



2023 ANNUAL REPORT

Climate &
Health Institute

THE GEORGE WASHINGTON UNIVERSITY

Milken Institute School
of Public Health

THE GEORGE WASHINGTON UNIVERSITY

A MESSAGE FROM THE DIRECTOR

Susan Anenberg, PhD



This past year saw significant action on domestic climate policy. In June 2022, the Supreme Court limited the Environmental Protection Agency's ability to broadly regulate greenhouse gas emissions through generation shifting to clean energy sources. A little over a month and a half later, the bipartisan Inflation Reduction Act was signed into law, with billions of dollars to aid in the transition to less carbon-intensive activities and reduce greenhouse gas emissions. These actions join a fast-moving landscape of EPA rules to limit emissions from vehicles, power plants, and the oil and gas sector, as well as the Biden Administration's Justice40 Initiative, which aims to ensure that 40% of the benefits of many governmental programs go to overburdened communities.

This shift in the U.S. climate action landscape underscores the urgent need for policy-relevant and community-oriented research on the intersection between climate change, human health, and equity and justice. In addition, it highlights the continued need for effective communication and translation of cross-disciplinary knowledge, and training programs that empower the newest generation of leaders to equitably improve public health through climate change mitigation and adaptation.

I am proud that the GW Climate and Health Institute operates within each of these three pillars of research, training, and engagement with policy and community partners. The 2022-2023 academic year had notable successes, which you will see highlighted in this report. Having just passed our 2nd anniversary of being a chartered GW institute, the CHI is well-positioned to further build on these successes in the coming year. I am also excited to continue working with innovative and impactful centers and institutes across GW, including the Sumner M. Redstone Global Center for Prevention and Wellness, Sustainable GW, Planet Forward, and the ground-breaking new Global Food Institute.

I am grateful and honored to continue serving as the Director of the GW Climate and Health Institute, and would like to thank all our affiliated faculty, staff, students, and alumni, along with other internal and external collaborators, for your continued engagement, collaboration, and partnership. I would also like to acknowledge the significant level of support that the CHI receives from the Milken Institute School of Public Health. The work we do and the impact it makes would be impossible without your dedication and endorsement.

Sincerely,

A handwritten signature in dark ink, appearing to be 'SA', written in a cursive style.

Susan Anenberg
Director, GW Climate and Health Institute
Professor and Chair of Environmental and Occupational Health
Milken Institute School of Public Health



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STRATEGIC OVERVIEW AND LOOKING AHEAD

The GW Climate and Health Institute (CHI) was chartered in May of 2021. The Institute is led by Director, Dr. Susan Anenberg, Professor and Chair of the Environmental and Occupational Health Department at the Milken Institute School of Public Health and Co-Directors, Dr. Anjeni Keswani, Associate Professor of Medicine and Dr. Neelu Tummala, Assistant Professor of Surgery, at the School of Medicine and Health Sciences. The CHI is a university-wide collaboration at GW that prioritizes cross-disciplinary research, training, and action, to advance solutions and opportunities that mitigate the harm of climate change on human health.

Because the CHI is situated within George Washington University, our affiliated faculty have both a breadth and depth of expertise and experience on topics related to climate and health, including air pollution, sustainability, risk assessment and policy, climate litigation, infectious disease, food systems and nutrition, and equity and Environmental Justice, among others. Furthermore, the University's unique position in the Nation's Capital offers unparalleled access to governmental, intergovernmental, and non-governmental institutions that help bridge research and training to action. The CHI currently engages with over 40 faculty and staff members across 10 schools at GW, and is supported by a full-time Program Manager, Katie O'Donnell, and two part-time graduate student Program Associates, Jason Humphrey and Erin Phillips.

The CHI recognizes the complex and dynamic ways in which climate change impacts human health. Global temperature rise and the further intensification of weather patterns continues to impact agriculture, nutrition, and food security, alter the geographic distribution of vectors that contribute to disease spread, and influence extreme weather events and ecosystem changes. And, while the effects of climate change impact the global community, communities of color and those with lower educational attainment and household income continue to be disproportionately affected. These complex interactions require multi-disciplinary, systems thinking, and equity focused approaches to mitigate the harm on human health and improve public health for all.

LOOKING AHEAD

The CHI remains committed to its vision of *an evidence-based global response by governments and stakeholders to mitigate the climate crisis and equitably improve public health*, and will continue to work to achieve the equitable protection of population health at the local, national and global level through:

- Conducting policy-relevant and community-oriented research that reveals relationships between climate change, human health and equity;
- Educating and empowering the newest generation of leaders in equitably minimizing climate change and its health consequences; and
- Communicating and translating cross-disciplinary knowledge to integrate health and equity into actions to address climate change.



AREAS OF ENGAGEMENT: RESEARCH

Research



Research is one of the CHI's three core pillars of engagement. Institute members are thought leaders in their respective fields and apply multidisciplinary approaches to conduct policy-relevant and community-oriented research on topics related to climate change, human health, and equity. Members of the CHI currently engage in 11 focus areas within the climate and health space: air pollution and asthma, infectious disease, sustainability, extreme weather and ecosystem changes, social movements around climate change, risk assessment and policy, the Arctic, climate litigation, occupational health, food systems and nutrition, and equity and Environmental Justice. In addition to faculty-led research, the CHI also supports regular undergraduate and graduate student research through the *CHI Research Fellows program*.

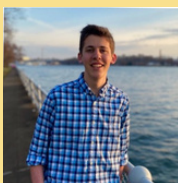
CHI RESEARCH FELLOWS

In Summer 2022, the CHI launched its *Research Fellows program*, a semester-long, paid opportunity open to all current GW students. Students are involved in interdisciplinary research projects on topics at the nexus of climate change and human health.



**Ben Skross,
Summer 2022**

Ben Skross is a recent graduate of the Master of Public Health program, concentrating in Global Environmental Health. Ben's fellowship project focused on identifying the current landscape of co-benefits resources and analyzing the way in which climate co-benefits are defined by different organizations.



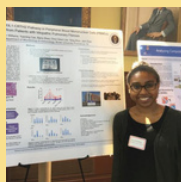
**Max London,
Fall 2022**

Max London is a current undergraduate student in the Elliott School of International Affairs, studying international relations. Max's fellowship project focused on the development of a resource guide for journalists on communicating the co-benefits of climate mitigation actions.



**Melina Triantos,
Fall 2022**

Melina Triantos is a current undergraduate student in the Milken Institute School of Public Health, studying public health. Melina's fellowship project consisted of elements that complemented the resource guide for journalists on communicating climate co-benefits, including an audience analysis and digital content development.



**River Williams,
Spring 2023**

River Williams is a current graduate student in the Milken Institute School of Public Health, concentrating in Global Epidemiology and Disease Control. River's fellowship project focused on the evaluation of parameters included in vector modeling under climatic conditions.

AREAS OF ENGAGEMENT: RESEARCH

Research



Ruth Cooper,
Spring 2023

Ruth Cooper is a current graduate student in the Elliott School of International Affairs, concentrating in International Science and Technology Policy. Ruth's fellowship project linked quantitative air pollution data with qualitative research on city-level climate or air quality policies to explore whether cities that are taking ambitious greenhouse actions can be classified by air pollution levels or CO2 emissions.



RESEARCH HIGHLIGHTS

Robert L. Glicksman, J. B. and Maurice C. Shapiro Professor of Environmental Law, GW Law: Protecting the Public Health with the Inflation Reduction Act — Provisions Affecting Climate Change and Its Health Effects. Glicksman calls upon his expertise in environmental law to explore how the recent passage of the IRA might affect emissions, the energy economy, and human health. While acknowledging the act's limitations, Professor Glicksman concludes that the IRA "may provide a firmer foundation for efforts to abate climate change and reduce its public health effects than traditional regulatory approaches."

Lisa Palmer, Research Professor of Science Communication, Columbian College of Arts and Sciences: Nature Sustainability Series: Clinical sustainability, Green energy financing, Solving twin crises; and Green structural transformation. In a series of short Q&A articles, Palmer interviews experts in different fields connected to sustainability. For example, in Clinical sustainability, Palmer interviews Dr. Jodi Sherman of Yale on how sustainability, pollution, and clinical care are interconnected.

Robert Orttung, Research Professor of International Affairs, Elliott School of International Affairs: Governing the green economy in the Arctic. Dr. Orttung and a team of researchers examine how sustainability and/or environmentalism are put into practice by different organizations and stakeholders in the Arctic. With a case study of a project in Sweden, Orttung and his team find that due to diverging definitions of sustainability, not all interests are fully heard.

Donna M. Attanasio, Assistant Dean for Energy Law and Professorial Lecturer in Law, GW Law: Promise, obstacles and hope for new nuclear's role in decarbonisation. In this commentary, Professor Attanasio explores the promises and challenges related to the next wave of nuclear energy technology, including its potential to facilitate deep decarbonisation.

Kate O'Dell, Postdoctoral Research Scientist, and **Susan Anenberg**, CHI Director and Professor and Chair of Environmental and Occupational Health, Milken Institute School of Public Health: Outside in: the relationship between indoor and outdoor particulate air quality during wildfire smoke events in western US cities. This research finds that, although remaining indoors during poor air quality days due to wildfire smoke is an effective strategy to limit harmful exposure, this only provides limited protection on days when air quality is extremely poor, suggesting the need for additional action.

Anjeni Keswani, CHI Co-Director and Associate Professor of Medicine, School of Medicine and Health Sciences: The Impact of Social Determinants and Air Pollution on Healthcare Disparities in Chronic Rhinosinusitis With Nasal Polyps. This review synthesizes the existing literature to discuss how air pollution, race, and socioeconomic status influence healthcare disparities in the diagnosis and management of chronic rhinosinusitis with nasal polyps, highlighting that increased exposure to air pollutants influences the cellular development of chronic sinusitis as well as the severity and response to treatments.

AREAS OF ENGAGEMENT: TRAINING

Schools across GW continue to offer a variety of courses and programs that encourage climate research, promote innovative responses to addressing the impacts of climate change on human health, elevate collaborative, multidisciplinary, and systems thinking approaches to mitigating climate change, and center environmental and social justice. In an effort that is complementary to course and program offerings, the CHI regularly hosts discussion series, with the aim of facilitating engagement on a range of topics in the climate and health space.



TRAINING HIGHLIGHTS

Climate and Health Connections Series: During the Spring 2023 semester, the CHI hosted a series of internal, interactive, and engaging discussions on topics at the nexus of climate and health. The Climate and Health Connections Series consisted of four sessions that were hosted by CHI members and covered topics such as advocacy strategies, environmental communication, climate change and respiratory health, and perspectives from early-career scientists conducting air quality, climate, and health research. The series engaged over **230** faculty, staff, students, and alumni, across GW schools, alternating between in-person and hybrid style discussions.

New longitudinal Climate and Health curriculum in GW School of Medicine and Health Sciences (SMHS): Our colleagues in SMHS have been advocating for the inclusion of climate change as a curriculum theme within medical school education for several years. In early 2023 the official approval was given to include climate change as a longitudinal curriculum, anticipated to be incorporated by the start of the Fall 2023 semester. Implementation of SMHS's new longitudinal curriculum on Climate and Health will be led by CHI Co-Director, **Dr. Anjeni Keswani**. The theme integrates climate change and environmental justice throughout all 4 years of medical school coursework in order to educate the next generation of clinicians on the health concerns of a changing climate and teach them how to best care for their future patients.

The new curriculum adoption garnered media attention, including:

- WUSA9 coverage in this [February 22, 2023 segment](#); and
- April 26, 2023 *STAT News* piece entitled [Led by students, a nascent climate movement is taking hold in medical education](#). CHI Co-Director and Assistant Professor of Surgery, Dr. Neelu Tummala, along with GW Medical Student and President of Medical Students for a Sustainable Future (MS4SF), Savita Potarazu, were quoted in the article.

New MPH@GW Climate and Health Concentration launched, Milken Institute School of Public Health (GWSPH): Launched Spring 2023, GWSPH now offers a new concentration in Climate and Health in the Online Master of Public Health program (MPH@GW)! This first-of-its-kind, groundbreaking concentration will train individuals to assess environmental exposures and public health risks associated with anthropogenic climate change, and to mitigate these health risks through taking a systems thinking approach.

AREAS OF ENGAGEMENT: ACTION

CHI members are active in the climate and health space beyond the Institute and University and frequently submit public comment, provide public testimony, participate in briefings and presentations, and engage with various forms of media, including writing op-eds, taking part in podcasts or news segments, and providing expert opinion for news publications. In addition, the CHI hosted a half-day symposium focused on the outlook of U.S. climate action.

Action



PROTECTING PUBLIC HEALTH THROUGH U.S. CLIMATE ACTION: MAKING SENSE OF THE SHIFTING LANDSCAPE AFTER WV V. EPA AND THE INFLATION REDUCTION ACT



Summer 2022 yielded landmark decision making that indicated a coming shift in the landscape of U.S. climate action, including the *West Virginia v. EPA* Supreme Court ruling on June 30, 2022 and the passage of the Inflation Reduction Act on August 16, 2022. In response to these two monumental actions on climate policy, the CHI hosted a half-day symposium that highlighted expert opinion on how these decisions are tied to human health and where to go next to advance a healthy climate for all.

Protecting public health through U.S. climate action: Making sense of the shifting landscape after WV v. EPA and the Inflation Reduction Act took place on October 13, 2022, and featured a keynote address from Senator Tom Carper. Carper's keynote highlighted the climate action he has spearheaded on the national stage and

how these actions influence health. He emphasized how pivotal this point in time is in U.S. policy and the need for politicians to unite to pursue ambitious climate action.

Following Senator Carper's keynote address, the rest of the afternoon was divided into two panels: 1) *Health and Environmental Justice implications of the WV v. EPA decision and IRA*, moderated by the Dean of the Milken Institute School of Public Health, Lynn R. Goldman, and featured Vicki Patton of the Environmental Defense Fund, Gretchen Goldman of the White House Office of Science and Technology Policy, and Sara Colangelo of Georgetown University; and 2) *Towards a healthy climate for all: Advancing action on multiple fronts*, moderated by CHI Director Susan Anenberg, and featured Robert L. Glicksman of GW Law, Kate Johnson of the US Federal Affairs (C40 Cities), Khalil Shahyd of the National Resources Defense Council, and Bill Dietz of the Sumner M. Redstone Global Center for Prevention and Wellness.

This Symposium brought together **40** in-person participants and over **220** livestream viewers, representing both internal GW community members and external collaborators, partners, and greater Washington area community members.

AREAS OF ENGAGEMENT: ACTION

ACTION HIGHLIGHTS

Action



Submitted Public Comments:

- February 13, 2023: DC Construction Codes Coordination Board (CCCCB). Comments in strong support of the building code proposal to require all electric equipment in new DC commercial buildings (ECC-En-4-1-2).
- January 17, 2023: U.S. Environmental Protection Agency (EPA). Comments on Climate Pollution Reduction Grants address the need for prioritizing strategies that maximize health co-benefits; advancing environmental justice; and sustained, consistent funding.
- December 1, 2022: U.S. Environmental Protection Agency (EPA). Comments submitted address the composition of the 14 candidates for the peer review panel for EPA's updated Social Cost of Greenhouse Gases report, raising issues related to the lack of inclusion of health experts and considerations of diversity and equity.
- August 11, 2022: National Park Service (NPS). Comments in strong support of prioritizing upper Beach Drive in Rock Creek Park in DC for resident, recreational, and zero-emissions commuter use by implementing a permanent closure of the road to vehicle traffic, citing the significant environmental and health benefits that will be gained by permanently closing upper Beach Drive.

Lynn R. Goldman, Michael and Lori Milken Dean, Milken Institute School of Public Health:

- Co-chairs the **Task Force on Climate Change and Health** established by the Association of Schools and Programs of Public Health (ASPPH). This Task Force brings together leaders in academic public health to transform public health education, research, and practice in the area of climate change and health. In addition to the Task Force's ongoing work, they launched a new report entitled Responding to the Climate Change and Health Crisis: A Framework for Academic Public Health, providing recommendations for reducing the impacts of climate change on population health.
- Serves as one of **ecoAmerica's Climate for Health Leaders**, a network of America's leading health associations and institutions that are committed to climate solutions in their organizations and communities and push to make climate change a national health priority.

Susan Anenberg, CHI Director and Professor and Chair of Environmental and Occupational Health, Milken Institute School of Public Health:

- Provided a briefing at the Congressional Climate Camp hosted by the Environmental and Energy Study Institute (EESI) on February 23, 2023. This session, "Non-CO2 Greenhouse Gases," the third session in the Congressional Climate Camp series, focused on the impacts of and solutions for other climate warming gases and pollutants, including black carbon and methane.
- Serves on two climate-related National Academies committees: **The Committee on Utilizing Advanced Environmental Health and Geospatial Data and Technologies to Inform Community Investment** advises the Council on Environmental Quality's implementation of the Justice40 initiative, specifically looking at how geospatial data and existing environmental screening tools can inform the Climate and Economic Justice Screening Tool. **The Committee to Advise the US Global Change Research Program (USGCRP)** provides continuing and targeted advice to the USGCRP, 13 federal entities charged by law to help understand, assess, predict, and respond to human-induced and natural processes of global change.

AREAS OF ENGAGEMENT: ACTION

Action



Neelu Tummala, CHI Co-Director and Assistant Professor of Surgery, School of Medicine and Health Sciences, published multiple op-eds over the past year focusing on the role that the health sector, along with support from medical professionals, plays in mitigating the health effects of climate change:

- Tummala and other co-authors published a peer-reviewed Case and Commentary in the *AMA Journal of Ethics* on October 1, 2022 entitled, How Should We Respond to Health Sector Emissions That Exacerbate Climate Change and Inequity?, articulating that “as a contributor to greenhouse gas emissions and air pollution, the health sector has obligations and ample opportunities to protect health by decreasing waste and motivating more system-wide sustainable clinical practices.”
- On November 14, 2022, Tummala published an opinion piece in *Scientific American* entitled, Climate Change Is Fueling a Public Health Crisis. Doctors Need to Address This, detailing the healthcare community's variable response to climate change, and highlighting the urgent need to mobilize health-driven action and advocacy to mitigate the climate-fueled public health crisis.
- In an opinion piece published in *Newsweek* on April 19, 2023 entitled, Climate Change Is Not a Progressive Issue. It Is a Medical Problem, Tummala says, "Recognizing the public health concerns of a warming world, doctors, nurses, and medical students across the country are advocating for environmental legislation, whether in California, Georgia, or Florida."

Gaige Kerr, Research Scientist, Milken Institute School of Public Health, was featured in a *WUSA9* segment ‘A step in the right direction: Why ECO9 is a commitment to covering the impacts of climate change in the DMV’ to speak about air pollution in Washington DC. Kerr also raised awareness of how racist historical and exclusionary zoning practices have put communities of color at higher risk for exposure to nitrogen dioxide and its associated health impacts.

Throughout the year, our partners at **The Sumner M. Redstone Global Center for Prevention and Wellness** gave public testimony at multiple oversight hearings that have local climate and greenhouse gas-related implications. For example, CHI member and Master of Public Health student, **Claire Summa**, testified before the Committee on Transportation & the Environment Performance Oversight Hearing on the District Department of Transportation. Claire’s testimony cites the public health benefits of mode shifts in transportation, including reduced greenhouse gas emissions and improved air quality. Other climate and health related testimony from Redstone staff includes:

- **Bill Dietz**: Testimony Before the Committee on Transportation & the Environment B24-949, the Booting and Impoundment Reform Amendment Act of 2022 Traffic Safety in the District. October 5, 2022.
- **Rachel Clark**: Testimony Before the Committee on Transportation & the Environment Waste Diversion Roundtable. November 7, 2022.
- **Kelly Whittier**: Testimony Before the Committee on Public Works and Operations Performance Oversight Hearing on the Department of Public Works. February 15, 2023.
- **Rachel Clark**: Testimony Before the Committee on Transportation & the Environment Council of the District of Columbia Performance Oversight Hearing on Department of Energy & the Environment. February 16, 2023.
- **Kelly Whittier**: Testimony Before the Committee on Public Works & Operations Council of the District of Columbia Public Roundtable on PR25-0071, the “The Director of the Department of Public Works Timothy Spriggs Confirmation Resolution of 2023”. March 14, 2023.

CHI EXPERTS QUOTED

Action



“Just as the tobacco industry had front groups and the opioid industry had front groups, this is part of the fossil fuel disinformation playbook. The role of these so called policy organizations is not to provide useful information to the public, but to promote the interests of their sponsors, which are often antithetical to public health.” - **David Michaels**. *The New York Times*. [The Texas Group Waging a National Crusade Against Climate Action](#). December 4, 2022.

“Because we had a milder winter overall, we’ve been seeing an earlier pollen bloom. Also, because of the milder winter, our mold spores did not significantly frost or freeze over, so we’re having a slightly earlier mold season as well.” - **Anjeni Keswani**. *The Washington Post*. [The worst cities in the U.S. for allergies](#). March 16, 2023.

“There’s a two-way interaction between wildfires and the power grid. Electric grids can trigger wildfires, where the interactions of power lines with surrounding vegetation have been found to be a major challenge nation-wide. The electric power grid is also impacted drastically by wildfires from physical failures and degradations resulting in massive electricity outages. What we’re trying to do as a team is to design and develop technological solutions and decision support tools that enhance resilience of the electric power grids against wildfires, making sure that the lights remain on at all times before, during and after wildfires.” - **Payman Dehghanian**. *Newswise*. [GW Researchers Lead Effort to Investigate Wildfire Resiliency in Alaska](#). February 16, 2023.

“[Infrastructure] changes must be coupled with robust enforcement of our traffic laws. Drivers who speed and run traffic lights are a threat to community safety. By strengthening enforcement, B24-949 will make our streets safer and more welcoming to non-motorized users. This outcome will increase opportunities for physical activity and reduce pedestrian and rider injury and death. The net effect of these changes will foster active lifestyles among residents and mitigate the transportation sector’s contributions to climate change.” - **Bill Dietz**. *Greater Greater Washington*. [Why would a hospital association fight a law to allow DC to boot and tow dangerous drivers’ cars?](#) October 14, 2022.

“The money could also be well spent on investing in new technologies that are "actually going to make a difference" in reducing greenhouse gas emissions, such as batteries and other forms of renewable power.” - **John J. Forrer**. *ABC News*. [Can a clothing company save the planet? Patagonia wants to find out](#). September 24, 2022.

COLLABORATIVES, PARTNERSHIPS, AND FUNDING

PARTNERS



The Sumner M. Redstone
Global Center for
Prevention and Wellness

Air, Climate and Health Lab

George Washington University



COLLABORATIVES



The Medical
Society Consortium
ON CLIMATE & HEALTH



NATIONAL ACADEMY of MEDICINE
ACTION COLLABORATIVE ON
DECARBONIZING THE
U.S. HEALTH SECTOR

In addition to support from the GW Milken Institute School of Public Health, the GW Cross-Disciplinary Research Fund, and generous donations from Dr. Ralph Mitchell and Dr. Jerry Paulson, CHI members receive grant funding from the following:







APPENDIX I: CHI-ORGANIZED EVENTS

External Events:

10/13/2022: Protecting Public Health Through U.S. Climate Action: Making sense of the shifting landscape after WV v. EPA and the Inflation Reduction Act. Featuring Senator Tom Carper with Panelists Vickie Patton, Bill Dietz, Gretchen Goldman, Kate Johnson, Sara Colangelo, Robert L. Glicksman, and Khalil Shahyd.

Internal Events:

9/9/2022: Fall 2022 CHI Retreat featuring presentations highlighting recent work from CHI members.

Climate and Health Connections Series

1/25/2023: Think Global, Act Local: Advocacy Strategies in the District of Columbia featuring Kelly Whittier and Rachel Clark from the Redstone Global Center.

2/6/2023: Research in Air Quality, Climate, and Health: Perspectives from Early-Career Scientists featuring Doyeon Ahn, Tess Carter, Gaige Kerr, and Kate O'Dell from the Air, Climate, and Health Lab at GW.

3/8/2023: Environmental Communication: Sustainability, storytelling and communicating on climate, environment, and health featuring Lisa Palmer.

3/31/2023: Climate Change and Respiratory Health: Impacts, Communication, and Action featuring Anjeni Keswani and Neelu Tummala.

APPENDIX II: ACADEMIC PUBLICATIONS

Air Pollution

Henneman LRF, Rasel MM, Choirat C, **Anenberg SC**, Zigler C. Inequitable Exposures to U.S. Coal Power Plant-related PM2.5: 22 Years and Counting. *Environmental Health Perspectives*. 2023;131(3). doi:10.1289/ehp11605

Nawaz MO, Henze DK, **Anenberg SC**, **Ahn DY**, **Goldberg DL**, et al. Sources of air pollution-related health impacts and benefits of radially applied transportation policies in 14 US cities. *Frontiers in Sustainable Cities*. 2023;5. doi:10.3389/frsc.2023.1102493

Sicard P, Agathokleous E, **Anenberg SC**, De Marco A, Paoletti E, Calatayud V. Trends in urban air pollution over the last two decades: A global perspective. *Science of The Total Environment*. 2023;858:160064. doi:10.1016/j.scitotenv.2022.160064

Carter TS, Heald CL, Selin NE. Large mitigation potential of smoke PM2.5 in the US from human-ignited fires. *Environmental Research Letters*. 2023;18(1):014002. doi:10.1088/1748-9326/aca91f

Pozzer A, **Anenberg SC**, Dey S, Haines A, Lelieveld J, Chowdhury S. Mortality Attributable to Ambient Air Pollution: A Review of Global Estimates. *GeoHealth*. 2022;7(1). doi:10.1029/2022gh000711

Malashock DA, Delang MN, Becker JS, **Anenberg SC**, et al. Global trends in ozone concentration and attributable mortality for urban, peri-urban, and rural areas between 2000 and 2019: A modelling study. *The Lancet Planetary Health*. 2022;6(12). doi:10.1016/s2542-5196(22)00260-1

Zhang H, Wei Z, Henderson BH, **Anenberg SC**, **O'Dell K**, Kondragunta S. Nowcasting Applications of Geostationary Satellite Hourly Surface PM2.5 Data. *Weather and Forecasting*. 2022;37(12):2313-2329. doi:10.1175/waf-d-22-0114.1

Nawaz MO, Henze DK, **Anenberg SC**, Braun C, Miller J, Pronk E. A Source Apportionment and Emission Scenario Assessment of PM2.5 and O3 Related Health Impacts in G20 Countries. *GeoHealth*. 2022;7(1). doi:10.1029/2022gh000713

Zhang J, Liu S, Lim Y, **Anenberg SC**, et al. Long-term exposure to air pollution and incidence of adult-onset asthma and COPD: Systematic review and Meta-analyses. *Eur Respir J*. Published online September 4, 2022. doi:10.1183/13993003.congress-2022.3910

Goldberg DL, Harkey M, de Foy B, et al. Evaluating NOx emissions and their effect on O3 production in Texas using TROPOMI NO2 and HCHO. *Atmospheric Chemistry and Physics*. 2022;22(16):10875-10900. doi:10.5194/acp-22-10875-2022

Kerr GH, Martin RV, Van Donkelaar A, **Goldberg DL**, **Anenberg SC**, et al. Increasing disparities in air pollution health burdens in the United States. *ESS Open Archive*. Published online August 13, 2022. doi:10.1002/essoar.10512159.1

Kleiman G, **Anenberg SC**, Chafe ZA, et al. Enhanced Integration of Health, Climate, and Air Quality Management Planning at the Urban Scale. *Frontiers in Sustainable Cities*. 2022;4. doi:10.3389/frsc.2022.934672

The Arctic

Garbis Z, McCarthy E, **Orttung RW**, Poelzer G, Shaiman M, Tafrate J. Governing the green economy in the Arctic. *Climatic Change*. 2023;176(4). doi:10.1007/s10584-023-03506-3

von Salzen K, Whaley CH, **Anenberg SC**, et al. Clean air policies are key for successfully mitigating Arctic warming. *Commun Earth Environ*. 2022;3(1). doi:10.1038/s43247-022-00555-x

Equity and Environmental Justice

Sumner M Redstone Global Center for Prevention & Wellness. Neighborhood Park Service: Strategies to create an equitable and activated park system for the District of Columbia. May 8, 2023

Peterson R, **Keswani A**. The Impact of Social Determinants and Air Pollution on Healthcare Disparities in Chronic Rhinosinusitis with Nasal Polyps. *American Journal of Rhinology & Allergy*. 2023;37(2):147-152. doi:10.1177/194589242311534

Cheeseman MJ, Ford B, **Anenberg SC**, et al. Disparities in Air Pollutants Across Racial, Ethnic, and Poverty Groups at US Public Schools. *GeoHealth*. 2022;6(12). doi:10.1029/2022gh000672

Hoffman-Hall A, Gorris ME, **Anenberg SC**, et al. A GeoHealth Call to Action: Moving Beyond Identifying Environmental Injustices to CO-creating Solutions. *GeoHealth*. 2022;6(11). doi:10.1029/2022gh000706

Sarfaty M, Duritz N, Gould R, **Paulson J**, et al. Organizing to advance equitable climate and health solutions: The medical society consortium on climate and health. *The Journal of Climate Change and Health*. 2022;7:100174. doi:10.1016/j.joclim.2022.100174

Extreme Weather and Ecosystem Change

Santos-Burgoa C, Garcia-Meza A, Talayero MJ, Kuenster N, Goldman Hawes AS, **Andrade EL**. Total Excess Mortality Surveillance for Real-Time Decision-Making in Disasters and Crises. *Disaster Medicine and Public Health Preparedness*. 2023;17. doi:10.1017/dmp.2023.15

Wei J, Wang J, Li Z, **Anenberg SC**, et al. Wildfire emissions disrupt black carbon and PM2.5 mortality burden trends across the continental US. *ESS Open Archive*. Published online December 31, 2022. doi:10.22541/essoar.167252699.90378578/v1

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APPENDIX III: OPINION EDITORIALS AND MEDIA ENGAGEMENT

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APPENDIX IV: TESTIMONY, PUBLIC COMMENTS, AND BRIEFS

Testimony

Bill Dietz: Testimony Before the Committee on Transportation & the Environment

B24-949, the Booting and Impoundment Reform Amendment Act of 2022 Traffic Safety in the District. October 5, 2022.

Rachel Clark: Testimony Before the Committee on Transportation & the Environment Waste Diversion Roundtable. November 7, 2022.

Kelly Whittier: Testimony Before the Committee on Public Works and Operations

Performance Oversight Hearing on the Department of Public Works. February 15, 2023.

Rachel Clark: Testimony Before the Committee on Transportation & the Environment Council of the District of Columbia Performance Oversight Hearing on Department of Energy & the Environment. February 16, 2023.

Claire Summa: Testimony Before the Committee on Transportation & the Environment

Performance Oversight Hearing on the District Department of Transportation. February 27, 2023.

Kelly Whittier: Testimony Before the Committee on Public Works & Operations Council of the District of Columbia Public Roundtable on PR25-0071, the “The Director of the Department of Public Works Timothy Spriggs Confirmation Resolution of 2023”. March 14, 2023.

Public Comment

2/13/2023: **Joint Faculty of CHI** to the DC Construction Codes Coordination Board (CCCCB) in response to ECC-En-4-1-23, Commercial Building Electrification

1/17/2023: **Gaige Kerr** and **Susan Anenberg** to the EPA in response to Proposed Climate Pollution Reduction Grants

12/1/2022: **Susan Anenberg** to the EPA in response to Peer Review Panel for “Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances”

8/11/2022: **Joint Faculty of CHI** to the National Park Service in response to a Proposal to Keep Beach Drive in Rock Creek Park Closed to Cars

Briefs

Susan Anenberg: Non-CO2 Greenhouse Gases - Briefing Series: Congressional Climate Camp. EESI. February 23, 2023.

Susan Anenberg: The Lancet Countdown on Health and Climate Change. APHA. October 28, 2022.

APPENDIX V: SELECTED PRESENTATIONS

- 3/27/2023: **Gaige Kerr** at From Space to the Streets: Leveraging Satellite Data for Air Pollution, Health, and Justice
- 3/9/2023: **Susan Anenberg** and **Gaige Kerr** at 2023 AGU/AMS #GeoHealth Showcase event
- 3/7/2023: **Donna M. Attanasio** at 2023 Wildfire Simulation Competition
- 3/4/2023: **Peter Linquiti** at 2023 Wildfire Simulation Competition
- 2/28/2023: **David Michaels** at HAA: Act Fast: New Strategies to Protect Your Workforce
- 2/27/2023: **Gaige Kerr** and **Tess Carter** at Meridian International Visitor Exchange
- 2/27/2023: **Susan Anenberg** at YCCCH Seminar Series with Dr. Susan Anenberg on "Climate change, air pollution, and public health: Bridging science to policy"
- 2/17/2023: **LeRoy C. Paddock** at Environmental Law Series: Pollution, Clean Water & Clean Air
- 2/16/2023: **Jeremy Liskar** on Comin' in Hot : Climate Corner with Jeremy Liskar
- 1/26/2023: **David Michaels** at Webinar entitled Unwrapping Conflict of Interest in Chemicals and Waste Governance
- 1/25/2023: **Samer Hamdar** at Resilience, #Electrification & the Path to #NetZero #CoF23
- 1/25/2023: **Lisa Palmer** at Walking Mountains Science Center Climate Speaker Series
- 1/23/2023: **Robert Orttung** at Institute for European, Russian, and Eurasian Studies
- 12/12/2022: **Susan Anenberg, Gaige Kerr, Kate O'Dell, Dan Goldberg** at AGU Fall Meeting
- 11/18/2022: **David Michaels** at ELSSA
- 11/18/2022: **Neelu Tummala** at Global Health Conference 2022 - Planetary Health and Sustainability
- 11/15/2022: **Robert Orttung** at NNA Annual Community Meeting
- 11/11/2022: **Lisa Palmer** at Meridian International Center Meeting
- 10/20/2022: **Susan Anenberg, Dan Goldberg, Gaige Kerr, Doyeon Ahn, and Tess Carter** at HAQAST Wisconsin - NASA Health and Air Quality Applied Sciences Team

10/20/2022: **Peter Linquiti** at NASPAA Conference

10/13/2022: **Ekundayo Shittu** at US-Africa Frontiers

10/12/2022: **Jerome Paulson** at Reach Out and Read: Environmental Health and Children

10/12/2022: **Donna M. Attanasio** and **Robert L. Glicksman** at GW Law Perspectives on the Inflation Reduction Act (IRA)

10/7/2022: **Susan Anenberg** speaking on Air Pollution and Health in Cities

9/30/2022: **David Michaels** at Accountability for the Deception Industry

9/29/2022: **Gaige Kerr** at Sat Summit 22: Voices of Climate Justice

9/27/2022: **Lisa Palmer** at Sustainability and Gastronomy in the US and the Basque Country

9/27/2022: **Neelu Tummala** at 2022 Social Medicine Rounds

9/22/2022: **Neelu Tummala** at Sustainable ophthalmology: Eye care with a vision for climate-smart surgery

9/20/2022: **Lisa Palmer** at Global Futures 22 Conference

9/19/2022: **Susan Anenberg** at NASA Health and Air Quality Annual Meeting

9/7/2022: **Susan Anenberg** at International Day of Clean Air for Blue Skies: Sharing the Air in North America

8/29/2022: **Donna M. Attanasio** at Seminar on Climate Science and the Energy Transition in Climate Litigation

8/28/2022: **Robert Orttung** at How Climate Change is Shaping the Future of the Arctic with Dr. Robert Orttung

8/16/2022: **Susan Anenberg** at Climate Change, Air Quality, and Lung Health

8/9/2022: **Gaige Kerr** at NASA Earth Science Applications Week 2022

8/8/2022: **Susan Anenberg, Kate O'Dell, Gaige Kerr, and Dan Goldberg** at AMS Conference

7/28/2022: **Robert L. Glicksman** at CCL's Big Tent Climate Talks

7/10/2022: **Neelu Tummala** at Medical Students for a Sustainable Future Op Ed Workshop

APPENDIX VI: AFFILIATED FACULTY AND STAFF

Milken Institute School of Public Health

Elizabeth Andrade, Assistant Professor, Prevention and Community Health

Susan Anenberg, CHI Director | Professor and Chair, Environmental and Occupational Health

Kate Applebaum, Associate Professor, Environmental and Occupational Health

Robert Canales, Associate Professor, Environmental and Occupational Health

Bill Dietz, Director, Sumner M. Redstone Global Center for Prevention and Wellness | Professor, Prevention and Community Health

Dan Goldberg, Assistant Research Professor, Environmental and Occupational Health

Lynn R. Goldman, Michael and Lori Milken Dean of the Milken Institute School of Public Health | Professor, Environmental and Occupational Health

Nirbhay Kumar, Professor, Global Health

Peter LaPuma, Professor, Environmental and Occupational Health

Cindy Liu, Chief Medical Officer, Antibiotic Resistance Action Center | Associate Professor, Environmental and Occupational Health

David Michaels, Professor, Environmental and Occupational Health

Chris Mores, Professor, Global Health

Carlos Santos-Burgoa, Professor, Environmental and Occupational Health

Emily Smith, Assistant Professor, Global Health, and Exercise and Nutrition Sciences

School of Medicine and Health Sciences

Hana Akselrod, Assistant Professor, Medicine

Aileen Chang, Assistant Director for Research, Rodham Institute for Health Disparities | Associate Professor, Medicine

Anjeni Keswani, CHI Co-Director and Director of the Allergy, Asthma & Sinus Center | Associate Professor, Medicine

Jerome Paulson, Emeritus Professor, Pediatrics, and Environmental and Occupational Health

Neelu Tummala, CHI Co-Director | Assistant Professor, Surgery

Children's National Hospital

Anand Gourishankar, Physician

School of Nursing

Kristen Stevens, Clinical Instructor, Nursing

Trachtenberg School of Public Policy and Public Administration

Peter Linquiti, Associate Professor, Environmental Resource Policy

Columbian College of Arts and Sciences

Ryan Engstrom, Director of Data Science | Professor, Geospatial Science and Applications

Lisa Palmer, Senior Editor and Education Lead, [Planet Forward](#) | Research Professor of Science Communication

School of Engineering and Applied Sciences

Payman Dehghanian, Director, [GW SmartGrid Laboratory](#) | Assistant Professor, Electrical and Computer Engineering

Royce Francis, Associate Professor, Engineering Management and Systems Engineering

Samer Hamdar, Associate Professor, Civil and Environmental Engineering

Ekundayo Shittu, Associate Professor, Engineering Management and Systems Engineering

Graduate School of Education and Human Development

Laura Engel, Associate Professor, International Education, and International Affairs

GW Law School

Donna M. Attanasio, Assistant Dean for Energy Law, Professorial Lecturer in Law

Robert L. Glicksman, J. B. and Maurice C. Shapiro Professor of Environmental Law

LeRoy C. Paddock, Distinguished Professorial Lecturer in Law

Elliott School of International Affairs

Nina Kelsey, Assistant Professor, Public Policy & International Affairs

Robert Orttung, Research Director for Sustainability Initiatives, Sustainable GW | Research Professor, International Affairs

Malcom Russell-Einhorn, Research Professor, International Affairs

Tara Scully, Director of Sustainability Minor | Associate Professor, Biology

GW School of Business

John J. Forrer, Director, Institute for Corporate Responsibility | Associate Research Professor, Strategic Management and Public Policy

Sumner M. Redstone Global Center for Prevention and Wellness

Rachel Clark, Policy Director

Kelly Whittier, Senior Center Specialist, Communications, Outreach & Engagement

Office of Sustainability

Josh Lasky, Director

Students and Staff

Doyeon Ahn, Postdoctoral Research Scientist; **Jason Humphrey**, Program Associate; **Gaige Kerr**, Research Scientist; **Jeremy Liskar**, Research Assistant; **Maha Malik**, Research Assistant; **Greta Martin**, PhD Student; **Kate O'Dell**, Postdoctoral Research Scientist; **Katie O'Donnell**, Program Manager; **Erin Phillips**, Program Associate; **Sydney Pryor**, PhD Student



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