conference rooms vs. offices). The Commission also sets energy efficiency standards for residences, which has resulted in reduced infiltration of outdoor air, or "tightening" of new homes compared to older homes. This has implications for indoor air quality, and the Commission is funding research to assess the need for revisions to the standard to assure healthful indoor air quality in homes.*

Anti-smoking law. *Cigarette smoking, a major source of indoor pollution, is prohibited in nearly all public buildings in California. A statewide, smoke-free workplace law passed in 1995 (AB 13) eliminated smoking in nearly all California indoor workplaces–including restaurants, bars and gaming clubs–and spurred a reduction in smoking by the California population. The ban has been very successful in reducing worker exposure to cigarette smoke. In 1999, 93 percent of California's indoor workers reported working in a smoke-free environment, compared to only 35 percent in 1990 (Gilpin et al., 2001). The prohibition of workplace smoking, along with the Department of Health Services Tobacco Control Program, have both had far reaching benefits. In 1994, 63 percent of Californians with children did not allow smoking in the house; by 2003, 77.5 percent did not allow it (DHS, 2004b). Additionally, smoking rates among California adults declined from 26 percent to 17 percent between 1984 and 2001 (BRFSS, 2001).*

State and national ambient air quality standards (AAQS) *and control programs, established by The California Air Resources Board (CARB) and U.S. EPA, respectively, are developed to protect the general public from the harmful effects of "traditional pollutants" in outdoor air, for specified averaging times (exposure times). California's AAQS are often more protective than the national AAQS. Currently, the State AAQS are under review to ensure that they are protective of sensitive populations, especially infants and children (ARB/OEHHA, 2000). In the absence of indoor air quality standards or guidelines, the AAQS serve as useful guideline levels for those pollutants indoors, because they are based on specified averaging times and incorporate a margin of safety. Both the California and federal AAQS are listed at:*

http://www.arb.ca.gov/research/aaqs/aaqs.htm

Consumer product standards. *The federal Consumer Product Safety Commission (CPSC) has jurisdiction over consumer products, except for pesticides, cosmetics, tobacco and cigarettes, food, drugs, automobiles, and a few others. CPSC has authority to ban a product, establish mandatory safety standards, recall products for repair or replacement, require warning labels, or develop voluntary standards in conjunction with manufacturers. However, CPSC is primarily focused on addressing safety issues, and most often uses voluntary processes and labeling requirements.*

CARB also regulates consumer products, for the purpose of reducing smog in California. An additional benefit is a reduction in the amount of certain types of Volatile Organic Compounds (VOCs) that are released in homes and institutions. In addition to reducing the reactive VOC content of products, ARB has prohibited the use of several toxic air contaminants in 13 categories of products, resulting in reduced indoor emissions of those substances. Reducing reactive VOC emissions and toxic pollutants from cleaning compounds, polishes, floor finishes, cosmetics, personal care products, disinfectants, aerosol paints, and automotive specialty products has likely reduced personal exposures to those VOCs as well.

Pesticides. *The U.S. EPA, the California Department of Pesticide Regulation (DPR), and county agricultural commissioners all have a role in regulating pesticides in California. The U.S. EPA registers, or licenses, pesticides, ensuring that the pesticide, when used according to label directions, can be used with a reasonable certainty of no harm to human health and without posing unreasonable risks to the environment. DPR provides for the proper, safe, and efficient use of pesticides, and for protection of the environment and health. To accomplish this, DPR has its own registration program and requirements, above those required by EPA. DPR continues to evaluate pesticides once they are registered, through programs to assess worker safety, water and air contamination, and pest management alternatives. DPR's pest management program promotes integrated pest management (IPM), which is the use of preventive measures, and the use of least toxic pesticides when pesticides are needed. California's county agricultural commissioners enforce pesticide laws and regulations at the local level: they issue/deny permits for restricted materials, taking into account local circumstances, and may include additional conditions on the permit. They also certify private applicators, conduct inspections, provide training, and are responsible for investigating pesticide-related illnesses and damage.*

Local woodburning ordinances. *Several communities in California have implemented woodburning ordinances or policies to reduce smoke emissions in their communities. For example, in the San Francisco Bay area, 24 cities have ordinances that prohibit conventional fireplaces in new construction. The mountain town of Truckee has a more aggressive policy that states that existing unapproved wood burning appliances were to be removed from all properties by July 15, 2006. The San Joaquin Valley Air Pollution Control District issues daily advisories on restrictions for residential wood burning.*

The Bay Area Air Quality Management District also has a rule that prohibits wood-burning during most Spare-the-Air Alerts. For additional information on this go to the sites linked below.

https://www.sparetheair.org/understanding-air-quality/wood-burning-rule

https://www.sparetheair.org/en/about/what-is-spare-the-air

https://www.familyhandyman.com/article/is-my-fireplace-illegal/

4. California's Nature Based Solutions

California is setting 81 targets to use millions of acres to help absorb more carbon emissions – a first for the state and among the most comprehensive in the world.[7]

As called for by Governor Gavin Newsom's California Climate Commitment, the state unveiled 81 targets for nature-based solutions today that will help California achieve its world-leading climate goals, including reaching carbon neutrality by 2045.

Nature-based solutions support the ability of lands to absorb more carbon than they release – a critical tool in the state's climate arsenal. Since 2020, the Newsom Administration has invested approximately $9.6 billion in nature-based solutions that combat the effects of climate change.

[7] Governor Gavin Newsom, California Climate Commitment, "With Historic Targets, California Will Use Millions of Acres of Land to Fight the Climate Crisis," April 22, 2024, https://www.gov.ca.gov/2024/04/22/with-historic-targets-california-will-use-millions-of-acres-of-land-to-fight-the-climate-crisis/

4.1. What the Targets Call For by 2045

California is taking unprecedented action to strategically harness the equivalent of more than half of its land to fight the climate crisis.

- *33.5 million acres managed to reduce wildfire risk, mostly through beneficial fire (controlled burns)*
- *11.9 million acres of forest managed for biodiversity protection, carbon storage, and water supply protection*
- *7.6 million acres conserved with protections*
- *3.4 million acres of croplands managed to boost healthy soils, drought resilience, and below-ground biodiversity*
- *4.2 million trees planted to protect California communities from the climate crisis, remove carbon and increase access to nature where it's needed most*
- *2.7 million acres of shrublands and chaparral managed for carbon storage, resilience, and habitat connectivity*
- *1.6 million acres of grasslands managed to restore native grasslands and protect biodiversity*
- *1.5 million acres of sparsely vegetated lands (deserts, beaches, etc.) to protect fragile ecosystems*

4.2. Why California is Setting These Targets:

For the first time, California's 2022 Scoping Plan analyzed the amount of greenhouse gas (GHG) emissions produced and absorbed by California's lands and found that California's lands currently emit more than they absorb.

The 2022 Scoping Plan set a numeric goal for California's lands to contribute as much as possible to achieving carbon neutrality by 2045: no more than 4% additional carbon stock losses below 2014 levels from California's lands by 2045.

This shift from carbon sink to carbon emitter is largely due to historic land use decisions, including disconnection from beneficial land management practices utilized by California Native American tribes, and the accelerating impacts of climate change.

Modeling suggests that aggressive near-term efforts to increase climate action on California's lands will put this sector on the path to course correction.