UTC SEMI-ANNUAL PROGRESS REPORT

Federal Agency: Office of the Assistant Secretary for Research and Technology
US Department of Transportation

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Project Title: Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH)

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DUNS & EIN Numbers: 93-848-5539; 74-2270624

Recipient Organization: Texas A&M Transportation Institute
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College Station, TX 77843-3135

Recipient Identifying Number: 12-608101; 12-165929

Grant Period: November 30, 2016 – September 30, 2022

Reporting Period End Date: March 31, 2019

Report Term: Semi-Annual

Signature of Submitting Official: [Signature]
OVERVIEW

The Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH) has been highly productive during this reporting period. This period was marked by the great success of the CARTEEH Transportation, Air Quality, and Health Symposium, held in February 2019, drawing over 150 participants to Austin, Texas. Both the cooperative and competitive research projects are progressing, all involving a talented group of students. We have initiated several technology transfer activities, which have received extremely positive feedback. At the end of this reporting period, we are proud of our progress and excited about upcoming activities in all our goal areas.

ACCOMPLISHMENTS

Major Goals of the Program

CARTEEH brings together experts from transportation and public health, two disciplines that have not traditionally worked together. CARTEEH’s primary purpose is to advance research on transportation emissions in a more comprehensive manner, mapping the holistic tailpipe-to-lungs spectrum which includes the impacts of transportation emissions on the environment and public health. Figure 1 shows a simplified version of the tailpipe-to-lungs chain.

Figure 1: Tailpipe to Lungs Spectrum
CARTEEH’s research focus areas were defined to cover this spectrum and are as follows:

- Transportation System
- Emissions and Energy Estimation
- Exposure and Health Impacts
- Data Integration
- Policy and Decision-Making

Progress in each CARTEEH goal area is detailed in the following sections.

**CARTEEH Goal #1: Research Program**

CARTEEH’s research program is divided into three areas: cooperative research, the competitive program, and strategic, targeted initiatives.

Work on cooperative projects identified in the first-year project work plan is successfully progressing, and most are scheduled to be completed during the next reporting period. The consortium partners have successfully met the collaboration requirements of these projects, and in the third year, are discussing future collaborative projects.

The competitive research projects awarded in CARTEEH’s second year are all underway at each partner institution. Principal Investigators submit quarterly progress reports, which are reviewed by CARTEEH leadership members who follow up with the project PIs with any comments or questions. Most competitive projects began in early 2018, and with the 12 – 18 month required timeline, many are scheduled to be completed during the coming reporting period.

**Strategic Initiatives**

In addition to cooperative and competitive projects identified above, three strategic initiatives targeting areas identified by CARTEEH leadership as being impactful and relevant to the area of health and transportation were underway during this reporting period.

*Technology Landscape and Future Direction for Transportation Emissions, Energy and Health*

This project was initiated to facilitate key elements of CARTEEH’s technology transfer plan. Its overall goal is to develop a technology roadmap for transportation emissions, energy, and health, by identifying:

- technologies currently available or under development in both software and hardware;
- technologies with high potential to further CARTEEH’s mission;
- partners in private and public sectors for technology transfer;
- gaps in research development.
Transportation and Health – Conceptualization and Quantification

As transportation, air quality and health issues are increasingly being tackled in an interdisciplinary manner, there is a need to address the transportation-health nexus beyond air quality and emissions topics. CARTEEH researchers developed a comprehensive conceptual model framing the various linkages between transportation and health, termed as "pathways." Some pathways are associated with beneficial health impacts, while others are associated with detrimental health impacts. Our framework identified the existing literature and evidence on each. We are also working on initiatives to quantify and monetize the impacts of selected pathways for case studies in Texas and beyond. This framework is a first step to promote holistic solutions that enhance the beneficial health impacts of transportation while addressing its detrimental health outcomes.

Urban Policy Interventions and Their Effectiveness in Reducing Traffic Emissions and Traffic-Related Air Pollution

In this study, researchers are conducting a systematic review to identify policy interventions at the urban level that can be implemented by local authorities to effectively reduce traffic emissions and/or traffic-related air pollution (TRAP) from on-road mobile sources. An interactive tool will be developed to allow local authorities to pinpoint policy interventions that may be most effective in their area. It is believed that this will be the first peer-reviewed systematic review exclusively focused on synthesizing international evidence on the effectiveness of urban-level policy interventions in reducing traffic emissions and/or TRAP from on-road mobile sources in the context of human exposure and health effects.

Reporting Requirements and Close-Out Procedures

During this reporting period, the closeout procedures for all research projects were finalized, and a report template and closeout checklist was created and distributed to all researchers. Final research reports are due 60 days after the completion of the project.

Research Results Disseminated

Preliminary findings from CARTEEH projects have been presented at various conferences throughout this reporting period, including TRB and the CARTEEH Transportation, Air Quality, and Health Symposium.

In addition, some of the projects lend themselves to public outreach and involvement, such as with cooperative project #3, “Border Crossing Emissions Impacts Study.” As part of the recruiting efforts, project researchers reached out to teachers in the El Paso Independent School District and discussed the impacts of vehicle emissions on their health, along with that of the students.

Community members in Baltimore City, Maryland play a significant role in securing site locations for data collection, on the projected titled “Assessing Regulatory Compliance and Community
Air Pollution Impacts of Crude Oil by Rail Transport, *which* is being conducted at Johns Hopkins University.

Our robust dissemination of research results is seen in the extensive list of presentations, conference papers, conference abstracts, and journal manuscripts that are detailed in the technology transfer section.

Table 1 provides a high-level picture of CARTEEH’s full research portfolio.

<table>
<thead>
<tr>
<th>Project</th>
<th>Lead Institution</th>
<th>Principal Investigator</th>
<th>Project Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transportation Emissions and Health Data Hub</strong></td>
<td>TTI</td>
<td>Dr. Andrew Birt</td>
<td>01-TTI</td>
</tr>
<tr>
<td>Reconciles differences in characteristics of transportation and health data; develops a platform to house datasets</td>
<td></td>
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<tr>
<td><strong>Truck Emissions Exposure Study in Ports</strong></td>
<td>GaTech</td>
<td>Dr. Michael Rodgers</td>
<td>02-GT</td>
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<tr>
<td>Assesses pollutant emissions at selected major ports; evaluates the potential reduction of exposure using multiple methodologies</td>
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<tr>
<td><strong>Border Crossing Emissions Impact Study</strong></td>
<td>TTI</td>
<td>Dr. Tara Ramani</td>
<td>03-TTI</td>
</tr>
<tr>
<td>Characterizes the emissions impact of border crossings and identifies population groups most affected by the emissions</td>
<td></td>
<td></td>
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<tr>
<td><strong>Healthy Living and Traffic-Related Air Pollution in an Underserved Community</strong></td>
<td>UTEP</td>
<td>Dr. Wen-Whai Li</td>
<td>04-UTEP</td>
</tr>
<tr>
<td>Quantifies traffic-related air pollution and the associated respiratory health for vulnerable school children in El Paso, Texas</td>
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<tr>
<td><strong>Development and Evaluation of Connected Vehicle Application for Alternative Fuel Trucks</strong></td>
<td>UCR</td>
<td>Dr. Peng Hao</td>
<td>05-UCR</td>
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<tr>
<td>Evaluates benefits of batter electric trucks and plug-in hybrid electric trucks over conventional diesel trucks</td>
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<tr>
<td><strong>Health Risk Characterization for Transportation Users</strong></td>
<td>JHU</td>
<td>Dr. Mary Fox</td>
<td>06-JHU</td>
</tr>
<tr>
<td>Develops a cumulative exposure and risk profile for transportation workers and/or system users considering chemical and other stressors</td>
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<tr>
<td><strong>Assessing Regulatory Compliance and Community Air Pollution Impacts of Crude Oil by Rail (CBR) Transport in Baltimore City, Maryland</strong></td>
<td>JHU</td>
<td>Dr. Genee Smith</td>
<td>07-JHU</td>
</tr>
<tr>
<td>Deliveries evidence-based characterization of emissions impacts of CBR within Baltimore City, Maryland</td>
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<tr>
<td><strong>PM Exposure for Paratransit Transport</strong></td>
<td>GaTech</td>
<td>Dr. Alex Samoylov</td>
<td>01-08-GT</td>
</tr>
<tr>
<td>Characterizes exposure to PM faced by sensitive populations using paratransit transport</td>
<td></td>
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</tr>
<tr>
<td><strong>Measuring Temporal and Spatial Exposure of Urban Cyclists to Air Pollutants Using an Instrumented Bicycle</strong></td>
<td>GaTech</td>
<td>Dr. Kari Watkins</td>
<td>01-09-GT</td>
</tr>
<tr>
<td>Develops an understanding of local cyclists’ exposure to PM2.5 air pollutants in an urban environment</td>
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<tr>
<td><strong>Traffic-Related Air Pollution and Childhood Asthma in the United States: A burden of Disease Assessment</strong></td>
<td>TTI</td>
<td>Dr. Haneen Khreis</td>
<td>01-10-TTI</td>
</tr>
</tbody>
</table>
Conducts a burden of disease estimate of childhood asthma attributable to traffic-related air pollution within the US

**Characterizing In-Cab Air Quality in Heavy Duty Diesel Construction Equipment**
TTI  Dr. Phil Lewis  01-11-TTI

Analyzes air quality and driver exposure inside the cabs of heavy-duty diesel construction equipment.

**Dockless Mobility: Addressing Safety, Emissions, and Gaps in Policy Making**
TTI  Dr. Suriya Vallamsundar  01-12-TTI

Examines emissions exposure on dockless mobility users in Dallas, Texas.

**Quantifying Bioavailable Metals and Potential Dust Emissions from Highway-Related and Desert Sediments at Lordsburg Playa, New Mexico**
UTEP  Dr. Thomas Gill  01-13-UTEP

Scopes the presence of bioavailable metals and potential dust emissions from highway-related and desert sediments in New Mexico.

**Secondary Particulate Matter Exceed Primary Emissions from Current Gasoline Vehicles: Air Quality and Public Health Implications**
UCR  Dr. Georgios Karavalakis  01-14-UCR

Assesses emissions from gasoline direct injection and multipoint injection vehicles when operated under different driving cycles.

**Quantifying Traffic Congestion-Induced Change of Near-Road Air Pollutant Concentration**
UCR  Dr. Jill Luo  01-15-UCR

Develops a statistical model to quantify the contribution to the ambient air quality degradation due to traffic congestion.

**Truck Driver Wellness Pilot Study**
TTI  Dr. Reza Farzaneh  01-16-TTI

Investigates health and wellness needs of long-haul truckers.

**Transportation and Health - Conceptualization and Quantification**
TTI  Dr. Haneen Khreis  01-17-TTI

Addresses the transportation-health nexus beyond air quality and emissions; develops a comprehensive conceptual “pathways” model.

**Urban Policy Interventions and Their Effectiveness in Reducing Traffic Emissions and Traffic-Related Air Pollution**
TTI  Dr. Haneen Khreis  01-18-TTI

Identifies policy interventions to effectively reduce traffic emissions and traffic-related air pollution from on-road mobile sources.

**Technology Landscape and Future Direction for Transportation Emissions, Energy, and Health**
TTI  Dr. Yanzhi (Ann) Xu  01-19-TTI

Develops a technology roadmap for transportation emissions, energy, and health.

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**Plans for Next Reporting Period to Accomplish Research Goal**

Due to the delay in receiving our third-year funding, as well as CARTEEH focused efforts on the CARTEEH Symposium in February, the call for the next round of competitive research projects was postponed until May 2019. The RFP is being updated to more carefully target impactful projects closely aligned to CARTEEH’s research and technology transfer goals. We are also increasing the response time window, to allow more time for preparation of the problem statements. We will make the awards in early September to coincide with the start of the fall semester. CARTEEH leadership will continue to provide support, guidance, and assistance to project principal investigators to aid in achieving individual project objectives.
CARTEEH Goal #2: Education and Workforce Development

CARTEEH research projects are catalysts for CARTEEH student involvement, with the number of students involved with CARTEEH increasing each semester. During the past six months, CARTEEH has expanded its student engagement to include intermediate-school level students, with its participation in the Advancement Via Individual Determination (AVID) program.

Curriculum Course Development

Progress continues on the development of CARTEEH’s cross-disciplinary course titled “Traffic-Related Air Pollution, Human Exposures, and Health.” The course outline has been revised with the addition of 8 lectures, and a pool of primary and back-up lecturers have been identified for each of the 60 planned sessions.

The course will cover key topics from transportation, urban planning, exposure assessment, and public health and policy domains. It is intended to set the foundation for a three-credit-hour graduate-level course offered by consortium member institutions. The course targets students and practitioners in the areas of urban planning, transportation planning, transportation engineering, geography sciences, environmental epidemiology, and public health. There will be 60 lectures, which will include a 15 minute pre-recorded video lecture from a subject matter expert for each. Preparation of the templates for each of the 60 planned sessions is ongoing to standardize reporting and delivery of course materials.

CARTEEH Summer Internship Program

During this reporting period, applications were accepted for the CARTEEH internship program to be held this summer at TTI. The number of applicants increased significantly from last year, and of the 18 applications received, four senior students were selected to receive internships. Students chosen are from Texas A&M, as well as two of the CARTEEH partner institutions – Georgia Tech and UC Riverside.

Held in conjunction with the SAFE-D UTC summer internship program, the internship program runs from May 28th through August 2nd, approximately nine weeks. Each student will be paired with a mentor and will spend their summer working on a health and transportation-related project. At the completion of the program, students will participate in a university-wide, undergraduate research poster session. A core group manages CARTEEH and the SAFE-D UTC internship programs from both UTCs.
Advancement Via Individual Determination (AVID) Program

In mid-December 2018, CARTEEH researchers and graduate students spoke to 91 local intermediate school students who visited TTI as participants in the AVID program. AVID encourages underachieving students who have shown an ability to succeed to consider college and introduces them to professions with which they may be unfamiliar.

Students received an introduction to the “World of Transportation and Engineering,” observed a crash test, and participated in multiple breakout sessions. CARTEEH staff and students hosted a breakout session designed to educate students on the links between transportation, air pollution, and health.

Student of the Year

Ms. Ayla Moretti from UC Riverside was chosen as CARTEEH’s 2018 Student of the Year. Ms. Moretti received her bachelor’s degree in Environmental Science at Oregon State University and is currently a third-year Ph.D. student at UCR with a research specialization of air quality, particularly secondary organic aerosols aged from vehicle emissions. Ayla attended TRB where she presented a poster titled “Understanding Air Quality Data, Traffic, and Weather Parameters Collected from Near-Road Stations.” She also joined others from TTI and the SAFE-D UTC at the CUTC banquet.

Education Results Disseminated

During this reporting period, one of the 2018 CARTEEH summer interns, Ms. Kristen Sanchez, completed her bachelor’s degree in public health from Texas A&M and was hired as a full-time researcher at TTI. Kristen is working on several of CARTEEH’s special initiatives, as well as serving as a member of the summer internship program core group. While Kristen hadn’t previously considered a career in transportation, her internship exposed her to the linkage between public health and transportation. Kristen’s story may be found here, on the CARTEEH website.

Plans for Next Reporting Period to Accomplish Education Goal

During the next reporting period, the current education initiatives will continue, and CARTEEH will look for additional opportunities for education and workforce development growth. We anticipate further progress on the curriculum course development, as well as a further refinement of the summer internship program.
CARTEEH Goal #3: Technology Transfer

CARTEEH views technology transfer as a vital part of the research process, and one that must be integrated with our R&D activities and not treated as an afterthought. We place a high value on stakeholder identification and engagement, as well as emphasizing information dissemination and the creation of open-access tools and methods that enable practical application of cutting-edge research findings.

Several technology transfer activities are underway and progressing. The CARTEEH technology transfer activities aim to make research results and knowledge available to the research community and beyond.

Transportation, Air Quality, and Health Symposium

During this reporting period, efforts were focused on the CARTEEH inaugural Transportation, Air Quality, and Health Symposium, which was held February 18-20, in Austin, Texas.

The symposium’s objective was to promote healthy transportation planning and policy by bringing together different disciplines working in the distinct areas of transportation systems, emissions, energy, air pollution, exposures, and public health. The targeted audience included students, researchers and university faculty or staff, as well as transportation professionals.
Keynote speakers for the symposium were Dr. Daniel Greenbaum, President of the Health Effects Institute and Mr. Neil Pedersen, TRB Executive Director. There was a total of 151 participants representing industry, higher education, and the public sector. The symposium attracted participants from the United Arab Emirates, Germany, the UK and from many states across the U.S.

The Symposium was a three-day event, beginning with workshops on topics such as “Beyond Air Quality – The Wider Impacts of Transportation on Health” on Monday afternoon. Tuesday provided a number of presentations, as well as on-going poster sessions and opportunities for discussions on collaboration and networking. At the conclusion of the symposium, two students were recognized for their outstanding posters and awarded certificates of recognition and a $250 award, which were donated by TTI.

Comments from the survey conducted at the completion of the symposium were very favorable, with the majority giving it the highest possible rating.

The symposium information is housed here on CARTEEH’s website. Slides from most presentations have been uploaded, and videos and slides of the opening remarks and keynote session may also be found at the same location.

**Transportation Emissions and Health Data Hub**

Work continues the Transportation Emissions and Health Data Hub, one of the initial collaborative projects identified in CARTEEH year 1 workplan. As a key component of CARTEEH’s technology transfer vision, the Data Hub will provide a means to reconcile different methods of data collection and analysis in the fields of transportation and public health and will serve as one of the products of our technology transfer goals. While the first phase of the data hub will be completed in late May, plans for the second phase and ongoing development are already underway.
**CARTEEH Seminars/Webinars**

The CARTEEH Seminar/Webinar series continued in this reporting period, with one seminar held at the University of California, Riverside. Dr. Andrea Polidori spoke on the “Use and Applications of Low-Cost Air Quality Sensors.” The seminar was well attended, with over 100 participants registered from across the country. Videos or slides from all CARTEEH seminars are posted to the CARTEEH website for future viewing, and information on Dr. Polidori’s seminar may be found [here](#).

**CARTEEH Literature Library**

The [CARTEEH literature library](#) continues to develop on the CARTEEH website. This tool is intended as a resource for students, researchers, and practitioners interested in transportation and health, especially the impact of transportation emissions and air pollution on human health. The reference list has grown to over 800 scientific studies addressing the full chain of events between transportation pollution sources and health impacts. This reference list is periodically updated to include new studies as they become available.

**Technology Transfer Results Disseminated**

All Center activities are posted to the CARTEEH website, with several updates made to the site following this reporting period. While early research projects are just coming to completion, a significant number of abstracts have been submitted, as well as presentations made.

The CARTEEH Transportation, Air Quality, and Health Symposium site remains active, and the detailed program has been supplemented with slides from each presentation, as well as videos in some instances.

The first CARTEEH Biannual report, covering the Center’s first two years, was completed and published during this reporting period. The report was distributed electronically to approximately 1200 members of the CARTEEH mailing list, as well as via TTI’s LinkedIn account and Twitter handle. It can be found posted [here](#) on the CARTEEH website.

**Plans for Next Reporting Period to Accomplish Technology Transfer Goal**

Work continues on the implementation of the Technology Transfer Plan, including incorporating revised reporting requirements. Further discussion of the implementation of the T2 plan is found in our “outcomes” section.

As a result of the success of the inaugural CARTEEH symposium, we will continue the momentum and hold a second symposium in 2020 in southern California. We will co-host this
event with our partners at UC Riverside. Planning has begun, and dates and location are currently being finalized.

**PARTICIPANTS AND COLLABORATING ORGANIZATIONS**

CARTEEHH is made up of a consortium of five institutions: TTI is a member of the Texas A&M University System and home to the Center. Faculty and students from other colleges such as the Texas A&M Health Science Center are also involved. Johns Hopkins University, Georgia Tech, University of Texas-El Paso, and the University of California, Riverside complete the partnership.

**Partner Organizations and Other Significant Collaborators**

CARTEEHH’s focus areas cross multiple disciplines, bringing opportunities for a unique collaborative effort with institutions and individuals. These partners are essential to the success of the Center. Organizations and individuals in the following tables have directly supported or collaborated on Center activities.

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Location</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Alliance Houston</td>
<td>Houston, Texas</td>
<td>Collaboration</td>
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<tr>
<td>American Thoracic Society</td>
<td>New York</td>
<td>Collaboration</td>
</tr>
<tr>
<td>Atlanta Bicycle Council</td>
<td>Atlanta, Georgia</td>
<td>Collaboration, In-kind support</td>
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<tr>
<td>Breathe Easy Dallas</td>
<td>Dallas, Texas</td>
<td>Collaboration</td>
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<td>California Energy Commission</td>
<td>Sacramento, California</td>
<td>In-kind support</td>
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<td>Chesapeake Climate Action Network</td>
<td>Takoma Park, Maryland</td>
<td>Collaboration</td>
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<td>City of Austin Department of Transportation</td>
<td>Austin, Texas</td>
<td>Collaboration</td>
</tr>
<tr>
<td>City of Carson</td>
<td>Carson, California</td>
<td>Personnel</td>
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<td>City of Dallas</td>
<td>Dallas, Texas</td>
<td>Collaboration</td>
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<td>City of Los Angeles</td>
<td>Los Angeles, California</td>
<td>Data</td>
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<td>Clean Water Action</td>
<td>Washington, D.C.</td>
<td>Collaboration</td>
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<td>Dallas Independent School District</td>
<td>Dallas, Texas</td>
<td>Access to facilities</td>
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<td>El Paso Independent School District</td>
<td>El Paso, Texas</td>
<td>Facility and student access</td>
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<td>Environmental Defense Fund</td>
<td>Austin, Texas</td>
<td>Collaboration</td>
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<td>Georgia Ports Authority</td>
<td>Savannah, Georgia</td>
<td>Collaboration</td>
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<td>Health Effects Institute</td>
<td>Boston, Massachusetts</td>
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<td>Houston-Galveston Area Council</td>
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<tr>
<td>Kelly Burt Dozer</td>
<td>College Station, Texas</td>
<td>In-kind support</td>
</tr>
<tr>
<td>Larry Young Paving</td>
<td>College Station, Texas</td>
<td>In-kind support</td>
</tr>
<tr>
<td>Los Angeles County Metropolitan Transportation Authority</td>
<td>Los Angeles, California</td>
<td>In-kind support</td>
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</table>
Table 3: CARTEEH Significant Collaborators

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Contribution</th>
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<tr>
<td>Dr. Ananya Roy</td>
<td>Environmental Defense Fund</td>
<td>Collaboration</td>
<td>USA</td>
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<tr>
<td>Dr. Andrea Polidori</td>
<td>University of California - Riverside</td>
<td>In-kind contributions</td>
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<tr>
<td>Dr. Andrea Strzelec</td>
<td>Mississippi State University</td>
<td>Collaboration</td>
<td>USA</td>
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<tr>
<td>Dr. Bakeyah Nelson</td>
<td>Air Alliance Houston</td>
<td>Collaboration</td>
<td>USA</td>
</tr>
<tr>
<td>Mr. Brandon Feenstra</td>
<td>South Coast Air Quality Management District</td>
<td>In-kind support</td>
<td>USA</td>
</tr>
<tr>
<td>Dr. Cassandra Gaston</td>
<td>University of Miami, Miami, FL</td>
<td>Contact/Collaboration/data sharing/leveraging</td>
<td>USA</td>
</tr>
<tr>
<td>Dr. Chanam Lee</td>
<td>Texas A&amp;M University</td>
<td>Collaboration</td>
<td>USA</td>
</tr>
<tr>
<td>Name</td>
<td>Institution/University</td>
<td>Role</td>
<td>Location</td>
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<tr>
<td>Dr. Daniel Tong</td>
<td>NOAA, Washington DC</td>
<td>Contact/leveraging</td>
<td>USA</td>
</tr>
<tr>
<td>Dr. David Cocker</td>
<td>UCR, Department of Chemical and Environmental Engineering</td>
<td>Experimental Design and Data Analysis</td>
<td>USA</td>
</tr>
<tr>
<td>Dr. David Dubois</td>
<td>Office of the State Climatologist, Las Cruces, NM</td>
<td>Collaboration</td>
<td>USA</td>
</tr>
<tr>
<td>Dr. Dongjoo Park</td>
<td>University of Seoul</td>
<td>Collaboration</td>
<td>Korea</td>
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<tr>
<td>Mr. Douglass Mann</td>
<td>Maryland Institute College of Art</td>
<td>Data collection access</td>
<td>USA</td>
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<tr>
<td>Dr. Ellen MacKenzie</td>
<td>Dean, JHU Bloomberg School of Public Health</td>
<td>Collaboration</td>
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<tr>
<td>Dr. Eun Sug Park</td>
<td>TTI – Mobility Analysis Program</td>
<td>Collaboration</td>
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<tr>
<td>Dr. George Delclos</td>
<td>University of Texas Health Science Center at Houston</td>
<td>Collaboration</td>
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<tr>
<td>Dr. George Thrushton</td>
<td>New York University School of Medicine</td>
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<td>Mr. Hugh Pocock</td>
<td>Maryland Institute College of Art</td>
<td>Data collection access</td>
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<tr>
<td>Dr. Jenny Mindell</td>
<td>University College London</td>
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<td>The U.K.</td>
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<tr>
<td>Dr. Joan Reibman</td>
<td>New York University School of Medicine</td>
<td>Collaboration</td>
<td>USA</td>
</tr>
<tr>
<td>Mr. John Smart</td>
<td>Advanced Vehicles - Idaho National Lab</td>
<td>Collaboration</td>
<td>USA</td>
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<tr>
<td>Dr. John Tatarko</td>
<td>USDA Agricultural Research Service, Fort Collins, CO</td>
<td>Collaboration</td>
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<tr>
<td>Dr. John Wright</td>
<td>Bradford Institute for Health Research</td>
<td>Collaboration</td>
<td>The U.K.</td>
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<tr>
<td>Dr. Jorma Keskinen</td>
<td>Tampere University of Technology</td>
<td>In-kind contributions</td>
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<tr>
<td>Dr. Julian Marshall</td>
<td>University of Washington</td>
<td>Collaboration</td>
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<tr>
<td>Dr. Kai Zhang</td>
<td>University of Texas Health Science Center</td>
<td>Collaboration</td>
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<tr>
<td>Dr. Karen Lucas</td>
<td>University of Leeds</td>
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<td>The U.K.</td>
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<tr>
<td>Dr. Kees de Hoogh</td>
<td>Swiss Tropical and Public Health Institute</td>
<td>Collaboration</td>
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<tr>
<td>Dr. Kent Johnson</td>
<td>University of California, Riverside</td>
<td>Data</td>
<td>USA</td>
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<tr>
<td>Dr. Kyuok Kim</td>
<td>Korea Transport Institute</td>
<td>Collaboration</td>
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<tr>
<td>Dr. Mark Benden</td>
<td>TAMU Health Science Center</td>
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<tr>
<td>Dr. Mark Burris</td>
<td>TAMU – Civil Engineering</td>
<td>Collaboration</td>
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<tr>
<td>Dr. Mark Nieuwenhuijsen</td>
<td>Barcelona Institute for Global Health</td>
<td>Collaboration</td>
<td>Spain</td>
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<tr>
<td>Dr. Martina Klose</td>
<td>Barcelona Supercomputing Center, Barcelona, Spain</td>
<td>Contact/ data sharing</td>
<td>Spain</td>
</tr>
<tr>
<td>Dr. Michael Jerrett</td>
<td>University of California, Los Angeles</td>
<td>Collaboration</td>
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</table>
### Outputs

In CARTEEH’s 2018 Technology Transfer Plan, several output performance measures were targeted to be tracked for our center. While the implementation of our Technology Transfer plan is still in its early stages, we have already successfully met several of our output target metrics, such as the number of conference presentations and papers based on CARTEEH research, as well as the number of public, industry, and nonprofit organizations engaged by CARTEEH researchers.

Our target metric for conference presentations and papers based on CARTEEH research is seven per year, and we have already exceeded this number in the current reporting period.
Also, the number of public, industry, and nonprofit organizations engaged by CARTEEH researchers is on target to exceed our identified goal. As shown in the previous list, we have partnered with over 40 organizations during the first half of this year.

**Presentations**

**Name:** Dan Seedah, Andrew Birt, TTI  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Developing a Transportation, Emissions, and Health Data Hub  
**Location:** Austin, Texas

**Name:** Reza Farzaneh, Joe Zietsman, TTI; Teresa Penbrooke, GreenPlay, LLC  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Truck Driver Wellness Pilot Study  
**Location:** Austin, Texas

**Name:** Phil Lewis, Sherif El Khouly, Texas A&M University; Andrea Strzelec, Mississippi State University; Jeremy Johnson, Adam Mayer, TTI  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Assessing In-Cab Air Quality for Construction Equipment  
**Location:** Austin, Texas

**Name:** April Gadsby, Kaitlyn Schaffer, Nic Alton, Kari Watkins, Christopher Le Dantec, Georgia Tech  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Influence of Bike Infrastructure on Cyclist Air Pollution Exposure  
**Location:** Austin, Texas

**Name:** Ji Luo, Kanok Boriboonsomsin, Matthew Barth, UCR  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Consideration of Exposure to Traffic-Related Air Pollution in Bicycle Route Planning  
**Location:** Austin, Texas

**Name:** Raed Alotaibi, TTI; Mathew Bechle, Julian Marshall, University of Washington; Tara Ramani, Haneen Khreis, TTI; Mark Nieuwenhuijsen, ISGlobal  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Air Pollution and the Burden of Childhood Asthma in the Contiguous United States in 2000 and 2010  
**Location:** Austin, Texas

**Name:** Farinoush Sharifi, Reza Farzaneh, Soheil Sohrabi, Haneen Khreis, TTI  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium  
**Title:** Active Transportation and Self-Impression of Health – Evidence from 2017 National Household Travel Survey Data  
**Location:** Austin, Texas

**Name:** Soheil Sohrabi, Haneen Khreis, TTI  
**Event:** CARTEEH Transportation, Air Quality, and Health Symposium
Title: Assessing the Health Impact of Transportation Systems: A Burden of Disease Analysis  
Location: Austin, Texas

Name: Mary Fox, Joseph Amoah, Andrew Patton, Misty Zamora, Kristen Koehler, Johns Hopkins University  
Event: CARTEEH Transportation, Air Quality, and Health Symposium  
Title: Exploring Transportation-Related Chemical Mixtures and Cumulative Risks  
Location: Austin, Texas

Name: Thomas Gill, Iyasu Eibedingil, Lixin Jin, Marcos Mendez, UTEP; David Dubois, Jaylen Fuentes, New Mexico State University; Junran Li, University of Tulsa; John Tatarko, R. Scott Van Pelt, Nicholas Webb, USDA-ARS  
Event: CARTEEH Transportation, Air Quality, and Health Symposium  
Title: Assessing the Acute Safety Hazard to Highway Transportation from Blowing Dust at Lordsburg Playa, New Mexico  
Location: Austin, Texas

Name: Ji Luo, Ayla Moretti, Guoyuan Wu, Brandon Feenstra, Kanok Boriboonsomsin, Matthew Barth, UCR  
Event: CARTEEH Transportation, Air Quality, and Health Symposium  
Title: Performance Evaluation of Low-Cost Air Quality Sensors at Near-Road Air Quality Monitoring Stations  
Location: Austin, Texas

Name: Wen-Whai Li, Soyoung Jeon, Leah Whigham, UTEP; Amit Raysoni, University of Texas Rio Grande Valley  
Event: CARTEEH Transportation, Air Quality, and Health Symposium  
Title: Near-Highway Criteria Pollutant Concentrations are Weakly Associated with Adverse Respiratory Symptoms for Asthmatic Children Attending Roadside Schools  
Location: Austin, Texas

Name: Soheil Sohrabi, Farinoush Sharifi, Haneen Khreis, TTI  
Event: CARTEEH Transportation, Air Quality, and Health Symposium  
Title: The Impact of Connected and Autonomous Vehicles on Public Health: A Conceptual Model  
Location: Austin, Texas

Name: Patton, A.  
Event: Johns Hopkins Dept. of Environmental Health and Engineering Seminar  
Title: Exposure and Risk in Occupational and Non-Occupational Groups from Commercial Gasoline Station Filling Events  
Location: Baltimore, Maryland

Name: Ayla Moretti, Ji Luo, Guoyuan Wu, Brandon Feenstra, Kanok Boriboonsomsin, Matthew Barth  
Event: Transportation Research Board Annual Meeting  
Title: Understanding Air Quality Data, Traffic, and Weather Parameters Collected from Near-Road Stations  
Location: Washington, DC
Name: Amit U. Raysoni, Juan A. Aguilera, Leah D. Whigham, Stephanie Garcia, Moises Garcia, Adan Rangel, Mayra C. Chavez, Ivan M. Ramirez, Wen-Whai Li
Event: American Public Health Association 2018 Annual Meeting and Expo
Title: Airway inflammation and lung function measurements in asthmatic children at two road-side elementary schools in El Paso, TX
Location: San Diego, California

Name: Wen-Whai Li, Soyoung Jeon, Amit U. Raysoni, Juan A. Aguilera, Leah D. Whigham, Adan Rangel, Mayra C. Chavez, Ivan M. Ramirez
Event: Air Sensors International Conference
Title: Associations of respiratory responses with traffic air pollution for asthmatic children attending roadside schools
Location: Oakland, California

Name: Juan Aguilera, Leah Whigham, Wen-Whai Li
Event: 73rd meeting of the Joint Advisory Committee (JAC) for the Improvement of Air Quality in the Ciudad Juarez, Chihuahua, El Paso, Texas, and Dona Ana County New Mexico Air Basin
Title: Physical activity levels and traffic-related air pollutants in children with asthma attending near-road schools
Location: Las Cruces, New Mexico

Conference Abstracts, Conference Papers, and Journal Articles


Juan Aguilera and Leah Whigham, 2018. Using the $^{13}$C/$^{12}$C carbon isotope ratio to characterize the emission sources of airborne particulate matter: a review of literature Journal of Isotopes in Environmental and Health Studies, Vol 54 (6): 573-587, 2018


Kyuhyun Lee¹ and Ipek N. Sener ²,

Website

The CARTEEH website continues to be the face of our Center and is regularly updated with weekly news articles relevant to the CARTEEH focus areas. It also provides access to the Transportation Emissions and Health Data Hub, as well as the literature library and videos from CARTEEH seminars.

During this reporting period, carteeh.org was reviewed and made compliant with the 508 requirements. CARTEEH staff members who regularly post to the website are receiving training to familiarize them with the 508 compliance requirements.

In the coming months, we will make significant updates to more prominently feature the Data Hub as well as expanding on CARTEEH tech transfer and education activities. In conjunction with TTI Communications, we are working to improve our graphics and strengthen our branding.

Technologies

None to report for this period

Inventions

None to report for this period

Other Products

None to report for this period

OUTCOMES

Though the implementation of the Technology Transfer plan is still in its early stages, and was impacted by our funding delay, we successfully met several of our outcome performance measures, such as the number of attendees at seminar and outreach events, and the number of visitors to the website, literature library, and Data Hub.
Our target measure for the number of attendees to the seminar, webinar, and outreach events is 150 per year; we are meeting that goal. As mentioned earlier, there was a high level of interest in the seminar conducted by Dr. Andrea Polidori on the “Use and Applications of Low-Cost Air Quality Sensors,” with over 100 participants registered. Plans for the next seminar/webinar to be held in the upcoming reporting period are currently underway.

The Transportation, Air Quality, and Health Symposium had over 150 participants, and we expect an even larger group at the second symposium next year.

A second performance measure is the number of visitors to the CARTEEH website, literature library, and Data Hub. Our target number is 700 per year. In the current reporting period, we’ve had over 460, so we are well on our way to meeting that goal.

**IMPACT**

While the initial research projects funded by CARTEEH are being completed, the impacts of this work are being established. We have already seen our contributions impact the body of existing scientific knowledge, with our publications in high-level journals and conference presentations reaching a scientific audience, as well as the local media. Our impact is evidenced by the requests CARTEEH researchers receive to speak to various audiences.

We continue to engage several transportation agencies and work with them collaboratively on solutions that can maintain and enhance the functioning of the transportation system while also promoting health.

**CHANGES/PROBLEMS**

None

**SPECIAL REPORTING REQUIREMENTS**

No special reporting requirements.