HEALTH EFFECTS INSTITUTE

REQUEST FOR QUALIFICATIONS AND PROPOSAL FOR QUALITY ASSURANCE OVERSIGHT

OCTOBER 2024

SUMMARY

The Health Effects Institute (HEI) is seeking qualified contractors to provide quality assurance services for 11 research studies in its Environment and Health Program and 4 research studies in its Energy Program.

BACKGROUND

About HEI

HEI is a nonprofit corporation chartered in 1980 as an independent research organization that provides impartial science to inform decisions that foster a healthier environment and better health for all. The projects that HEI funds either provide scientific information of direct and immediate policy relevance or pave the way for developing such information. HEI's research programs are guided by a 5-year Strategic Plan. The independent Research Committee and Review Committee Research Committee and the Review Committee, work in an environment uniquely structured to foster the necessary separation between selecting and overseeing research on the one hand and critically reviewing results on the other (**Figure 1**). This separation allows HEI to fund and guide research and to credibly peer review and comment on that same research. Scientific staff work with the committees to conduct the Institute's business. Please visit our website at the following links for more information about HEI's research and review process, investigator commitments, ongoing studies, and our quality assurance (QA) policy.

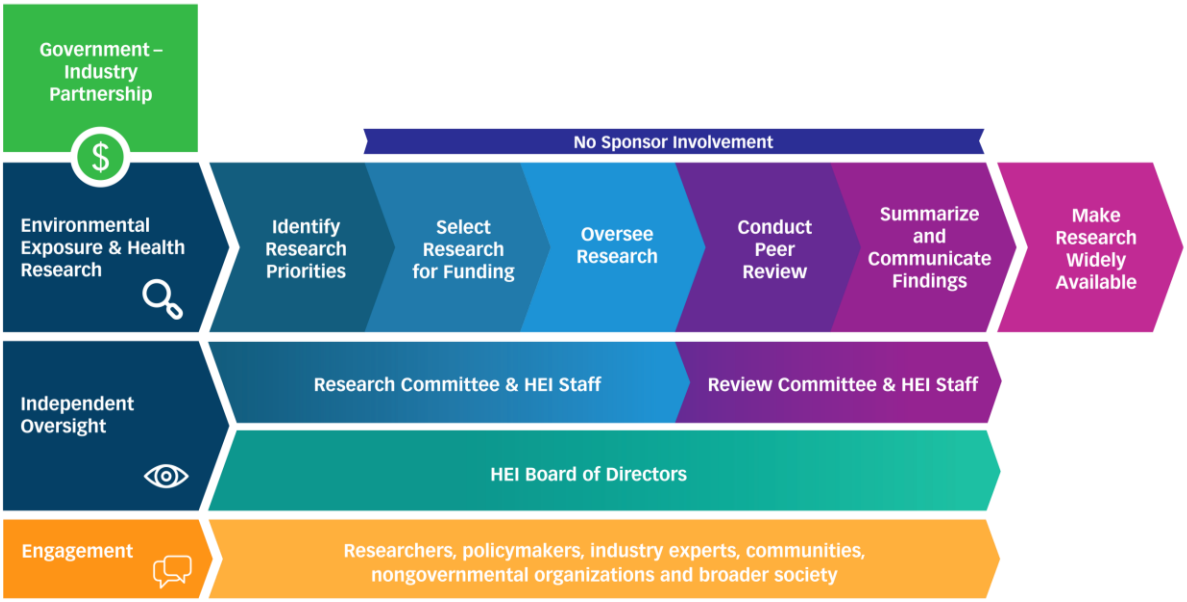

Figure 1. HEI funds, oversees, and evaluates research with a rigorous model that promotes its quality, impartiality, and relevance to public health policy. Sponsors and others with an interest in or affected by HEI's work provide recommendations on research priorities, but the final priorities are determined by each program's research committee.

HEI Audit Objectives

As accurate scientific conclusions depend on the validity of the underlying data and the precision with which it is reported, HEI uses third-party quality assurance oversight for most research projects that involve human subjects or have a high potential for use in regulatory decisions. These procedures augment the general Quality Assurance/Quality Control (QA/QC) procedures applied to all HEI studies (through staff and committee oversight) and provide assurance that data are collected under defined conditions and are reliable and traceable from collection through final analyses and reporting.

EXPECTATIONS FOR QA/QC AUDITS

Activities

HEI special QA oversight entails one or both of the following audits:

1. QA audit during the study. An audit of ongoing processes is held after study startup. Auditors generally share an agenda several weeks in advance of the audit and request materials in advance for discussion. The audit is generally held remotely over one to two days but can be held on-site if requested by the HEI oversight team, study investigator, or QA auditor and approved by HEI.
2. QA audit of the Final Investigator's Report. An audit of the HEI Final Report and any additional supporting materials as requested by the audit team is held remotely. This audit involves evaluation of the accuracy of the study data, code and analysis, and presentation of the main results and adherence to the study QA plan.

Scope

Study audits should ensure that the investigators follow standard QA/QC procedures and conduct their work according to their QA/QC plans. Activities include ensuring that the tables and figures reflect data code outputs, that results and interpretations align, that methods are sufficiently documented (e.g., how something was calculated), that figures are clear enough to be assessed by the reader and have been correctly interpreted by the author, and that quality assurance and quality control measures are sufficiently documented. Please note that both the Research and Review Committees will have commented and provided feedback on the study design, model development, instrument selection, and conclusions. *Therefore, the scope of the QA audit should be limited to questions of quality assurance and quality control compliance and not questions related to scientific decisions.*

Deliverables

1. Kick off call with investigators.
2. QA audit during the study: QA audit on the in-progress study with a QA audit report marked confidential and delivered to the Director of the applicable HEI Program within 4-6 weeks or on the timeline negotiated with HEI.
3. QA audit of the Final Investigator Report:
    a. QA audit report on the Final Investigator Report marked confidential and delivered to the Director of the applicable HEI Program within 4-6 weeks or on the timeline negotiated with HEI.
    b. Signed QA statement for publication in the report after any essential comments in the QA audit report have been addressed.

Audit reports remain confidential to those outside of the research team and HEI staff involved with the study and should be delivered directly to the Director of the applicable HEI program. Science staff will send the report to the investigator and schedule a follow-up call with the auditors if needed.

Materials HEI provides to auditors

HEI will provide confidential background materials to the selected auditors to aid in preparation for the audit:

- A copy of the full application.
- Latest version of the QA/QC plan.
- 5-month and 10-month progress reports for each year of the study.
- Draft final report, associated appendices, and review feedback letters for planning purposes only.
- Accepted version of the final report and appendices for the final report audit.
- Edited version of the final report showing any changes made in response to the final report audit.

The auditor should contact the PI directly for additional documentation that they would like to review, such as qualifications of personnel, SOPs, and protocols. The study's scientific contact and HEI QA manager should be copied on any communications with the PI. All materials provided by HEI or the PI will be considered confidential unless noted otherwise.

RESEARCH SOLICITATIONS INCLUDED IN THIS RFQP

This RFQP includes studies funded under the following research solicitations under HEI's Environment and Health Program. Dr. Ellen Mantus is the Director and Dr. Anna Rosofsky is the QA Manager of this program.

- RFA 21-1, Quantifying Real-World Impacts of Non-Tailpipe Particulate Matter Emissions
- RFA 22-1, Walter A. Rosenblith New Investigator Award
- RFA 23-1, Assessing Health Effects of Traffic-Related Air Pollution in a Changing Urban Transportation Landscape
- RFA 23-2, Assessing Changes in Exposures and Health Outcomes in Historically Marginalized and Environmentally Overburdened Communities from Air Quality Actions, Programs, or Other Interventions
- RFQ 24-1, Benefits Assessment of Accelerated Turnover of the On-Road Diesel Vehicle Fleet in the United States
- RFQ E23-1, Trends in Air Quality & Community Exposures Associated with Oil and Gas Development
- RFQ E23-2, Regional Groundwater Modeling to Understand Community Exposures Associated with Oil and Gas Development

DESCRIPTION OF STUDIES NEEDING QA OVERSIGHT

Individual studies, including their current status and QA needs, are listed in Appendix A. More details about the studies can be found in Appendix B and at https://www.healtheffects.org/research/ongoing-research.

APPLICATION PROCESS

The application process consists of two phases:

1. Statement of qualifications (Phase 1)
2. Proposal for auditing HEI-funded research studies (Phase 2)

Interested teams may apply for QA oversight of one or multiple studies.

Statement of Qualifications (Phase 1)

Interested applicants should submit a statement of qualification using Form 1 (see Table 1 for recommended areas of expertise for each RFA).

The Statement should include the following: a) statement of qualifications that includes a list of QA projects completed during the last 5 years that are relevant to the HEI studies, b) curriculum vitae of the key personnel who would conduct the QA oversight, c) specific studies that the applicant is interested in auditing (see Appendices A and B), d) an anticipated lead time for delivering reports on QA audits (ideally reports would be delivered within 4-6 weeks of the audit), and e) list of any actual or potential conflicts of interest between the applicant and the study investigators. The statement of qualifications is non-binding.

HEI will invite the most qualified applicants to submit proposals for auditing one or more HEI-funded research studies.

Deadline: December 2, 2024. Applicants will be informed if they have been selected to submit a proposal and for which studies, within 2 weeks of the deadline. All applicants selected to submit a proposal will be offered a conversation about expectations with HEI staff.

Table 1. Recommended Areas of Audit Team Expertise. Some areas of expertise might not apply to all studies under the listed RFA.

RFA	Areas of expertise
RFA 21-1	• Statistics, including knowledge of statistical source apportionment. • Air pollution measurements and methods development, including field- and laboratory-based air pollution sampling and real-time monitoring approaches. • Air pollution exposure assessment for epidemiological studies, including land use regression modeling.
RFA 22-1	• Epidemiology, including experience with use of administrative databases. • Statistics, including knowledge of statistical source apportionment and causal inference methods. • Air pollution exposure measurement and modeling, including experience with low-cost particulate matter sensors and emissions modeling.
RFA 23-1	• Epidemiology, including experience with use of administrative databases. • Statistical expertise, including Cox proportional hazard models, regression, agent-based modeling, and multilevel modeling, preferably with machine learning techniques and causal inference methods. • Air pollution exposure measurement and modeling, including experience with low-cost sensors, satellite data, dispersion models, and land-use regression modeling. • Human biomarker measurement.
RFA 23-2	• Air pollution exposure measurement and modeling, including experience with emissions modeling, chemical transport modeling, satellite data, dispersion models, and land-use regression modeling. • Statistical expertise, including regression, multilevel modeling, and machine learning techniques. • Air quality, exposure, and health impact assessment.
RFQ 24-1	• Air pollution exposure modeling, including experience with emissions modeling and regulatory chemical transport modeling.

Table 1. Recommended Areas of Audit Team Expertise. Some areas of expertise might not apply to all studies under the listed RFA.	
RFA	Areas of expertise
	• Air quality, exposure, and health impact assessment. • Qualitative data collection (e.g., via surveys and focus groups) and analysis.
RFQ E-23-1	• Air pollution exposure measurement and modeling, including experience with emissions modeling, chemical transport modeling, satellite data, dispersion models, and trend analyses.
RFQ E-23-2	• Regional groundwater modeling of oil and gas-related spills

Request for Proposals (Phase 2)

Selected Phase 1 applicants will be asked to submit a written proposal for QA oversight for the specific studies using Form 2.

The proposal should include for each study a) proposed scope of work, b) schedule and detailed list of tasks for the audits and hours allocated to each task, c) list of personnel involved and their responsibilities, and d) budget estimate for each study with separate items for personnel costs (indicating the number of hours and the hourly rate of each member of the QA team) and travel costs, if applicable. Important deliverables to be included in the proposal shall include confirmation that confidential interim QA audit reports (audits during the study only) and final QA audit reports will be submitted to the Director of the applicable HEI Program and a signed QA audit statement will be provided for publication with the final report. The proposal should include references to the applicable QA protocols that the applicants plan to follow.

Please note that HEI does not pay for travel time; however, travel time can be billed if it is used for work related to the visit. HEI will provide additional relevant material (e.g., project plans, progress reports) to the selected applicants.

Deadline: February 3, 2025. HEI staff will review the proposals based on the quality of the QA plan, expertise of the team, and reasonableness of the proposed costs. A response to all applicants will be provided by February 28, 2025.

Please direct all questions about the RFQP and application process to Dr. Anna Rosofsky at arosofsky@healtheffects.org. Submissions should be submitted by email to funding@healtheffects.org.

Appendix A. HEI Studies Requiring Audits

Study #	Solicitation #	PI	Institution	Study title	Study location	Anticipated study period	Status as of October 1, 2024	QA needs[1]
1	RFA 21-1	Evans, Greg	University of Toronto	Improved Characterization of the Real-World Contributions and Impacts of Non-tailpipe Particulate Matter Emissions	Toronto, Canada	December 1, 2023 to November 30, 2025	Near end of year 2 of 3	FR
2	RFA 22-1	Ornelas van Horne, Yoshira	Columbia University	What's in the Air? Engaging Native American Youth in the Northern Plains to Reduce Air Pollution	South Dakota	February 1, 2024 to January 31, 2027	Middle of year 1 of 3	B
3	RFA 22-1	Nethery, Rachel	Harvard University	Designing Optimal Policies for Reducing Air Pollution-related Health Inequities	United States	April 1, 2024 to March 31, 2027	Middle of year 1 of 3	FR
4	RFA 23-1	Brauer, Michael	The University of British Columbia	An Agent-based Model for Evaluating Long-term Impacts of TRAP on Disadvantaged Communities under Multiple Scenarios	San Francisco Bay Area, California	June 1, 2024 to May 31, 2027	Middle of year 1 of 3	B
5	RFA 23-1	Gibson, Heike	Harvard University	Traffic-Related Air Pollution, Lipoproteins, and Cardiovascular Disease Risk in the VITamin D and OmegA-3 TriaL (VITAL)	United States	March 1, 2024 to August 31, 2026	Middle of year 1 of 2.5	FR
6	RFA 23-1	Knote, Christoph	University of Augsburg	Predicting Cardiometabolic Health and Air Pollution in Future Transportation Landscapes Using Agent-based Models	Augsburg and Munich metropolitan area, Germany	September 1, 2024 to August 31, 2027	Beginning of year 1 of 3	B

Study #	Solicitation #	PI	Institution	Study title	Study location	Anticipated study period	Status as of October 1, 2024	QA needs[1]
7	RFA 23-1	Paulson, Suzanne	University of California, Los Angeles	Novel Exposures, Birth Outcomes, and Environmental Justice in a Changing Transportation Landscape	Los Angeles, California	August 1, 2024 to July 31, 2027	Beginning of year 1 of 3.5	B
8	RFA 23-2	Goodchild, Anne	University of Washington	Managing the Traffic-related Air Pollution (TRAP) Effects of Urban Warehousing near Historically Marginalized Communities: a Scenario Analysis of Technology and Land Use Based Strategies	Seattle and NYC	September 1, 2024 to August 31, 2026	Beginning of year 1 of 2	B
9	RFA 23-2	Horton, Daniel[2]	Northwestern University	Efficacy of Vehicle Emission Control Interventions in Ameliorating Air Pollution Exposure and Health Burdens in Marginalized Communities	Nationwide, Chicago	August 1, 2024 to July 31, 2027	Beginning of year 1 of 3	B
10	RFA 23-2	Zhang, Jiachen	University of Southern California	Impact of Zero-Emission Truck Regulations on Tailpipe and Non-Tailpipe Air Pollutant Exposures and Health Risks in Southern California Communities	California	August 1, 2024 to July 31, 2026	Beginning of year 1 of 2	B
11	RFQ 24-1	Horton, Daniel[2]	Northwestern University	Roadmap for MHDV Fleet Renewal: Maximizing Health and Environmental Justice Benefits in Air Pollution-Burdened Warehouse-Adjacent Communities	Chicago	September 1, 2024 to February 28, 2026	Beginning of year 1 of 1.5	FR
12	RFQ E23-1	Baek	George Mason University	Long-term criteria and toxic pollutants trends and community exposures over	OH, PA, WV	May 2024-April 2025	Middle of Year 1 of 1	FR

Study #	Solicitation #	PI	Institution	Study title	Study location	Anticipated study period	Status as of October 1, 2024	QA needs[1]
				the Marcellus Shale in the U.S.				
13	RFQ E23-1	Gernand	Penn State University	Trends in Marcellus-Utica Shale Regional Air Quality due to Unconventional Oil and Gas Development (TriMAQs)	OH, PA, WV	April 2024-March 2025	Middle of Year 1 of 1	FR
14	RFQ E23-1	Schade	Texas A&M	Air Quality Trends in Texas and Colorado Associated with Unconventional Oil and Gas Development	11 locations in CO and TX	May 2024-April 2025	Middle of Year 1 of 1	FR
15	RFQ E23-2	Saiers	Yale University	A Groundwater Modeling Framework for Elucidating Community Exposures Across the Marcellus Region to Contamination Associated with Oil and Gas Development	OH, PA, WV	March 2024-Feb 2025	Middle of Year 1 of 1	FR

[1] Abbreviations: **B** – Both audit during the study and final report audits, **FR** – final report audit only.
[2] Both studies led by Dr. Horton will be audited by the same group.

Appendix B. Description of Studies Requiring QA Oversight

RFA 21-1, Quantifying Real-World Impacts of Non-Tailpipe Particulate Matter Emissions

1. **Improved Characterization of the Real-World Contributions and Impacts of Non-tailpipe Particulate Matter Emissions**
   Dr. Evans and colleagues are investigating real-world field measurements to estimate and understand population exposure to non-tailpipe versus tailpipe particulate matter. They are conducting the work as four integrated sub-studies: (1) laboratory studies of oxidation potential and chemical speciation; (2) spatial studies incorporating saturation sampling, mobile monitoring, and a low-cost sensor network; (3) temporal studies of long-term positive matrix factorization (PMF) and high time resolution PMF; (4) and non-tailpipe hot spot studies of outdoor and enclosed environments. They are assessing the contribution of non-tailpipe emissions to ambient PM in large, high-traffic cities and whether it varies spatially and temporally to manifest distinguishable population exposure patterns that are different enough to enable future studies to assess the health risk of real-world non-tailpipe particle exposures.

RFA 22-1, Walter A. Rosenblith New Investigator Award

2. **What's in the air? Engaging Native American Youth in the Northern Plains to Reduce Air Pollution.**
   Dr. Ornelas Van Horne and colleagues seek to advance a community-academic partnership with Missouri Breaks Industries Research (an American Indian-owned research center that serves Indigenous communities and others in North and South Dakota) and her associated research institution to characterize sources of air pollution and identify community-driven solutions through an emissions reduction plan. Specifically, she plans to engage Native American youth in the formation of a community-based air monitoring network and personal monitoring using low-cost sensors, to determine local sources of $PM_{2.5}$ and then leverage those findings to develop a potential emissions reduction plan.

3. **Designing Optimal Policies for Reducing Air Pollution-related Health Inequities**
   Dr. Nethery and colleagues are developing statistical methods for characterizing spatial and racial and ethnic variation in health effects associated with exposure to fine particulate matter ($PM_{2.5}$) across the United States and designing potential policies for reducing inequities associated with $PM_{2.5}$ exposures. The study will integrate concepts from Bayesian causal inference, simulation-based approaches, and literature on constrained optimal treatment regimes and spatial optimization. The study will make use of a nationwide Medicare cohort representing approximately 64 million older adults and $PM_{2.5}$ exposure models at a spatial resolution of 1 km x 1 km.

RFA 23-1, Assessing Health Effects of Traffic-Related Air Pollution in a Changing Urban Transportation Landscape

4. **An Agent-based Model for Evaluating Long-term Impacts of TRAP on Disadvantaged Communities under Multiple Scenarios**
   Dr. Brauer and colleagues will link and extend several models (including BEAM CORE, originally developed with funding from the U.S. Department of Energy) to create a framework for full-chain assessment of transportation systems and impacts of traffic-related air pollution on population health

in the San Francisco Bay Area. They will evaluate impacts of three policy scenarios—(1) federal/CA long-term transportation electrification, (2) telecommuting impact from COVID-19, and (3) community-led scenario—on ambient air pollution and associated mortality and morbidity outcomes, including environmental justice disparities. The proposal would extend BEAM CORE to estimate tailpipe and non-tailpipe emissions, resulting ambient concentrations of $PM_{2.5}$, NO_2 and black carbon, and associated health impacts and disparities.

5. **Traffic-Related Air Pollution, Lipoproteins, and Cardiovascular Disease Risk in the VITamin D and OmegA-3 TriaL (VITAL)**
   Dr. Gibson and colleagues will use an existing study (VITAL) to examine both cross-sectional and longitudinal associations of traffic-related air pollution with a panel of standard lipid risk factors and novel apolipoprotein and lipoprotein subfractions and with incident cardiovascular disease events and explore potential mediating pathways of risk. VITAL is a recently completed double-blind, placebo-controlled clinical trial of vitamin D and marine omega-3 fatty acid supplements in the primary prevention of cancer and cardiovascular disease. Traffic-related air pollution exposure at participants' addresses will be assigned by using exposure models to estimate daily levels of NO_2, $PM_{2.5}$, and tailpipe and non-tailpipe PM components, taking into account residential history. In addition to the association between cardiovascular disease outcomes and lipid biomarkers with traffic-related air pollution, the proposal aims to examine whether a randomized intervention of vitamin D or omega-3 fatty acid supplementation or both mitigates the detrimental effects of traffic-related air pollution.

6. **Predicting Cardiometabolic Health and Air Pollution in Future Transportation Landscapes Using Agent-based Models**
   Dr. Knote and colleagues will assess impacts of future urban transportation landscapes on cardiometabolic health through novel exposure estimation using an agent-based approach together with numerical air quality modeling that focuses on ultrafine particulate matter, black carbon, and metal compounds in particular matter. Exposures will be associated with clinical and subclinical markers of cardiovascular diseases, and prevalence and incidence data of cardiometabolic and cerebrovascular events using an existing population-based cohort in Augsburg, Germany (KORA). In a health follow-up study, additional studies will be incorporated with a mobility questionnaire to evaluate travel behavior, and volunteering participants will carry a personal exposure monitoring device to evaluate individual time-activity and modelled exposure. An agent-based model will be developed to mimic the whole study area population and then scaled up to Germany.

7. **Novel Exposures, Birth Outcomes, and Environmental Justice in a Changing Transportation Landscape**
   Dr. Paulson and colleagues will develop models relevant for characterizing exposures from vehicle (tailpipe and non-tailpipe), rail, and aircraft sources and relate those exposures to birth outcome data in the Los Angeles area. They will also include a social vulnerability analysis and will assess the impact of electric vehicles, flight technologies, and the COVID-19 travel disruptions on air pollution and birth outcomes. The investigators will add monitoring stations in Los Angeles to measure and characterize ambient fine particulate matter by mass, elements (metals), ions, black carbon, and oxidative potential. They will use the new data and leverage exposure data from earlier and ongoing studies to create detailed spatial exposure estimates. Areas selected for additional monitoring include sites near electric vehicle charging stations and conventional fueling stations and sites around the LAX airport and railyards. These spatially specific pollutant estimates will be linked to birth outcomes, including preterm birth, term low birth weight, and ischemic placental disease, assessed via Los Angeles County birth certificate data, and the relationships evaluated.

RFA 23-2, Assessing Changes in Exposures and Health Outcomes in Historically Marginalized and Environmentally Overburdened Communities from Air Quality Actions, Programs, or Other Interventions

8. **Managing the Traffic-related Air Pollution (TRAP) Effects of Urban Warehousing near Historically Marginalized Communities: A Scenario Analysis of Technology and Land Use Based Strategies.**
   Dr. Goodchild and colleagues are identifying state and local zoning policies for minimizing traffic-related air pollution emissions from warehouse and distribution (W&D) fleets in historically marginalized communities in Seattle and New York City. The investigators first will develop a household-level demand model using a combination of publicly available data and assumptions informed by expert interviews to predict 2035 adoption of low- and zero-emission vehicles and will identify W&D locations based on local land use policies. They will then quantify tailpipe and non-tailpipe emissions to estimate urban freight system emissions, concentrations of $PM_{2.5}$ and its precursors, associated mortality and asthma onset or prevalence, and disparities. The investigators have devoted a separate aim to investigating uncertainties at each phase of the modeling process. Stakeholder engagement will build on the Urban Freight Lab's existing connections and activities for disseminating and translating research results.

9. **Efficacy of Vehicle Emission Control Interventions in Ameliorating Air Pollution Exposure and Health Burdens in Marginalized Communities**
   Dr. Horton and colleagues are assessing the emissions from heavy-duty vehicles in freight hubs, along with the air quality, health, and equity implications of adopting the US EPA Clean Trucks Plan and California's Advanced Clean Truck (ACT) and Heavy-Duty Engine and Vehicle Omnibus Regulations in Illinois. They will use TROPOMI and TEMPO observations of columnar NO2, emissions inventories, vehicle telemetry data, and warehouse location data to improve the accuracy of nationwide heavy-duty vehicle NOx emissions and concentrations. They will then use the emissions, chemical transport model simulations, and land use regression models to assess NO2 contributions from heavy-duty vehicles under proposed regulations compared to baseline. from Aim 1 to determine the air quality, health, and equity implications of the three regulations noted in the southern Lake Michigan region. The project will compare the exposure and health disparities under current and aspirational transportation policies. The study will leverage existing connections with community groups who are part of the Equitable Transition to Zero-Emissions coalition to translate and disseminate findings.

10. **Impact of Zero-Emission Truck Regulations on Tailpipe and Non-Tailpipe Air Pollutant Exposures and Health Risks in Southern California Communities**
    Dr. Zhang and colleagues propose to evaluate the exposure and associated health effects from two California Air Resources Board (CARB) heavy-duty diesel vehicle regulations: Advanced Clean Trucks (adopted in 2021, aimed at manufactures) and Advanced Clean Fleets (adopted in 2023, aimed at fleet owners) in California goods transportation corridors. They will first quantify changes in particulate matter (PM) and NO_X emissions and PM, NO_x, and O_3 concentrations at neighborhood scale resulting from the regulations. They will also quantify disparities in exposures and health outcomes in freight transport communities and assess the monetized economic impact of attributable avoided or added mortality and asthma emergency department visits. They will assess those outcomes in the near-, mid-, and long-term. They will collaborate with community partners to design research dissemination strategies and develop education materials.

RFQ 24-1, Benefits Assessment of Accelerated Turnover of the On-Road Diesel Vehicle

Fleet in the United States

11. Roadmap for MHDV Fleet Renewal: Maximizing Health and Environmental Justice Benefits in Air Pollution-Burdened Warehouse-Adjacent Communities

Dr. Horton and colleagues propose to conduct a study in an area of the west side of Chicago, Illinois that is heavily affected by diesel emissions. They intend to assess changes in air quality (fine particulate matter, ozone, nitrogen dioxide, and elemental carbon) using the two-way coupled WRF-CMAQ modeling system (nested 1.3-km grid) and to conduct census-tract level health impact assessment and equity-focused analysis using associations from the literature. Air pollution exposure and health burden scenarios to be compared are (1) current effects associated with older medium- and heavy-duty vehicle tailpipe emissions and (2) setting tailpipe emissions from pre-2010 medium- and heavy-duty vehicles to lower levels in line with newer vehicle fleet emissions. They will engage with industry through advisory board listening sessions, an outlook workshop, semi-structured interviews, and a fleet manager survey. Community engagement will include a windshield and walking survey coupled with Small Area Analysis with community members.

RFQ E23-1, Trends in Air Quality & Community Exposures Associated with Oil and Gas Development

12. Long-term criteria and toxic pollutants trends and community exposures over the Marcellus Shale in the U.S.

Dr. Baek and colleagues aim to assess trends in air quality and community exposures in the Marcellus Shale region and whether any might be explained by changes in oil and gas development-related operations or governance. The analysis will focus on local and regional exposures to criteria and hazardous air pollutants from 2002-2021, with special attention toward historically disadvantaged communities. The investigators are achieving their research aims with the following steps:

- Perform a long-term emissions trend analysis by integrating bottom-up oil and gas emissions and ambient measurements of criteria and select hazardous air pollutant concentrations.
- Conduct a long-term air quality trend analysis by applying a chemical transport model to simulate the criteria and select hazardous air pollutant concentrations over the region.
- Use a more advanced chemical transport model that employs machine-learning to investigate sources of and control strategies for oil and gas emissions.
- Apply a county-level community health vulnerability index approach to identify disproportionately exposed communities.

13. Trends in Marcellus-Utica Shale Regional Air Quality due to Unconventional Oil and Gas Development (TriMAQs)

Dr. Gernand and colleagues aim to understand how oil and gas development might contribute to any local or regional trends in air quality and associated population exposure across the Marcellus-Utica Shale region from 2004-2023. The team is assessing whether changes in operations or governance may have contributed to any observed trends. The investigators are achieving their research aims with the following steps:

- Organize daily air quality monitoring data for criteria air pollutants and volatile organic compounds into a single dataset for the study region from 2004-2023.
- Develop a dataset of daily oil and gas operational activity (including drilling, fracturing, transport, and gas compression) and an inventory of expected emissions across the study region for the same period as the air quality dataset (2004-2023).

- Estimate population exposure to the criteria air pollutants and volatile organic compounds, including exposures experienced by economically disadvantaged areas using the US Census American Community Survey data.
- Estimate the fraction of emissions in the region that come from oil and gas development and how changes in industry practice and governance might have led to changes in air quality.

14. Air Quality Trends in Texas and Colorado Associated with Unconventional Oil and Gas Development

Dr. Schade and colleagues aim to determine trends in the atmospheric concentrations of methane and non-methane hydrocarbons at eleven locations in the Haynesville, Eagle Ford, Barnett, and Permian regions of Texas and six locations in the Denver-Julesburg region of Colorado. The research team is using air quality monitoring data that date back as far as 1997 at one of the Texas locations, including:

- Texas Commission on Environmental Quality ambient air quality data collected in proximity and downwind of oil and gas production.
- Air quality data from the Colorado Department of Public Health & Environmental, the National Oceanic and Atmospheric
- Administration, and from a Northern Colorado Front Range Regional Government Coalition.
- Satellite-based measurements of formaldehyde above the Permian basin as a proxy for non-methane hydrocarbon emissions in the last 10 years.
- The research team is separating long-term trends from seasonal and other short-term variations and is seeking to understand whether any observed trends are the result of changes in oil and gas operations or significant disruptions such as the COVID-19 pandemic shutdowns in 2020.

RFQ E23-2, Regional Groundwater Modeling to Understand Community Exposures Associated with Oil and Gas Development

15. A Groundwater Modeling Framework for Elucidating Community Exposures Across the Marcellus Region to Contamination Associated with Oil and Gas Development

Dr. Saiers and colleagues aim to build and test a model for understanding residential well water vulnerability to contamination from unconventional oil and gas development (UOGD) across the Marcellus region. This analysis will increase the understanding of risk to groundwater quality using publicly available data describing UOGD spills. The investigators will achieve their goal by:

- Modeling residential drinking water well vulnerability to contamination from UOGD sources over time across the Marcellus region. The model will describe how contaminants move in the subsurface.
- Using the model to understand the likelihood that specific UOGD spills will contaminate the water in residential wells.
- Refining the model and assessing its performance with statistical analyses using the characteristics of documented cases of UOGD spills and known contamination at well locations.