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Environmental Justice Research Roadmap FY16 Annual Report

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U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT

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Abbreviations and Acronyms

ACE	Air, Climate, and Energy research program (ORD)
C-FERST	Community-Focused Exposure and Risk Screening Tool
EPA	U.S. Environmental Protection Agency
EJ	Environmental Justice
FY	Fiscal Year
HHRA	Human Health Risk Assessment research program (ORD)
HS	Homeland Security research program (ORD)
MVD	Making a Visible Difference
NCER	National Center for Environmental Research
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
ORD	Office of Research and Development (EPA)
RARE	Regional Applied Research Efforts
RESES	Regional Sustainable Environmental Science
RFA	Request for Applications
SHC	Sustainable and Healthy Communities research program (ORD)
SSWR	Safe and Sustainable Water Resources research program (ORD)
STAR	Science to Achieve Results
Tribal-FERST	Tribal Focused Environmental Risk and Sustainability Tool

Introduction

Purpose of the Environmental Justice Research Roadmap

The *Environmental Justice (EJ) Research Roadmap* describes the interface between environmental justice and science and outlines opportunities for scientific research that exist in the link between environmental equity and technology. Science is needed to allow the U.S. Environmental Protection Agency (EPA) to consider environmental justice in its regulatory analyses and program implementation. The research included in the Roadmap is intended to provide the scientific basis for EPA and other stakeholders to understand health disparities from environmental conditions and pollution and take actions to prevent them. The Roadmap also describes gaps that remain in EPA's approach for advancing science to address EJ issues. The EJ Research Roadmap does not describe a research program; instead, it describes the various research activities being implemented in the Office of Research and Development's (ORD) six Strategic Research Action Plans (<https://www.epa.gov/research/strategic-research-action-plans-2016-2019>) that are relevant to environmental justice.

Status of the Environmental Justice Research Roadmap

In February 2016, EPA's Board of Scientific Counselors reported that they considered the December 2015 draft of the EJ Research Roadmap a good foundation and recommended several revisions to the document. Revisions have been completed, and ORD anticipates finalizing the document with the Board's Executive Council in November 2016.

Also in 2016, EPA promulgated its Draft EJ 2020 Action Agenda. EJ 2020 is an Agency-level strategy for integrating environmental justice into all of EPA's activities, including science. EJ 2020 contains a chapter on science with proposed metrics drawing heavily from the draft EJ Research Roadmap.

Finally, in June 2016, EPA issued its *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis*. This important companion document to the EJ Research Roadmap contains key definitions, a review of factors that contribute to potential EJ concerns, and recommendations for considering environmental justice when planning human health risk assessments, with an emphasis on cumulative risk assessment.

Purpose of the Annual Report

This *FY2016 Environmental Research Roadmap Annual Report* presents progress on ORD's EJ research goals and activities. Because this EJ Annual Report is the first and because the development of the EJ Research Roadmap has spanned multiple years, this report includes research progress and accomplishments from FY15 and FY16 and some activities that began before FY15. EPA's efforts to address environmental justice span the Agency's Programs and Regions, including place-based research and technical support. This EJ Annual Report contains updates on ORD EJ research completed in conjunction with several Agency partners, including ORD's Regional Sustainable Environmental Science program; ORD's Regional Applied Research Effort; and the Agency's Making a Visible Difference

program. It also includes intramural research by scientists in ORD's Laboratories and Centers. This EJ Annual Report highlights successes and challenges of implementing an integrative approach to ORD's crosscutting EJ research. It also previews research activities for FY2017.

Summary of FY15 and FY16 EJ Research Accomplishments

ORD's EJ Research Roadmap recognizes that addressing issues in overburdened communities requires a broad range of research. The accomplishments for FY15–FY16 include research on focused solutions for:

- Drinking water quality for small communities and Tribes
- Active and community-engaged monitoring of air quality in communities located near the fencelines of potential sources of regular and fugitive emissions
- Reuse of soil in remediated sites
- Community engagement in incorporating green infrastructure for direct benefits to stormwater handling and indirect benefits to community well-being
- Place-based issues addressed through collaborations of ORD with EPA's Regional Offices
- Enhanced community engagement and participatory research through Science to Achieve Results (STAR) investigator-community partnership grants

Accomplishments also include the completion or initiation (especially for STAR grantees) of research addressing longer-term issues and conceptual issues, such as:

- Incorporating nonchemical stressors, including social determinants of health, in human health risk (cumulative risk) assessment
- Applying structured decision approaches to address environmental quality and environmental health issues in overburdened communities
- Building community resilience
- Understanding causal relationships of environmental influences on the microbiome and epigenome, especially in early-life development
- Use of traditional ecological knowledge in environmental assessment and management
- Addressing climate change impacts on Tribal sustainability

Tables containing detailed information are presented in Appendices A–E.

I. Accomplishments

A. Awarding of STAR Grants

The incorporation of environmental justice into ORD's research program in FY15–FY16 occurred most markedly through the STAR grant program (Appendix A):

- Five Research Centers on Children's Environmental Health and Disease Prevention [National Institute of Environmental Health Sciences (NIEHS)/EPA] – focusing on environmental causes of high-priority health outcomes such as asthma, obesity, adverse neurodevelopmental outcomes, and cancer. Each Center is investigating the interplay between environmental exposures and social determinants of health, using cutting-edge, systems-level science that includes the microbiome and the full range of genomic approaches, including epigenetics.
- Five Centers of Excellence on Environmental Health Disparities Research [National Institutes of Health (NIH)/EPA] –incorporating social, economic, and dietary stressors to address health disparities with a focus on issues that affect the urban and rural poor, communities of color, and Tribal and Alaskan native communities. The Centers build on the 10 original pilot environmental health disparity grants awarded in 2012.
- Six grants on Air Pollution Monitoring for Communities – emphasizing the use of new, low-cost sensors and citizen science to address community-scale air quality issues.

These 16 grants build on ORD's sponsorship of earlier Request for Applications (RFAs), such as Science for Sustainable and Healthy Tribes (2013), the Children's Environmental Health and Disease Prevention Research Centers (2012), and research on Understanding the Role of Chemical and Nonchemical Stressors and Developing Methods for Cumulative Risk Assessment (2009). In addition, some STAR-funded research on small water systems has been completed, and other work is continuing. The goals of all these grants are briefly described in Appendix A.

Looking Ahead

ORD's Sustainable and Healthy Communities (SHC) research program has two additional RFAs anticipated for release in FY17. These two RFAs will continue to advance EPA-sponsored research toward systems-level approaches to promote community health and well-being. The RFA, Using a Total Environment Framework (Built, Natural, Social Environments) to Assess Life-long Health Effects of Chemical Exposures, is anticipated to be released in late FY16 or early FY17. In FY17, awards will be made for the RFA on Integrating Human Health and Well-Being with Ecosystem Services.

In addition, ORD's National Center for Environmental Research (NCER) will report on research findings from (1) 15 years of funding for the Children's Environmental Health Centers, (2) the transdisciplinary Centers for research on environmental health disparities, and (3) the role of chemical and nonchemical stressors in cumulative risk assessment.

B. Making a Visible Difference in Communities

MVD is a high profile initiative of the EPA Administrator to address environmental and public health impacts that affect people most significantly where they live: in the community. EPA is focused on providing better support to communities, especially in environmentally overburdened, underserved, and economically distressed areas where the needs are greatest. ORD has partnered with EPA's Regions on 15 MVD projects either directly or in conjunction with funding provided through the Regional Applied Research Efforts (RARE) program (see next section). MVD projects focus on green infrastructure solutions to stormwater, water treatment, and water quality issues; air quality monitoring through citizen science approaches; community-engaged approaches to air quality issues in communities near ports; and building partnerships between EPA's Regions, local colleges and universities, and communities for community engagement in addressing environmental and land use issues. These projects are briefly described in Appendix B and Appendix C.

C. Regional Applied Research Efforts

EPA's Regions are the Agency's principal interfaces with communities. The RARE program provides resources for EPA's Regions to conduct collaborative research with ORD to address priority topics. Research initiated or completed in the past three years includes 20 projects that address environmental justice and Tribal issues (Appendix C). Like the MVD projects, many of these are focused on building community capacity for air quality monitoring and place a premium on building community capacity for meaningfully engaging in the decisions that affect the environmental health and well-being of the community. Several of these projects also include issues related to safe drinking water or Tribal health and safety.

D. Regional Sustainable Environmental Science

The RESES program focuses on forming regional research partnerships to enable effective, efficient, and socially responsible solutions to commonly faced resource sustainability problems. ORD's SHC program sponsors RESES, providing funding to seed collaborations between EPA's Regions and ORD. SHC's goal is to develop and refine its research products by directly collaborating with the users of its research, while providing technical support for pressing issues in the Region.

Appendix D lists projects funded in FY14–FY16. Projects funded in FY14 and 15 are underway; FY16 projects have just completed their project plans. Historically, a very high proportion of RESES proposals address issues related to environmental justice. For example, EPA's first health impact assessments were carried out collaboratively between ORD and Regions 1 and 4.

One key strength of the RESES program for environmental justice is that the research, in most cases, is place-based, with the goal to transfer solutions in one community to others facing the same issues. Currently active RESES projects include community engagement in decision-making, citizen science for air monitoring, air quality issues in near-port communities, and a range of Tribal issues.

E. Intramural Research

ORD's main intramural research effort on environmental justice is distributed across Air, Climate, and Energy (ACE), SHC, Safe and Sustainable Water Resources (SSWR), Human Health Risk Assessment (HHRA), and Homeland Security (HS). A search of ORD's publication clearance database using keyword "environmental justice" yielded 167 abstracts, presentations, reports, and articles cleared or initiated for clearance from FY15 and FY16. This Annual Report lists journal articles, EPA reports, technical fact sheets, and a book chapter (Appendix E).

Near-source air quality is an important issue for overburdened communities. Many of these communities are located in busy transportation corridors, near ports, or near heavy industry, potentially exposing individuals to disproportionate levels of exposure to diesel or other industrial emissions. Research from the ACE program includes the development of mobile and onsite sensing approaches for monitoring air quality in these environments.

One of the primary EJ issues raised by the National Environmental Justice Advisory Council and others is community engagement. ORD's EnviroAtlas produced an instructional module, *Building a Greenway: Using EnviroAtlas in the Classroom*, to help build community capacity for using this information delivery and analysis tool. This curriculum adds to the Community-scale Use Cases, available on the EnviroAtlas website, that guide users in how to evaluate the distribution of ecosystem services to different segments of the population. Additional research on decision support is represented in the report from the Guanica Bay, Puerto Rico project, which engaged community members to develop a conceptual model of the interrelationship between environmental runoff affecting coral reefs and community health, environmental quality, and economic issues. ORD scientists used the EnviroAtlas to evaluate the interaction between accessibility to natural areas and physical inactivity levels, including stratification by socioeconomic status. This research can inform equitable land use planning and community development that will benefit human health and well-being.

ORD also produced a body of research addressing epigenetic mechanisms of action that might account for cumulative impacts of exposure to environmental chemicals and nonchemical stressors, including social stressors. This important area of research could provide an avenue for integrating chemical and nonchemical stressors into cumulative human health risk assessments. Two articles that are the outcome of this research are [*Epigenetic Regulation of Newborns' Imprinted Genes Related to Gestational Growth: Patterning by Parental Race/Ethnicity and Maternal Socioeconomic Status*](#) and [*Neighborhood and Family Environment of Expectant Mothers May Influence Prenatal Programming of Adult Cancer Risk: Discussion and an Illustrative DNA Methylation Example*](#). The articles directly address the influence of social stress on changes in DNA methylation.

Looking Ahead

The next two years hold much promise for ORD intramural research. ORD anticipates completing significant research on health disparities and on indices and indicators. Research on several MVD, RARE, and RESES projects will come to fruition. In addition, ORD anticipates that several decision-support tools that have been under development or in beta testing will become available. These products include:

- C-FERST: Community-Focused Exposure and Risk Screening Tool
- C-PORT: Screening model and alternative scenario impact evaluation tool for near-source communities
- Multipathway exposure analysis for lead in children
- Wildfire community vulnerability index
- Tribal-FERST: Tribal Focused Environmental Risk and Sustainability Tool
- Environmental drivers of public health and well-being particular to minority communities
- Development of Climate Resilience Screening Index
- Grouping stressors for human health cumulative risk assessments: A simplifying approach for inclusion of nonchemical stressors and vulnerabilities

II. Addressing Emerging Issues

Many of the Agency's most pressing problems affect overburdened communities including, for example, the recent water quality problems in Flint, Michigan and concerns about Zika virus, especially in Puerto Rico and border communities like Brownsville, Texas. ORD's EJ portfolio has expanded to include research and technical support to support the Agency's response to these immediate needs and to rule-makings proceeding from them.

- *Lead contamination in drinking water* – ORD researchers provided technical support to the City of Flint, Michigan in response to lead contamination. Researchers are working with local and State officials to improve water quality in the drinking water system to mitigate lead in drinking water, optimize disinfectant levels, and minimize exposure to *Legionella*. In addition, ORD researchers are evaluating exposure to lead from multiple pathways using probabilistic multimedia exposure modeling linked to pharmacokinetic models. The latter will inform the Agency's decisions about Household Action Levels for drinking water in the Lead and Copper Rule by showing how much lead exposure is due to drinking water, air, food, and soil and dust ingestion.
- *Zika virus and microcephaly* – In response to concern over the birth defects cluster in Brazil linked to the mosquito-borne Zika virus, ORD researchers are moving forward in collaboration with Regions 2 and 6 through SHC's RESES program to analyze mosquito-breeding habitat and disease-vector mitigation in communities potentially affected by Zika virus.

Appendix A. STAR Grants Addressing Environmental Justice and Tribal Issues

Table A-1. National Research Program: Air, Climate, and Energy

Table A-1. National Research Program: Air, Climate, and Energy			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: Measurements and Modeling for Quantifying Air Quality and Climatic Impacts of Residential Biomass or Coal Combustion for Cooking, Heating, and Lighting (2012) Current End date: 2017; extension requested to 2018</p>			
Experimental Interventions to Facilitate Clean Cook Stove Adoption, Promote Clean Indoor Air, and Mitigate Climate Change	<p>This study is using price and social interaction experiments to provide valuable information about behavioral dimensions of stove adoption and use, as well as field measurements and modeling to estimate impacts on air pollution and climate change. The project builds on preexisting partnerships with two Indian nongovernmental organizations already promoting stoves in rural communities in two different Indian states, Himachal Pradesh, in the north, and Karnataka, in the south. As of mid-2016, the study is about half completed with stove interventions underway for about 1 year in the northern study communities and more than 6 months in the south. In the Himachal Pradesh communities, most participants chose aspirational technologies (e.g., liquefied petroleum gas or electric induction stoves) as compared to improved biomass stoves. After several months, when given an opportunity to try a different technology, most participants chose to stay with their original choice. Similar choices will be offered to the participants in the southern communities.</p>	<p>Yale University, University of British Columbia, University of Minnesota</p>	India
<p>RFA TITLE: Air Pollution Monitoring for Communities (2014) Newly Awarded Grants (2016)</p>			
Democratization of Measurement and Modeling Tools for Community Action on Air Quality, and Improved Spatial Resolution of Air Pollutant Concentrations	<p>This project is motivated by a desire to improve air quality and human health in Pittsburgh, particularly in EJ communities. Distributed air quality monitoring with low-cost sensors and air quality modeling are key tools in this study. CMU researchers will partner with three local community groups to investigate the accuracy and reliability of existing sensors and their potential effectiveness in helping communities understand local levels of air pollutants and how to respond.</p>	<p>Carnegie Mellon University, Pittsburgh, PA</p>	Pittsburgh, PA

*Institutions in bold indicate the primary recipient of the grant.

Table A-1. National Research Program: Air, Climate, and Energy			
Grant	Brief Status Report	Institution*	Study location
RFA TITLE: Air Pollution Monitoring for Communities (2014) Newly Awarded Grants (2016)			
Shared Air/Shared Action (SA ²): Community Empowerment through Low-cost Air Pollution Monitoring	This research project involves multiple universities and four local community organizations working to improve air quality for citizens of South Chicago. Researchers plan to investigate whether people become more engaged with their environment if they are provided with relevant scientific and technical tools, including low-cost portable sensors and appropriate technical assistance. Collaboration between academic researchers and the communities in planning and conducting the study is key to this project, with plans to evaluate how community-led research with sensors can help improve community understanding of pollution concentrations. This project features development of sustainable, community-specific strategies to monitor pollutants and analyze and communicate results and to see if communities can leverage their resources to create coordinated action plans to reduce exposure and mitigate health risks.	Kansas State University, Manhattan, KS	South Chicago, IL
The Hawai'i Island Volcanic Smog Sensor Network (HI-Vog): Tracking air quality and community engagement near a major emissions hotspot	Air quality on the Island of Hawai'i can be exceedingly poor due to high emissions of sulfur dioxide from Kilauea Volcano. The resulting "volcanic smog" ("vog"), a mixture of sulfur dioxide and fine particulate matter, has negative impacts on human health and agriculture, and is consequently a major local concern. Because community members' exposure to vog cannot be readily estimated, the region can be a unique test case for the use and assessment of distributed air quality networks based on portable low-cost sensors. This project includes the development and deployment of a state-of-the-art community-based air quality sensor network across Hawai'i Island. A network of sensors can provide improved measurements of air quality and vog exposures across the island. Researchers will also assess the utility of air quality sensor networks as community resources and as tools for atmospheric chemistry research.	Massachusetts Institute of Technology, Cambridge, MA	Hawaii
Monitoring the Air in Our Community: Engaging Citizens in Research	This research team will investigate whether communities can successfully use low-cost sensors to understand the air quality in their neighborhood and their personal exposure to pollutants. Researchers plan to identify what type of air pollution data would best fulfill community needs and preferences. They then will assess how well community members can understand the data and whether they modify their behavior to reduce their exposure to potentially harmful pollutants.	Research Triangle Institute, Research Triangle Park, NC	North of downtown Denver, CO
Engage, Educate, and Empower California Communities on the Use and Applications of "Low-cost" Air Monitoring Sensors	The overall objective of this research project is to provide California communities with the knowledge necessary to select, use, and maintain low-cost air pollution sensors appropriately and interpret sensor data correctly. Researchers plan to develop new methodologies to educate and engage communities on using and applying the sensors. Additionally, they will conduct testing to characterize sensor performance and identify candidates for field deployment. The group plans to deploy the selected sensors in local communities, interpret the collected data, and communicate the lessons learned to the public through a series of outreach activities.	South Coast Air Quality Management District, Diamond Bar, CA	2 north, 2 central, 2 southern California communities

Table A-1. National Research Program: Air, Climate, and Energy			
Grant	Brief Status Report	Institution*	Study location
RFA TITLE: Air Pollution Monitoring for Communities (2014) Newly Awarded Grants (2016)			
Putting next generation sensors and scientists in practice to reduce wood smoke in a highly impacted, multicultural rural setting	This research team plans to deploy next-generation, low-cost particulate matter air sensors in student-directed studies pertaining to wood smoke impacts in their rural community. The researchers and students will evaluate the quality of sensor measurements and identify effective platforms for data dissemination and communication to the community through multigenerational and multicultural outreach. Researchers will partner with faculty at Heritage University, whose students represent the community's population of predominantly Yakama Nation and Latino immigrant families. This project builds on the EnvironMentors program, which pairs undergraduates with high school students. Students will be trained to formulate and test hypotheses on wood smoke exposure and plan to compare sensor data to validated air pollution measurements.	University of Washington, Seattle, WA	Yakima Valley, WA

Table A-1. National Research Program: Sustainable and Healthy Communities

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
RFA TITLE: NIEHS/EPA Children's Environmental Health and Disease Prevention Research Centers (2015)			
All grants were funded by EPA and announced in July 2016. Grants were funded by NIEHS in 2015, and Year 1 final reports have been received. Grants are scheduled to close in 2019.			
Center for the Study of Childhood Asthma in the Urban Environment	The long-term goal of this Center is to understand how exposures to indoor and outdoor airborne pollutants and allergens interact with a variety of contextual factors in the inner city to create high asthma morbidity.	Johns Hopkins University	
Center for Children's Health, the Environment, Microbiome, and Metabolomics	The overall goal of this Center is to assess the influence of the environmental exposures of pregnant women on their microbiome and the subsequent impact of the mother's microbiome on neurodevelopment of the fetus and infant. This interdisciplinary Center will conduct studies on exposures in an urban environment, the microbiome of pregnant women and their infants, and associated neurocognitive health outcomes. The work of the Center is based on a longitudinal cohort of 800 pregnant African-American women who are currently being followed through delivery and designed to examine maternal prenatal stress and its association with the infant microbiome.	Emory University	

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: NIEHS/EPA Children’s Environmental Health and Disease Prevention Research Centers (2015) All grants were funded by EPA and announced in July 2016. Grants were funded by NIEHS in 2015, and Year 1 final reports have been received. Grants are scheduled to close in 2019.</p>			
The Columbia Center for Children’s Environmental Health, Columbia University	The Columbia Center for Children’s Environmental Health (CCCEH) proposes an innovative program that builds directly on prior research findings in a well-characterized cohort of inner city children enrolled prenatally and now being followed into adolescence. Repeated waves of assessment prior to age 11 have shown that high prenatal exposure to polycyclic aromatic hydrocarbons (PAHs) is associated with recurrent neurodevelopmental abnormalities, higher rates of obesity, and a failure to increasingly improve the capacity to regulate thought, emotion, and behavior over the course of development. The proposed program will (1) provide essential evidence of PAH impacts on these significant public health problems; (2) shed light on how PAH affects the development of neural systems in the brain; (3) inform environmental and public health policy; and (4) suggest new avenues for prevention and early intervention.	Columbia University	
Center for Research on Early Childhood Exposure and Development in Puerto Rico	The overall goal of this Center is to understand the impact of a mixture of environmental exposures and modifying factors on fetal and early childhood health and development in the children of the heavily contaminated northern coast of Puerto Rico—an underserved, highly exposed, and low-income population with significant health disparities.	Northeastern University	
Center for Integrative Research on Childhood Leukemia and the Environment	During the past half century, the incidence of childhood acute lymphoblastic leukemia (ALL) has steadily increased in children, with the highest rates reported in Latinos. This rapid increase strongly supports the role of environmental exposures in the etiology of childhood ALL, either alone or in combination with genetic and epigenetic factors. Existing biological and epidemiological studies suggest that childhood ALL is often initiated in utero and fetal exposure to carcinogenic chemicals might play a role in the etiology of the disease. Given these findings and novel laboratory methods developed during the Center’s first cycle, the overarching theme for the next cycle is to identify additional in utero chemical risk factors for childhood ALL in an ethnically diverse population, and to understand how chemicals increase risk via immunological, genetic, and epigenetic mechanisms.	University of California, Berkeley	
The UCSF Pregnancy Exposures to Environmental Chemicals (PEEC) Children’s Center, University of California San Francisco, Tracey Woodruff	This Center will advance scientific and public understanding of how environmental chemicals affect the seminal early stages of human in utero development, which could manifest as adverse effects on children’s health. The Center is testing the hypothesis that the mechanisms include damage to the placenta—which governs in utero programming, birth weight, and, consequently, childhood health—and that these effects are exacerbated by social stress. Part of the project will evaluate the cumulative effects of prenatal polybrominated diphenyl ethers and perfluorinated compound exposures and chronic psychosocial stress on fetal growth in a diverse population of pregnant women. The investigators will employ innovative approaches for measuring psychosocial stress, including geocoded neighborhood measures of the social environment and interviews to assess participants’ perceived stress and social standing. Biological assays—telomere length and hormone levels—will be used to measure maternal and fetal stress responses.	University of California, San Francisco	

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: NIEHS/EPA Children’s Environmental Health and Disease Prevention Research Centers (2012) All grants were completed in Year 3 in May 2016, and annual reports are due Sept. 2016. Grants are scheduled to close in 2018.</p>			
Lifecourse Exposures & Diet: Epigenetics, Maturation & Metabolic Syndrome, University of Michigan	Capitalizing on two existing human cohorts [Early Life Exposures in Mexico to ENvironmental Toxicants (ELEMENT) and the Michigan Mother-Infant Pairs (MMIP)] and the viable yellow agouti mouse model, the focus of this Center is to examine the impact of endocrine disrupting chemical mixtures and their interaction with diet on metabolic health. Research findings will shed light on epigenetic and transcriptional changes leading to changes in growth, maturation, and metabolic outcomes, and provide an invaluable basis for designing future interventions to reduce the impact of pervasive endocrine disrupting chemicals on children’s health. Research includes analysis of socioeconomic factors associated with obesity.	University of Michigan	
Neurodevelopment and Improving Children’s Health following EtS Exposure, Duke University	The Center for Study of Neurodevelopment and Improving Children’s Health following EtS exposure (NICHES) will investigate mechanistic relationships between environmental tobacco smoke exposure and developmental neurocognitive impairments including attention-deficit/hyperactivity disorder. NICHES integrates complementary in vitro, in vivo, and human clinical studies to identify how epigenetic changes caused by developmental environmental tobacco smoke exposure are expressed in the brain and how they are associated with neurobehavioral dysfunction in children. These studies include epigenetic research on the impacts of exposure to toxicants such as lead and arsenic and of maternal stress.	Duke University	
Southern California Children’s Environmental Health Center, University of Southern California	This Center includes a Community Outreach and Translation Core, the goal of which is to protect children’s health through educating new constituencies to understand the complex land use, public health, and public policy dilemma between the need for increased outdoor physical activity to reduce obesity and the potential risks of active recreation near traffic pollution. The Core aims to develop new constituencies and new media outlets for disseminating research findings on near-roadway air pollution and its adverse health effects on children. Targets include advocates for (1) physical activity to reduce obesity; and (2) new parks and outdoor exercise facilities and equitable access to green space in the city, including elected officials, urban planners, architects/landscape architects, land conservation, and EJ groups.	University of Southern California	
<p>RFA TITLE: NIEHS/EPA Children’s Environmental Health and Disease Prevention Research Centers (2012) All grants were completed in Year 3 in May 2016, and annual reports are due Sept. 2016. Grants are scheduled to close in 2018.</p>			
UC Berkeley/Stanford Children’s Environmental Health Center	Proposed projects will provide new data on (1) the associations between exposures to air pollutants, particularly PAHs, and important health outcomes throughout childhood, from gestation to late adolescence; (2) mechanistic pathways by which air pollutants cause adverse outcomes; and (3) the modifying roles of genetic and neighborhood contextual factors. The themes of the projects build on previous research; the resulting data will allow improved risk assessment in a region characterized by both high air pollution and health disparities related to socioeconomic and minority ethnic status.	University of California, Berkeley; Stanford University	

Table A-2. National Research Program: Sustainable and Healthy Communities

Grant	Brief Status Report	Institution*	Study location
<p style="text-align: center;">RFA TITLE: Science for Sustainable and Healthy Tribes</p> <p style="text-align: center;">All grants are currently in their second year of research and making progress on proposed milestones. Year 1 annual reports have been received, and Year 2 annual reports are in preparation or submitted. A progress review meeting is scheduled in RTP Sept. 20–21, 2016.</p>			
<p>Water, Our Voice to the Future: Climate Change Adaptation and Waterborne Disease Prevention on the Crow Reservation</p>	<p>Objective 1. Integrate traditional ecological and community knowledge, scientific data, and climate models to produce a cohesive document describing existing and projected local climate, hydrologic and microbial water quality changes and their impacts on resources, Crow traditions, ecosystems, and community health.</p> <p>Objective 2. Improve community adaptation to climate change and reduce climate change-related health risks by increasing community understanding of current and projected climate change impacts, reducing associated waterborne disease risks, identifying and implementing other key adaptation measures, and investing in community capacity building.</p> <p>Objective 3. Disseminate project results locally, regionally, and nationally, through appropriate community venues, peer-reviewed publications, and conferences, including the National Tribal Science Forum. Contribute lessons learned to other tribes.</p>	<p>Little Big Horn College, Montana State University</p>	
<p>Coastal Climate Impacts to First Foods, Cultural Sites, and Tribal Community Health and Well-being</p>	<p>Objective 1. Develop an integrated model characterizing the variability in projected coastal hazards of inundation and erosion due to the combined influence of sea level rise, storm surge, and wave energy through Year 2100 alongshore of the Swinomish Reservation.</p> <p>Objective 2. Map the vulnerability of Swinomish coastal ecosystem habitats of first foods and culturally significant sites in relation to cumulative impacts of sea level rise, storm surge, and shoreline development.</p> <p>Objective 3. Using results from Objectives 1 and 2, assess impacts to Swinomish community health and well-being and opportunities to build adaptive capacity using a sustainable systems-based approach.</p> <p>Objective 4. Create assessment and strategy matrices based on outputs of Objectives 1–3 as adaptation/mitigation planning tools in the Swinomish Climate Change Initiative.</p> <p>Objective 5. Employ a multipronged education and dissemination approach to ensure that tools (models), results, and associated meanings for Tribes are widely disseminated locally, regionally in Coast Salish communities, and beyond.</p>	<p>Swinomish Indian Tribal Community, Skagit System Cooperative, USGS Western Fisheries Research Center</p>	<p>Swinomish Reservation</p>

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: Science for Sustainable and Healthy Tribes</p> <p>All grants are currently in their second year of research and making progress on proposed milestones. Year 1 annual reports have been received, and Year 2 annual reports are in preparation or submitted. A progress review meeting is scheduled in RTP Sept. 20–21, 2016.</p>			
From Home to School: Tribal Indoor Air Quality Intervention Study	By improving indoor air quality and reducing environmental asthma triggers, this study intends to reduce asthma symptoms related to tribal home-and-school childhood exposures. The study will demonstrate the importance of a total exposure approach based on traditional ecological knowledge (TEK). TEK from three tribes in different regions/climates will refine education, source control of allergens by targeted cleaning and other asthma trigger removal activities, ventilation, and air cleaning interventions that reduce asthma triggers.	University of Tulsa, Cherokee Nation Environmental Program and Health Services, Institute for Tribal Environmental Professionals, Navajo Nation - EPA and Dept. of Diné Education, Nimiiipuu Health, University of Oklahoma	
Assessment, Monitoring and Adaptation to Food and Water Security Threats to the Sustainability of Arctic Remote Alaska Native Villages	The outcomes of the research will be risk data enabling Alaska Native Tribal Health Council and Tribal councils to develop adaptation strategies to reduce exposure to the pathogens, contaminants, and toxins in subsistence foods and village water supplies. Having these data will help reduce risk for the most vulnerable subset of the resident population, and ensure that Alaska Native people can continue to harvest and consume their traditional diet, which is essential to their cultural and economic survival. The outcome will be to provide data to Tribal, State, Federal, and international agencies and organizations, which will assist in better understanding the movement of animal species, pathogens, and contaminants as climate affects ocean and atmospheric transport mechanisms.	Alaska Native Tribal Health Consortium	
Identifying, Assessing and Adapting to Climate Change; Impacts to Yurok Water and Aquatic Resources, Food Security, and Tribal Health	The Yurok Tribe is extremely vulnerable to hydrologic changes resulting from climate change due to their geographic location and continued reliance on surface waters and aquatic resources by Tribal members. The study will identify areas of water resource vulnerability and resiliency, assess impacts on Yurok food security and tribal health, and increase the Tribe’s adaptive capacity to prepare and respond to climate change.	Yurok Tribe Environmental Program, Northern Arizona University	

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p style="text-align: center;">RFA TITLE: Science for Sustainable and Healthy Tribes</p> <p style="text-align: center;">All grants are currently in their second year of research and making progress on proposed milestones. Year 1 annual reports have been received, and Year 2 annual reports are in preparation or submitted. A progress review meeting is scheduled in RTP Sept. 20–21, 2016.</p>			
Subsistence Hunting and Associated Activities of Native North Americans in Remote Communities: Measurement of Indoor Air Quality in Tents as Related to Wood-Smoke Exposures, and the Identification of Potential Health Risks	<p>The objectives of this research are to (1) measure indoor air quality in tents used for subsistence hunting activities by characterizing wood-smoke, aerosol components; (2) determine the resultant biological effects associated with exposure to wood-smoke aerosol components; and (3) provide recommendations for system improvements based on intervention strategies in a population of Native North American hunters living in subarctic North America. We hypothesize that inhalation exposures to high levels of wood-smoke emissions resulting from unique Tribal practices lead to measurable and relevant biological changes in members of this community and simple-to-implement techniques for intervention can substantially reduce exposure levels and ultimately their corresponding health impacts.</p> <p>Expected results and outcomes from this investigation include collecting an extensive data set that characterizes high-intensity wood-smoke exposures and includes quantitative information on physical and chemical characteristics; field testing of simple technology that promises to reduce these exposures greatly; providing extensive training and mentoring to a group of Omushkego Cree Native North Americans; and mobilizing critical knowledge to these communities to reduce exposures. The project directly collaborates with the Tribal community and thus will continue to build strong connections to support community-based participatory research.</p>	<p>University of Massachusetts - Amherst, Ryerson University, University of Toronto</p>	
<p style="text-align: center;">RFA TITLE: Understanding the Role of Nonchemical Stressors and Developing Analytic Methods for Cumulative Risk Assessments (Search within this list of grants)</p> <p style="text-align: center;">Research for these grants has concluded. Each grant is closed, and a final report has been received. A report summarizing the results of these grants is in preparation and scheduled for delivery in FY18.</p>			
Community Stressors and Susceptibility to Air Pollution in Urban Asthma	<p>This project aims to understand relative spatial distributions in key community-level psychosocial stressors and air pollution exposures across New York City and to examine their separate and synergistic effects of childhood asthma exacerbation.</p>	<p>University of Pittsburgh – Main Campus; West Harlem Environmental Action (WE ACT for Environmental Justice)</p>	<p>New York City, NY</p>

Table A-2. National Research Program: Sustainable and Healthy Communities

Grant	Brief Status Report	Institution*	Study location
<p style="text-align: center;">RFA TITLE: Understanding the Role of Nonchemical Stressors and Developing Analytic Methods for Cumulative Risk Assessments (Search within this list of grants)</p> <p>Research for these grants has concluded. Each grant is closed, and a final report has been received. A report summarizing the results of these grants is in preparation and scheduled for delivery in FY18.</p>			
<p>Boston University/NorthStar Learning Centers – Effects-Based Cumulative Risk Assessment in a Low Income Urban Community Near a Superfund Site</p>	<p>This study had the objective of characterizing the contributions of multiple chemical and nonchemical stressors to attention-deficit/hyperactivity disorder-related behavior and elevated blood pressure in New Bedford, Massachusetts. The initial study objective was to characterize exposures to relevant stressors across the population, with an emphasis on the population attributes that contributed to high exposures to multiple stressors. Multivariable attribute data at high geographic resolution, however, do not exist because of privacy concerns. To address this limitation, researchers first developed a simulated population of New Bedford that included census tract of residence and extensive individual attributes relevant to chemical and nonchemical stressor exposures (Levy, et al., 2015). The simulated population was derived by applying probabilistic reweighting using simulated annealing to data from the 2006–2010 American Community Survey. Researchers then developed a series of multivariable regression models to predict key behaviors (e.g., smoking) using New Bedford-specific data from the Behavioral Risk Factor Surveillance System. These behaviors and individual attributes were used as predictors of chemical exposures as measured within a New Bedford cohort study focused on attention-deficit/hyperactivity disorder-related behavior and from the National Health and Nutrition Examination Survey, which included blood pressure measures.</p>	<p>Boston University; NorthStar Learning Centers</p>	<p>New Bedford, MA</p>
<p>University of Rochester – Combined Effects of Metals and Stress on Central Nervous System Function</p>	<p>Chemical exposures do not occur in isolation but concurrently with other risk factors for human diseases and disorders, including host, genetic, and lifestyle risk factors. This application asks two crucial questions related to the inclusion of nonchemical stressors in cumulative risk assessment: (1) How general is the ability of one such risk factor, that is, stress, to enhance effects of chemical exposures? (2) Under what conditions would such synergies be expected, that is, can a biological framework be proposed to help define such conditions, thereby circumscribing the agenda required for protecting human health?</p> <p>This project tests the hypothesis that nonchemical and chemical stressors acting on the same biological systems or substrates, or producing common adverse outcomes could produce additive or greater effects when they co-occur as risk factors. The hypothesis is based on prior studies demonstrating synergistic and potentiated central nervous system effects in response to combined exposures to lead and stress, co-occurring risk factors that both act on the hypothalamic–pituitary–adrenal axis and on brain dopamine and glutamate systems and produce common adverse outcomes, including cognitive deficits.</p>	<p>University of Rochester School of Medicine and Dentistry</p>	
<p>The Effects of Stress and Traffic Pollutants on Childhood Asthma in an Urban Community</p>	<p>We will test a plausible mode of action by which psychosocial stress could worsen asthma responses to air pollution. Improved understanding of how chronic stress might increase susceptibility to air pollutants among people with asthma is important for understanding cumulative risk in urban and other communities. Ultimately, better understanding of modes of action of stress on pollution-health associations will lead to improved characterization of risk among susceptible populations. Additional long-term outcomes might include support for better-integrated public health interventions that address both environmental pollution and nonchemical stressors.</p>	<p>Rutgers University</p>	<p>Newark, NJ</p>

Table A-2. National Research Program: Sustainable and Healthy Communities

Grant	Brief Status Report	Institution*	Study location
<p style="text-align: center;">RFA TITLE: Understanding the Role of Nonchemical Stressors and Developing Analytic Methods for Cumulative Risk Assessments (Search within this list of grants)</p> <p>Research for these grants has concluded. Each grant is closed, and a final report has been received. A report summarizing the results of these grants is in preparation and scheduled for delivery in FY18.</p>			
Analytical Strategies for Assessing Cumulative Effects of Chemical & Non-Chemical Stressors Assessments	<p>This study's purpose is to develop and test empirically valid models for understanding cumulative risks in community settings. We are modeling population data drawn from Texas City in 2004–2006, using generalized linear latent and mixed models, to understand how ambient chemical exposures interact with nonchemical stressors (at both the neighborhood and individual levels) and result in adverse health effects. The key health effect of interest is allostatic load, as measured by a suite of biological markers.</p>	The University of Texas School of Public Health	Texas City, TX
Hypertension in Mexican-Americans: Assessing Disparities in Air Pollution Risks	<p>The incidence of hypertension, a key risk factor for cardiovascular disease, has been growing in the United States and remains the leading cause of death among the U.S. Hispanic population. This research will examine the association between fine particulate and other air pollutants and hypertension, with a focus on quantifying modifying effects of nonchemical stressors on air pollutant effects. Novel methods for addressing interactions between chemical and nonchemical stressors in a logistic regression context will be developed. A community-based research participatory approach that involves both advisory and focus groups also will be developed.</p> <p>Research for this grant has been extended until Jan. 31, 2017, and a final report is expected by April 2017.</p>	The University of Texas School of Public Health, National Chiao-Tung University, The University of Texas MD Anderson Cancer Center	Houston, TX
New Methods for Analysis of Cumulative Risk in Urban Populations	<p>Using computer-assisted qualitative research methods and structural data analysis to characterize environmental burden on an individual and community level in a small but densely populated, ethnically and economically diverse city. The project had four specific aims. The first was to use established qualitative and quantitative research techniques to collect, code, and characterize information about chemical exposures of concern, social and economic concerns, behavioral risk factors for disease, self-reported health outcomes, and perceptions of environment and quality of life from residents abutting an urban designated port area. The second was to use previously developed research software to examine the hierarchical and structural relationships of quantitative and qualitative data elements. The third was to use the lattice as a technique for cumulative risk assessment by examining the relationships revealed by computation. The final aim was to share results of analysis with community members and public health officials and move refined and mature research software into the hands of public health practitioners to use as an additional and practical tool for epidemiologists and data analysts in local, State, and Federal health agencies.</p> <p>This grant is closed. The final report is undergoing revisions, and is expected to be completed by late 2016.</p>	Boston University/Chelsea Collaborative	City of Chelsea

Table A-2. National Research Program: Sustainable and Healthy Communities

Grant	Brief Status Report	Institution*	Study location
<p style="text-align: center;">RFA TITLE: NIH-EPA Centers of Excellence on Environmental Health Disparities Research</p> <p style="text-align: center;">These grants were awarded July 2015 and are expected to finish July 2020. A webinar series featuring interim results of these grants has been proposed for FY19.</p>			
Center for Comparing Urban and Rural Effects of Poverty on COPD (CURE COPD)	The aim of the Center is to understand the interactive effects of high indoor air pollution, obesity and low antioxidant, proinflammatory diets in both urban (Project 1) and rural (Project 2) low-income communities, both of which suffer disproportionate prevalence and morbidity from chronic obstructive pulmonary disease, obesity, and poor diet.	Johns Hopkins University	
Center for Indigenous Environmental Health Research	The goal of this proposal is to develop a Center for partnering with American Indian and Alaska Native communities to build capacity for determining the contribution of chemical and other environmental exposures to health inequities and to support efforts to address these threats.	University of Arizona	
Center for Research on Environmental & Social Stressors in Housing across the Life Course (CRESSH)	The primary objective of the proposed Center is to understand and reduce environmental health disparities by conducting three fully integrated research projects applying novel methods in epidemiology, exposure science, and cumulative risk assessment, with strong community engagement across the Center. The Center will focus on multiple health outcomes across the life course with evidence for environmental health disparities (birth outcomes, childhood growth rates, and cardiovascular mortality) in Massachusetts and within two low-income communities (Chelsea and Dorchester). The influence of housing and the neighborhood environment on multiple exposures and health outcomes will be emphasized throughout the Center.	Harvard T.H. Chan School of Public Health , Boston University	Chelsea, Dorchester, MA
Maternal and Developmental Risks from Environmental and Social Stress (MADRES)	Establish the Maternal And Developmental Risks from Environmental and Social Stressors (MADRES) Center for Environmental Health Disparities in a large, prospective pregnancy cohort of lower income, predominantly Hispanic women in Los Angeles. The proposed MADRES Center will examine whether environmental exposures (including air pollution, metals, water contaminants, and toxic releases), coupled with exposures to psychosocial and built environment stressors, lead to excessive gestational weight gain and postpartum weight retention in women and to perturbed infant growth trajectories and increased childhood obesity risk through altered psychological, behavioral and/or metabolic responses.	University of Southern California	Los Angeles, CA
Center for Native American Environmental Health Equity Research	The focus of the University of New Mexico’s proposed Center for Native American Environmental Health Equity Research is to address pervasive environmental health disparities with primary biomedical and environmental research and Native-focused community engagement. The partners in the Center consist of three university research programs and three Tribal Nations— Navajo, Sioux, and Crow—with plans to expand to a fourth in later years of the project.	University of New Mexico Health Sciences Center	Navajo, Sioux, Crow Nations

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: EPA/NIMHD Centers of Excellence on Environmental Health Disparities Research for this RFA has concluded. The grants are closed, and final reports have been received. A report summarizing the results of these grants is in preparation for delivery to SHC in FY17.</p>			
Center of Excellence in Disparities Research and Community Engagement (CEDREC)	<p>The excellence on environmental disparities research core anchors the Center of Excellence in Disparities Research and Community Engagement in the community and seeks to:</p> <ul style="list-style-type: none"> • Collaboratively prioritize key areas of environmental health disparities and identify optimal ways to intervene through research and policy. • Expand opportunities for developing interest in environmental health disparities research. • Create ongoing dialogue between the Environmental Health Core and community stakeholders. • Build community capacity to address environmental health disparities. 	Weill Cornell Medical College	
Center for Integrative Approaches to Health Disparities (CIAHD), Environmental Assessment Core	<p>The goal of the Center for Integrative Approaches to Health Disparities is to investigate the multilevel determinants of health disparities in cardiovascular risk by integrating social and biologic factors. The specific aims are to (1) enhance the neighborhood-level data available in the Multi-ethnic Study of Atherosclerosis (MESA) by adding novel data on food price and various built environment measures that can be used to study the impact of neighborhoods on changes in cardiovascular risk; (2) create comparable time-varying measures of access to healthy foods, recreational facilities, and other price and built environment data for Jackson Heart Study (JHS) (3) promote analyses of neighborhood effects on cardiovascular risk that take advantage of the new environmental data in MESA and JHS.</p>	University of Michigan	
Center of Excellence: Environmental Health Disparities Core	<p>The environmental health core will build capacity for multidisciplinary study of unique urban environmental health disparities. The focus of the Center of Excellence is an understanding of the syndemic burden on populations experiencing health disparities in urban Atlanta; the environmental health core will integrate environmental health disparities and environmental injustices into our understanding of the syndemic burden.</p>	Georgia State University	Atlanta, GA
Analysis and Action on the Environmental Determinants of Health and Health Disparities	<p>This grant is (1) building the capacity to assess environmental health disparities in the State through data collected by the South Carolina Department of Health and Environmental Control's Environmental Public Health Tracking Program; (2) assessing community perception of environmental determinants of cancer risk and disparities in rural and urban communities in South Carolina; and (3) engaging and training members of community-based organizations that represent EJ communities and environmental health disparity populations in the use of the block assessment methodology to help stakeholders identify ecological stressors and intervene to address disparities in burden, exposure, and health.</p>	University of South Carolina at Columbia, University of Maryland	

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: EPA/NIMHD Centers of Excellence on Environmental Health Disparities</p> <p>Research for this RFA has concluded. The grants are closed, and final reports have been received. A report summarizing the results of these grants is in preparation for delivery to SHC in FY17.</p>			
Environmental Health Disparities in the Northern Manhattan Center of Excellence in Minority Health and Health Disparities	<p>The focus of this grant is threefold:</p> <ol style="list-style-type: none"> 1. Conduct cross-sectional analyses of the respective contributions of health disparity environmental factors at the national, state, city, neighborhood, and individual levels to proximal behavioral and biological risk and protective factors for diabetes and depression in a midlife Hispanic population, using an existing cohort study and existing clinical trials. 2. Examine how these factors at the national, state, city, neighborhood, and individual levels modify the response to community-based interventions. 3. Enhance the data and biospecimen repository managed by the research core through the data collected with support from this application. 	Columbia University Medical Center	
Environmental Context of Health Disparities	<p>The focus of this grant is threefold:</p> <ol style="list-style-type: none"> 1. Establish a transdisciplinary, environmental health disparities core at Meharry. 2. Identify, secure, and process health databases that will enable hypothesis generation and testing of the relationship between health and the environment in 11 southeastern states. 3. Establish an environmental context of health disparities relational database and web portal to include georeferenced information on the natural, built, social, and policy environments in these southeastern states. 	Meharry Medical College	
Environmental Health Disparities Research	<p>The vision for this Center is to (1) advance knowledge of interrelationships between environmental and social determinants of health disparities, particularly within heterogeneous Hispanic populations, through a commitment to transdisciplinary research; and (2) use this knowledge to influence policy change, public health practice, and community-based interventions to reduce disparities. This vision will be operationalized through the following three specific aims:</p> <ol style="list-style-type: none"> 1. Conduct research to evaluate complex interactions between social, built, and natural environmental systems, while clarifying which aspects of Mexican-origin/Hispanic status are most important as determinants of environmental health disparities. 2. Build research and training capacities to examine and address environmental health disparities. 3. Facilitate the translation of environmental health disparities research into policy, public health practice, and community-based engagement. 	The University of Texas at El Paso, The University of Texas Health Science Center Houston	

Table A-2. National Research Program: Sustainable and Healthy Communities			
Grant	Brief Status Report	Institution*	Study location
<p>RFA TITLE: EPA/NIMHD Centers of Excellence on Environmental Health Disparities</p> <p>Research for this RFA has concluded. The grants are closed, and final reports have been received. A report summarizing the results of these grants is in preparation for delivery to SHC in FY17.</p>			
New Mexico Center for Advancement of Research, Engagement & Science on Health Disparities	The objective of the environmental health core is to establish a research focus in the science of intervention on environmental health disparities based at the University of New Mexico Health Science Center. This effort will be grounded in sound research practices, informed by community needs, and focus on filling information gaps to inform policy and clinical care. The core will initiate vigorous, self-sustaining, research that advances the scientific base of knowledge about interventions and solutions to socioeconomic, natural, chemical, and built environment issues contributing to the health disparities faced by Native Americans and Hispanic communities in New Mexico and will work to ensure these results are used to inform policy, clinical, social, and behavioral interventions to reduce disparities.	University of New Mexico Health Sciences Center	Espanola, NM, Four Corners Region, Native American Pueblos
Improving Environmental Health Disparities: A Fundamental Cause Approach	This core supports a research project that explores mechanisms explaining racial differences in exposure to environmental hazards and access to care and in health outcomes. To achieve this objective, relevant neighborhood-level data will be compiled on environmental hazards and access to care in Cook County, which will be linked to other social determinants data in the data repository.	University of Illinois at Chicago	Cook County, IL
Central Plains for American Indian Community Health (CAICH)	The environmental health sub-core addressed the critical issue of poor housing conditions in the American Indian community, identifying the problems and then linking community members to programs that will help them alleviate the problems. It will also provide significant environmental health education to community members, providers, and facilities maintenance professionals. In addition to service and education, we will begin to understand American Indian exposure to environmental tobacco smoke and how to address this important health concern. Through all these projects, we provide educational opportunities for American Indian college and graduate students interested in environmental health, thus increasing the number of American Indians entering this field.	University of Kansas Medical Center	

Table A-2. National Research Program: Safe and Sustainable Water Resources

Table A-3. National Research Program: Safe and Sustainable Water Resources				
RFA Title	Grant	Brief Status Report	Institution*	Study location
Research and Demonstration of Innovative Drinking Water Treatment Technologies in Small Systems	Improving Drinking Water Quality for Small Rural Communities in Missouri	This project addressed the potential drinking water issues for selected small rural communities in Missouri with an integrated approach to identify trihalomethanes and N-nitrosamines associated with elevated dissolved organic carbon and dissolved nitrogen in surface water supplies; develop novel, cost-effective water treatment technologies that reduce the health threats; and transfer and implement such technologies (primarily improved activated carbon and enhanced solids contact) for small drinking water treatment plants. This project provided guidance on best management practices of various surface water supplies for dissolved organic carbon and dissolved nitrogen control and helped small water treatment systems meet the Stage II requirements of the EPA drinking water regulations. Grant Closed 11/2015. Final report submitted.	Lincoln University-MO, Missouri University of Science and Technology, University of Missouri - Columbia	Odessa, Vandalia, Boonville, MO
Advancing Public Health Protection through Water Infrastructure	Water Infrastructure Sustainability and Health in Alabama's Black Belt	The objectives of this study are to (1) assess public health impacts associated with rural water supply system performance and water quality across a range of small public and private utilities in rural Alabama; (2) conduct a quantitative microbial risk assessment using measured water quality exposure data; (3) identify possible transmission pathways for waterborne pathogens in rural water supply systems; and (4) identify low-cost, practicable risk mitigation strategies to protect public health. This project includes active surveillance of water quality across 14 different systems in a three-county area over 3 years. During this reporting period, we have concluded system-level, large-volume field sampling (household-level water quality and survey data collection; refined methods for pathogen sampling, storage, and processing; and completed system-level sampling using dead-end ultrafiltration for indicator and molecular work). We also have concluded our planned work with water system operators.	University of Alabama at Birmingham, Georgia State University	

Appendix B. ORD Laboratory and Center Engagement in Making a Visible Difference in Communities Projects

Program (RESES, RARE, MVD)	Project Title	Location	Brief Status Report
MVD	Water Resiliency	Lawrence, MA	Planned and are implementing a strategic water strategy for environmental justice, resilience, water quality, and combined sewer overflow compliance
MVD	Resiliency and Risk Around Ports	Newark, NJ	Established a solid community and academic partnership to advance cumulative risk assessment, air quality modeling, and citizen science for local applications and decision-making
MVD	Resiliency and Risk Around Ports	Newport News, VA	Established a solid community and academic partnership to advance cumulative risk assessment, air quality modeling, and citizen science for local applications and decision-making
MVD	College and Community Partnership on Risk, Using C-FERST Tool	Dover, DE	Providing and supporting Delaware State University with training materials and use-case examples for using C-FERST in some public health classes; Region 3 completed a C-FERST assessment for several target communities in Delaware, showing the value of using the information in C-FERST—along with locally collected data and “ground-truthing” done by students—to help identify and work with local communities
MVD	Stormwater in North Birmingham	North Birmingham, AL	Local collaboration to obtain and input high-resolution country data into EnviroAtlas for community planning and development of a cost-module for the National Stormwater Calculator
MVD	Green Infrastructure and Health	Atlanta, GA	Health impact assessment in progress for the Proctor Creek watershed green infrastructure improvements, expanding earlier work
MVD	Green Infrastructure and Hydrology	Cincinnati, OH	Developing a report for a rain garden pilot, which will present hydrology and water quality data
MVD	Village Green	Chicago, IL	Installing a Village Green community monitoring bench at an elementary school, and developing accompanying curriculum to coordinate with national science standards
MVD	Public Health and Wood Treatment	Alexandria/Pineville, LA	Providing technical assistance on the health and environmental threats posed by wood-treatment operations
MVD	Cumulative Risk Around a Paper Plant	Crossett, AR	Creating a conceptual model of cumulative risk for the paper plant that discharges into a creek through Crossett, the first step to a cumulative risk assessment and foundation for developing next steps
MVD	Green vs. Gray Infrastructure	Omaha, NE	Documenting the contributions and impacts of grey and green infrastructure demonstration projects, with goal of proactively addressing local challenges
MVD	Air Monitoring	Imperial Valley, CA	Working with the region to install small meteorology measurement stations to integrate functionally with existing university air pollution sensors, to provide a better understanding of pollution movement

Appendix C. Regional Applied Research Effort Projects Addressing Environmental Justice and Tribal Issues

Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
2 SSWR NRMRL	FY13 RARE	Evaluation of the Effectiveness of UV Disinfection over Time for Inactivation of Waterborne Pathogens in Surface and Groundwater Supplies in Non-PRASA Communities in Puerto Rico	La Sofia and Apeadero, PR	Puerto Rico has 247 Non-PRASA water systems (outside the jurisdiction of the Puerto Rico Aqueduct and Sewer Authority) serving fewer than 500 people. Yet, only 186 of these systems use some form of chlorination, and very few use filtration technologies for removal of chlorine-resistant pathogens. Since 2005, ORD has been conducting research studies on low-cost filtration and disinfection technologies to protect human health in non-PRASA communities. In this project, sand filtration systems, a conventional treatment system, and UV disinfection were installed and demonstrated in the non-PRASA communities of La Sofia and Apeadero in rural Puerto Rico. Epidemiology studies are being completed before and after installation of the drinking water treatment systems to document the health benefits of the water systems. This RARE project was completed in October 2014 and the contractor's final report to EPA/NRMRL is available in ORD's internal RSP Tracker database.	EJ
2 SHC ACE NERL	FY14 RARE	Citizen Science Toolbox	Newark, NJ	EPA and ORD partnered with Newark's Ironbound community to design, develop, and pilot a Citizen Science Toolbox meant to enable communities like Ironbound to collect their own environmental data and increase their ability to understand local environmental conditions. EPA's resulting Citizen Science Toolbox provided the community with the components needed to initiate and support a community-based, participatory environmental monitoring study, including four stationary air sensor monitors, built by EPA researchers for use by community volunteers to collect data on two common air pollutants: nitrogen dioxide and fine particle pollution (PM2.5); detailed guidance on instrument siting and operation; software for data recovery, processing, visualization, and interpretation; and a template and guidance manual for developing a quality assurance plan to ensure that the data collected are meaningful and appropriate for their intended use. After a half day of training on the use and maintenance of the monitors, community volunteers deployed them at over 20 sites over a 6-month period. ORD analyzed the resulting data and summarized findings at a well-attended community event in November of 2015. A final report is in the clearance process.	R2 MVD

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Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
2	FY15 RARE	Green Infrastructure in Puerto Rico	Cano Martin Pena, PR	Caño Martin Peña (Martin Pena Channel) is a 3.5-mile long tidal channel in the San Juan Bay National Estuary. Over time, the channel has become clogged with sediment and debris, threatening the health and livelihood of more than 25,000 residents of the 8 communities clustered around the channel. Wetlands in the channel were historically filled with trash and debris, narrowing the channel and obstructing water flow resulting in frequent flooding. In this project, a green infrastructure practice is being designed and will be constructed and monitored in the Caño Martin Peña community to investigate how Puerto Rico’s unique tropical/subtropical climate, which features high evapotranspiration rates, a year round growing season and intense rainfall events, impacts the effectiveness of these practices. It is anticipated that community members will also be trained to use equipment made available through EPA’s loan program for citizen science equipment to collect additional data on microbial water quality.	R2 MVD
2	FY15 RARE	Evaluation of Renewable Water Treatment and Monitoring Technologies to Support Communities in Puerto Rico with the Operation of Non-PRASA Drinking Water Systems	Apeadero, PR	Puerto Rico has 247 small water systems that are neither owned nor administered by Puerto Rico’s Aqueduct and Sewer Authority (PRASA). Many challenges are associated with providing safe drinking water to these small “non-PRASA” communities, including their remote location, lack of reliable power, and the cost and availability of material and supplies. Since 2005, ORD has conducted research on the development of low-cost and easy-to-maintain filtration and disinfection technologies appropriate for non-PRASA communities, including 2 RARE projects that provided UV disinfection, solar powered pumps, and rapid sand filtration to 300 individuals in 2 communities. In this project, a solar-powered water pump and waterlines are being installed to combine two remote water sources for conventional treatment and distribution to residents in Apeadero. The operators/volunteers from the communities and students from InterAmerican University are also being trained on the sustainable operation and maintenance of these water treatment systems.	EJ
2 ACE SHC NERL	FY16 RARE	The Efficacy of Citizen Science Air Monitoring for Building Awareness of Exposures for Citizens in a U.S. Caribbean Urban Neighborhood Impacted by Heavy Industrial Contamination	Peñuelas, PR	This project will assess the efficacy of citizen science air monitoring for delivering ambient air quality data to a Spanish-speaking U.S. Caribbean community to enhance awareness and help reduce exposures. The Tallaboa-Encarnación neighborhood of Peñuelas, Puerto Rico, is the selected venue for this study. For 50 years, this community has lived in the shadow of a 3,500-acre petrochemical manufacturing complex. Some 1,400 people, including children, the elderly, and pregnant women living in the community are exposed to multiple air contaminants from heavy industry. Initial ambient air quality data are indicative of nitrogen dioxide, PM 2.5, and PM 10, sulfur dioxide and ozone, and emissions from heavy traffic of diesel trucks, volatile organic compounds, and fugitive asbestos dust from asbestos-lined breaks, asphalt materials, and demolition at industrial sites. This RARE project team will work with Citizen Scientists in the community, among them environmental activists, science teachers, and students from public schools, to research the application of citizen science air monitoring in educating and informing Tallaboa-Encarnación residents about air quality in their specific neighborhood and options for reducing exposures. Air quality data from the EJ project can be leveraged to inform future decisions regarding appropriate air monitoring.	EJ

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Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
3 SHC NERL	FY15 RARE	Building Regional Capacity to Assess the Impacts of Federal, Regional, State, and Local Decisions on Public Health and to Support the Reduction of Disproportionate Impacts on Overburdened Communities	Region 3	Region 3 and ORD scientists are working together to build Regional capacity to assess the implications of Federal, Regional, State, and local decisions on public health and to broaden the understanding of disproportionate impacts of decisions on overburdened, EJ communities. The goal of this project is to bring community public health to the forefront in assessments of Federal and industrial activities. The project team has been meeting to assess the applicability of health impact assessment to Region 3 needs in MVD communities. Difficulty in aligning health impact assessment with status of activities in MVD communities has led the team to refocus the project to Dover, DE. The team plans to apply health impact assessment to an aquaculture development project on a brownfield site in Dover. Region 3's recent work in Dover has bolstered existing partnerships and the use of the Community-Focused Exposure and Risk Screening Tool (C-FERST). The C-FERST efforts have converged with the aquaponics project to create a compelling need for use of a health impact assessment to select among brownfields projects to provide the greatest overall socioeconomic and health benefits from the project.	EJ
3 ACE NRMRL	FY12 RARE	Understanding air Quality Impacts from Regional Energy Production Activities – Extension Request for the Philadelphia Passive Sampler and Sensor Study	South Philadelphia	Dramatic increases in domestic oil and natural gas production have created a need to improve knowledge of emitted volatile organic compounds, hazardous air pollutants, and greenhouse gases to understand potential air quality impacts more fully. This collaborative project investigated the use of low-cost sensor and passive sampler measurement systems to help improve information on variability in air pollutant concentration in areas with many potential sources. The passive samplers developed in this study provide a cost-efficient monitoring approach for communities and will enable advanced leak detection for compliance. The project, which brought a new technology to Region 3, could be used for other applications in the energy extraction and production industry.	EJ
4 SHC ACE NERL	FY13 RARE	Characterization of Near-Source Local-Scale Air Quality Related to Port Expansion Activities	Region 4	Ports along the eastern United States are expected to continue expanding over the next several years, and increased freight volume and traffic along shipping corridors could lead to elevated air pollution in nearby EJ communities. Region 4 and ORD scientists are using data collected from ports such as the one in Charleston, SC to modify existing air quality models to evaluate the potential air quality impacts associated with port expansion. This project has led to collaborations with several stakeholders including the Army Corps of Engineers, the State environmental quality department and port authority, cross-agency National Environmental Policy Act representatives, and community groups. This range of expertise has helped the research team leverage new technologies, scientific approaches, and communication strategies, and led to improved estimates of emissions and interpretation of dispersion results. This modeling system will assist with future mitigation and regulatory efforts. The modified modeling system will help future research efforts aimed at mitigation, impact analyses, and regulation of future port expansion projects.	EJ

Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
EJ	FY15 RARE	Improving Control Technologies Governing Release of Lead into Drinking Water Under the Safe Drinking Water Act to Limit Impacts on Phosphorus Discharges under the Clean Water Act	MI	As lead service lines age and deteriorate, public water utilities often use blended orthophosphate to inhibit lead corrosion in aging public water systems. Although adding orthophosphate can minimize lead release, it can also burden surface waters with phosphate discharge. ORD and Region 5 are conducting bench-scale analyses and pilot studies to determine the degree of effectiveness for different levels of phosphate treatment and the relative effectiveness of using pH/alkalinity adjustment as a treatment method. This research will directly determine the necessity and cost-effectiveness of different orthophosphate dosages, support the development of an alternative treatment technique, and assist public water systems in Flint, MI and other Great Lakes water-fed systems with simultaneous compliance under the Clean Water Act and Safe Drinking Water Act.	EJ
5 ACE NRMRL	FY15 RARE	Application of Lower- Cost Air Monitoring Technologies for Local- Scale Air Quality Investigations in an Environmental Justice Community	Chicago, IL	ORD researchers are working with members of an EJ community in Chicago, IL to build awareness of air quality monitoring and research. ORD installed a solar- and wind-powered Village Green bench station at an elementary school that measures ozone, fine particulate pollution, and weather conditions around the clock. Data collected by the station are updated every minute online at www.airnow.gov/villagegreen and on a display monitor next to the bench. ORD is creating lesson plans that will involve using the Village Green data. ORD is developing an AirMapper portable air sensor for use in collecting particulate pollution and environmental conditions and shares the data online through the RETIGO tool. ORD will publish the design plans so others can build similar devices. An article about this project was recently published on the Chicago Tonight Website at: http://chicagotonight.wttw.com/2016/06/02/how-park-bench-monitors-air-quality-chicago-s-southeast-side .	EJ

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Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
6 SSWR NERL NHEERL	FY16 RARE	Understanding which Gastrointestinal Illness-Associated Pathogens are Native to a Population to Determine the Source and Generate Risk Assessment Models	Region 6	This project will provide valuable information regarding waterborne pathogen exposures in Tribal populations in Region 6, specifically which waterborne pathogens are native to a population and which are emerging. Understanding this key element can assist with additional public health protection of Tribal populations by enhancing drinking water treatment plant operations, maintaining appropriate disinfection residuals, and educating operators on source water protection. The project team will build relationships with Tribes to assist with developing consistent water disinfection practices that will improve their water quality and water safety. The results obtained from this project will (1) assist EPA and tribal nations with risk mitigation tools that can be used to identify drinking water pathogens rapidly and address risks to public health, (2) provide Region 6 with a better understanding of the dynamics occurring in Tribal systems that might lead to better prevention strategies for various waterborne disease outbreaks, and (3) provide sound science for policy-makers and drinking water operators to develop better management practices that could improve drinking water treatment practices in Tribal Nations. These partners can implement innovative and emerging methods for source water protection plans and effective treatment barriers that use the most cost-effective method of water source protection against invasions by emerging pathogens.	Tribal
6 ACE NRMRL	FY16 RARE	Next-Generation Air Measurement Technology Development and Application to an Environmental Justice Community in Houston, Texas	Houston, TX	Region 6 has an ongoing need to provide air quality information for EJ communities. Emerging next-generation air measurement technologies are of great interest as a cost-effective solution to investigate pollution sources affecting EJ communities and communicate local air quality information. Region 6 will install a Village Green station in an EJ community in Houston, TX that will measure fine particulate matter, ozone, and weather every minute and report the data on a public website. This study will help advance the Village Green station technology and provide important research data on local air pollution to the EJ community.	EJ

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Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
8 SHC NRMRL	FY16 RARE	Tribal High- Performance Home Analysis	Fort Peck Reservation, Montana	Native American Tribes in EPA Region 8 reside in some of the poorest counties in the country, often with insufficient and inadequate housing to meet demand. The Tribes face difficult housing decisions that have environmental, health, economic, and cultural implications. Despite these challenges, ingenuity and persistence is visible in many new examples of alternative Tribal housing, including use of straw bale, compressed earth block, and other high-performance technologies that might be healthier, greener, and more economically viable to Native American people. The Fort Peck Reservation is a Region 8 MVD community that is in the early stages of a multiphased sustainable community development project, planned and implemented by the Make It Right Foundation. This offers a unique opportunity to engage the community, collect and analyze energy performance in new construction, high-performance homes, and compare to energy analysis of existing homes on the Fort Peck Reservation. This project will help Region 8 work toward addressing the main concern of inadequate and inefficient housing for regional Tribes. Understanding how these designs operate will be valuable for informing similar design options for Tribal communities in other climate zones.	MVD/ Tribal
9 SHC NRMRL	FY14 RARE	Sustainable Approaches for Materials Management in Remote, Economically Challenged Areas	U.S. Pacific Island Territories	Many of Region 9's Pacific Island territories and Tribal lands face waste management challenges due to their remote geography, small populations, and economic status. Communities like these often rely on open dumps with virtually no controls. ORD and Regional scientists are researching a wide variety of cost-effective and sustainable waste management alternatives to create a decision-support tool to assist local governments in affected areas. The tool will help these communities divert waste from open dumps, build compliant low-cost facilities, and improve solid waste management to promote sustainability.	EJ
9 CSS NERL	FY14 RARE	Development of a Simple Approach to Check for Pesticide Drift at Schools	Fresno County, CA	Off-target pesticide drift can occur during or after application of pesticides. Community-based air monitoring has been demonstrated for use to determine whether pesticide drift affects nearby communities. This project seeks to use community-based air monitoring to measure pesticides of most concern to Region 9 in the San Joaquin Valley. The goals are to (1) build community capacity to measure the levels of pesticides in the air at homes or schools; (2) develop a robust sampling and analysis approach that makes community air monitoring data useful for EPA and other regulatory agencies; (3) identify measures to reduce or mitigate exposure to pesticide drift at homes and schools; and (4) provide data that could be used to refine or validate State tools or programs. This project will help fill data gaps regarding pesticide exposure due to drift. It also will help determine whether nonvolatile pesticides should be considered during assessments or estimations of exposure to pesticides in communities located near heavy pesticide use areas. Furthermore, this project will help identify whether physical barriers, such as roads or vegetation, help reduce pesticide drift to schools and homes.	EJ

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Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
9 SHC NHEERL	FY15 RARE	Evaluating Health Care Cost Savings from San Diego's Healthy Homes Program in Support of an Asthma Health Impact Bond	Fresno County, CA	Asthma is one of the most prevalent and costly chronic diseases, and is often treated in the emergency department rather than through comprehensive management and prevention. Homes contain numerous asthma triggers that play a significant role in making asthma worse and triggering asthma attacks. Healthy Homes programs that remediate health and safety hazards can reduce exposure to asthma triggers and decrease the frequency of emergency room visits and hospitalizations. The City of San Diego has conducted a Safe and Healthy Homes intervention project since 2006 with funding from the U.S. Department of Housing and Urban Development. The program has reached nearly 500 homes with services that include repair of mold and moisture problems; removal of indoor contaminants such as lead, allergens, and asthma triggers; and repair of home safety hazards. This RARE project's analyses will provide critical cost/benefit (i.e., return on investment) data to support the launch of an Asthma Health Impact Bond in San Diego. For this project, the team will work with the City of San Diego and the City will work with Rise Health to evaluate medical and insurance records of past program participants (after receiving participant consent).	EJ
9 ACE NERL	FY16 RARE	Sensor Kit Performance Testing and Pollutant Mapping for Community Air Monitoring: An Innovative Partnership with the South Coast Air Quality Management District Air Quality Sensor Performance Evaluation Center	Los Angeles, CA	The increasing emergence of small, low-cost air quality sensors highlights a shift in the traditional air monitoring paradigm and the future of air quality monitoring. As these devices become more widespread and publicly available, the need is increasing to characterize the performance and data quality of various sensor technologies to guide selection of sensors for specific applications; correctly interpret and communicate sensor data; and promote conscientious sensor use by academics, industry, communities, and individuals. The project team is partnering with the South Coast Air Quality Management District's Air Quality Sensor Performance Evaluation Center to help expand the knowledge of available air quality sensors, their performance, and potential applications. Efforts include field and laboratory performance demonstrations of a fine particulate matter (PM2.5) or ozone (O ₃) sensor kit, data visualization, and development of regional guidelines for using emerging technologies for air quality sensors. This project will yield a spatial map of pollutant concentrations, summary of sensor package performance relative to reference standards, and sensor data analytics. The final products also will include small, portable air monitoring kits that communities can check out from the Evaluation Center to better understand their local air quality. Through this work, EPA staff will engage in efforts to assemble data analysis tools for complex sensor arrays, including evaluation of quality assurance features, pattern recognition, and normalization versus reference monitors. Regional standard operating procedures and QA/QC guidance for sensor performance kit implementation and training materials will be developed for internal and external use, including appropriate strategies for communicating sensor performance results to the public. Results will contribute to the District's Evaluation Center sensor library, ORD's Air Sensor Toolbox, and broader community air monitoring projects.	EJ

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Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
10 ACE NRMRL	FY13 RARE	Agricultural Smoke Emissions in Support of Tribal and State Smoke Management	Northern Idaho, Eastern Washington	In Region 10, agricultural burning is strictly regulated in Washington, Idaho, and Oregon; on the Nez Perce, Coeur d’Alene, and Umatilla Reservations; and for the Kootenai Tribe of Idaho. Under federally enforceable State and Tribal regulations, smoke managers in these areas make daily decisions about who can and cannot conduct agricultural burning. These regulations and smoke management programs exist as a result of past agricultural smoke-related health impacts, citizen complaints, and lawsuits across the Pacific Northwest. Smoke management programs are a critical part of a compromise that allows the agriculture industry to burn material on days when the smoke will quickly disperse and restricts burning on poorly ventilated days when smoke would not disperse and would adversely affect human health. A poorly informed burn decision can mean the difference between very clean air and air that greatly exceeds national air quality standards for the tens of thousands of people that live in any one of several agricultural airsheds in the Pacific Northwest. This project measured the amount and height of smoke from representative agricultural burns. The data will be used in the Airpact and ClearSky modeling tools to produce dispersion forecasts that more accurately reflect the amount of smoke released from an agricultural burn and its distribution vertically above the ground. The Airpact and ClearSky smoke forecasts are displayed on the Washington State University website every morning in time for smoke managers to finalize burn decisions for that day and to assign preliminary burn decisions for the following day. Better smoke forecasts lead to better smoke management decisions and fewer instances of “smoked-out” populated areas. The project team will draft a journal article incorporating the emissions data.	Tribal
10 SSWR HHRA CSS SHC NERL	FY15 RARE	Identification of Safe Dust-Control Products for Alaska Native Villages: A Study of the Toxicity of Palliatives	Alaska	Unpaved roadways in the State of Alaska are common. Vehicular traffic, especially during the dry season, raises considerable amounts of dust, which is transported, creates air quality and safety concerns, and settles on roadside vegetation and in waterways where Alaska Tribes routinely gather plants and fish that are consumed as part of their traditional subsistence activities. To help control the dust problem, palliatives are often sprayed on the rural, unpaved roads. Palliatives can range from plain water, which has a short effective life, to synthetic organic compounds, which have a much longer effective life. Concern has arisen about the exposure of the local populations to the chemicals sprayed on the dirt roads when nearby foodstuffs are gathered and eaten. This RARE project is the first phase evaluating the issue and is focused on conducting a literature review of available palliatives, their frequency of use, and information on their effectiveness for dust control. Later follow-up research might involve collecting and analyzing local food sources near areas of palliative use to determine ingestion exposure capacity. The research team recently completed the literature review.	EJ

Region ORD	Award Year	Project Title	Location	Brief Status Report	Category: EJ, MVD, Tribal
10 SHC NERL	FY16 RARE	Lead, Allergen, Pesticide, and Polychlorinated Biphenyl Levels in Licensed Childcare Centers in Portland Area Indian Country	Portland Area Indian Country (all federally recognized Tribes within WA, ID, and OR)	This study will provide valuable concentration data about lead, allergens, pesticides, polychlorinated biphenyls, and possible other chemical or biological agents in Portland Area Indian country childcare facilities. This information will help prioritize services and funding based on known needs and risks to help facilities obtain needed services. We will compare our study findings to the results measured in a national survey to determine how potential chemical exposures in childcare facilities in Portland Area Indian country compare to chemical exposures measured in childcare facilities in the continental United States. EPA and the Indian Health Service plan to conduct follow-up outreach and education with the Tribes and facilities on how to reduce exposure risks from contaminants that are detected in the facilities.	Tribal

Appendix D. RESES Projects Addressing Environmental Justice and Tribal issues

Region	Lab/Center	Project Title	Community	Status
R7	NRMRL	Kansas City Transportation and Local Scale Air Quality Study (KC-TRAQS): Comparing Citizen Science and PM Data	Kansas City, KS	Awarded 2016
R6, R2	NERL	Temporal-Spatial Analysis of Mosquito Breeding Habitat, Arbovirus Health Risk, and Vector Mitigation in Brownsville, Texas	Brownsville, TX Puerto Rican suburb (to be determined)	Awarded 2016
R6	NRMRL	Use of Decision Analysis for a Sustainable Environment, Economy and Society (DASEES) to Develop Remediation and Restoration Options for Small Dairy Farm Operations and Enhance Community Stakeholder Involvement	Mid-East Louisiana (Saint Helena, Tangipahoa, Washington Parishes)	Awarded 2016
R10, R2	NRMRL	Deployment of Decision Analysis for a Sustainable Environment, Economy and Society (DASEES) to Support Superfund Remedial Action Decision Process and Enhance Community Involvement	Coeur d'Alene River, ID Lower Darby, PA	Awarded 2016
R4, R6	NERL	Community Participatory Port Resilience Assessment	Memphis Tri-City Port Area	Awarded 2016
R10	NERL	Making a Visible Difference (MVD) in N/NE Portland: Engaging Communities, Using Citizen Science to Assess and Address Children's Environmental Health from Transit and Air Pollution	Portland, OR	Awarded 2015
R10, R3, R9	NERL	Understanding and Evaluating Ecosystem Services at Site Remediation Projects and Applying Their Benefits to Sustainability and Livability for Surrounding Communities	Coeur d'Alene, ID Philadelphia, PA	Awarded 2015
R9, R5	NRMRL	Improving Public Health through Urban and Roadside Vegetation	Detroit, MI Imperial Valley/Oakland, CA	Awarded 2015
R5	NHEERL	How the Relative Valuation of Ecosystem Goods and Services Empowers Communities to Impact the Outcomes of Remediation, Restoration and Revitalization Projects	St. Louis River Estuary, MN	Awarded 2015
R2	NERL	Using Ecosystem Services Assessment and Health Impact Assessments as Part of a Stakeholder-driven Approach to Storm Recovery: Long Island Case Study	Long Island, NY	Awarded 2015
R4, R6, R7	NRMRL	CitySpace & Air Sensor Network: Evaluating Spatial Gradients of Urban Air Pollution with Low-Cost Air Sensor Technology	To be determined among Memphis, TN; Birmingham, AL; Louisville, KY	Awarded 2015
R9	NERL	Floating Vegetation Islands: Using TEK for Development of Leading Indicators of Ecosystem Function for BMP Effectiveness, Water Quality Standards, Biological Criteria, and Control of Harmful Algal Blooms	Lake Havasu, AZ Colorado River Indian Tribes Indian Reservation	Awarded 2015
R4	NRMRL	Using Green Infrastructure to Address Climate Change Resiliency: A Case Study in North Birmingham, AL	Birmingham, AL	Awarded 2014
R4	NRMRL	Community Resilience Planning and Decision Making Framework for Coastal Communities	Southeast FL	Awarded 2014
R1	NRMRL/NERL	Preparing Communities for Disruptive Climate Events in Southeastern Mass	Southeastern Massachusetts	Awarded 2014

Appendix E. Intramural Laboratory- and Center-based ORD Research Addressing Environmental Justice Issues

Appendix E. Intramural Laboratory – and Center-based ORD Research Addressing Environmental Justice Issues				
Citation	Topic	Product Subtype	Research Program	Location
U.S. EPA. Environmental Resilience: Exploring Scientific Concepts for Strengthening Community Resilience to Disasters. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/163, 2015.	Community resilience	EPA Report	Homeland Security	
U.S. EPA. EPA Pursues Interest in Developing Community Environmental Resilience Indicators and Indices. U.S. Environmental Protection Agency, Washington, DC, EPA/600/F-15/153, 2015.	Community resilience	Technical Fact Sheet	Homeland Security	
Hu, S., and A. Keeley. Sustainable Urban Waters: Opportunities to Integrate Environmental Protection in Multi-objective Projects. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/305, 2015.	Community resilience	EPA Report	SSWR	
Green, O., A. Garmestani, C. Allen, L. Gunderson, J. Ruhl, C. Arnold, N. Graham, B. Cosens, D. Angeler, B. Chaffin, and C. Holling. Barriers and Bridges to the Integration of Social-ecological Resilience and Law. Frontiers in Ecology and the Environment. Ecological Society of America, Ithaca, NY, 13(6):332-337, 2015.	Community resilience	Journal article	SSWR	
Sadd, J., E.S. Hall, M. Pastor, R. Morello-Frosch, J. Hayes, and C. Swanson. Ground-Truthing Validation to Assess the Effect of Facility Locational Error on Cumulative Impacts Screening Tools. International Journal of Environmental Research and Public Health. Molecular Diversity Preservation International, Basel, Switzerland, 2015:1-8, 2015.	Cumulative impacts	Journal article	SHC	California
Daniel, J., P. Barclay, and K. Bush. Building a Greenway: Using EnviroAtlas in the Classroom. Case Study. US EPA Office of Research and Development, Washington, DC, EPA/600/R-16/006, 2016	Decision support - Eco-health	EPA Report	SHC	
Yngve, L., and B. Pamela. Health Impact Assessment (HIA) and EnviroAtlas: Integrating Ecosystem Services into the Decision-Making Process-Guide. US EPA Office of Research and Development, Washington, DC, EPA/600/RR-15-128, 2015.	Decision support - Eco-health	EPA Report	SHC	
Bradley, P., W. Fisher, B. Dyson, and A. Rehr. Coral Reef and Coastal Ecosystems Decision Support Workshop April 27-29, 2010 Caribbean Coral Reef Institute, La Parguera, Puerto Rico. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-14/386, 2015.	Decision support – Eco-health	Report	SHC	Puerto Rico
Jiang, Y, Yuan, Y, Neale, A, Jackson, L, and Mehaffey, M. Association between Natural Resources for Outdoor Activities and Physical Inactivity: Results from the Contiguous United States. Int. J. Environ. Res. Public Health 2016, 13, 830; doi:10.3390/ijerph13080830.	Decision support – Eco-health	Journal article	SHC	
Sykes, K., J. Moya, L. Phillips, C. Penalva-Arana, and S. Gilbert. Aging: Characteristics, Exposure Factors, Epigenetics, and Assessment of Health Risks of Older Adults. Chapter 23, Anna M. Fan, Elaine M. Khan, George V. Alexeeff (ed.), Toxicology and Risk Assessment. Pan Stafford Publishing Pte Ltd, Singapore, Malaysia, 1029-1086, 2015.	Disparities – Health and exposure	Book Chapter	N/A	

Appendix E. Intramural Laboratory – and Center-based ORD Research Addressing Environmental Justice Issues				
Citation	Topic	Product Subtype	Research Program	Location
Berland, A., K. Schwarz, D. Herrmann, and M. Hopton. How Environmental Justice Patterns Are Shaped by Place: Terrain and Tree Canopy in Cincinnati, Ohio, USA. Cities and the Environment. Digital Commons Loyola Marymount University, Los Angeles, CA, 8(1): Article 1, 2015.	Disparities – ecosystem services	Journal article	SSWR	Cincinnati, OH
McCullough, Shaun D., E. Bowers, D. On, D. Morgan, Lisa A. Dailey, Ronald N. Hines, Robert B. Devlin, and D. Diaz-Sanchez. Baseline Chromatin Modification Levels May Predict Interindividual Variability in Ozone-Induced Gene Expression. Toxicological Sciences. Society of Toxicology, 150(1):216-224, 2016.	Disparities – Epigenetics and health	Journal article	ACE	
King, K., S. Murphy, and C. Hoyo. Epigenetic Regulation of Newborns’ Imprinted Genes Related to Gestational Growth: Patterning by Parental Race/Ethnicity and Maternal Socioeconomic Status. Martin Bobak and James R. Dunn (ed.), Journal of Epidemiology and Community Health. BMJ / British Medical Journal Publishing Group, London, UK, 12(1):1-20, 2015.	Disparities – Epigenetics and health	Journal article	SHC	
Vidal, A., V. Semenova, T. Darrah, A. Vengosh, Z. Huang, K. King, M. Nye, R. Fry, D. Skaar, R. Mcguire, A. Murtha, J. Schildkraut, S. Murphy, and C. Hoyo. Maternal Cadmium, Iron and Zinc Levels, DNA Methylation and Birth Weight. BMC Pharmacology and Toxicology. BioMed Central Ltd, London, UK, 15:16-20, 2015.	Disparities – Epigenetics and health	Journal article	SHC	
King, K., J. Kane, P. Scarbrough, C. Hoyo, and S. Murphy. Neighborhood and Family Environment of Expectant Mothers May Influence Prenatal Programming of Adult Cancer Risk: Discussion and an Illustrative DNA Methylation Example. Biodemography and Social Biology. Taylor and Francis, Philadelphia, PA, 62(1):87-104, 2016.	Disparities – Epigenetics and health	Journal article	SHC	
Senthilkumar P. Kuppusamy, J. Phillip Kaiser, and S.C. Wesselkamper Epigenetic Regulation in Environmental Chemical Carcinogenesis and its Applicability in Human Health Risk Assessment International Journal of Toxicology Vol. 34(5) 384-392, 2015.	Disparities – Epigenetics and human health risk assessment	Journal article	HHRA	
Joca, L., J. Sacks, D. Moore, J.S. Lee, R. Sams, and J. Cowden. Systematic Review of Differential Inorganic Arsenic Exposure in Minority, Low-Income, and Indigenous Populations in the United States. Environment International. Elsevier Science Ltd, New York, NY, 2016.	Disparities – Health and exposure	Journal article	HHRA	
McEwen, A., H. Hsu-Kim, N. Robins, N. Hagan, S. Halabi, O. Barras, D. Richter, AND J. Vandenberg. Residential Metal Contamination and Potential Health Risks of Exposure in Adobe Brick Houses in Potosi, Bolivia. Science of the Total Environment. Elsevier BV, Amsterdam, Netherlands, 562:237-246, 2016.	Disparities – Health and exposure	Journal article	HHRA	Potosi, Bolivia
Gernes, R., R. Hertzberg, M. MacDonell, G. Rice, J. Wright, G. Beresin, T. Miller, J. Africa, G. Donovan, J. Hipp, P. Hystad, L. Jackson, M. Kondo, Y. Michael, R. Mitchell, M. Nieuwenhuijsen, P. Ryan, W. Sullivan, and M. Annerstedt van den Bosch. Estimating Greenspace Exposure and Benefits for Cumulative Risk Assessment Applications. (Summary Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/025, 2016.	Eco-health and cumulative assessment	EPA Report	HHRA	

Appendix E. Intramural Laboratory – and Center-based ORD Research Addressing Environmental Justice Issues				
Citation	Topic	Product Subtype	Research Program	Location
Foster-Wittig, T., E. Thoma, and J. Alberston. Estimation of Point Source Fugitive Emission Rates from a Single Sensor Time Series: A Conditionally Sampled Gaussian Plume Reconstruction. Atmospheric Environment. Elsevier Science Ltd, New York, NY, 115:101-109, 2015.	Near source air quality	Journal	ACE	Wyoming
Brantley, H., E. Thoma, AND A. Eisele. Assessment of VOC and HAP Air Emissions from Oil and Natural Gas Well Pads Using Mobile Remote and Onsite Direct Measurements. Journal of the Air & Waste Management Association. Air & Waste Management Association, Pittsburgh, PA, 65(9):1072-82, 2015.	Near source air quality	Journal article	ACE	Denver-Julesburg, Barnett, and Pinedale Basins
Albertson, J., T. Harvey, G. Foderaro, P. Zhu, X. Zhou, S. Ferrari, S. Amin, M. Modrak, H. Brantley, AND E. Thoma. A Mobile Sensing Approach for Regional Surveillance of Fugitive Methane Emissions in Oil and Gas Production. Environmental Science & Technology. American Chemical Society, Washington, DC, 50(5):2487-2497, 2015.	Near source air quality	Journal article	ACE	National. Experimental Studies in CO, NC
Thoma, E. Next Generation Source Measurements: CRADA partner communication sheet. US Environmental Protection Agency, Cincinnati, OH, 2015.	Near source air quality	Technical Fact Sheet	ACE	
Grosse, D., J. Enriquez, J. McKernan, S. Bessler, AND A. Dindal. Quality Assurance Project Plan for Verification of Black Carbon Monitors. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/032, 2016.	Near source air quality	EPA Report	N/A	
U.S. EPA. Extraction and analysis of Lewisite 1, by its degradation products, using liquid chromatography tandem mass spectroscopy (LC-MS/MC). U.S. Environmental Protection Agency, Washington, DC, 2015.	Potential hazardous waste	EPA Report	HS	
Luxton, T., B. Miller, E. Holder, AND J. Voit. Omaha Soil Mixing Study: Redistribution of Lead in Remediated Residential Soils Due to Excavation or Homeowner Disturbance. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/054, 2015.	Site remediation	EPA Report	SHC	Omaha, NE
Bessler, S. and J. McKernan. Engineering Technical Support Center Annual Report Fiscal Year 2014; Technical Support and Innovative Research for Contaminated Sites. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/132, 2015.	Site remediation	EPA Report	SHC	
Jianping, X., V. Zartariana, B. Mintza, M. Weber, K. Bailey, A. Gellerd. Modeling tribal exposures to methyl mercury from fish consumption. Science of The Total Environment, Vol. 533, 15 November 2015, Pages 102–109.	Tribal	Journal article	CSS	
Smith, L., C. Wade, J. Case, L. Harwell, K. Straub, AND Kevin Summers. Evaluating the Transferability of a U.S. Human Well-being Index (HWBI) Framework to Native Americans Populations. Social Indicators Research. Springer, New York, NY, 124(1):157-182, 2015.	Tribal	Journal article	SHC	
DeMarini, D., V. Marshall, R. Hillger, S. Warren, A. Swank, T. Hughes, A. Elskus, C. Byrne, J. Ferrario, C. Orazio, R. Dudley, J. Diliberto, S. Stodola, S. Mierzykowski, K. Pugh, AND C. Culbertson. The Penobscot River and Environmental Contaminants: Assessment of Tribal Exposure Through Sustenance Lifeways. US EPA Office of Research and Development, Washington, DC, 2015.	Tribal	EPA Report	SSWR	Penobscot River, ME

Appendix E. Intramural Laboratory – and Center-based ORD Research Addressing Environmental Justice Issues				
Citation	Topic	Product Subtype	Research Program	Location
<u>Warren, S., L. Claxton, T. Hughes, A. Swank, J. Diliberto, V. Marshall, D. Kusnierz, R. Hillger, and D. DeMarini. Survey of the Mutagenicity of Surface Water, Sediments, and Drinking Water from the Penobscot Indian Nation. Chemosphere. Elsevier Science Ltd, New York, NY, 120(1):690-696, 2015.</u>	Tribal	Journal article	SSWR	Penobscot Indian Nation