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UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

ALLIANCE OF NURSES FOR HEALTHY ENVIRONMENTS, *et al*., *Plaintiffs*, v. LEE M. ZELDIN, in his official capacity as Administrator of the United States Environmental Protection Agency, *Defendant*.	Case No. 3:26-cv-03118-TSH Judge Thomas S. Hixson

EXHIBIT 13

DECLARATION OF VIJAY LIMAYE

I, VIJAY LIMAYE, do hereby affirm and state:

1. I make the following declaration from personal knowledge, information, and belief, and if called to testify, I could competently testify thereto.

2. I am a climate and health scientist at the Natural Resources Defense Council (NRDC). I have worked at NRDC for 8 years. Among NRDC's priorities is protecting public health from the substantial adverse health effects caused by exposure to air pollutants.

3. I received my Ph.D. in Environmental Epidemiology from the University of Wisconsin-Madison's Department of Population Health Sciences and the Nelson Institute for Environmental Studies in 2015.

4. I previously served as a Physical Scientist at the U.S. Environmental Protection Agency (EPA) from 2015 to 2017, working in EPA Regions 5 and 9, focusing on Clean Air Act regulatory implementation, air quality monitoring policy and data analysis using EPA's Air Quality System, and health risk communication. During my time at EPA, I contributed as an author to the 2019 Integrated Science Assessment for Particulate Matter.

5. I also have extensive experience with EPA's Benefits Mapping and Analysis Program (BenMAP), which is a modeling software used by EPA in regulatory impact analyses to estimate the health harms and health-related economic costs of fine particulate matter, or PM2.5, air pollution and other criteria air pollutants and environmental hazards. *See* Vijay Limaye *et al.*, *Climate Change and Heat-Related Excess Mortality in the Eastern USA*, 15 ECOHEALTH 485, 485-96 (2018); Vijay Limaye *et al.*, *Air quality and health co-benefits of climate change mitigation and adaptation actions by 2030: an interdisciplinary modeling study in Ahmedabad, India*, 12 ENV'T RSCH. HEALTH 1 (2023).

6. I have published several articles relating to the health implications of air pollution and climate change, including an article estimating the future health burden of PM2.5, in the U.S. *See* David W. Abel *et al.*, *Air-quality-related health impacts from climate change and from adaptation of cooling demand for buildings in the eastern United States: An interdisciplinary modeling study*, PLOS MED. (2018).

7. I have also contributed to NRDC's public comment letters relating to the National Ambient Air Quality Standards for Particulate Matter, and I serve as an expert peer reviewer for scientific journals and have reviewed other scientific studies on this topic. These experiences provide me with ongoing familiarity with the up-to-date science on PM2.5 risks and the growing list of health harms associated with both short- and long-term PM2.5 exposure in the United States.

The 2024 PM2.5 Standards

8. In 2024, EPA strengthened the health-based National Ambient Air Quality Standards for Particulate Matter (PM NAAQS), lowering the primary annual standard for fine particulate matter (PM2.5) from a level of 12 micrograms per cubic meter to 9 micrograms per cubic meter. 89 Fed. Reg. 16,202 (Mar. 6, 2024). The update of the PM2.5 standards was based on EPA's recognition that exposure to PM2.5 has significant health impacts at concentrations allowed by EPA's previous standard set in 2012, and that a strengthened standard was necessary to protect the public health with an adequate margin of safety. *Id.* at 16,204 ("Based on the current evidence and quantitative information, as well as consideration of CASAC advice and public comments, the Administrator concludes that the current primary annual PM2.5 standard is not adequate to protect public health with an adequate margin of safety.").

9. Moreover, the record for the 2024 rulemaking, along with subsequent scientific studies, demonstrates that health effects can occur at much lower levels than the 2012 standards—and even at levels lower than the 2024 standards—especially in sensitive populations. *Id.* at 16,234-35. For that reason, EPA's independent Clean Air Scientific Advisory Committee (CASAC) unanimously concluded that the previous annual standard of 12.0 $\mu g/m^3$ was "not sufficiently protective of public health," *id.* at 16,253, 16,275, with the majority of the committee further recommending that the agency establish the standard's level between 8 and 10 micrograms per cubic meter. *Id.* at 16,204, 16,253. In fact, EPA based the 2024 standard's stringency on *mean* PM2.5 levels reported in various studies; however, numerous commenters—including CASAC—explained that EPA's approach was too conservative. Because key studies relied on hundreds of millions of data points, EPA would have been well justified in relying on the 25th percentile PM2.5 level reported in those key studies, rather than the mean PM2.5 level. *See* Letter from Dr. Elizabeth A. (Lianne) Sheppard, Chair, Clean Air Scientific Advisory Committee, to Michael S. Regan, Adm'r, EPA, at 8-9 (EPA-CASAC-22-002, Mar. 18, 2022). Similarly, health and medical associations called on EPA to set a more protective standard than the 9 micrograms per cubic meter one that EPA ultimately selected. *See, e.g.*, Comment Letter from the American Thoracic Society (EPA-HQ-OAR-2015-0072-1986, Mar. 27, 2023); Comment Letter from the American Lung Association (EPA-HQ-OAR-2015-0072-2348, Mar. 28, 2023).

10. In its Regulatory Impact Analysis for the final 2024 PM standards, EPA estimated that the strengthened standards would result in significant public health net benefits that could be as high as $46 billion in 2032. Health benefits would include up to 4,500 avoided premature deaths, 800,000 avoided cases of asthma symptoms, and 290,000 avoided lost

workdays (in 2032). *See* Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter (Jan. 2024) [hereinafter "RIA"], https://www.epa.gov/system/files/documents/2024-02/naaqs_pm_reconsideration_ria_final.pdf.

11. In estimating these benefits, EPA assumed that all areas would be designated by late 2025. *See* RIA at 3, 37. A failure to finalize designations for a significant portion of the country will result in continued PM2.5 pollution and delays in developing and implementing abatement measures to reduce PM2.5 pollution. This will reduce, or delay, many of the benefits of decreased PM2.5 pollution expected to result from implementation of the 2024 standards.

12. As demonstrated by daily PM2.5 air quality monitoring readings, many areas of the country experience unhealthy levels of PM2.5 in their air on a frequent basis. These unhealthy levels of PM2.5 can result in respiratory, cardiovascular, neurological harm, cancer, and other damaging health outcomes, as described below.

Exposure to PM2.5 Harms Human Health

13. Fine particulate matter, also known as PM2.5, refers to microscopic particles suspended in the air with an average aerodynamic diameter of 2.5 micrometers or less. These particles are small enough to be inhaled deep into the lungs and enter the bloodstream. EPA-HQ-OAR-2015-0072-0212, Integrated Science Assessment for Particulate Matter (Dec. 2019), at 4-2 to 4-3 [hereinafter "2019 Science Assessment"].

14. A longstanding body of science, including several EPA assessments, demonstrates that exposure to PM2.5 harms human health. EPA found that there is "strong evidence for a range of health effects due to short- and long-term PM2.5 exposures observed

in the general population." 2019 Science Assessment, at 12-1. In fact, EPA concluded that there is a "causal relationship between long- and short-term exposures and mortality and cardiovascular effects" and that there is "likely to be a causal relationship between long-term exposures and respiratory effects, nervous system effects, and cancer." 89 Fed. Reg. at 16,203; *see generally* 2019 Science Assessment. Such effects include, but are not limited to: asthma, chronic obstructive pulmonary disease (COPD), lung cancer, impaired lung function, respiratory and cardiovascular disease, hypertension, heart failure, heart attacks, dementia, Alzheimer's disease, and even premature death. 2019 Science Assessment, at ES-12 to -16, ES-22 to -23, 1-21 to -30, 1-33 to -38 tbl.1-2, 5-1 to -220, 6-1 to -223, 8-1, 8-17 to -61, 10-1 to -77, 11-1 to -102. These health effects can be severe, leading to increased hospital admissions and emergency department visits and missed workdays. *Id.*

15. Though PM2.5 can harm any person, children, the elderly, and people with preexisting heart or lung conditions are at greater risk of harm from PM2.5 pollution. 89 Fed. Reg. 16,234-35. In children, short-term PM2.5 exposure reduces lung function, *see generally* Yueming Zhang *et al.*, *Effect of Acute PM2.5 Exposure on Lung Function in Children: A Systematic Review and Meta-Analysis*, 16 J. ASTHMA & ALLERGY 529 (2023), while long-term exposure increases their risk of developing asthma. *See* Ruijing Ni *et al.*, *Long-term exposure to PM2.5 has significant adverse effects on childhood and adult asthma: A global meta-analysis and health impact assessment*, 7 ONE EARTH 1953, 1954 (2024). Moreover, PM2.5-related neurotoxic and cognitive harms amongst children are increasingly apparent, as research indicates that exposure is associated with a significant increase in emergency department visits for psychiatric problems and reduced cognitive function, including IQ loss and lower test scores. *See generally* Cole Brokamp *et al.*, *Pediatric Psychiatric Emergency*

Department Utilization and Fine Particulate Matter: A Case-Crossover Study, 127 ENV'T HEALTH PERSP. 97006 (2019); Naomi C. Alter *et al.*, *Quantifying the association between PM2.5 air pollution and IQ loss in children: a systematic review and meta-analysis*, 23 ENV'T HEALTH 101 (2024); Pak Hung Lam *et al.*, *Long-Term Exposure to Fine Particulate Matter and Academic Performance Among Children in North Carolina*, JAMA NETWORK OPEN (2023). Among older populations, PM2.5 exposure is linked to higher risk of hospital admission for stroke, chronic obstructive pulmonary disease, pneumonia, myocardial infarction, heart failure, and lung cancer, *see* Mahdieh Danesh Yazdi *et al.*, *Long-term exposure to PM2.5 and ozone and hospital admissions of Medicare participants in the Southeast USA*, 130 ENV'T INT'L 5, 5-6 (2019), as well as increased risk of hospital admission for Parkinson's disease and Alzheimer's disease and related dementias. Liuhua Shi *et al.*, *Long-term effects of PM2.5 on neurological disorders in the American Medicare population: a longitudinal cohort study*, 4 LANCET PLANET. HEALTH 557, 558 (2020). PM2.5 exposure further worsens respiratory tract diseases in children and in populations contending with existing respiratory ailments. Qian Liu *et al.*, *Effect of exposure to ambient PM2.5 pollution on the risk of respiratory tract diseases: a meta-analysis of cohort studies*, 31 J. BIOMED. RSCH. 130, 135-38 (2017).

16. There is also "strong evidence" that there are "racial and ethnic disparities in PM2.5 exposures and PM2.5-related health risk." 89 Fed. Reg. at 16,235. EPA found "evidence of health risk disparities for both Hispanic and non-Hispanic Black populations compared to non-Hispanic White populations for cause-specific mortality and incident hypertension." *Id.* Lower income communities are also often exposed to higher concentrations of PM2.5 and experience greater risks of PM2.5-related harms outcomes. *Id*.

While absolute disparities have narrowed somewhat over time, relative disparities in PM2.5-related health problems persist across the country. Jonathan Colmer *et al.*, *Disparities in PM2.5 air pollution in the United States*, 369 SCIENCE 575 (2020). Because PM2.5 can be transported across state lines, its impacts are widespread; for 36 U.S. states, as of 2019, most of the health impacts from PM2.5 pollution are attributable to emissions in other states. *See* Maninder Thind *et al.*, *Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography*, 53 ENV'T SCI. & TECH. 14010, 14010 (2019).

17. In its 2019 Integrated Science Assessment, EPA found that PM2.5 pollution was causally linked to mortality (from both short- and long-term exposure) and likely to cause respiratory ailments, cardiovascular disease, and cancer. 2019 Science Assessment, at ES-8 to -11, Tbl. ES-1. Compared to its prior Integrated Science Assessment in 2009, causality linkages were strengthened by additional evidence for metabolic effects, nervous system effects, and cancer related to PM2.5 exposure. *Id.* In making its conclusions, EPA relied on diverse sources of evidence (including laboratory studies of humans and animals and robust epidemiological studies) and assessed consistency across geographies, populations, and analytical methods used to estimate exposures and health effects. *Id.* at ES-8 to -9.

18. EPA supplemented the 2019 Integrated Science Assessment in 2022 because of new scientific studies that had developed, which only strengthened the conclusions it drew in 2019. *See* EPA-HQ-OAR-2015-0072-1585, Supplement to the 2019 Integrated Science Assessment for Particulate Matter (May 2022) [hereinafter "2022 Supplemental Science Assessment"]. Since the 2022 Supplemental Science Assessment was published, researchers have identified additional evidence on the health harms linked to PM2.5 exposure, including

its role in lung adenocarcinoma, osteoporosis, pathogenesis for Parkinson's disease, earlier age of menarche in girls, and worsened racial and ethnic health disparities from cardiovascular mortality. *See, e.g.*, William Hill *et al.*, *Lung adenocarcinoma promotion by air pollutants*, 616 NATURE 159 (2023); Jiyang Zhang *et al.*, *Fine particulate matter and osteoporosis: evidence, mechanisms, and emerging perspectives*, 202 TOXICOL. SCI. 157 (2024); Brittany Krzyzanowski *et al*., *Fine Particulate Matter and Parkinson Disease Risk Among Medicare Beneficiaries*, 101 NEUROLOGY 2058 (2023); Robert B. Hood *et al.*, *Exposure to Particulate Matter Air Pollution and Age of Menarche in a Nationwide Cohort of U.S. Girls*, 131 ENV'T HEALTH PERSP. 107003 (2023); Yiqun Ma *et al.*, *Racial/ethnic disparities in PM2.5-attributable cardiovascular mortality burden in the United States*, 7 NAT. HUM. BEHAV. 2074 (2023).

19. Evidence is also growing of PM2.5-related health harms to people living with pre-existing illnesses. For example, a 2022 cohort study of 6,683 patients with fibrotic interstitial lung disease in Pennsylvania linked PM2.5 exposure to worse disease severity, disease progression, and mortality risk. Gillian C. Goobie *et al.*, *Association of Particulate Matter Exposure with Lung Function and Mortality Among Patients with Fibrotic Interstitial Lung Disease*, 182 JAMA INTERNAL MED. 1248 (2022).

20. It is well-established that there is no safe level of exposure to PM2.5 pollution. *See, e.g.*, Alina Vodonos *et al.*, *The concentration-response between long-term PM2.5 exposure and mortality; A meta-regression approach*, 166 ENV'T RSCH. 677 (2018). Any amount of PM2.5 is unhealthy and poses health risks. *Id.*; 2022 Supplemental Science Assessment, at 2-29 to -30; 2019 Science Assessment, at ES-23.

EPA's Failure to Issue Nonattainment Designations Will Harm Public Health and Wellbeing

21. EPA's delay in designating any nonattainment areas will allow additional emissions of PM2.5 in these areas. Delaying these designations causes many areas to remain legally not classified as nonattainment areas, despite having PM2.5 levels that violate EPA's 2024 PM2.5 standard or contributing to violations of the standard in nearby areas. This will lead to a longer period of inaction before measures to abate health-harming PM2.5 are undertaken in these important, heavily-impacted areas. The delay in abatement measures will ultimately result in delayed attainment and more exposure to dangerously elevated levels of PM2.5. Both the delay in implementing pollution control measures and in ultimately attaining the standards expand the risk of short- and long-term harm to all populations, and especially harm to children, older adults, those suffering from respiratory diseases such as asthma, low-income populations, and persons of color. The result will be more asthma attacks, hospitalizations, lost workdays, emergency room visits, and premature deaths in those areas.

22. Concerns about the health impacts of PM2.5 are entirely reasonable, particularly for those living in areas where pollution levels exceed the 2024 PM NAAQS. This is also true for individuals, irrespective of their location, who are older, have preexisting conditions that increase their vulnerability to air pollution, or have family members—including children—who fall into these categories. In light of the very real human health risks associated with exposure to PM2.5, it is reasonable for exposed individuals to take precautions and adjust their behavior when PM2.5 levels are high, even avoiding or limiting activities they otherwise enjoy.

23. Even in areas where air quality does not violate the 2024 PM NAAQS, designations will have beneficial effects. Areas located near or in close proximity to areas violating the PM NAAQS may themselves be designated nonattainment. Such nonattainment designation would result in decreased PM2.5 pollution, and any level of reduction would be beneficial because there is no threshold below which PM2.5 is harmless. *See* Quan Di *et al.*, *Air Pollution and Mortality in the Medicare Population*, 376 N. ENG. J. MED. 2513 (2017) (identifying harms below annual concentrations of 12 $\mu g/m^3$); Dan L. Crouse *et al.*, *Risk of Nonaccidental and Cardiovascular Mortality in Relation to Long-term Exposure to Low Concentrations of Fine Particulate Matter: A Canadian National-Level Cohort Study*, 120 ENV'T HEALTH PERSP. 708 (2012); Richard Burnett *et al.*, *An Integrated Risk Function for Estimating the Global Burden of Disease Attributable to Ambient Fine Particulate Matter Exposure*, 122 ENV'T HEALTH PERSP. 397 (2014) (identifying harms as low as 2-6 $\mu g/m^3$). Additionally, PM2.5 can remain in the atmosphere for days or weeks and travel long distances. 2019 Science Assessment, at 2-5, tbl. 2-1. As a result, even faraway, downwind areas classified as attainment or unclassifiable will experience pollution reductions from nonattainment designations because there will be less PM2.5 in the atmosphere that travels to those downwind areas, and consequently, residents in those areas will also benefit from improved air quality.

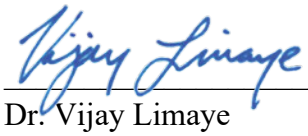
Conclusion

24. Administrator Zeldin's failure to designate nonattainment areas under the 2024 PM2.5 standards will result in additional harm from exposure to unhealthy levels of PM2.5 pollution. Individuals exposed to PM2.5 face a higher risk of adverse health effects, including acute and immediate respiratory ailments like asthma and enhanced risk of longer

term, deleterious health effects associated with PM2.5 pollution. Failure to designate nonattainment areas will also harm public wellbeing, forcing individuals in areas with particularly high levels of PM2.5 to modify their behavior and limit activities due to real, reasonable concerns regarding the adverse effects of exposure to PM2.5. Alternatively, EPA's designation of nonattainment areas will benefit public health and welfare by reducing levels of harmful PM2.5 pollution.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct, to the best of my knowledge, information, and belief.

Dated: April 9, 2026



Dr. Vijay Limaye