



Engaging Diverse Partners: Strategies to Address Environmental Public Health

A joint NIEHS meeting of the Partnerships for Environmental Public Health (PEPH) network
and Disaster Research Response (DR2) program

September 18-20, 2017

NIEHS Building 101, Rodbell Auditorium
111 TW Alexander Drive, Research Triangle Park, N.C.



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National Institutes of Health

U.S. Department of Health and Human Services

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Engaging Diverse Partners: Strategies to Address Environmental Public Health

September 18 - 20, 2017 | Research Triangle Park, North Carolina

Welcome!

The National Institute of Environmental Health Sciences (NIEHS) has promoted and advanced the use of community-engaged research approaches since 1994. Most recently, the institute has emphasized the importance of community engagement by highlighting it as one of the key elements of the 2012-2017 Strategic Plan. Disaster response also requires extensive community engagement to be successful and to ensure protection of all segments of society. In this context, we are coordinating the PEPH meeting with the DR2 workshop to highlight the successful approaches of engaging diverse partners and consider effective partnerships in the aftermath of disasters.

PEPH Goals

The purpose of the PEPH meeting is to focus on successful approaches for engaging with diverse partners. These include: Community-based and Environmental Justice Organizations, Educators, Healthcare Professionals, Tribal Communities, Decision Makers, and Workers. The meeting builds off conversations started during the [NIEHS Environmental Health Science FEST](#) on this topic.

PEPH Objectives:

1. Promote in-depth conversations on successful approaches
2. Identify similarities and differences across the partners
3. Share educational resources
4. Identify and prioritize collaborative actions and outputs to advance and promote CEnR approaches

DR2 Meeting Description

The [NIEHS DR2 program](#) facilitates awareness of best practices for conducting research following disasters, and promotes the many successes in disaster research response undertaken by NIEHS grantees. In the immediate aftermath of the recent hurricanes, a purpose of this meeting is to facilitate discussions among NIEHS grantees with the goal to create a registry of disaster research expertise that may be leveraged to respond following future disasters to inform and improve the health and wellness of those immediately impacted. In addition to discussing current events, this meeting will build on previous hands-on DR2 workshops that connected grantees with disaster response personnel to explore the benefits and challenges associated with conducting research immediately following a disaster, such as, the hypothetical scenarios explored in the Los Angeles, Houston and Boston tabletops. Workshop participants will also learn how to assess their organization's preparedness to respond and conduct research activities following a disaster—culminating in the development of a Disaster Research Response "playbook."

Meeting Overview

We will begin with a broader discussion on community-engaged research approaches as part of the PEPH meeting.

Concurrent Sessions

There are three sets of concurrent sessions on Monday. The purpose of these moderated sessions is to have smaller group discussions to share common approaches for engaging with different partners, successes, challenges, and actions for how grantees can work together to advance the science and increase awareness about community engaged research in environmental public health.

Action-oriented Report Back

On Tuesday morning, we will have an action-oriented report back session, where representatives for each of the concurrent sessions will highlight actions and outputs discussed for that topic. As a large group, we will discuss similarities, synergize proposals, and prioritize actions. Collaborative work team will begin discussing next steps before the PEPH meeting ends at noon on Tuesday.

Immediately following lunch on Tuesday, we will transition into a focused discussion on disaster research response, which requires partnerships at many levels.

Presentations and Workgroups

On Tuesday after lunch we will start by hearing about disaster research efforts that worked. Participants will then engage in active groups to work on products that can be used for future disaster research response efforts.

Appreciation

Thanks to all the help and contributions from our planning team and session leaders.

Marti Lindsey	University of Arizona	Robin Fuchs Young	TAMU
Diana Rohlman	Oregon State University	Madeleine Scammell	Boston University
Kathleen Gray	UNC	Jim Remington	NIEHS
Jill Johnston	USC	Symma Finn	NIEHS
Melanie Pearson	Emory	Sharon Beard	NIEHS
Rania Sabty-Daily	UCLA	Chip Hughes	NIEHS
Mitch Rosen	Rutgers	Kristi Pettibone	NIEHS
Annemarie Charlesworth	UCSF	Justin Crane	MDB, Inc
Maida Galvez	MSSM	Suzanne France	MDB, Inc
Panagis Galiatsatos	Johns Hopkins	Kerri Voelker	MDB, Inc
Marissa Hauptman	Harvard		

PEPH Annual Meeting – Agenda at a Glance

Monday, September 18, 2017

9:00 – 10:00 a.m.	Welcome and Introductions	<i>Rodbell ABC</i>
10:00 – 10:15 a.m.	Break	
10:15 a.m. – Noon	Breakout Session #1* Community-Engaged Research with EJ Communities	<i>Rodbell BC</i>
	STEM/Educators	<i>Rodbell A</i>
Noon – 1:15 p.m.	Lunch (on your own)	<i>Cafeteria</i>
1:15 – 3:00 p.m.	Breakout Session #2* Healthcare professionals	<i>Rodbell BC</i>
	Workers.....	<i>Rodbell A</i>
3:00 – 3:15 p.m.	Break	
3:15 – 5:00 p.m.	Breakout Session #3* Decision Makers.....	<i>Rodbell BC</i>
	Tribal Communities.....	<i>Rodbell A</i>

Tuesday, September 19, 2017

9:00 a.m. – Noon	Report back and next steps	<i>Rodbell ABC</i>
Noon	PEPH Meeting Adjourns	

PEPH Annual Meeting Agenda

Monday, September 18, 2017

9:00 – 10:00 a.m.	Welcome and Introductions <i>Rodbell ABC</i>
10:00 – 10:15 a.m.	Break
10:15 a.m. – Noon	Breakout Session #1* <i>Community-Engaged Research with EJ Communities..... Rodbell BC</i> This session will explore innovative models, best practices, and future directions for community-engaged research. The main focus will be on environmental health scientists rooted in local on-the-ground community organizations, particularly with those communities disproportionately burdened by pollution. This group is targeting community leaders and scientists actively involved in community-engaged research and action to discuss expertise, models and experience. <i>STEM/Educators</i> <i>Rodbell A</i> K-12 teachers are natural partners in science education on environmental health topics. Teachers have both baseline levels of science literacy and the opportunity to prepare students to make informed decisions about environmental exposures that may impact health. Their students, in turn, are developing as future leaders and benefit from understanding current science and its relevance to individual and societal decisions. In this session, we will discuss the outcomes of NIEHS-supported outreach and engagement programs that work in K-12 settings and brainstorm ways to respond to the unique challenges of this environment.
Noon – 1:15 p.m.	Lunch (on your own) <i>Cafeteria</i>
1:15 – 3:00 p.m.	Breakout Session #2* <i>Healthcare professionals</i> <i>Rodbell BC</i> This PEPH break-out session aims to identify best practices of advancing environmental health across the career trajectories of clinicians. This includes starting with medical education, continuing with clinical care assessment, and extending to engagement with community. The discussion will begin with the break-out organizers briefly sharing innovative examples from each sphere, followed by an open dialogue with participants to learn more about their respective work. We will explore the opportunities and challenges faced by clinicians in bringing an environmental health emphasis to their academic institution, clinical practice, or community. Discussions will also identify key elements to successful implementation, such as building on evidence-based practices and garnering diverse stakeholder support. Our goal is to create a tool kit reflecting our shared experiences in advancing environmental health that will permit the replication and expansion of best practices in educational, clinical, and community spheres.

Workers.....Rodbell A

This session will focus on the different types of partnerships that have fostered effective collaborations between workers and employers, learning and educational institutions, government organizations, and communities. Some of the partnerships promote strong training alliances as such as those between unions, employees, employers, and communities through the development of labor management agreements, worker and community benefit agreements, and community university partnerships. Participants will discuss tools and strategies used to develop and promote these partnerships. They will also share how these approaches have been used in various settings to educate, train, and uplift communities during diverse events.

3:00 – 3:15 p.m.

Break

3:15 – 5:00 p.m.

Breakout Session #3*

Decision Makers..... Rodbell BC

This break out session will bring together community facing cores and partnering groups that are interested in engaging decision/policy makers. The session will explore how emerging educational/informational needs of decision makers are identified. Participants will also discuss optimal ways for establishing effective bi- and multi-directional communications. Participants will be encouraged to share examples of their engagement and educational activities with policy makers, including outcomes and challenges. They will further discuss how this target audience is similar or different from others. The goal of the session will also be to identify and capitalize on opportunities for collaboration on continuing or new engagement activities.

Tribal Communities..... Rodbell A

This break out session will focus on building and sustaining tribal-university partnerships. It will highlight aspects of data sharing and tribal sovereignty in conducting collaborative and successful community engagement and research. We will utilize case studies and will discuss the intricacies of conducting activities with tribes in the wake of a disaster. The goal of this session is to collate the collective experiences, challenges, successes, and stories of various partnerships. These discussions and insights will result in a publication that covers basic principles of tribal work and can serve as an introduction for researchers new to this work.

5:00 p.m.

Adjourn for the day

Tuesday, September 19, 2017

9:00 – Noon **Report back and next stepsRodbell ABC**

Objectives:

1. Learn about outputs from all groups
2. Add new ideas
3. Synthesize common ideas for outputs
4. Prioritize outputs
5. Volunteer to help with prioritized outputs
6. Begin initial work on prioritized outputs

9:00 – 9:45 a.m.

Speed Round

Participants have time to walk through the room, review information from each break out, ask questions and provide feedback. During this session, participants can also sign up to work on various efforts. We will have six poster boards set up around the room.

9:45 – 10:45 a.m.

Report Back and Synthesis

Each group will provide quick overviews of the key topics, challenges/opportunities, and common approaches discussed during their session. This session is designed to provide additional context to the information displayed around the room. This report out and group discussion will provide an opportunity to ask clarifying questions and consider ways to synthesize the actions and outputs.

10:45 – 11:15 a.m.

Dot Voting and Prioritization

In this active session, participants will spend the first 15 minutes revisiting the groups around the room and using dot voting to prioritize outputs and products they think are most important, feasible and achievable. Recognizing that we cannot accomplish everything proposed, the goal of the session is to identify the activities that people are most willing to work on.

Participants will receive 3 yellow dots, 3 blue dots, and 1 red dot. Before removing the dot from their backing, put your name and email on the dot! You may also wish to write down the items you marked with a dot.

- 3 yellow dots -- place these dots on the three outputs or products that you think are important and feasible
- 3 blue dots – place these dots on the three outputs or products that you think are most important and feasible AND that you are willing to work on.
- 1 red dot – use this dot to indicate an output or product you are willing to LEAD.

During the last 15 minutes of this session we will review the dots and decide which outputs and products will work on. This information will be used to inform the final meeting report. All proposed outputs will be noted and included in the final report.

11:15 a.m. – Noon

Small group, product-oriented discussion & planning

Small groups will now form to develop implementation and action plans for each of the outputs or products selected in the earlier session. Participants will re-group based on the outputs and products they voted to participate in or lead. If several products or outputs that you voted for are included in the prioritized list, select the one that you are most interested in working on, or the one that seems to need more people.

Noon

PEPH Meeting Adjourns

Disaster Research Response (DR2) Meeting Agenda

Tuesday, September 19th

1:00 – 1:30 p.m.	Welcome and Introductions <i>Rodbell BC</i>
1:30 – 2:30 p.m.	Disaster Research Responses that have worked <ul style="list-style-type: none">• Linda Delp, UCLA Labor Occupational Safety and Health Program• Richard Kwok, NIEHS Gulf Worker Study• Joan Pakenham, NIEHS
2:30 – 3:30 p.m.	DR2 Resource Registry (small groups)
3:30 – 4:30 p.m.	DR2 Playbook
4:30 p.m.	Adjourn for the day

Wednesday, September 20th

9:00 – 9:30 a.m.	DR2 Exercise Evaluation..... <i>Rodbell BC</i> <ul style="list-style-type: none">• Aubrey Miller, NIEHS
9:30 – 9:50 a.m.	National Library of Medicine Resources <ul style="list-style-type: none">• Steve Ramsey, Social and Scientific Systems, Inc.
9:50 – 10:00 a.m.	NIEHS Time Sensitive Funding Opportunity Announcement/Researcher Deployment Guide <ul style="list-style-type: none">• Jim Remington, NIEHS
10:00 a.m. – Noon	Workgroups reconvene
Noon	Adjourn



Project Highlights

Decision Makers

UC Davis Center for Children's Environmental Health

PROJECT TITLE: Nickelodeon's Beyond the Backpack Collaboration: Children's Environmental Health Public Service Announcement

PROJECT DESCRIPTION: The UC Davis Center for Children's Environmental Health and Disease Prevention (CCEH) brings together a team of multidisciplinary researchers, working in partnership with the community to identify and understand the environmental, immunologic, and genetic risks contributing to the incidence and severity of childhood autism so that targeted interventions can be developed to improve outcomes for at-risk children and their families. UC Davis has been at the forefront of research on the role of environment in risk for neurodevelopmental disorders like autism and other learning and behavioral disorders. Although our Center focuses specifically on research within this realm of environmental health science, the increased awareness of environmental hazards and children's unique susceptibility to these hazards is a critical prerequisite to effective outreach and translation of our center's findings to the public.

COMMUNITY/PARTNER PARTICIPATION: The current project has multiple dimensions of community partnership. First and foremost, the development of the Public Service Announcement involves a partnership with Nickelodeon Television Programming. We have provided our Nickelodeon contact with a proposal describing the key messages to be conveyed, and with a brief storyboard of the way that we would like the messages to be communicated visually and verbally. Specifically, the proposed project utilizes Rugrats® characters to illustrate the behavioral and physiological elements of children's susceptibility to environmental hazards. From our preliminary proposal, Nickelodeon will determine which elements of our proposed message and storyboard are appropriate for their audiences. Second: once the preliminary sketches of the PSA have been provided by Nickelodeon, the COTC will qualitatively evaluate the efficacy of the messages by conducting focus groups with members of the lay public and community partners engaging in children's health advocacy work. The COTC has worked in partnership with local children's health advocates to collaboratively develop outreach materials for other projects, and will utilize input from those partners to tailor and enhance the final product. Third: once the PSA has been finalized, imagery and the PSA itself will be shared with local community partners to integrate into their outreach materials. This is part of a larger effort by a COTC graduate student research assistant to integrate environmental health into the children's health outreach materials and messages being developed by local organizations, and to engage these community partners in collaboratively developing culturally appropriate, accessible, and engaging outreach materials pertaining to children's environmental health.

BACKGROUND: The Community Outreach and Translation Core (COTC) of the UC Davis Center for Children's Environmental Health acts as a primary conduit for the bi-directional flow of information between the center and community. It works to engage families of children with autism spectrum disorders, the California Department of Health Services, and the broader cross-cultural community in the research process and the translation and application of research findings. Collaboration with community organizations can enable us to more effectively translate our findings into engaging, accessible, and actionable messages to the public. A central paradigm of pediatrics and children's environmental health is that children are far more sensitive to harmful exposures in the environment than adults. This is the message that we wish to convey to adults of childbearing age by using Rugrats® imagery. Because young adults who grew up in the 1990's and likely watched the popular Rugrats show are now of child-bearing age, we would like to

develop messages targeting this population using Rugrats characters, which we believe will be an effective way to capture their attention. Our goal is therefore to communicate brief, comprehensible, simple and actionable messages using these familiar characters.

OUTCOMES: Although this project is still in progress, our COTC has developed the content and key messages to be conveyed to the public. If, for some reason, the project runs into obstacles on Nickelodeon's end, we plan to use the same content to develop a PSA using novel characters rather than Rugrats characters. Ultimately, we aim to produce an animated PSA that provides parents with actionable messages as well as links to public domain sites for further information regarding the identified environmental hazards. The four actionable messages relate to four types of chemical risk factors: indoor insecticides, indoor air pollution, personal care products, and outdoor air pollution and insecticides. The messages offer simple steps parents can take to protect their children from each of these risks. We have developed the content such that there is one scenario and message per character, using the main characters Phil & Lil, Chuckie, Tommy & Dill, and Angelica.

IMPACTS: This project has the potential to have a number of significant impacts. First, a widely accessible, brief, and informative animation could be disseminated very successfully through a range of social media outlets. These animated shorts could ultimately be featured on Nickelodeon films or television shows, shared on social media sites such as Instagram and Facebook, shown in hospital waiting rooms, and displayed at outreach events by organizations such as the COTC. Such broad dissemination of key messages pertaining to children's environmental health could significantly raise awareness of these issues, and activate interest and concern for protecting children from environmental hazards. Second, engaging local partners in the development of environmental health outreach materials enables the COTC to build stronger, bidirectional channels of communication with relevant community advocates, and to benefit from their critical insights into our target audiences. By designing outreach materials that can be used by a variety of organizations and that reflect the needs and interests of their audiences, we can expand the recognition and promotion of children's environmental health. These types of partnerships enable university entities - whose work is often obscured by dominant notions of and stigmas around science by communities - to work with community organizations toward common goals and identify common ground.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Although we are eager to use the widely recognized Rugrats© characters for our outreach, working with a big name such as Nickelodeon comes with a few drawbacks. Namely, the process is slow and bureaucratic, and the timeline is slower than we would prefer. However, the advantages of using Nickelodeon's characters and influence in this project far outweigh the potential challenges. This project has potential to incite an exciting social media campaign around children's environmental health. Getting popular attention focused on children's environmental health would create many opportunities to promote the work of environmental health research institutions and push for public policy changes that protect children from environmental health hazards. For our COTC, this project represents an ongoing effort to build relationships with local organizations. Many local organizations engaging in children's health advocacy have not yet integrated information about children's environmental health into their materials, and this represents a lost opportunity to connect with audiences that we at the University may not necessarily have access to. We are therefore eager to create relevant materials, co-produced with these partner organizations, that can be distributed by their organizations.

RESOURCES AND PRODUCTS: As part of this project we have produced a storyboard of the hazards, exposure pathways, exposure descriptions, and mitigation strategies that we wish to depict in our PSA.

CONTACT INFORMATION:

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Disaster Research Response (DR2)

Wayne State University

PROJECT TITLE: Flint Area Community Health and Environment Partnership

CONTEXT OF PROJECT: In 2014, the Flint, Michigan Municipal Water Department changed its water source from the treated water of the Detroit Water and Sewerage Department to the untreated water of the Flint River. Improper treatment of the Flint River water led to a system wide exposure to lead, disinfection by products, and bacteria. The nature of the contamination and the damage to the system also resulted in a dramatic loss of disinfectant residual chlorine, likely resulting in the growth of bacteria, such as legionella, throughout the distribution system. Some 102,000 residents were exposed to a number of public health threats including elevated levels of lead, disinfection by-products, and pathogens. Residents tried repeatedly to call attention to discolored and foul smelling and foul-tasting water but were largely ignored by local officials. By the time officials finally acknowledged the problems and declared a state of emergency, the public had been exposed to significant health risks, they had lost trust in government officials, and they were angry. In addition, the water system was badly damaged and it was unclear as to what was happening to Flint's drinking water. The Flint Water Advisory Task Force concluded that "The Flint water crisis is a story of government failure, intransigence, unpreparedness, delay, inaction, and environmental injustice"

(https://www.michigan.gov/documents/snyder/FWATF_FINAL_REPORT_21March2016_517805_7.pdf). The Flint Area Community Health and Environmental Partnership (FACHEP) is a multi-institutional and trans-disciplinary research team working to develop and deploy evidence based guidance to the policy makers and residents of Flint Michigan following a major water contamination disaster. The project team of public health, environmental engineers and crisis and risk communication researchers began working in Flint in 2015 and in early 2016. FACHEP was created to coordinate and expand efforts across several projects.

COMMUNITY/PARTNER PARTICIPATION: FACHEP has worked with a very diverse group of partners. This includes: Genesee County Health Department; Genesee County Medical Society; Centers for Disease Control and Prevention (CDC); Michigan Department of Health and Human Services (MDHSS); City of Flint Mayor's Office; US Environmental Protection Agency; Flint Neighborhoods United; Flint Area Congregations Together (FACT); Genesee Health Systems; Habitat for Humanity; M.A.D.E. Institute; City of Ecorse, Michigan; City of River Rouge, Michigan; and the Wayne County Health Department.

BACKGROUND: Disasters are typically defined as events or interrelated series of events that are outside what is considered normal and which severely and negatively impact and disrupt society or some part of society (Sellnow, Seeger, 2013; Perry 2007). They create very high levels of uncertainty about what is happening, why, and how the affected public, the response community and policy makers should respond. A variety of interacting factors are associated with the onset of a disaster. At the time of a crisis, these interactions and their consequences may be poorly understood, and in many cases, simply unexamined. Thus, disasters may be described as contexts of emerging science (Funtowicz, Ravetz, 1993). Disasters are also generally understood as interdisciplinary events. That is to say, they often require expertise from a variety of fields such as public health, emergency medicine, engineering, sociology, social work and communication for their effective management. Employing science in a disaster situation is often critical to answering fundamental questions about what happened, and what should be done in response. Systemic inquiry is increasingly recognized as a key strategy in disaster management. A recent UNISDR Science and Technical Advisory Group Report (http://www.unisdr.org/files/42848_stag2015.pdf) noted: "Science and technology's continued advancements and research have allowed us to apply strategies and policy to mitigate risks and build resilience to natural and human-made disasters in ways that were unimaginable 20 years ago. The importance of science and technology in better understanding the processes before, during and after disasters is becoming increasingly important."

Funtowicz, S.O., Ravetz, J. R. (1993). "Science for the post-normal age." *Futures* 25.7 739-755.

Perry, R. W. (2007). What is a Disaster? In *Handbook of disaster research*.

Springer, Sellnow, T. L., Seeger, M. W. (2013). *Theorizing crisis communication* (Vol. 4). John Wiley & Sons.

OUTCOMES: The experiences of FACHEP in deploying a trans-disciplinary research team during the Flint water disaster includes issues of access, interaction with policy makers, efforts to engage the public, and risk communication. Disaster research can present significant access challenges. Natural disasters, for example can create dangerous condition for access and in cases of emergency evacuations, researchers generally are unable to access the site of disaster. Data regarding disasters can be time sensitive and researches may need to get on the ground quickly even through funding and protocols are often not in place. Institutional Review Boards are designed to ensure that research involving human subjects is conducted in an ethical and responsible manner. Disasters can create challenges with victims who have been traumatized, individuals who are unable to provide informed consent, and time constraints (Collogan et al. 2004). Disaster victims are often traumatized and in many cases, may believe that they have been mistreated and harmed by the decisions and actions of others. In some cases, disaster victims may believe that researchers are taking advantage of the situation. Issues of trust can be exacerbated by long standing issues of race and class. Elected officials and policy makers have the responsibility for managing disasters. Policy makers usually have limited experience in managing disasters and are very sensitive to public opinion. Their efforts to manage and control information, including research conclusions, can significantly complicate the research process. Disasters create intense uncertainty and high informational needs. Providing disaster information to the public is a complex process influenced by the ways risk information is received and processed. Risk communication can facilitate public understanding and engagement and reduce confusion, uncertainty, and distrust. Collogan, L.K., et al. (2004). *IRB: Ethics & Human Research*, 26(4), 9-11.

IMPACTS: Our group has provided independent, rigorous scientific evaluation of the Flint Water Crisis (FWC). Some of this has been documented in peer-reviewed publication highlighting: improper treatment of drinking water (Masten, et al, 2016), the change in blood lead levels over the course of the FWC (Zahran, et al, 2017), and protocols for assembling sampling kits required for community participator research (Zarb et al, 2017). Other important impacts: 1) increased awareness of bacterial growth in Point-of-Use filters, 2) identification and characterization of pathogens in residential premise plumbing of residents with associated infection, 3) characterization of legionella within residential plumbing, 4) evaluation chlorine residual and Legionnaires' disease, and 5) identification of areas with low chlorine residual to assist water utilities with enhancing water quality. These and other results are being prepared for publication but have been presented to public health partners and water utility experts, at the US EPA data summit used to guide management of the response to the FWC, to the public at public meetings hosted by our team as well as partners. Additionally, our work has resulted in other researchers to investigate potential sources of exposure previously overlooked.

Masten, S.J.; Davies, S.H.; McElmurry, S.P. (2016) Flint Water Crisis: What happened and why? Journal of American Water Works Association. 108:12, 22-34. DOI: 10.5942/jawwa.2016.108.0195 (NIHMSID: 845813)

Zahran, S.; *McElmurry, S.P., Sadler, R.C. (2017) Four Phases of the Flint Water Crisis: Evidence from Blood Lead Levels in Children. Environmental Research. 157, 160-172. DOI: 10.1016/j.envres.2017.05.028

Zarb, A.R, McElmurry, S.P., Moldenhauer, J.A. (2017) Technical to Teachable: The Flint Water Crisis and the Design of Instructions for Assembling Water Sampling Kits. In Design, User Experience, and Usability: Theory, Methodology, and Management, Springer. p. 697.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: A variety of challenges occur in deploying science to disaster situations. These include logistics of access and data collection, interaction with policy makers, agencies and emergency response officials, effectively engaging the public and communicating risk in effective ways. Disaster zones may be inaccessible to investigators making timely data collection difficult. Policy makers and emergency response officials often struggle to integrate science into post crisis policy decisions (Birkland, 1996). The lack of data and high levels of uncertainty make it difficult challenging to provide unequivocal recommendations that are often desirable. Because systems are often operating outside of normal conditions, it is critical to have multi-disciplinary teams that are open to evaluating unanticipated interactions. Effectively engaging the public in research requires trust which is often in short supply following a disaster (Pearce, 2003). Finally, risk communication is a critical resource to disseminating science based evidence following a disaster event.

Birkland, T. A. (1996). Natural disasters as focusing events: Policy communities and political response. International journal of mass emergencies and disasters, 14(2), 221-243.

Pearce, L. (2003). Disaster management and community planning, and public participation: how to achieve sustainable hazard mitigation. Natural hazards, 28(2-3), 211-228.

RESOURCES AND PRODUCTS:

Fact sheet on Legionnaires' disease (http://flint.wayne.edu/resources/legionnaires_disease_faq_finalv2.pdf)

Patient Perspectives: An Experience with Legionnaires' Disease (<https://youtu.be/674Tr3cu67w>)

Masten, S.J.; Davies, S.H.; McElmurry, S.P. (2016) Flint Water Crisis: What happened and why? Journal of American Water Works Association. 108:12, 22-34. DOI: 10.5942/jawwa.2016.108.0195 (NIHMSID: 845813)

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Environmental Justice/Community-Based Organizations

Texas A&M University Health Science Center

PROJECT TITLE: Mission BREATHE (Better Recognition of Environmental Asthma Triggers in the Home and Environment)

PROJECT DESCRIPTION: Childhood asthma is a serious health and economic concern in the United States. In 2008, asthma accounted for 10.5 million missed school days, and in 2009, one in five children in the U.S. had an asthma related emergency department visit. The area of focus for this study is the state of Texas, namely the South Texas Valley Region, where asthma is a growing health concern, and the leading chronic disease affecting children. The Mission BREATHE study intends to examine the following research questions: Does an educational intervention impact parental knowledge about child's asthma? Does parental knowledge about asthma correlate with severity of asthma symptoms in the child? Does a 45-minute asthma educational program result in: 1) increased asthma related knowledge of parents of children diagnosed with asthma? 2) increased household changes to eliminate asthma triggers? 3) increased perception of control of child's asthma? and 4) improved child health and relief, measurable both subjectively and objectively. The asthma education program includes a short presentation of useful information for parents about controlling their child's asthma. Adult participants (parents) will be asked to take a written survey about their understanding of and opinions on asthma before and after a 45-minute presentation about asthma. Children participants will be tested (FEV1) to determine the severity of their asthma and they will also be required to provide 3ml of blood to measure serum biomarkers of inflammation - high-sensitivity CRP, arginine and citrulline. In 4-5 weeks, parents will be contacted for a short phone follow up survey to determine the impact of the asthma education session. And then in 8-9 weeks, they will be required to come for a second visit where parents will take a 15 minutes survey again and children will provide

another 3ml of blood sample. 50 participant dyads, each comprising of a parent and a child (100 total participants) are required to complete the study.

COMMUNITY/PARTNER PARTICIPATION: The region of focus for this study (McAllen, Texas) represents a minority population, mainly Hispanics. For this reason and because health educational resources are limited in this area, we collaborate with a Promotora as part of the management team to assist with this project. A promotora is a member of the community with in depth understanding of the culture who acts as a health educator. Promotoras meet regularly with people in their neighborhoods to encourage participation in education, health, and job training programs delivered in the community resource centers. We also work in partnership with a local hospital (Rio Grande Regional Hospital) as the study venue, for the purposes of addressing cultural differences and language barriers. Participant enrollment is obtained with the cooperation of other local doctors' offices in the region. Local physicians talk to their patients who they identify might benefit from the study during a clinic visit and advise them of an opportunity to participate. They subsequently refer interested patients that also meet the study criteria to us for further follow up and enrollment into the study.

BACKGROUND: Childhood asthma is a growing health concern throughout the state of Texas. In 2010, 7.6% of children in the state were diagnosed with current asthma¹. Furthermore, the prevalence of asthma among children living near the US - Mexico border is as high as 10.1% in some locations. The South Texas area is an area of high poverty and low level of education, and asthma is reported as one of the most prevalent diseases among a population with these characteristics. In 2008, the per capita income in McAllen, TX was \$20,395 compared to a national average of \$40,947. Because of this low SES, many of the families in the area cannot afford proper asthma treatments. Research has shown that environmental exposures are a major source of asthma problems in impoverished communities. According to the IOM, exposure to cigarette smoke, house dust mites, indoor pets, mold, and cockroaches can exacerbate asthma symptoms. Studies have shown that low parental literacy level or asthma-related knowledge is associated with more severe forms of asthma in children. Evidence also shows that environmental educational interventions can help reduce the severity of asthma in children living in these environments. Assessment of the impact of the interventions in majority of previous studies has been through the use of survey questionnaires. The limitation of this subjective method of assessment is the likelihood of getting biased reports from participants, and this could cause conflicting data. We therefore propose to evaluate the state of the child's asthma by assaying biomarkers of inflammation at two-time points, at baseline and then again at 2 months following the intervention. Results from these analyses will provide a quantifiable measure of asthma control. Our study will test the hypothesis that these biomarkers can be effectively used in conjunction with survey results to allow a more accurate assessment of the impact of educational interventions aimed at controlling asthma symptoms.

OUTCOMES: The following outcomes are preliminary results and are anecdotal. To date, we have 27 completed parent participants with 31 completed children participants (58% completion). There has been a 3.33% lost-to-follow-up rate. Results indicate about a 5% mean score increase on the asthma knowledge post-test compared to the pre-test for parent participants, and 75% of them showed improvement in mean ratings on the asthma control survey compared to baseline.

IMPACTS: Of those who have completed the study, 100% of them indicate that they have implemented changes in their homes to address asthma triggers. Some of the changes reported (direct quotes) by the participants include: “The first thing was to change the pillow cases and then discard the Fabuloso.” “I changed the way I clean; I stopped using strong odors and pesticides.” “I look out for mold in the bathrooms and change the air filters.” “Keeping the pet out of our child’s room...” “I removed the stuffed animals and plants with pollen from her room.” “We use roach traps instead of sprays.” Also, 80% of participants who did not have an asthma action plan prior to participating have now implemented one as a result of their participation. We are yet to commence biomarker analysis to determine if the improvements can be demonstrated objectively. We hope this research will initiate the development of a biobank of blood samples of asthmatic children in the Rio Grande Valley, which will be a valuable resource for possible future studies to look at genetic markers of respiratory disease and metabolism.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: The limitation of this subjective method of assessment is the likelihood of getting biased reports from participants, and this could cause conflicting data. We therefore propose to evaluate the state of the child's asthma by assaying biomarkers of inflammation at two-time points, at baseline and then again at 2 months following the intervention. Results from these analyses will provide a quantifiable measure of asthma control. Our study will test the hypothesis that these biomarkers can be effectively used in conjunction with survey results to allow a more accurate assessment of the impact of educational interventions aimed at controlling asthma symptoms. Another challenge we have faced in the implementation of this project has been determining which time of day is best to deliver the educational intervention, given that these families work full- or part-time jobs.

RESOURCES AND PRODUCTS:

- Project-generated asthma PowerPoint presentation and take-home flip chart.
- EPA fact sheets on asthma (10 steps to making your home asthma-friendly).
- Asthma action plan.

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University of Arizona

PROJECT TITLE: To’łitso, the water is yellow: Investigating short-term exposure and risk perception of Navajo communities to the Gold King Mine Toxic Spill

PROJECT DESCRIPTION: Despite the fact that there are hundreds of thousands of abandoned mines across the United States, the Gold King Mine Spill of August 2015 (the Spill) revealed that little empirical data on potential post-spill community exposures and long-term health impacts exist. Of particular concern are Native American communities, such as the Dine (Navajo), who have unique potential exposure pathways because of their spiritual, cultural and subsistence

land-based practices. Results from this study can help to inform risk communication and intervention strategies in the unfortunate event of future mine spills, particularly in Native American communities.

COMMUNITY/PARTNER PARTICIPATION: We partnered with 70 members representing 20 organizations from the Navajo Nation, including: Navajo Department of Health, Navajo Environmental Protection Agency, and To Bei Nihi Dził (indigenous environmental group). Mae-Gilene Begay (Director of Navajo Community Health Representatives), (Duane) Chili Yazzie (Shiprock Chapter President), and Perry Charley (Director of the Uranium Education Program, Dine College) visited and toured the University of Arizona water and soil laboratories to see sampling processing. These Navajo community leaders were also on a panel at the University of Arizona to share their perspectives and experiences of the impacts of the Spill on the Navajo Nation and Dine communities. In March 2016, Vice President Nez of the Navajo Nation, Mr. Jonathan Nez, delivered samples collected by our partner To Bei Nihi Dził and toured multiple laboratories where the samples are processed and analyzed. In August 2016, we trained 25 Navajo Community Health Representatives to conduct household sampling and biomonitoring of blood and urine. We also conducted listening sessions at each chapter to hear community concerns. Since March 2016, we have held eight teach-ins to disseminate information and study results.

BACKGROUND: On Wednesday, August 5, 2015, during an Environmental Protection Agency (US EPA) investigation of the Gold King Mine near Silverton, CO, approximately 3 million gallons of acid mine drainage were accidentally released, flowing into the Animas, San Juan and Colorado Rivers. These waterways are adjacent to 12 tribes and 6 states in the Colorado River Basin. The Spill contained high concentrations of metals, such as lead and arsenic. While this specific incident may have been one of the largest spills in recent history, the Department of Interior has estimated there are more than 500,000 abandoned mines throughout the US. There is high potential for ongoing acid mine leaks or future large-scale spills to impact many communities and ecosystems. Given that only recreational users of the river (e.g., hikers, campers) were considered during the decision-making process, it is clear that there is a lack of awareness on how the Spill had devastating effects on the daily activities of the impacted Dine communities along the San Juan River. This includes impacts on the local agricultural, ranching, ceremonial, and cultural activities, which were compounded with mental and emotional stress because of their spiritual connection and reverence to the San Juan River. Shortly after the Spill, the Navajo Nation declared a state of emergency because of a rapid increase in suicides. For the Dine people, the impact is not just on recreational activities during the weekends and vacations. Dine farmers have been using the San Juan River for hundreds of years to irrigate their fields and grow their heirloom seeds passed down through generations. When the river turned yellow from the Spill, there was great angst, as Dine farmers and their families had to decide if to irrigate their crops while being unsure on how the Spill would affect the environment.

OUTCOMES: In the two years following the Spill, we have received Navajo Nation Human Research Review Board approval, conducted listening sessions, focus groups, and teach-ins and completed all sampling. We started reporting back results in a staggered phase since March 2017. Environmental Sampling: The team developed sample collection protocols and procedures for soil, sediment, and water samples and conducted four sampling trips (November 2015, and March, May and June 2016). In total, the team collected 849 samples (256 sediment, 305 agricultural soil, and 288 water) from the study area. Over 45 students from the University of Arizona, Dine College, and Northern Arizona University have received training and assisted in environmental sample collection. Focus Groups: Janene Yazzie of To Bei

Nihi Dziil assisted in developing the focus group questions. We trained community members, researchers, and students to facilitate the focus groups using cultural considerations. This team held 12 focus groups (6, 4, and 2 in Shiprock, Upper Fruitland, and Aneth, respectively) with 123 consented participants (69, 37, and 17 from Shiprock, Upper Fruitland, and Aneth, respectively). Focus group consensus panels were conducted to identify key activities whereby individuals interacted with the San Juan River and may have the potential to be exposed. These consensus panels also identified key community concerns. This information was used to develop the household questionnaire which included a risk perception section and a component to collect pre- and post-Spill activity patterns. Through these focus groups and consensus panels, we identified over 40 different ways that Navajo community members interact with the river. These exposure activities were organized into the following categories: use of river water for routine activities; physical contact with river water; use of river water for cultural, ceremonial, and spiritual practice; and use of materials from the river area for arts and crafts.

IMPACTS: Household Sampling Preparation: The team developed and refined several versions of data collection instruments and sample collection protocols for the household exposure sampling with the help of numerous individuals. Mae-Gilene Begay, Program Director of the Community Health Representatives (CHRs), assisted in refining the materials on several occasions. With the help of Mae-Gilene Begay and Brenette Pine, a CHR area director, 22 CHRs were trained in environmental health sampling methods, blood lead monitoring, and human subjects research. Recruitment and Sampling of Households: In August 2016, during a one-week period, a study team assisted by 22 CHRs, collected surveys and environmental and biomonitoring samples from 59 homes in the study area (i.e., Shiprock, Aneth, and Upper Fruitland). From these households, 48-hour food recalls were obtained from participating adults and children. A questionnaire was administered to collect data on adults and children's interactions with the San Juan River, behaviors that might influence participants' exposure to metals, and perceptions on risks from the Spill. From these homes, 61 and 31 adult and child blood tests were completed and 60 and 27 adult and child urine samples were collected, respectively. During August 2017, CHRs provided each household with their individualized results over a one-week period. We worked with more than 70 community members or partners to carry out this project. We also trained and worked with 71 students from University of Arizona, Northern Arizona University, Dine College, University of Arkansas, Fort Lewis College, Navajo Technical University, Navajo Preparatory High School, New York University, Claremont McKenna, and Tohono O'odham Community College. These students have ranged from middle schoolers to doctoral candidates and include 30 Dine and 20 additional students from underrepresented minority backgrounds. There have been over 140 community members that have attended Teach-Ins.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: The results of this investigation will be used to develop a community-based intervention, designed to: a) prevent potentially harmful exposures based on measured and perceived risk, and/or b) communicate the projected long-term risks from the Gold King mine spill, effectively. While this specific incident may have been one of the largest mine spills in recent history, the potential for ongoing acid mine leaks or large-scale spills to impact many communities and eco-systems is high. Empirical data collected from this study will be used to improve risk assessment and communication in the unfortunate event of future mine spill disasters. Broader impacts of this work are healing from the Spill impacts through improved resilience and empowerment using k'e (the Dine clan system) and protection of the River by engaging Dine community members to design, implement and interpret a study focused on long-term impacts of the Spill. Our framework will increase tribal capacity for conducting

environmental assessments and emergency response, as well as for risk communication addressing social, environmental, and health disparities.

RESOURCES AND PRODUCTS: We developed the following protocols: navigating to sampling sites and recording locational information; collecting and processing soil/sediment core and soil grab samples; collecting and processing surface dust wipe samples; collecting and testing water samples; storing and shipping environmental samples; collecting and processing urine samples; collecting and analyzing blood samples; conducting home visits; and recording travel information. We developed the following survey instruments: a 48-hour diet recall log for very young children; a 48-hour diet recall log for older children and adults; an accompanying food portion guide and model; a questionnaire about child and adult interaction with the San Juan River and risk perception related to the San Juan River; and a questionnaire on how effective the results report back items were for household participants. We developed the following household results dissemination materials: a flipbook used to explain environmental health basics and each household participants results; a Navajo/English diction of commonly-used environmental health terms; and individualized results materials with relevant comparison levels and applicable action items. We distributed 3 newsletters to the community and have an active Facebook page dedicated to the project.

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SWEHSC

PROJECT TITLE: Water Talks - Building a Risk Communication Model

PROJECT DESCRIPTION: Public distrust in drinking water, water utility, and government combined with low environmental health literacy rates have led to miscommunication and misunderstanding of the quality and safety of Tucson's drinking water. A risk communication model will improve communication with the community about the safety and quality of their drinking water

COMMUNITY/PARTNER PARTICIPATION: There are four long time (15+ years) partners for this project:

1. Unified Community Advisory Board of the Tucson Airport Area Superfund Site
2. Environmental Justice Task force (Community Group)
3. City of Tucson Water Utility
4. Pima County Health Department

BACKGROUND: TCE was being disposed of in unlined pits and landfills from the 1940s to early 1970s, and was discovered in Tucson's groundwater in 1981. The contamination of the ground water and drinking water up until 1981 lead to a large amount of distrust from the community in the quality and safety of drinking water. The UCAB was formed

in 1992 as a combined advisory board to the responsible parties. Although the drinking water has been clean of TCE since 1981, community distrust in the drinking water, government, and water utility remains.

OUTCOMES: Because the community does not trust the process or the information provided the Water Utility has contracted with the University of Arizona to develop a risk communication model to improve the messaging and the methods used to discuss water quality that will focus on both the risk and on how the utility and individuals and families can keep themselves safe.

IMPACTS: We are mid-way through the process.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: We have conducted focus groups and analyzed the results, which will be used to adapt best practices in risk and safety communication from both the utility standpoint and that of the university.

RESOURCES AND PRODUCTS: <http://coep.pharmacy.arizona.edu/tce/index.html> is the curriculum developed with EPA funds to provide lessons for the local school systems.

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University of Kentucky College of Nursing, BREATHE
(Bridging Research and Advocacy Toward Healthy Environments)

PROJECT TITLE: FRESH: Dual Home Screening for Lung Cancer Prevention

PROJECT DESCRIPTION: The FRESH study (R01 ES021502, 2012-2017; E. Hahn, PI) tested the effects of a personalized environmental report back intervention on: (a) stage of action to test for air nicotine and radon in the home and remediate; and (b) exposure to tobacco smoke and radon in the home. The study employed a two-arm parallel group randomized controlled trial with stratified quota sampling (half reported smokers living in the home). The treatment group (N = 515 homeowners) received free air nicotine and radon home test kits and a brief problem-solving phone intervention; the control group received a coupon for free test kits. In addition, we enrolled a small quota sample of renters (N=47) to explore the impact of a personalized environmental report-back intervention on home exposure in rental property. Taking actions to reduce radon and SHS exposure were assessed at baseline, and 3-, 9-, and 15-months post-intervention; home testing occurred at baseline and 15-months. As a result of our experience with the FRESH study, we were invited to partner with organizations in a 17-county region of Appalachian Kentucky, an underserved, medically distressed area, to plan and implement a community-engaged pilot study to explore radon testing behaviors with 58 patients in two remote primary care clinics. Participants received education on the dangers of radon and tobacco smoke, received free radon test kits, and were encouraged to test their homes for radon. Through this community-engaged pilot

project in Appalachia, eight homes (30% of those who tested) had radon levels higher than the EPA's recommended mitigation level of 4 picocuries per liter.

COMMUNITY/PARTNER PARTICIPATION: Our experience with FRESH and the resulting community-engaged pilot project in Appalachian Kentucky prompted the development of the Step Up to Reduce Radon Alliance of healthcare, hospital, and housing organizations, community and technical schools, and businesses led by the Northeast Area Health Education Center (AHEC), with a mission to increase access to affordable and adequate radon mitigation.

BACKGROUND: While most people have heard of radon, most do not test their homes for radon. There are very low rates of radon testing in Appalachian Kentucky. As a result, most radon maps seem to show that radon exposure is low in these regions. Our BREATHE team partners with the Kentucky Geological Survey to map radon potential in our state and we find more variation in radon risk than previously estimated by the EPA. We analyzed home radon testing data from 20+ years of data in Kentucky (>60,000 observed radon data), compiled geologic rock formation data, and combined them into county-level maps (see Resources and Products). In addition to low radon testing levels, there are few certified radon measurement and mitigation professionals in our state. Further, we found through the community-engaged pilot project that there were no certified radon measurement and mitigation professional in Northeast Appalachian Kentucky. This is one reason why the Step Up to Reduce Radon Alliance was formed, to increase access to affordable and adequate radon mitigation especially for low to middle income families. Compounding the problem of higher-than-expected radon levels, low radon testing, and no access to affordable and adequate radon remediation, the prevalence of adult smoking far exceeds the national adult smoking rate. Combined environmental exposure to tobacco smoke and radon increases lung cancer risk. As a result, Kentucky leads the nation in lung cancer incidence and mortality.

OUTCOMES: For the main FRESH study, treatment homeowners were more ready to test for air nicotine and radon and to take action to mitigate for radon than controls at 3-months. There were no group differences in stage of action to adopt a smoke-free home. Participants with higher self-efficacy for radon and air nicotine testing and remediation were more likely to take action to test and remediate. Synergistic risk perception was associated with stage of action for radon mitigation and adoption of a smoke-free home. Analysis of 15-month outcomes with homeowners is pending. Among renters, stage of action in home testing and in adopting a smoke-free home policy increased from baseline to 3 months; no further changes in stage of action were observed over time. Airborne nicotine declined from baseline to 15 months among renters remaining in the study ($p = .031$; $n = 9$).

IMPACTS: The Step Up to Reduce Radon Alliance leveraged \$22,500 in mini-grant funding from the Kentucky Department for Public Health through support from CDC's Environmental Health Link program. This funding provided financial assistance to four eligible property owners in Appalachian Kentucky to remediate their homes for radon using a newly certified radon mitigation professional in the region. The funding allowed the Alliance to identify and support a HVAC professional in the region to be trained as a certified radon mitigation professional. The funding also supported a public education campaign including giving away 1,000 radon test kits in the region to encourage more residents to test their homes for radon. Evaluation is ongoing.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Lessons learned from FRESH: Homeowners provided free radon and air nicotine test kits, given their results, and engaged in a brief telephonic problem-solving consultation were more likely to take action to test their homes for radon and air nicotine and to remediate for radon compared to those who received standard public health practice. More research is needed to evaluate interventions to motivate renters and landlords to test and mitigate for radon and adopt smoke-free policies.

Future opportunities with the Step Up to Reduce Radon Alliance: With the success of leveraging funding to support the initial work, the Alliance is in the process of exploring cost sharing partnerships with banks, mortgage companies, home improvement stores, and housing organizations to sustain its ability to ensure financial assistance to support radon remediation for low to middle income families in Appalachia. In addition, the Alliance is developing and planning a regional radon certification program in collaboration with the community and technical college system that would offer Appalachian construction and HVAC companies greater opportunities for supporting staff to become certified radon measurement and mitigation professionals. This would be a win-win for both environmental public health and economic development in this underserved, medically distressed region of Central Appalachia.

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Alaska Community Action on Toxics

PROJECT TITLE: Protecting the Health of Future Generations: Assessing and Preventing Exposures to Endocrine-Disrupting Chemicals in Two Alaska Native Arctic Communities on St. Lawrence Island, Alaska

PROJECT DESCRIPTION: The Protecting the Health of Future Generations project is a collaboration of Alaska Community Action on Toxics, a non-profit environmental health research and advocacy organization, with the two Arctic Yupik villages of St. Lawrence Island (SLI), Native Village of Gambell and Native Village of Savoonga; as well as Northern

Arizona University, University at Albany, and University of Oregon. The purpose of this project is to 1) assess multiple exposure routes of two classes of emerging endocrine-disrupting chemicals (EDCs), polybrominated diphenyl ethers (PBDEs) and perfluorinated chemicals (PFCs), and, 2) provide information and training for the people of SLI so that they can plan and participate in public health actions, including promoting policy changes and reducing environmental health risks. A major objective of this project is to respond to requests from the people of SLI for exposure assessments of PBDE and PFC contaminants in water, homes, traditional foods, and human serum. The team filled research gaps in determining routes of exposure and trends of emerging contaminants that are increasing in levels in the Arctic but are poorly understood (especially in the U.S. Arctic).

COMMUNITY/PARTNER PARTICIPATION: The research team works with the St. Lawrence Island (SLI) Working Group, a community advisory board that is comprised of designated leaders from the tribal governments of the Native Village of Gambell and Native Village of Savoonga, city councils, and Native village corporations, as well as elder and youth representatives. We also work with public health agencies and organizations of health care providers such as the Alaska Nurses Association, the All Alaska Pediatric Partnership, and Norton Sound Health Corporation.

BACKGROUND: A major objective of this project is to respond to requests from the people of SLI for exposure assessments of PBDE and PFC contaminants in water, homes, traditional foods, and human serum from military sources as well as long-range transport of chemicals concentrating in the Arctic environment.

- Employ the stickleback model to compare the relative prevalence of PBDEs and PFCs in surface waters and as a bio-indicator of thyroid and reproductive health impairment due to aquatic contaminants.
- Collect dust and blood serum of residents in SLI households to analyze for PBDE and PFC contaminant levels in order to link dust contamination to levels in human plasma and human thyroid biomarkers.
- Analyze samples of traditional foods of the St. Lawrence Island Yupik people to identify contaminant levels of PBDEs and PFCs in order to identify risk of this route of exposure important to SLI residents.
- To respond to requests from the people of SLI for assistance in developing interventions and preventative behaviors, the research team collaborates with the leaders, elders, and youth of SLI to achieve the following specific objectives:
 - Conduct regular community meetings in both villages on the Island to exchange information, report results of research, conduct special events (e.g., health fairs), and train adults and youth so they have the tools to continue monitoring and initiating public health actions.
 - Sponsor education and public health policy actions, including a SLI Youth Leadership Mentoring Program, Community-Based Research Institute, meetings of the Stockholm Convention, briefings of policymakers in Washington D.C., round table discussions with national and international non-governmental organizations, and with Alaska State environmental health officials. We also work with public health agencies and organizations of health care providers such as the Alaska Nurses Association, the All Alaska Pediatric Partnership, and Norton Sound Health Corporation.

OUTCOMES:

- The research team determined congener-specific levels of polybrominated diphenyl ethers (PBDEs), perfluorinated compounds (PFCs), polychlorinated biphenyls (PCBs), and organochlorine pesticides as well

as endocrine biomarkers in freshwater sentinel fish species (ninespine stickleback and Alaska blackfish) collected at Northeast Cape and in the community of Gambell on St. Lawrence Island (SLI). Congener-specific profiles indicate both global and local sources of contamination.

- We found strong evidence for endocrine disruption of fish related to reproductive health in the Suqi River at NE Cape. We found elevated levels of PCBs in Suqi River stickleback and blackfish due primarily to contamination from the formerly used defense site (FUDS) at Northeast Cape.
- The research team collected household dust from a total of 50 households in Gambell and in Savoonga. We obtained 85 blood serum samples from men and women of the two communities. After completing the laboratory analyses for 13 PFC and 40 PBDE congeners, we prepared individual letters to each participant that included information on the chemicals that we analyzed, information on how to read the data, and the participant's actual blood serum and household dust levels.
- We reported back to each village, including scheduled meetings with each participant to discuss their individual results and ways to reduce exposures, as well as presentations and discussions with the tribal leadership and in public meetings in each community. We prepared a series of fact sheets that included information on associations with health effects, exposure pathways, and ways to reduce exposures.
- We collected traditional foods samples (reindeer and marine mammals) from households and hunters. We obtained 50 samples of commonly-consumed organs, meat, rendered oils, and blubber. The samples were analyzed for 13 perfluorinated compounds (PFCs) and congener-specific polybrominated diphenyl ethers (PBDEs).

IMPACTS: The research team made significant contributions to research concerning levels and exposure pathways of endocrine-disrupting chemicals in the Arctic, specifically in fish, household dust, traditional foods, and blood serum of the Yupik people of St. Lawrence Island. The research informed interventions and policies concerning military site cleanup as well as state, national, and international chemicals policy. We organized regular educational events in Savoonga and Gambell, including workshops, community meetings, environmental health fairs, and community-based research institute. We conducted a Community-Based Environmental Health Research-A Field Sampling Institute on SLI and organized environmental health fairs in Savoonga and Gambell. The environmental health fairs engaged the community in educational activities and workshops in collaboration with the Norton Sound Health Corporation (health care provider for the 16 villages of the Norton Sound region of Alaska).

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES:

- Weather is always a challenge when working in remote locations in Alaska.
- ACAT has been doing community-based participatory research for 17 years. This requires patience, a good communications plan/system and a serious commitment from all parties involved. Inclusion and diversity in your work team and community advisory board is indispensable to succeed.

RESOURCES AND PRODUCTS:

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UC Davis Environmental Health Sciences Core Center

PROJECT TITLE: Community Environmental Health Sciences Academy

PROJECT DESCRIPTION: The UC Davis Environmental Health Sciences Core Center (EHS CC)'s Community Engagement Core (CEC) helps align the EHS CC's activities with the needs and interests of communities facing high concentrations of environmental hazards and social vulnerability. This enriches the EHS CC's scholarship, training science literacy, university-community relationships, and public policy outcomes with the ultimate impact of community empowerment and improved health equity. The CEC'S Environmental Health Science (EHS) Academy has the goal of building both academic and community partners' capacity to actively communicate and engage in research collaborations. In addition to cultivating equitable partnerships and facilitate collaborative project development, the Academy specifically helped community partners develop a deeper understanding of their academic collaborator's scientific work. The presentations and workshop built community partners' understanding of the potential as well as limitations of the research by Center affiliates.

COMMUNITY/PARTNER PARTICIPATION: The primary audiences of the inaugural Academy Day event were executive directors, employees and volunteers and affiliates of the two community partner organizations involved in the community-based participation research featured project: the Community Water Center (CWC) and the Environmental

Justice Coalition for Water (EJCW). The event was also open to all members of the CEC's Community Stakeholders Advisory Committee (CSTAC). The Academy Day reflected the CSTAC's input and requests regarding content, structure, and format.

BACKGROUND: The Academy's inaugural event was a one-day series of short seminars and workshops given by EHSCC researchers to community members on select topics related to a Center funded project submitted by Environmental Toxicology Professor Swee Teh: "Impact of California Drought on Community Health? The water quality side" in collaboration with the Community Water Center (CWC) and the Environmental Justice Water Coalition (EJCW). The project utilized a fish model to investigate potential adverse health effects of well and tap water in California's Central Valley. Drought affects groundwater-surface water exchange, and pollutants may inadvertently enter wells that provide drinking water. This is of particular concern in the California Central Valley, where contaminants originating from agricultural runoff can have substantial adverse health effects such as cancer, neurodevelopment disorders, acute toxicity impacts, and a range of epigenetic effects. Specific sites for water sampling were selected in consultation with the Community Stakeholders Advisory Committee. Because chemical detection methods are not well-suited to assess the potential toxicity of individual pollutants, pollutant mixtures, or substances present below the limit of detection, the Teh lab has used an aquatic fish model to conduct a suite of toxicity assays to screen and monitor drinking water contaminants.

OUTCOMES: The Academy Day provided CWC and EJCW staff and volunteers with an opportunity to gain exposure to and a better understanding of the science being conducted by their academic partners in the Teh lab. Participants provided a "behind the scenes" view of scientific research the Teh lab and other UC Davis faculty about the use and purpose of animal models, the process of assessing toxicity, and the movement of groundwater.

IMPACTS: One of the over-arching impacts of the Academy Day was to "lift the veil of science" and create a space in which community partners could engage with the more technical aspects of the collaborative project. This enables them to better understand, interpret, and utilize the data provided by their research partners, and to build their capacity to participate in future research collaborations. The participating UC Davis faculty were likewise effectively challenged to communicate their work to a lay audience, enhancing their capacity to meaningfully engage in research partnerships with community members.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: This inaugural Academy Day was the first of a series that the CEC is developing. In a recent meeting with the Community Stakeholder Advisory Committee, the CEC received positive feedback about the Academy Day and specific requests and ideas for the next one. Some of the input included: bringing in more female scientists to present their work, providing more opportunities for hands on activities and reducing the number and lengths of lectures. Based on this feedback, the CEC is developing curricula for Academy Days that will focus on air pollution, agriculture, and children's environmental health. The CEC will continue encouraging Center faculty to move beyond their comfort zones of the lab and scientific networks to develop public presentations of their research for community partners. The faculty are now developing their skills to distill their work into short, jargon-free, and engaging summary. While posing a significant challenge, this process also reinforced the importance of creating spaces in which Center researchers practice communicating their work to non-academic audiences.

RESOURCES AND PRODUCTS: The CEC has created a written curriculum for the Academy day and collected all of the training materials from the sessions. This will be developed into a publicly-available version in the next year. The CEC is also preparing several manuscripts that examine questions about translating science for public audiences, addressing the different cultures of environmental health science and environmental health advocacy, and methods to build capacity for citizen and civic science.

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California Department of Public Health

PROJECT TITLE: Imperial County Community Air Monitoring Project

PROJECT DESCRIPTION: Imperial County, California, is a primarily Latino county with some of the highest rates of unemployment and poverty in the nation. Along with numerous environmental concerns cited by residents, including water contamination and pesticide use, air pollution is a major concern. For decades, the county has exceeded the state standard for PM10 for periods lasting over six months, and the county consistently has one of the highest asthma hospitalization and emergency room visit rates in the state for school-aged children. With a limited number of regulatory air pollution monitors in a county that spans over 4,000 square miles, the county's air quality monitoring network had limited ability to measure air pollution hotspots of greatest community concern. While Imperial County has a historically active and committed population, this lack of information is an impediment to assessing and informing policies and practices to reduce exposures and improve health. A community-based organization, Comit  Civico Del Valle (CCV), has been building the capacity of residents in Imperial County for 30 years by engaging in community-academic and -government partnerships.

COMMUNITY/PARTNER PARTICIPATION: This project builds on a longstanding partnership between the California Environmental Health Tracking Program (CEHTP) and Comit  Civico del Valle (CCV), along with the University of Washington and other partners. The project engaged members from impacted communities to design a Community Air Monitoring Network and to develop strategies to use data from the Network for public health action. A Community Steering Committee plays a key role in project design, implementation, and decision-making. Additional community members have engaged in data collection, placing air monitors, results interpretation, and dissemination. CCV has been a leader in utilizing participatory research methods, including citizen science and crowd-sourcing. They developed an innovative, crowd-sourcing mapping tool (Identifying Violations Affecting Neighborhoods, IVAN) designed to enable residents to report environmental violations and work with a government partner to investigate and respond. The IVAN tool has already been replicated in 6 communities across the state. Both the original IVAN project and its adaptation for the display of data from the Imperial Community Air Monitoring Network engage community residents in collecting and reporting data and information, and using the information to develop public health actions.

BACKGROUND: The Network established through this project consists of 40 low-cost, portable air monitors placed throughout Imperial County. The project used an innovative approach to determine the locations of the monitors, incorporating community-generated data and community input, along with requirements for scientific rigor. Community members set up and maintain the monitors, which will remain in the community after the project. Bringing together scientists, community advocates, and local residents, this project aims to collect air quality data for research while providing information that is immediately and directly useful to residents. It established a community air monitoring network that allows parents and other residents to access data that they can use to make immediate decisions about the health of their families.

OUTCOMES: Using a community-based approach, we have sited 40 low-cost particle sensors measuring PM2.5 and PM10 in locations ranging from the U.S./Mexico Border to the Salton Sea. The field installation and maintenance of the monitors is largely handled by the community partner on the study, Comite Civico del Valle (CCV). This is important to the longer-term sustainability of the network. A key component to the translation of air monitoring results to action is to make the air monitoring data available in a way that is accessible, understandable, and useful. We updated an existing community environmental reporting website called IVAN (Identifying Violations Affecting Neighborhoods) to display individual monitoring data in near real-time, with results updated every 5 minutes. The updated website was launched to the public on September 30, 2016.

IMPACTS: Project researchers are combining data from the Network with data from existing state and federal air monitors to create highly detailed maps of air pollution by location and time. Using advanced analytical methods (such as state-of-the-art dispersion and land use regression modeling), the project will result in the most accurate and detailed picture of air quality (PM10 and PM2.5) throughout the county, enabling identification of hot spots near vulnerable populations. In a community burdened by poor health quality and adverse health outcomes, the availability of real-time neighborhood-level air quality information is already enabling community members to take action to reduce their personal exposure. All schools monitor sites now use both the community network and regulatory network data to determine when children should remain indoors to reduce exposure to PM. Participation in the project has also promoted the engagement of CCV staff and members of the project Community Steering Committee in community actions, including meeting with local, state, and national officials to discuss the priority concerns: agricultural burning and water quality issues. Community Steering Committee members have shared numerous examples of how participation in the project has helped them to engage in other community actions outside of this project. Project staff have also updated a series of agricultural burning fact sheets for use in the outreach with schools, farmers, and other stakeholders.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: As CCV demonstrates, these “low-cost” participatory research methods can continue to be replicated in other impacted communities. They can be used to investigate other topics of growing interest to communities. Challenges in meeting the goals of the project have included difficulties in many practical aspects of monitor installation and maintenance: poor availability and reliability of Wi-Fi for transmitting the data, harsh climate conditions in a desert environment that have required frequent cleaning, maintenance and repair of the monitors. Detailed documentation of the methods of this project and the lessons learned will be available next year in a "Community Air Monitoring Manual" that the project will produce under this grant.

RESOURCES AND PRODUCTS: The Network relays data to the internet for immediate information on air pollution levels. Data are displayed in real-time on a community-initiated online mapping tool IVAN (Identifying Violations Affecting Neighborhoods; <https://ivan-imperial.org/air>).

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Tufts University

PROJECT TITLE: Community Assessment of Freeway Exposure and Health (CAFEH)

PROJECT DESCRIPTION: CAFEH is a series of research studies and projects (6 with full funding so far) that began a decade ago with inquiries from one of the affected communities. The broad aims of CAFEH are to study exposure to traffic-related air pollution, with a focus on ultrafine particle, and their health effects while translating what we learn, along with the broader literature, into policy and practice that addresses the issue.

COMMUNITY/PARTNER PARTICIPATION: The CAFEH projects have all been either community-based participatory research or community-engaged research. Our main communities have been the City of Somerville and Boston Chinatown, although we have worked to a lesser extent in other communities as well. Our core community partners are the Somerville Transportation Equity Partnership and the Chinese Progressive Association, although, as before, we have had numerous other community partners in smaller or shorter-term roles.

BACKGROUND: People living near highways and busy roadways have been shown to suffer numerous adverse health outcomes, including elevated cardiovascular risk. Ultrafine particles (UFP; as well as some other pollutants) are higher near high traffic areas. We are seeking to test the hypothesis that UFP are responsible for some of the increased risk of living near traffic. We are also testing the efficacy of in building air filtration to reduce exposure and risk. And we are working with developers and policy makers to implement protective measures near highways in our target communities and across the region and state.

OUTCOMES: We were one of the first studies (there were three others within about a year of our main outcome paper) to show associations between chronic exposure to UFP and health outcomes or indicators. Only ours and one of the other studies showed associations with finer grain spatial and temporal UFP exposure. Our models of ambient UFP levels across our study areas are competitive with the best exposure science as it currently stands and have, to some extent, pushed the envelope to advance the field. Our efforts at using in home HEPA filtration to reduce UFP levels and improve indicators of cardiovascular health in low income housing that lack mechanical air handling systems has been partly successful at reducing UFP levels, but not at improving biomarkers of inflammation so far.

IMPACTS: Scientifically, we have published over 30 peer reviewed papers, many in top environmental health and environmental science journals. This makes us one of a small number of UFP research teams around the world that are pioneering work in this area. We have had some impact on policy and practice both within our studies areas and

regionally by influencing building design, urban planning and zoning policy. We have the potential, not yet realized, to influence statewide policy as well.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: We have learned a tremendous amount about UFP exposure assessment, leading us to realize the exposure misclassification is a serious limitation in UFP epidemiology which reduces the ability to see associations. We have also seen how important community engagement is for translating research into practice. Another lesson is that it is important to retain high scientific rigor while operating with deep community engagement. Future opportunities include our new Research to Action project which will look at short term exposure to UFP and its effects on blood pressure as well as implement a community-level intervention using health impact assessments and design charrettes to try to influence design and construction of near highway developments.

RESOURCES AND PRODUCTS: See: <https://sites.tufts.edu/cafeh/>

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[Duke Superfund Research Center Community Engagement Core](#)

PROJECT TITLE: Helping Community Gardeners in North Carolina to Understand and Reduce Exposure to Soil Contaminants and Pesticides

PROJECT DESCRIPTION: Despite the many benefits of gardening for human health, soil contaminants such as heavy metals and pesticides may be present at community garden sites, creating potential health risks for gardeners including possible developmental impacts caused by exposure to contaminants during early life stages. The Duke University Superfund Research Center's Community Engagement Core (DUSRC CEC) has initiated a five-year community-based participatory research project to assess possible sources of contamination at community gardens in North Carolina and to support gardeners in exploring exposure reduction and prevention options. The goal of the preliminary phase of the research project-including a pilot soil testing project in summer 2015, as well as a study conducted by three Master's students at Duke's Nicholas School of the Environment from September 2016 through May 2017-was to characterize the extent of the issue in our state, and to explore knowledge, attitudes, and behaviors of gardeners, garden managers, and garden support organizations, as well as their barriers to and motivations for health-protective behavior change. Results will inform the design and implementation of a social marketing campaign to influence behavior that aims to prevent or reduce exposures to soil contaminants in community gardens.

COMMUNITY/PARTNER PARTICIPATION: This project uses a number of participatory approaches to engage community partners. Primary partners include North Carolina Community Garden Partners (NCCGP), NC State Extension, Resourceful Communities. The DUSRC CEC also has engaged representatives from the US Environmental Protection Agency (EPA), and the Agency for Toxic Substances and Disease Registry. We used iterative community-engaged feedback before starting the project to determine if our research questions were relevant to communities and other

stakeholders, including a presentation and feedback session during an NCCGP board meeting and in their electronic newsletter, and a poster presentation at the North Carolina Environmental Justice summit. To identify our sample of gardens, we used snowball sampling techniques and an interactive mapping/screening process. Our sample selection and data collection methods, including surveys, interviews, focus groups, and participatory observation, also were informed by the best practices of community-engaged research. We employed participatory evaluation techniques by soliciting feedback from our community partners on the value and accessibility of research products to share with study participants and the general public. We will continue to use participatory approaches throughout the research project.

BACKGROUND: So far, our study has aimed to answer research questions about gardeners' potential exposure to soil contaminants in community gardens, as well as their knowledge, attitudes, behaviors, barriers and motivations related to the issue. The research team is using community-based social marketing as a theoretical framework to guide development of a survey, interviews, observations, and focus groups. The following questions were addressed: What are the most significant sources and potential pathways for contaminant exposure? What is the level of awareness, knowledge, and concern among gardeners on the topic of soil contamination? How do gardeners get information about soil contamination and communicate about it with others? What are the barriers to and motivations for gardeners to change their behavior to prevent exposure to soil contaminants? And finally, what are the most effective approaches for conducting social marketing research in a participatory and engaged way in a community setting? To select an initial sample population, the CEC has designed a customized interactive GIS map of North Carolina as a screening tool for sample selection of the case study garden sites. The map contains nine GIS data "layers" including both environmental contamination data and demographic indicators, overlaid with the 239 community garden sites in the North Carolina Community Garden Partners' online database. Through a screening process and with input from community partners using the "snowball sample" method, the research team identified around 30 gardens where there was an overlap of potential sources of environmental contamination and demographic risk factors, and narrowed this list to three to pursue as case study sites based on the potential for site contamination as well as interest and availability of the garden manager.

OUTCOMES: The research team conducted focus groups, interviews, and observations at three community garden sites across North Carolina. Interviews and site visits were conducted at three additional gardens. An online survey was sent to gardeners and garden managers, yielding 151 responses representing 107 unique gardens in 60 geographic locations around the state of North Carolina. After analyzing the quantitative and qualitative data using the NVivo and STATA software, the Master's students created final products to report back their findings to the community, which were then evaluated by community partners. Analysis of qualitative and quantitative data addressed questions in several categories including contaminant sources and exposure pathways; knowledge, awareness, and concern; and barriers and motivations to behavior change. Results have provided information on the gaps in these areas, and point to future directions for research.

IMPACTS: Initial results from this research will be used to inform and implement a social marketing campaign to reduce gardeners' exposure to soil contaminants by influencing gardener awareness and behavior change, especially among at-risk populations. Our work over the last year has allowed us to move forward with identifying partner gardeners in North Carolina with whom we can continue our research in a longer-term capacity by 1) performing soil testing and 2) working

with the selected gardens to create an action plan to manage soil contamination. The action plans may include pilot testing of a tailored social marketing campaign to positively influence gardener behaviors and management choices, exploring possible bioremediation or phytoremediation options at the 3-4 sites, and/or connecting gardens with additional resources from partnering organizations and continuing to provide technical assistance and translation/gathering of needed scientific information.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: The first phase of this project has presented challenges and has offered lessons, but also many areas for future opportunity. First, working through organized networks, such as statewide gardening support organizations like NCCGP and NC State Extension, facilitated connections to communities and made it easier to disseminate our research results and to use participatory approaches in our research. One challenge of using a social marketing theoretical framework in this project is that there was a very wide range of types of gardens involved in the study. While our goal is to eventually tailor specific behavior-change messages to gardeners for our social marketing campaign, we are challenged by the need to make these messages relevant for a variety of stakeholders at all levels, from a state or local Extension agent to a low-income participant in a refugee support garden with limited English language ability. Creating materials and communications that are relevant and accessible to gardens with different populations, management structures and capacity, etc., is a particular challenge of this project. An opportunity of using participatory approaches in this project is that it has yielded the potential to provide results and tools that will be widely relevant to gardeners and garden support organizations beyond the scope of our current research topic. Our GIS map could potentially be used for a broad range of community-based environmental management projects, and we hope to continue to work with NC State Extension and other partners to gather feedback on our work and meet the needs of communities on specific environmental health issues.

RESOURCES AND PRODUCTS: This research project has yielded a number of resources and products so far, including an interactive GIS map with nine GIS data “layers” including both environmental contamination data and demographic indicators, overlaid with the 239 community garden sites in the North Carolina Community Garden Partners’ online database. We hope to make the map publicly accessible at some point in the future. We have also compiled a number of resources for a website to serve community gardeners, including soil testing resources, an executive summary of our research study’s current results, a fact sheet on soil contamination in gardens, an original video presentation on soil contaminants and exposure reduction, and a 4-page handout for gardeners on our study that offers information and tips for exposure reduction.

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Boston University School of Public Health

PROJECT TITLE: Predictive value of tree damage for identifying methane leaks: a community-based study

PROJECT DESCRIPTION: Chelsea, MA is a community with a strong history of environmental justice advocacy whose community members are concerned and passionate about environmental health issues, including urban trees and greenspace development. The Massachusetts Department of Conservation and Recreation conducts tree re-planting campaigns throughout the city each year to replace dead trees and fill empty tree plots; however, natural gas leak locations are not currently considered in spatial planning. Natural gas emissions are known to negatively impact tree health, meaning that unrepaired gas leaks could pose a threat to Chelsea's urban forest. As of 2016, there were 45 unrepaired gas leaks Chelsea reported by utility companies and there are likely many more. In order to generate a more accurate representation of natural gas leaks in Chelsea, methane leaks were measured and mapped through a mobile monitoring campaign carried out by Boston University faculty member, Dr. Nathan Phillips. These data present a method to spatially visualize all of the gas leaks in the city of Chelsea and provide an opportunity for Chelsea residents to assess how these leaks are impacting their urban forests. By conducting a blind tree health assessment with the help of Chelsea residents, the CRESSH CEC in partnership with GreenRoots and the City of Chelsea, aims to determine the predictive value of tree damage for identifying urban gas leaks. By independently assessing tree damage and gas leaks, and publishing results in the scientific literature, we hope to raise awareness among community members, public health and city officials, and utilities regarding the dangers of natural gas leaks to urban vegetation.

COMMUNITY/PARTNER PARTICIPATION: The methane gas mapping was done in direct response to concerns expressed by CRESSH community partner, GreenRoots and the City of Chelsea Board of Health. In order to assess the relationship between damage to street trees and measurement of ambient street methane in Chelsea, we are collaborating with GreenRoots, a community-based environmental justice organization that works to improve the environmental landscape and public health in Chelsea, and the City of Chelsea Department of Public Works. Through community engagement, program development, and youth leadership, GreenRoots has achieved numerous victories in areas such as waterfront restoration, water quality improvement campaigns, and green space development. Because of their dedication to improving and sustaining urban greenspace, GreenRoots recently embarked on numerous street tree stewardship initiatives in order to promote the growth and maintenance of Chelsea's urban forest. These initiatives have largely been driven by GreenRoots' ECO (Environmental Chelsea Organizers) Crew, which is a group of Chelsea youth who serve as advocates and leaders of various environmental justice campaigns in their community. The Nature Conservancy trained ECO Crew members to assess tree health. Using a smartphone app provided by the City of Chelsea Tree Board, ECO Crew members and CRESSH staff are working to update the existing Chelsea street tree inventory, log stewardship efforts, and evaluate tree health. The tree health data that they are collecting will be used to assess the impact of gas leaks on urban tree health in Chelsea.

BACKGROUND: Massachusetts has one of the oldest gas pipeline systems in the United States, with much of the infrastructure still composed of cast iron, wrought iron, and unprotected steel pipes which can date back to the mid-1800s. The age and material of these pipes subject them to corrosion and pose a high risk of rupture and leaks, making the state of the Massachusetts pipeline system a growing public health concern. In order to decrease the number of leaks throughout Massachusetts, a finite number of aging gas mains are replaced each year by materials such as plastic

and protected steel; however, pipe replacement in communities such as Chelsea can be a slow and expensive process. As noted above, natural gas emissions are known to negatively impact vegetation health. This threat has been well documented in experimental settings and in non-tree plant species; however, formal assessment of tree health in relation to gas leak locations at a community-level has not been conducted despite the extensive anecdotal evidence of tree death near natural gas leaks in the Boston metro area. The work of GreenRoots and their ECO Crew to collect data on tree health through their urban forest stewardship initiatives provides the opportunity for this sort of community-level assessment to take place.

OUTCOMES: In preparation for data collection, the ECO Crew, GreenRoots members, and CRESSH staff were trained on how to accurately assess tree health as well as stewardship best practices. Data collection for this project is currently underway. ECO Crew members along with CRESSH staff are assessing street tree health in Chelsea based on pre-determined routes throughout the city. Once assessment is complete, CRESSH investigators will pool the tree health data with the geo-located methane concentration measurements in order to analyze the spatial relationship between them. The data will also be used by GreenRoots and their ECO Crew to identify areas to target with their stewardship efforts.

IMPACTS: Information on impacts of natural gas leaks on street tree health could be used in the future to inform planting and stewardship efforts. The information could also be used by community members to demonstrate to government officials and utility companies how the gas leaks are negatively impacting the health of their green spaces.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: While this project is still in the data collection phase, the future opportunities and directions are notable. The protocol generated for this tree health assessment as well as the larger stewardship initiatives being carried out by GreenRoots provide a framework for other communities to identify natural gas leaks and better understand how those leaks are affecting their urban green spaces. With this information, community members may be able to better advocate for gas pipe infrastructure repair as well as green space development in their own neighborhoods.

RESOURCES AND PRODUCTS:

OpenTreeMap (<https://www.opentreemap.org/>) is a mobile application that allows individuals to document tree planting, growth, health, and stewardship activities in their communities. All of the information inputted into the app contributes to a dynamic tree inventory that can be utilized by a variety of different stakeholders.

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UC Davis Environmental Health Sciences Core Center's Community Engagement Core

PROJECT TITLE: UC Davis Environmental Health Sciences Academy Day

PROJECT DESCRIPTION: The UC Davis Environmental Health Sciences Core Center (EHS CC)'s Community Engagement Core (CEC) helps align the EHS CC's activities with the needs and interests of communities facing high concentrations of environmental hazards and social vulnerability. This enriches the EHS CC's scholarship, training science literacy, university-community relationships, and public policy outcomes with the ultimate impact of community empowerment and improved health equity. The CEC'S Environmental Health Science (EHS) Academy has the goal of building both faculty and community partner capacity to actively communicate and engage in research collaborations. While other CEC activities aim to cultivate equitable partnerships and facilitate collaborative project development, the Academy specifically aims to help community partners have a deeper understanding of their academic collaborator's scientific work. The presentations and workshop aimed to build community partners' understanding of the potential as well as limitations of the data they will receive.

COMMUNITY/PARTNER PARTICIPATION: The primary audience of the inaugural Academy Day event was executive directors, employees and volunteers and affiliates of the two community partner organizations involved in the featured project: the Community Water Center (CWC) and the Environmental Justice Coalition for Water (EJCW). The event was also open to all members of the Community Stakeholders Advisory Committee (CSTAC). As the CSTAC was the primary audience for the event, the Academy Day reflected their input and requests regarding content, structure, and format.

BACKGROUND: The Academy's inaugural event was a one-day series of short seminars and workshops given by UCD faculty to community members on select topics related to a UCD 2016 EHS Center funded project submitted by Professor Swee Teh: "Impact of California Drought on Community Health? The water quality side" in collaboration with the Community Water Center (CWC) and the Environmental Justice Water Coalition (EJCW). The selected project utilized a fish model to investigate potential adverse health effects of well and tap water in California's Central Valley. Drought affects groundwater-surface water exchange, and pollutants may inadvertently enter wells that provide drinking water. This is of particular concern in the California Central Valley, where contaminants originating from agricultural runoff can have substantial adverse health effects. Specific sites for water sampling were selected in consultation with the Community Stakeholders Advisory Committee. Because chemical detection offers little insight on the potential toxicity of individual pollutants, pollutant mixtures, or substances present below the limit of detection, the Teh lab has used an aquatic fish model to conduct a suite of toxicity assays to screen and monitor drinking water contaminants.

OUTCOMES: The Academy Day provided the Community Water Center (CWC) and Environmental Justice Coalition for Water (EJCW) staff and volunteers with an opportunity to gain exposure to and a better understanding of the science being conducted by their academic partners in the Teh lab. Participants were given presentations by members of the Teh lab and other UC Davis faculty about the research project itself, the use and purpose of animal models, the process of assessing toxicity, and the movement of groundwater.

IMPACTS: One of the over-arching impacts of the Academy Day was to "lift the veil of science" and create a space in which community partners could engage with the more technical aspects of the collaborative project. This enables them to better understand, interpret, and utilize the data provided by their research partners, and to build their capacity to

participate in future research collaborations. The participating UC Davis faculty were likewise challenged to communicate their work to a lay audience, enhancing their capacity to meaningfully engage in research partnerships with community members.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: This inaugural Academy Day was the first of a series that the CEC is developing. In a recent meeting with the Community Stakeholder Advisory Committee, the CEC received positive feedback about the Academy Day and specific requests and ideas for the next one. Based on this feedback, we are developing curricula for Academy Days that will focus on air pollution, agriculture, and children's environmental health. We will continue encouraging our faculty to develop presentations of their research for community partners. The faculty are developing their skills to distill their work down to a short, jargon-free, and engaging summary. While posing a significant challenge, this process also reinforced the importance of creating spaces in which our researchers practice communicating their work to non-academic audiences.

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Center for Environmental Research and Children's Health (CERCH)/UC Berkeley

PROJECT TITLE: Chamacos Of Salinas Evaluating Chemicals in Homes & Agriculture (COSECHA)

PROJECT DESCRIPTION: The COSECHA study is a three-year project of the CHAMACOS Youth Council, a youth participatory action research (YPAR) cohort of teen leaders living in Salinas, and is funded by the California Breast Cancer Research Program. Its principal investigators are Dr. Kim Harley (UCB) and Mr. Jose Camacho (la Clinica de Salud de Valle Salinas) and it is facilitated by James Nolan (UCB). COSECHA stands for The Chamacos Of Salinas Evaluating Chemicals in Homes & Agriculture study. Translated from Spanish into English, the word means "harvest", indicating that we prioritize the optimization of our food system so that communities can more equitably prosper from its bounty. COSECHA study participants were nested within the larger CHAMACOS Study. Initiated in 1998, CHAMACOS is the longest running longitudinal birth cohort study of pesticides and other environmental exposures among children in a farmworker community. This larger study has a long history of prioritizing community engagement in study design, analysis and results dissemination.

BACKGROUND: California uses more than 185 million pounds of pesticides each year, approximately 7 million of which have been identified as probable or possible carcinogens or hormone disruptors. Yet, scientists know little about how teenage girls living in agricultural communities may be exposed to pesticides used on fields near their homes. One concern is that pesticide exposure during puberty, when breast tissue is developing, may increase risk for breast cancer later in life. The COSECHA study was initiated to investigate these concerns. Though Salinas is rich in history, agriculture and diversity, it also faces disproportionate socio-economic inequities. Previous CHAMACOS studies have indicated that the combination of such adversities and exposures to some pesticides may be associated with increased severity of children's health effects.

OUTCOMES: COSECHA youth researchers were engaged in team building and environmental health literacy, during which youth gained foundational knowledge, created team guidelines, modified study protocols and informed study design. Facilitated by adult staff, youth researchers visited participant's homes in the summer of 2016, collecting a complex and innovative array of data from their peers using: GPS devices, a passive environment sampling bracelet (a novel technology from Dr. Kim Anderson at Oregon State University, capable of detecting 1,500+ chemicals), two types of indoor dust samples, online questionnaires, daily text reminders, urine samples and cataloguing crops grown on nearby fields. Preliminary bracelet analysis indicates that up to 69 pesticides were detected and helped clarify potential methods for reducing exposures. Youth researchers were able to improve their environmental health literacy, develop new relationships, interact with community stakeholders, build professional skills and collect critical environmental health data. They are continuing to educate members of their community and are working with staff on making plans to attend college.

IMPACTS: To the best of our knowledge, this was the first study to harness youth participatory action research to gather data on ambient exposures using a specially calibrated bracelet, GPS, urine samples and dust samples. By serving on the CHAMACOS Youth Council, local high school students helped guide research priorities, design and implement studies, and return the scientific results to their community helping to improve study relevance, rigor and reach. The COSECHA Study empowers Latino high school students in environmental health research and action. Through the study, local high school students are able to become paid youth researchers, learning about and acting upon pesticide exposures associated with hormone disrupting and/or carcinogenic effects amongst teens in the Salinas Valley, CA.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Currently, youth researchers are developing a public health communication strategy, including the development and dissemination of video segments on pesticide related health topics, a short radio "edu-tainment" series, social media, tabling at local events and community presentations. To date, they have given PowerPoint presentations to dozens of community members, including stakeholders from organizations such as the Natural Resource Defense Council and the California Strawberry Commission, tabled at nearly a dozen events and personally distributed more than seven hundred informational brochures. We look forward to facilitating the youth in presenting findings to stakeholders in Sacramento, the state capital, and collaborating with organizations involved in addressing environmental health challenges. One emerging possibility is that collaborations could help provide doormats, associated with reductions in exposures to some pesticides, which could be distributed free of charge in areas where there are large populations of agricultural workers.

RESOURCES AND PRODUCTS: The COSECHA Team has made four news appearances, authored an article from UC Berkeley's Youth Participatory Action Research (YPAR) Hub, made a "Radio novella" series on how to reduce potential pesticide exposures and created a video that outlines how people can look up pesticide use near their homes and take measures to reduce potential exposures. They are scheduled for a one-hour radio interview to discuss their work, educate the community and outline next steps.

For more information, please visit: <http://cerch.berkeley.edu/research-programs/cosecha-study> and sign up for our newsletter at: <http://oi.vresp.com/?fid=cee399448a>

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Silent Spring Institute

PROJECT TITLE: Engaging Communities in Biomonitoring Studies through Interactive Digital Report-Back with DERBI

PROJECT DESCRIPTION: Returning personal exposure results to participants in biomonitoring studies is known as report-back. Report-back is now the ethical standard, but producing personalized reports can be time consuming and requires in-depth interdisciplinary domain knowledge. The Digital Exposure Report-Back Interface (DERBI) partially automates the process of generating personalized reports, making report-back feasible in large studies. DERBI contains a database of information about common chemicals, including exposure reduction tips, as a starting point for researchers writing reports. DERBI is the outcome of interdisciplinary collaboration between toxicologists, exposure scientists, psychologists, and computer scientists from multiple institutions. Digital reports have several benefits over print: information can be layered, with high-level explanations visible first and in-depth content hidden until users choose to see it. Users can also flexibly navigate the report according to their interests. Digital reports can include interactive data visualizations that allow participants to explore their data (see <https://goo.gl/SKf9zF> for an example of an interactive visualization). In addition, web-based reports are cheaper to produce and deliver than print reports, although DERBI can be used to generate print reports in communities with limited internet access.

COMMUNITY/PARTNER PARTICIPATION: DERBI has been used to report back in three studies so far. We reported to public housing residents in South Boston enrolled in the CDC Green Housing Study (GHS) and to women biomonitoring as part of the Child Health and Development Studies (CHDS), half of whom are African American. In each study, reports were user-tested with participants and tailored to the community. We are currently reporting back to participants in Detox Me Action Kit (<http://silentspring.org/detoxmeactionkit>), a crowdfunded biomonitoring study open to the public. Anyone can join the study and be tested for a suite of common endocrine disruptors by covering the cost of the analysis, but we are also working with community organizations to provide kits to individuals who otherwise could not afford them. So far, we have partnered with Black Women for Wellness in Los Angeles, CA and the Resilient Sisterhood Project in Boston, MA. For many participants, learning about personal exposure levels is the incentive to join this study.

BACKGROUND: Historically, researchers returned results only when there were clear health guidelines for exposure (e.g., lead). Research by Silent Spring Institute has shown that participants want to know their results even when the health implications are uncertain. Most participants request to receive their results, and returning results does not cause excessive worry. For example, in the Household Exposure Study on Cape Cod, MA in the early 2000s, 97 percent of participants opted to receive their results. The study was extended to Richmond, CA where participants used data obtained through report-back to block the expansion of an oil refinery.

OUTCOMES: To date, DERBI has been used to provide reports to 295 women in CHDS, 94 households in GHS, and 152 participants in Detox Me Action Kit. Each of these studies represents different communities; DERBI provides a flexible

way to customize reports to the concerns and interests of each study population. We evaluated report-back using structured and semi-structured interviews in CHDS and GHS. Report-back can benefit researchers by improving communication and collaboration with participants. All reports provide contact information for the study team so participants can ask questions. We have found that participants take advantage of this opportunity, and that the resulting conversations can be helpful both to the participant and to the research team. Talking to participants directly about possible sources of exposure can lead to new hypotheses for future research, especially for participants with unusually high exposures.

IMPACTS: Report-back is informative for participants and can motivate action to reduce personal exposure to environmental chemicals. Preliminary evidence from CHDS suggests that environmental health knowledge increases after report-back. Participants in both GHS and CHDS reported taking individual action to reduce personal exposure to chemicals. In GHS, for example, participants said they reduced their use of fragrances and pesticides.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Many participants are motivated to reduce exposure after report-back. A main challenge is balancing suggestions for individual action while acknowledging the need for regulatory and policy change. Participants are often more eager to change consumer behaviors. We seek new ways to engage participants in advocacy at community, state, and national levels. We look forward to deploying DERBI in more studies and communities. We are currently developing a smartphone optimized interface for reports so that DERBI can be used in communities that rely on smartphones for internet access. Multiple community groups have partnered with us to provide biomonitoring testing through the Detox Me Action Kit study, and we are open to new collaborations to expand the project.

RESOURCES AND PRODUCTS: For more information about DERBI, see our paper in Environmental Health Perspectives (<https://ehp.niehs.nih.gov/EHP702/>) and the Silent Spring Institute website, which includes links to sample print and online reports (<https://goo.gl/EjIEly>). For more general information about best practices for report-back, see the Silent Spring Institute Report-Back Handbook: http://www.silentspring.org/personal_exposure_report_handbook.pdf

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University of Washington

PROJECT TITLE: Home Air in Agriculture; Pediatric Intervention Trial (HAPI)

PROJECT DESCRIPTION: The Yakima Valley area of Washington State is comprised of rural environmental justice communities, many known for intensive agricultural practices. El Proyecto Bienestar (EPB) is a longstanding partnership between the academic community of environmental health researchers at the University of Washington and partner organizations in rural Yakima Valley. Over the years, EPB has worked to understand priority occupational and environmental health concerns in the region. Priority issues have included occupational pesticide exposure, outdoor air pollution, safe drinking water, and childhood asthma. All have been topics of EPB research activities, with asthma the

most recent focus. EPB research on asthma has matured from novel characterization of the public health impact of PM_{2.5} and NH₃ in this setting to an intervention trial to reduce these exposures and asthma morbidity among children with asthma. The HAPI study is a randomized intervention trial designed to test the effectiveness of combining a community health worker (CHW) led asthma education program with portable home indoor air cleaners to improve indoor air quality and pediatric asthma morbidity in areas with intense agricultural production.

COMMUNITY/PARTNER PARTICIPATION: El Proyecto Bienestar (EPB) comprises four core organizations, the Yakima Valley Farm Worker's Clinic (YVFWC), the Northwest Communities Education Center/Radio KDNA, Heritage University, and the University of Washington (UW) Pacific Northwest Agricultural Health and Safety Center (a NIOSH funded agricultural center). The core leads the direction of the partnership activities. In addition, EPB has a community advisory board (CAB) The CAB includes membership from the core organizations and community members with an interest in occupational and environmental health in the Yakima Valley. In designing the HAPI Study, both the CORE and CAB emphasized the importance of solution-driven research. This motivated the interventional design embedded in a sustained community health worker (promotora) education program. This project engages with the CAB on a regular basis. This provides an opportunity for updating the community on the study's progress and receiving feedback on community engagement. In conducting HAPI, the YVFWC's Asthma Educators have taken the lead in participant screening, recruitment, enrollment and scheduling, in addition to maintaining a relationship with participants. The Asthma Educators are the central liaisons between study subjects and the research team. During the study visits, Asthma Educators also perform key health outcome measurements, which include questionnaires and lung function measurements. Staff from NCEC/Radio KDNA are responsible for setting up, collecting and preliminary processing of both active and passive exposure samples, urine specimen collection and transport, and conduct of household environmental surveys. The staff have also participated in numerous local health fairs, sharing information about the study and related asthma health education information. The UW study team provides training, back up support, and oversight of the study procedures.

BACKGROUND: Our community based participatory research seeks to reduce exposure to asthmagens in the homes of an environmental justice community of rural Latino children. Children with asthma experience high morbidity in this region and our preliminary research discerned adverse impacts of ambient fine particulate matter and ammonia. However, children spend the majority of their time indoors and pollutants generated outdoors can infiltrate and compromise indoor air quality. Studies conducted in urban settings demonstrate that indoor particulate matter (PM) influences asthma outcomes and HEPA (high efficiency particulate air) cleaners can reduce indoor and ambient generated PM. This study seeks to characterize key indoor pollutant exposures for children with asthma who reside near crop production or dairy operations. Subject recruitment utilizes an existing community health worker delivered asthma education program operated by the region's federally qualified health center, the Yakima Valley Farm Workers Clinic. Children aged 6-12 years with poorly controlled asthma are randomized to the usual educational program or an enhanced version, which includes portable room HEPA cleaners with filters designed to reduce PM and ammonia (NH₃). Children in the usual program group receive HEPA cleaners at the end of their study participation. Prioritizing methods with low participant burden as well as innovative sampling approaches, we are evaluating the effectiveness of the enhanced intervention on: 1) Reducing indoor measures of PM and NH₃ across seasons, 2) Improving clinically relevant measures of asthma health (Asthma Control Test, lung function, oral steroid treatment, unscheduled clinical utilization),

and 3) Reducing biomarkers of inflammation (urinary cysteinyl leukotriene - LTE₄, exhaled nitric oxide). Caregiver psychosocial stress and behavioral components are being evaluated as modifiers of these effects.

OUTCOMES: This project recruits and enrolls study subjects on a rolling basis so the sample of subjects who have completed the entire study year of procedures is limited. Retention is high, after visit 1, 88% of enrolled subjects continued. In the Spring of 2017, we conducted preliminary summaries for the first 56 subjects who had entered the study. This included 31 children randomized to the intervention arm and 25 as controls. The mean (standard deviation) age of these subjects is 8.7 (2.1) years. All but two subjects self-identified as Hispanic. Approximately 95% of subjects are on some form of public insurance. Based on self-report of household features within ¼ mile, 46% live close to animal agriculture (dairy primarily), 98% live proximal to crop agriculture, 73% are close to major roads with heavy traffic, and 59% to dusty roads. None of the subjects reported a smoker in the household (consistent with eligibility criteria). Most (74%) of these subjects showed sensitization (skin prick test positivity) to one of six common aeroallergens. Many reported an urgent care visit for asthma in the past year (68%) or ED visit (46%). Approximately 7% had an overnight hospitalization in the past year. At the baseline health assessment, nine subjects (14%) demonstrated lung function impairment (FEV₁ less than 80% predicted). Close to half (48%) of subjects had an asthma control test score that indicated their asthma was not well controlled at baseline. The PM_{2.5} concentrations observed to date are comparable to limited data from other rural US locales and lower than typically reported indoor concentrations reported among children studied in inner city cohorts (including homes with smokers). Overall, the indoor ammonia (NH₃) concentrations we observe exceed most published results from other indoor settings. The indoor-to-outdoor ratio are within the range observed in other studies.

IMPACTS: Through the community-academic partnership, this project has continued to build capacity in the community partner organizations, Yakima Valley Farm Worker's Clinic and Radio KDNA at the Northwest Communities Education Center, by strengthening the existing Asthma Home Visiting program, providing additional resources for community outreach and education, and enhancing professional development. The project has engaged multiple students with an interest in community engaged research and has two current PHD students developing dissertations related to the project.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: One of many important lessons learned through this project is the importance of consistent community involvement, participatory decision-making and regular evaluations in the design and implementation of the study. Evaluations conducted with the participants demonstrate that our project is well regarded by participating families. The project has had several challenges; including creating a culturally appropriate, low burden methodology to collect environmental samples. In addition, the project staff had to develop and modify sampling equipment and operating procedures in order to accommodate for the location of the equipment (often in child's bedroom) and complexity of the protocol. Communication regarding best practices for sampling equipment was developed in order to address issues with samplers inadvertently being turned off or relocated. Despite efforts to recruit approximately the same number of participants throughout the year, we have had difficulty recruiting during certain seasons such as the harvest season or the winter when many families travel back to Mexico. We plan to work with our community to identify future opportunities to promote community empowerment and reduce

environmental health inequities by supporting the voice of our partners and informing decision-makers of our research findings.

RESOURCES AND PRODUCTS: Through this project, various resources for study subjects and the greater community have been developed or are currently in development. Two reports have been created to provide study results directly to the participants. All reports generated for participants are available in both English and Spanish. The first report provides health measurements. All subjects receive health outcome results regarding spirometry and exhaled nitric oxide during study visits immediately. At the conclusion of the study, subjects receive a final report with personalized feedback on all health outcome measurements collected during the study. This report includes both written and graphical representation of the measurements for exhaled nitric oxide, spirometry, and skin prick responses (six common allergens). At the end of the study year, participants are also given a letter updating them on the study progress and thanking them for their participation. The second report gives a summary of the baseline particulate matter (PM) and ammonia (NH₃) measurements over a two-week period inside the subject's homes. The report provides information on why the study measured PM and ammonia levels, what the relationship is between the measurements and asthma, and how to reduce exposure and improve the indoor air quality. This second report is in final stages of design and translation and will be sent to participants once their baseline data becomes available. During this past year, Asthma Educators from the Yakima Farm Worker's Clinic have provided community asthma education as guests on four radio shows for the local Spanish community radio station, Radio KDNA. The partners most recently developed a plan for creating a set of radionovelas on asthma and environmental triggers.

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Boston University School of Public Health

PROJECT TITLE: Health and Environment Assistance Resources Database (HEAR-DB.org)

PROJECT DESCRIPTION: This database exists to link community groups who have research questions with technical experts who are willing and able to assist them. It was developed out of a need to improve the infrastructure and resources so that academics and organizations that assist small neighborhood groups would have more capacity to do so while tracking and recognizing the work the results from brokering such relationships.

COMMUNITY/PARTNER PARTICIPATION: The database was developed with direct participation and partnership with Toxics Action Center New England, Alternatives for Community & Environment in Roxbury, MA and Greater Boston Physicians for Social Responsibility. We all pooled our resources to develop the database. It is managed by BU Superfund Research Program.

BACKGROUND: The HEAR database is a collaborative project of Alternatives for Community & Environment (ACE), Boston University School of Public Health (BUSPH) and Toxics Action Center. Every day, members of community groups

across New England call our organizations seeking advice on their work confronting environmental hazards. Sometimes we can handle the questions ourselves, but often we have to look outside our own networks for help. When groups need a lawyer to review siting documents or a doctor to weigh in on the effects of air pollution on health, we turn to the network of HEAR experts to match communities with volunteers. This kind of assistance, and in some cases partnership, is absolutely essential to our work and the services we provide community groups.

OUTCOMES: There are over 400 volunteers in the database. Approximately half are lawyers affiliated with the Massachusetts Environmental Justice Action Network. Nearly 70 PhD scientists, 25 Licensed Site Professionals, etc. the database is searchable by a variety of key words and areas of expertise. Each year, volunteers in the database are selected by Toxics Action Center for the "Science for the Benefit of Environmental Health Award."

IMPACTS: We have this year populated the main page to illustrate stories of how communities have been served by this resource. Cleaning up lead contaminated soils, winning EJ policy victories, curbing noise and air pollution, and conducting research in direct response to community questions.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Tracking the results of partnerships is always challenging. However, we are seeing the effect it has. Most recently we are working with National NGOs, the International Society for Children's Health and the Environment, to adapt the database to serve a national purpose focused on Children's Environmental Health. We are also hoping to collaborate with other community-university partnerships to similarly create such an infrastructure so we can collectively increase and advance the research driven by community concerns, and the expertise available to them that is truly empowering.

RESOURCES AND PRODUCTS: www.HEAR-DB.org

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[University of Michigan](#)

PROJECT TITLE: Michigan Lifestage Environmental Exposures and Disease Center (MLEEaD), Community Outreach and Engagement Core (COEC)

PROJECT DESCRIPTION: The Community Outreach and Engagement Core (COEC) serves as a resource to increase awareness and understanding of environmental health research, and to further scientific collaboration among University of Michigan environmental health researchers and the communities involved. The COEC works to facilitate translation and dissemination of research in a way that is meaningful to all stakeholders, including community members in Detroit and Southeast Michigan as well as local, state, regional and national policy makers and public health decision makers charged with establishing regulations and policies regarding environmental exposures and health outcomes. The specific aims of the COEC are to: 1. Enhance, expand, and sustain partnerships with stakeholders (e.g. CBOs, local health departments, health advocacy groups, and other local, state, and regional partners) to translate and disseminate

scientific findings on the role of environmental exposure in disease, and to increase understanding of community concerns among Center members.2. Increase awareness and understanding of environmental public health among community members, policy makers, and public health decision makers at the local, regional, state, and national level through the translation and dissemination of scientific findings (from the M-LEEAD Center) on the association between environmental exposures across the lifecycle and adult disease, to enhance capacity to promote improved environmental decision making.3. Promote multi-directional dialogue and interaction among all stakeholders, to improve capacity to make informed environmental health decisions, and to guide M-LEEAD Center research that addresses the needs of community and policy/decision making audiences.4. Advance the field of community engagement through evaluation of our process and outcome evaluation activities, dissemination of results at local and national levels, and promotion of community engagement models for national implementation.

COMMUNITY/PARTNER PARTICIPATION: We have a Stakeholder Advisory Board (SAB) that serves to strengthen dialogue and interaction between the M-LEEAD Center and community stakeholders, to ensure understanding by Center researchers of community and policy needs, and to ensure effective dissemination of research in appropriate venues. This group meets quarterly, and is made up of community leaders with extensive experience in collaborative engagement in the development and translation of knowledge, building on community strengths and resources, facilitation of co-learning and capacity building, and dissemination of research findings to all partners. Current SAB members represent health service providers, state and local health departments, and community-based and environmental justice organizations.

OUTCOMES: We strengthened capacity among researchers and community members to foster connections and improve communication with public health decision-makers and policy makers through several policy education trainings. In the first, we worked with Center members and the SAB to provide policy education modules which aimed to enhance the capacity of diverse groups to engage with policy makers to build healthy and equitable communities in Detroit and Southeast Michigan. This workshop was hosted by Detroit Hispanic Development Corporation, a member of the SAB. The second policy education training was co-hosted by the COEC and Community Action to Promote Healthy Environments (CAPHE), an NIEHS-supported project led by M-LEEAD Center affiliated researchers Schulz and Batterman, working to develop a public health action plan to improve Detroit's air quality and health. This policy education training session was conducted in November 2016; participants included members of the Wayne State University EHS CC COEC, center-affiliated researchers, and members of the M-LEEAD COEC SAB and CAPHE steering committee. We are currently working with community-based organizations and the Genesee County Health Department to plan and conduct a policy education training session in Flint, MI in Fall 2017 that will be focused on water quality/safety, affordability, and recognizing water as a basic human right. The goal is to enhance community capacity to engage in emergent water policy issues.

IMPACTS: We have utilized a variety of formats to facilitate multi-directional dialogue and interaction about environment-related topics between community members, decision makers and center researchers (e.g., science cafes, trainings, bus tours, legislative forums, presentations at community meetings). We implemented two Residents and Researchers (R&R) environmental justice bus tours in Detroit: Air quality, demolition, and climate change (Fall 2015); and Green infrastructure and sustainability (Fall 2016). The overarching goal of the R&R Bus Tours is to promote

multidirectional exchange of information on environmental health issues in the city of Detroit between community leaders, residents and researchers affiliated with the M-LEEd Center. Key community members, including members of the SAB, and M-LEEd affiliated researchers shared their knowledge regarding environmental health issues in Detroit communities. Each event involved multiple opportunities for discussion and dialogue, with explicit connections between center research and community issues, and exploration of potential areas for future research collaboration.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: We continue to seek opportunities for Center researchers and community partners to interact and exchange information. We are interested in learning about how other CECs are facilitating such interaction.

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PROJECT TITLE: An Anishinabe Fish Consumption Advisory to Promote Environmental Health Literacy

PROJECT DESCRIPTION: The Inter-Tribal Fisheries and Assessment Program (ITFAP) of the Chippewa Ottawa Resource Authority (CORA) in Sault Ste. Marie, Michigan, has been monitoring contaminant concentrations in the fillet portions of lake trout (*Salvelinus namaycush*) and lake whitefish (*Coregonus clupeaformis*) from the 1836 treaty-ceded waters of lakes Superior, Huron, and Michigan since 1991. The contaminant monitoring program was initiated because the CORA-regulated commercial fishery annually harvests about 2 million kg of lake whitefish and 0.5 million kg of lake trout from the three upper Great Lakes, and many Native American families derive income from the fishery. Despite the cultural history and known benefits of eating fish, the Anishinaabe (Laurentian Great Lakes Ojibwe/Chippewa, Ottawa, and Potawatomi) report to consume only one third of the recommended daily fish intake. The loss of traditional foods in general creates a nutritional health disparity for indigenous North Americans. The decreased access to fishery and other traditional foods has coincided with a general trend of decreased dietary quality, obesity, and cardiovascular disease within Native Americans. We recently reported that application of a novel risk-benefit quantification to the tribal harvests monitored by CORA reveals potential health benefits from Omega-3 Polyunsaturated Fatty Acids (PUFA-3) adjusted for methylmercury (MeHg) risks. We further suggested that presentation of the risk-benefit quantification, along with culturally-tailored fish consumption advice (to cover other PBTs) would serve as an acceptable and effective vector to operationalize CORA data for Anishinaabe. Therefore, an interactive fish consumption advisory for the Anishinaabe Gijiigoo'inaan" [Our Fish] was created.

COMMUNITY/PARTNER PARTICIPATION: Project partners include the Medical College of Wisconsin (MCW), Great Lakes Inter-Tribal Council (GLITC), Inter Tribal Council of Michigan (ITCM), Chippewa Ottawa Resource Authority (CORA) and Inter Tribal Fisheries and Assessment Program (ITFAP). These activities were conducted as part of the collaborative project "An Anishinaabe Fish Consumption Advisory to Promote Environmental Health Literacy," funded by the National Institutes of Health (Dellinger et al. 2015-2017). In summer 2016, CORA coordinated their monitoring efforts in

collaboration with an NIEHS R21. Fish sampling methods are identical to previous CORA monitoring. The sampling design is based on EPA-approved CORA methods that were originally designed to compare to the Michigan Fish Contaminant Monitoring Program protocols. The following six fish species from tribal fishery (CORA) areas were sampled: whitefish (*Coregonus clupeaformis*) (n=12), lake trout (*Salvelinus namaycush*) (n=12), walleye (*Sander vitreus*) (n=7), yellow perch (*Perca flavescens*) (n=7), herring (*Coregonus artedii*) (n=7), and smelt (*Osmerus mordax*) (n=7). Four species of fish not caught in subsistence areas, but were available for purchase, were selected by commercial names (n=7 each): farmed salmon, tuna, cod, and tilapia. Focus groups were conducted on site at various tribal governments to assess Gigiigoo'inaan. Each focus group consisted of eight to ten (8 -10) participants from the Anishinaabe community. Specific inclusion criteria were: 1) age 18+ years who make dietary decisions 2) reside in the area covered by the treaty-ceded territories, and 3) self-reported tribal membership. Project partners at ITCM recruited from their member tribes in the Great Lakes region. A complete list of these eleven tribes can be found at <http://www.ITCMI.org>.

BACKGROUND: The software program (App) “Gigiigoo’inaan” [Our Fish] offers personalized, culturally-tailored advice that presents contaminant and PUFA-3 data in a user-friendly format. Gigiigoo’inaan employs some crucial innovations based on our previously-identified best practices as well as some novel features. It also provides personalized consumption advice based on user-input. In addition to evaluating the mobile software format using focus groups, we explored participant reactions to a quantitative method for comparing the risks and benefits of fish consumption put forward by Ginsberg et al. (2005, 2015). Gigiigoo’inaan was programmed by the University of Wisconsin-Milwaukee Mobile Innovation Lab to the specifications of the research partners at MCW, ITCMI, and CORA/ITFAP. The software was built using a popular scripting language (PHP 5.6.6) that is used to develop websites, native apps (downloaded to a device), and web apps (run through web browser). The pilot version works on both Android™ and IOS™ allowing for on-demand calculation of safe consumption rates for three species of fish (lake trout, whitefish, and walleye) based on user input data of age, sex, and weight. The app features custom-made woodland-styled digital images made in the Woodland Style founded by the Anishinaabe artist Norval Morrisseau.

OUTCOMES: The general concept of the app and the presentation of the data were deemed culturally acceptable and pleasing to the participants. Focus group responses indicate a desire to understand what levels and types of fish consumption are safe without discouraging people from eating fish. The contaminant monitoring aspect of the project revealed important patterns in harvested fish contamination as well as previously unconfirmed benefits from PUFA-3. Although traditionally caught species of fish tended to contain greater levels of contaminants, they also contained more protective factors such as Selenium and PUFA-3 than farm raised fish. Paired with the cultural importance of fish consumption, this provides compelling evidence to support Anishinaabe motivations to safely eat fish.

IMPACTS: Promoting a culture of natural resource stewardship would impart many benefits to a community. If the benefits of wild caught fish are highlighted in fish consumption advice, the value of traditional food to the Anishinaabe will be evident and tribal organizations might promote the notion that their populations are environmental stakeholders. Furthermore, reporting the loss of beneficial nutrients because of the presence of a preventable contaminant helps to quantify the health costs and consequences of environmental pollution in these communities.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: This sampling was part of a larger effort to communicate important advice and environmental data to the populations who are served by CORA. Monitoring efforts must strive to

provide the clearest picture possible on environmental conditions for the public. A clear picture includes the positive aspects of environmental monitoring and stewardship in addition to the vigilance required to reduce contaminant emissions. Over 14 years of collaborations with CORA and other tribal consortia throughout the Great Lakes region have repeatedly demonstrated that Native American populations feel demoralized when the benefits of fish consumption are omitted from advisories which are instead focused solely on contaminants. Data like those reported here should be added to fish consumption advisories to support the mission of improving the environmental health of the Great Lakes region and the health of Great Lakes populations.

RESOURCES AND PRODUCTS: Gigiigoo'inaan is fully functional with a database of fish contaminants and nutrients by species and lake that was gathered by Anishinaabe fishermen, scientists, and students. More work is being proposed to expand opportunities for other tribes to participate and benefit from this effort to operationalize their data. We are also designing experiments to test the culturally-contextualized behaviors of Gigiigoo'inaan end-users. A long-term goal is to publicly release the app and maintain the required database so that the ongoing monitoring efforts translate more efficiently to healthy behaviors in these populations.

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Healthcare professionals

University of Arizona SWEHSC

PROJECT TITLE: Asthma and Allergy Information Walks

PROJECT DESCRIPTION: To ensure learning about asthma and allergies in American Indian and rural communities through active informational engagement, with a docent (1-1) approach, plain language and interactive table top activities.

COMMUNITY/PARTNER PARTICIPATION: The original AA Walk was developed with middle school students in mind. However, in multiple testing and subsequent community activities the multi station mini health fair was well received in both tribal and dominant culture settings. Each of the stations consisted of the information posters, physical models regarding the poster description, and the Asthma and Allergy brochure. The overall outing had been successful in informing learners of all ages (children to elders) about the causes and ways to help control their or someone else asthma and allergies.

BACKGROUND: The Southwest Environmental Health Sciences Center formatted an information walk, using a mini health fair or mobile museum format. It was designed to teach students and their families about the causes, symptoms and prevention of asthma and allergies. The walk consists of five informational stations along with either a physical model or hands-on activity. Each station focuses on one of the key concepts, lung function, describing asthma, indoor air pollutants, outdoor air pollutants, and less toxic cleaners. It is an activity with “tours” given by the students and/or staff members serving as docents to teach about these illnesses, how to identify and assist asthmatic individuals, to answer

questions, and demonstrate one way to take preventive measures. The information presented is appropriate for all ages and education levels.

OUTCOMES: Through a Promatora project the materials were translated into Spanish and those materials were also well received. The Walk has been used in trainings for tribal partners and at partner community events. The Walk was then taken to present at the Hopi Environmental Health Fair in Kykotsmovi Village, Arizona. The overview was presented at the 2017 National Tribal Forum on Air Quality.

IMPACTS: In 2016, at a training with the environmental quality office of a partner tribe, the Community Engagement Core was requested to create culturally appropriate walks for each of the tribal communities we collaborate with. Therefore, the stations were updated before we began to make them culturally appropriate. The partners both suggested the information did not need to be translated fully but rather they needed to have native words inserted to be more familiar to the community members. This project update is in the final stages of completion. We are including terms in tribal languages and the images of people are of tribal people.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: The major lesson learned is that the materials and practices we use need to be tailored for the community we are collaborating with and that the best results are when we use common materials and practices, evaluate the outcomes and then collaborate with partners to improve materials for their community. While time consuming this leads to more trust and true partnerships.

RESOURCES AND PRODUCTS: http://coep.pharmacy.arizona.edu/hope2/aa_hops.html houses the asthma and allergy materials and the Walk.

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STEM/Educators

Texas A&M University Health Science Center

PROJECT TITLE: Model Education Network To Optimize Rural Science (MENTORS) Project

PROJECT DESCRIPTION: The overarching goal of the MENTORS Project is to actualize an exportable and sustainable model for the development and dissemination of culturally relevant and sensitive learning environments that stimulate interest in and enhance preparation for STEM careers in medicine, science, engineering and technology. Aim 1: To engage a network of K-12 teachers from magnet and partner schools and TAMU faculty in career and professional development activities that enhance STEM instruction through these project activities: Summer Educator Fellowships, (SEF) in which teachers work collaboratively with TAMU faculty, staff and trainees to develop, test and implement novel, research-inspired instructional modules. K12 Summer Institute, a professional development conference for K-12 educators in Texas that introduces innovative, classroom-ready, STEM-based educational materials and trains teachers in their use (www.k12summerinstitute.org). Regional Workshops designed exclusively for teachers from our partner

schools and aimed at providing an opportunity for them to meet together and plan the next year's activities. Aim 2: To provide authentic, field, research and service learning experiences for middle and high school students, designed to enhance STEM education, promote community wellness and stimulate interest in and pursuit of a range of science, technology and health-related careers, via these project activities: Mentored classroom activities, with the chance to "Ask the Expert," Field Experiences (FEs) that will provide experiential learning, The School-based Health Awareness and Regional Education (SHARE) Program that provides training and mentoring to prepare high school students to serve as Health Ambassadors in their communities, and Summer Research Internship ("Lab Rats") that provides an opportunity for students to conduct authentic hands-on, hypothesis-driven research for 6-8 weeks, during their summer break.

COMMUNITY/PARTNER PARTICIPATION: The MENTORS project employs a unique and highly exportable organizational approach that implements mentoring at multiple levels including: peer-peer, K-12 students-teachers, K-12 administrators-teachers, university-K-12 faculty and university faculty and trainees- K12 students. In this plan, the triad includes schools in South Texas Independent School District (STISD) and Mercedes ISD along with faculty and trainees at Texas A&M. This design is informed by the reality that many communities have significant achievement disparities between highly successful schools, which typically have a higher proportion of non-URM (underrepresented minority) students, a higher tax base, more experienced teachers and more resources, and schools that serve more URM students and fewer resources. The South Texas School for Health Professions (Med High) is a longtime partner. STISD serves students in three of the poorest and most medically underserved counties in the U.S. Despite this, Med High is nationally recognized and has high levels of student attainment. It was recognized as one of the top 100 High Schools in the U.S. The challenge is that these outstanding schools have absolute limits to the number of students that they can accept. Mercedes ISD is in the same community as Med High, but despite substantial progress, the district consistently scores below the state average on four major accountability indices: student progress, closing student performance gaps, post-secondary readiness and system safeguards. Therefore, for this MENTORS project, we have forged a partnership between these schools to foster the sharing of resources and best practices and to implement project activities that will advance education and directly benefit their shared community. We also selected four teachers from each school through an application process to join the project management team (2 Implementation Leaders and 2 SHARE Mentors from each school).

BACKGROUND: According to the AMA, less than 9% of current U.S. physicians are from minority or underserved populations: only 3.5% are African-American, 4.9% Hispanic and 0.16% American Native/Pacific Islander, compared to their percentages of the population, at 12.6%, 16.3% and 1.1%, respectively. Resources for science education are also unevenly distributed geographically, and students in rural areas have less access. In 2013, 6.2 million Americans in rural areas lived in poverty, including about 1.5 million children. Education lags behind in these areas, and science education often is least supported due to limited finances and teacher training. In Texas, rural populations are increasingly Latino, and the state will be majority Latino in a few years. Latinos pursue higher education and science-associated careers at a lower rate than the overall population in the U.S. The overall consensus of multiple studies is that the relative reduction in the proportion of students pursuing STEM careers in industrialized nations such as the U.S. can be attributed, at least in part, to a lack of understanding about what scientists and researchers actually do and what their lives are like. In addition, the reports point to inadequate teaching and the critical lack of motivating influences from families, teachers, role models and mentors to encourage underserved students to pursue these poorly understood careers. An important

conclusion of these reports is the clear understanding that effective efforts to address under-representation of students in science must begin prior to the college level.

OUTCOMES: The outcomes of the MENTORS Project in its first year of implementation includes:

- Development of strong partnership between host institution (Texas A&M University) and partner schools (Med High and Mercedes High School), through consistent visits and engagement.
- Two fully functional, modern, interactive and dynamic websites (see Resources and Products section below) that provide information about our activities and programs.
- Successful completion of project activities such as:
 - Student Summer Research Internship (Lab Rats) - June 11-July 21, 2017
 - Field Experience - July 7-8, 2017
 - EHS Summer Institute for K-12 Educators - July 23-27, 2017
 - Regional workshop - July 28, 2107

IMPACTS: Here are few evaluation results from our project activities in the past year:

- 2017 Field Experience: The responses to the evaluations completed by the students revealed the following: 78% of the students (18 out of 23 students) indicated that they were more interested in a STEM career as a result of the program. Selected responses when asked about the most important thing they learned from the experience include: "Besides learning new information about the medical career, I learned a lot about other careers and know to follow what I truly want and love." "To find and pursue my passion as a career, yet not be afraid to fail and learn from the failure." "I learned that there's much more careers I can explore than pure medical jobs set in hospitals, clinics and pharmacies." "I was able to further my understanding of Public Health, I also learned that through perseverance, anything is possible."
- 2017 Summer Research Internship (Lab Rats): Selected responses when asked how the program has influenced their career goals: "Having research experience made me realize my potential in the field of bioengineering, as opposed to simply biology." "I realized the importance of taking a statistical approach towards results in an experiment." "I learned a lot in this program and would be very helpful in my future career." "I came into this program not knowing what biomedical engineering really was, and I learned that I want more of a mechanical engineering background. I learned about the EnMed Program, and I think that I would like to go forth with that idea in mind for my education." "It gave me a clear path of what I want to do with my future career."
- 2017 Summer Institute: 188 Texas teachers from 72 ISDs attended the conference. It featured 28 unique workshops with 38 expert trainers from all over the nation. 79% of teachers that responded to the evaluation indicated that the overall quality of the training experience was good, excellent or outstanding.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: The biggest challenge we faced during the last year was the unenthusiastic response to the SEF program. We planned to host 6 STEM teachers (3 from each school) for a 3-week residential curriculum development fellowship in College Station, Texas. However, we only received two applications, and neither application had a science background (certifications in English and Mathematics). We decided that it would

be difficult to develop an integrated, science curriculum with only Mathematics and English teachers, so we ultimately decided not to conduct the SEF this summer. Meetings with selected teachers at the schools indicated that one reason for the low response was due to the design of the program that requires teachers with families to be away from their homes for 3 weeks. To address this and other possible causes, some of our discussions during the regional workshop focused on strategies to address the low response to the SEF opportunity. We discussed this and other aspects of the program, and got inputs and ideas about programmatic challenges and solutions. The participants (teachers from our partner schools) proposed improvements to the current SEF structure in order to increase participation, and their suggestions have been incorporated and will be implemented in the current year.

RESOURCES AND PRODUCTS: www.k12summerinstitute.org ; www.mentorsproject.org

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University of North Carolina at Chapel Hill

PROJECT TITLE: The Impact of Climate Change on Health: Engaging Youth and Health Professionals

PROJECT DESCRIPTION: The Community Outreach and Engagement Core (COEC) at the UNC-Chapel Hill Center for Environmental Health and Susceptibility (UNC-CEHS)-together with COECs from the NIEHS Center for Environmental Health in Northern Manhattan at Columbia University (CU) and the Harvard T.H. Chan School of Public Health-NIEHS Center for Environmental Health (Harvard)-partnered to develop and implement informal educational programming to 1) increase high school students' knowledge of climate change and potential health impacts and build their capacity to participate in the development of locally relevant solutions and 2) create networking opportunities among youth and public health professionals to enhance understanding of how locally relevant solutions may be applicable more widely and to increase students' knowledge of public health careers. Cultivating climate literacy among youth positions them to develop solutions and advocate for actions that prepare communities to adapt to climate change, mitigate emissions and ultimately protect human health and well-being, with an eye towards protecting the most vulnerable populations.

COMMUNITY/PARTNER PARTICIPATION: This project represents an innovative partnership among the three NIEHS-funded Environmental Health Sciences Core Centers named above (with leadership from the COECs at UNC, CU and Harvard) and their community collaborators: the Alliance for Climate Education (ACE) in central North Carolina, Boston Children's Hospital Pediatric Environmental Health Center in Boston, and WE ACT for Environmental Justice (WE ACT) in New York City. Each of these community partners has an established relationship with the Core Center in its local area; and through these longstanding partnerships, the participating programs have implemented a variety of informal science education programs, including science enrichment programming with middle and high school students.

BACKGROUND: Resilient communities require an informed and engaged citizenry, an innovative workforce, and prepared public health professionals. In the context of climate change, resilience depends equally upon an understanding of climate science and the ways climate influences human health combined with an ability to integrate

and apply that knowledge, both at individual and societal levels. Climate adaptation strategies are a critical component of resilient communities and represent an opportunity to engage today's and tomorrow's public health professionals in the development and implementation of solutions to protect human health. This collaborative partnership enabled the participating Core Centers to come together to develop and implement a model for engaging youth in the identification of locally relevant solutions to the health impacts of climate change. Additionally, the partnership broadly engaged health professionals in dialogue about potential impacts they may see among patient populations and connected these professionals to the participating youth. The project responds to several NIEHS strategic themes-including translational science, health disparities and global environmental health, training and education, and communications and engagement-and goals (#5: identify and respond to emerging EH threats and #8: enhance teaching and training of EHS at all levels to increase scientific literacy and generate awareness of the health consequences of environmental exposure).

OUTCOMES: Major outcome: the development and implementation of parallel long-duration extracurricular youth science enrichment programs, in North Carolina (NC) and New York. Joint activities were conducted virtually and in person to connect students with each other and with leading public health professionals and others working to promote community resilience and climate justice. In total, 40 high school students, 20 from central NC and 20 from West Harlem in New York City, were enrolled in each program.

- In spring 2017, the Harvard COEC and its community partner, Boston Children's Hospital Pediatric Environmental Health Center, facilitated two webinars for the students that featured public health professionals. These webinars were titled:
 - 1) Disaster Preparedness & Resiliency in Health Care
 - 2) Climate Change and Human Health: A Clinician's Perspective.
- In July 2017, 25 students came together for a 3-day summer institute in NC, Climate Change & Community Resilience, in which they interacted with public health professionals, scientists and others to learn about climate impacts to public health and its infrastructure, vulnerable populations and planning for resilient communities.

IMPACTS: Each COEC collected a variety of quantitative and qualitative data to assess program impacts. Although evaluation data is still being summarized, preliminary data from the July 2017 summer institute revealed the following impacts of the youth program (n=25):

- 100% of students either agreed (40%) or strongly agreed (60%) that the summer institute increased their understanding of how climate change will impact their communities.
- 96% of students either agreed (36%) or strongly agreed (60%) that the summer institute increased their understanding of the human health impacts of climate change.
- 100% of students either agreed (12%) or strongly agreed (88%) that the summer institute increased their understanding of how climate change will impact some groups of people more than others.
- 96% of students either agreed (44%) or strongly agreed (52%) that the summer institute increased their awareness of actions they can take to promote community resilience.

- 80% or more of the program participants reported that they gained the following skills as a result of participating in the summer institute: Identifying assets & vulnerabilities in my community (84%); Analyzing climate impacts at a community level (80%); Identifying & evaluating adaptation strategies (80%)

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Facilitating effective collaboration among individuals spread across three states requires active and thoughtful communication. Monthly calls with participating COEC staff have been essential to the success of the program. Leaders of the youth programs met even more often to develop engaging program content tailored to a teenage audience and designed to provide science, technology, engineering and math (STEM) learning opportunities along with access to scientists and public health professionals. A challenge with developing any informal youth science enrichment program is sustaining student enthusiasm while providing numerous and robust science learning opportunities. We utilized several strategies to keep students engaged during talks and lab tours by scientists and public health professionals: asking invited speakers to tailor their remarks to teenagers, utilizing a science cafe model for talks, involving graduate students and asking speakers to tell students about their educational background and career path. These strategies were met with success as many of the students who attended the summer institute reported that meeting scientists and touring research labs were favorite activities. Another challenge associated with conducting informal science programming is developing an evaluation plan that includes creative learning assessments for measuring progress towards achieving program goals; program staff worked together to identify opportunities to assess student learning gains through a variety of informal measures. This collaboration between COECs and their community partners enabled us to offer an engaging and highly interdisciplinary program that effectively combined STEM learning opportunities with social justice education to prepare students to address climate change impacts in their communities. While this collaborative effort is winding down, the relationships built as a result of this work will be sustained and will facilitate future collaboration.

RESOURCES AND PRODUCTS: The following deliverables will result from the youth programming component of this project:

- 1) Agenda and associated educational materials for a three-day climate change and health-focused youth science enrichment program;
- 2) Agendas and educational materials for shorter duration events that were conducted in NC and NYC;
- 3) Examples of the student action projects that resulted from the program;
- 4) Evaluation data that identify successful program elements. Additionally, the project team will present on this project at the 2017 APHA annual meeting in Atlanta, GA, the 2017 National Science Teachers Association regional conference in Baltimore, MD and (pending acceptance) the Fall 2017 Meeting of the American Geophysical Union in New Orleans, LA.

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University of Cincinnati

PROJECT TITLE: University of Cincinnati Community Engagement Core STEM Education Water Quality Tool Kits

COMMUNITY/PARTNER PARTICIPATION: The University of Cincinnati (UC) Community Engagement Core (CEC) within the National Institute of Environmental Health Sciences (NIEHS) funded Center for Environmental Genetics (CEG) developed a citizen science tool for assessing water quality for use by middle school and high school students. The UC CEC partnered with students from the UC College of Engineering, Master of Public Health (MPH) program, and Epidemiology PhD program to develop Water Quality Tool Kits, and then collaborated with teachers from Meadowbrook Middle School and Meadowbrook High School in eastern Ohio to pilot the kits.

BACKGROUND: As the Water Quality Tool Kits were developed, the CEC designed a student manual and teacher resource guide to accompany the kits. Once students use the devices provided in the Water Quality Tool Kits to collect and test water samples, they input their data on Google Fusion, an online platform developed for data sharing. Students then have the ability to view and analyze the water data from their peers at neighboring schools. The Water Quality Tool Kit project aligns with Ohio's state learning standards, so teachers are able to easily incorporate the activity into preexisting lesson plans.

IMPACTS: Since piloting the project, more than 100 Water Quality Tool Kits have been distributed. Through the CEC's strong connections in rural Ohio, they have been able to incorporate the tool kit project into 30 classrooms throughout schools in Guernsey, Noble, and Belmont counties, reaching more than 2,220 students.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: As more schools are involved in the Water Quality Tool Kit project, the number of users will reach beyond the capabilities of the online data platform, Google Fusion, and the CEC will look to develop an online data cloud specifically for the tool kit project.

RESOURCES AND PRODUCTS: Each Water Quality Tool Kit includes devices for measuring pH, temperature, and conductivity, water collection cups, water bottles, a manual and data collection sheet for students and a resource guide for teachers.

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Meadowlark Science and Education, LLC

PROJECT TITLE: Water Follies: STEM Edition

PROJECT DESCRIPTION: Improving STEM-focused curriculum is crucial for ensuring that upcoming generations receive the training and skills necessary to compete in the existing global economy. Our project's goal is the development of a highly effective, marketable, and interactive educational video game (iEVG) that focuses on STEM topics and targets middle school students-the age at which interest in STEM subjects is developed or lost.

COMMUNITY/PARTNER PARTICIPATION: Our community and partners in iEVG development includes Meadowlark Science and Education, LLC® (MSE) and the University of Montana (UM) media team working with students and teachers. An important part of our combined effort is developing focus groups of students and teachers who assist the curriculum and script development phases. Furthermore, we recruit additional teachers and students during the evaluation phase of iEVGs development. Our goal is to continuously expand diversity in our partner engagement.

BACKGROUND: Initial work began with transforming a middle school environmental health board game, developed by UM investigators, into a digital game format. After conducting side-by-side evaluation, it was evident that students preferred the digital game format in part because it was computer-based. This led to the creation of MSE with the vision of creating iEVGs with 3D characters that incorporated all aspects of STEM to simulate the challenges scientists face in the real world to solve environmental health problems. We have successfully developed two iEVGs based on air quality issues under The Mice of Riddle Place®.

OUTCOMES: Evaluation results from the two iEVGs show significant positive outcomes in content knowledge. In addition to its measurable academic success, students, teachers and parents showed a great deal of enthusiasm and were highly positive towards The Mice of Riddle Place®; iEVGs. From this success, our long-term goal is to continue to produce an expanding library of educational iEVGs with immersive graphics and audio, challenging gameplay, and a well-rounded delivery of STEM-focused educational content related to environmental health. Accomplishing this goal will provide teachers with an innovative classroom tool that is engaging to the students, while improving interest in STEM subjects, increasing STEM knowledge and improving problem-solving skills.

IMPACTS: The desired impacts of this project include: increasing student interest and proficiency in STEM and environmental health topics, improving student critical thinking and problem-solving skills, and providing teachers with a variety of innovative educational materials for their classrooms. Our overarching goal is the eventual widespread adoption of iEVGs and corresponding lesson plans in STEM classroom environments nationwide.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES: Currently, there is a paucity of high quality and critically-evaluated interactive educational materials, particularly addressing the overlap between STEM and environmental health sciences. Many of the available video games have fallen short of expected outcomes, either due to a general disinterest on the part of the children from boring games or a failure to achieve the necessary learning objectives. In addition, since 2001 the majority of technology-based learning games have focused on elementary, high school, and higher education leaving middle school teachers without adequate support. Therefore, the iEVGs we are developing will provide middle school teachers with an innovative solution to enhance classroom education in STEM that also addresses national standards for education. Our approach in developing iEVGs is based on a combination of sound science and critical evaluation methods that ensures scientific rigor. In addition, our iEVGs increase scientific knowledge and demonstrate the application of technology, engineering, and math in order to problem solve. Our initial success with

iEVGs have been highly encouraging by demonstrating game effectiveness as a learning tool. Classroom teachers have noted near 100% engagement by their students during game evaluations and expressed their desire to obtain these games for their classrooms. Overall, these results suggest that our iEVGs accomplished the intended goals. Therefore, in our new efforts we will continuously strive to improve our iEVGs by increasing game complexity and expanding topic areas that are expected to result in even more positive outcomes and greater variety for teachers to select materials for their classrooms.

RESOURCES AND PRODUCTS: More detailed evaluation results, lesson plans, and games are available on our website (www.meadowlarkscience.com). Our games are also available on the Apple App Store.

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Tribal Communities

University of New Mexico Health Sciences Center

PROJECT TITLE: UNM Native Environmental Health Equity Research Center

PROJECT DESCRIPTION: The UNM Native Environmental Health Equity Center (Native EH Equity) is a partnership of tribal communities and academic institutions located in the western United States where nearly half of the US Native American population lives and an estimated 161,000 abandoned hard rock mines are located. The goal of Native EH Equity is to develop comparable data sources across native communities to expand our understanding of mixed-metal toxicity and our confidence in the characteristics of the exposures, and the populations, that influence the generalizability of the results

COMMUNITY/PARTNER PARTICIPATION: Tribal/Tribal-based Partners: Navajo Nation, Cheyenne River Sioux Tribe (CRST), Crow Environmental Health Steering Committee, Missouri Breaks (on CRST) Academic Partners: University of New Mexico, Montana State University, University of Washington Non-Profit Partner: Southwest Research and Information Center (SRIC)

BACKGROUND: The Native EH Equity Center extends work in progress within each of these communities over the last two decades to fill gaps in existing knowledge for each tribe. Through these strong partnerships, the Center is examining and comparing mechanisms of toxicity in mining waste metal mixtures of different composition across three tribal populations. The distribution of contaminants, cultural practices, and genetic origins of the three core tribes involved provide a basis for the first steps in sorting out the health effects of metal mixtures in tribal communities. Our partnership creates the opportunity for comparison across these groups to expand our understanding of mixed-metal toxicity and our confidence in the characteristics of the exposures, and the populations, that influence the generalizability of the results. The Center also strives to build the research capacity, the understanding of data, and interpretation and use of biomedical results across these communities, as well as provide a framework that characterizes the unique exposure pathways and defines health from a perspective not only reflective of tribal perceptions, but ultimately useful in informing regulatory decision-making.

OUTCOMES:

- Tribal student/trainee pipeline into environmental health research. Trainees actively participate in each of Center research and community-engagement activities, contribute to and lead trainings and workshops.
- Collaborations with tribal partners to develop multi-pathway exposure models representative lifeways and customs bringing tribal communities into contact with mining-related contaminants.
- A native student-led summer project with Dr. Gonzales and a tribal partner led to a poster of a representative exposure scenario for a traditional ceremony. The poster was tribe-approved for sensitivity to cultural appropriateness and respect.
- Regional Center meetings have led to impacts and products, including: an “Artist-in-Residence” program (initiated to improve science communication through more visual arts and integrate tribal symbology into the translation of scientific concepts), expansion to additional regional tribes, inclusion of historical trauma a social determinant of tribal environmental health equity.
- New collaboration with USEPA and regional tribal colleges and universities on a local livestock contamination as an ingestion pathway for metals (Cove Livestock Study).
- Policy Development Workshop on Tribal Data Sharing and Genetics - August 31-Sept 1, 2017 Albuquerque, NM.

IMPACTS:

- Transition of Career Development Interns have to faculty and advocacy positions in environmental health disparities and exposure.
- Native doctoral students (2) pursuing research projects in direct collaboration with the Center’s tribal partners.
- Transition of undergraduate students to
 - 1) NIH Diversity Supplement support for environmental health master’s thesis with his tribe (Crow)
 - 2) from tribal junior college to completion of an environmental sciences degree. Three undergraduate students worked on environmental sampling and exposure assessment with the Cheyenne River Sioux Tribe during summer 2017.
- Integration of cross-tribal perspectives on health into oral and visual translations of Center research. Close collaboration with tribal communities on culturally-sensitive of translation of methods, outcomes and impacts continues to be hallmark of our community-engaged processes.
- Interactive engagement across Center partners has expanded the dialogue to address the unique and distinct aspects of metals contamination, exposure pathways and underlying social determinants influencing native environmental health equity.
- USEPA regional offices to parameterize unique tribal exposure pathways developed by our Center into risk assessments.
- Translation of Center initiatives to two regional USEPA offices and tribes through the Regional Tribal Operations Committees.
- The design of survey and sampling projects benefit from the local knowledge and concerns of the impacted communities.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES:

- Tribe-tribe cross training expands local capacity and community-engagement among our tribal partners as well as opportunities for Center trainees and partners.
- Community engagement with a range of tribal community stakeholders (e.g. elders, young people, decision makers, government representatives) is necessary to understand the range of environmental and social determinants influencing environmental health. For example, since traditional communities rely on visual symbolic, to be effective, community engaged research must incorporate these aspects in order to meaningful.
- Our work will expand to 1) engage additional native partners address historical trauma as a social determinant of environmental health disparities, and 2) exposures across pathways to provide framework for integrated exposure assessment, which can be applicable across tribes.
- Our Center is the lead on a joint manuscript with the other five NIH/EPA Centers of Excellence in Environmental Health Disparities Research demonstrating the relevance of the Centers' socio- and demographic indicators to the overall population of the United States.

RESOURCES AND PRODUCTS:

- REDTalks video featuring our Center was presented at the 2nd Tribal Environmental Health Conference (2016), and also selected for inclusion in the NIEHS PEPH Film Fest (2016). REDTalks is a web-based platform to increased awareness and novel strategies to address issues facing Native American Tribes.
- Paintings using traditional symbols depicting the Center's biological research into the effect of metals exposure on DNA damage and repair, and autoimmunity are in the final stages of input from our partner communities.
- Other Relevant Web Sites: <http://pharmacy.unm.edu/research/healthy-voices/equity-map.html> ; <http://src.org/uranium/rirf.php> ; <http://nehr.skc.edu/tehs-2016/>)

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Oregon State University

PROJECT TITLE: Chemical Spills Disasters and Outreach and Translation with Native American Communities

PROJECT DESCRIPTION: In June 2016 at Mosier, Oregon, a train carrying Bakken crude oil derailed adjacent to the Columbia River, spilling some of its cargo onto the ground and accidentally igniting some of the crude oil. Shortly thereafter, sheens of oil were observed on the surface of Columbia River and, later in the summer, oil was measured in a ground water monitoring well close to the area. Concern from Mosier residents and their neighboring communities about their water and air quality from the train derailment highlighted the lack of an easy-to-use sampling technology, one able to assess how episodic environmental exposures impact human and environmental health and how chemicals distribute through the environment. In addition, tribal fishermen were concerned about the impact of oil on traditional fishing grounds. Additionally, the translation and community outreach interest indicated a need to create PAH-related environmental health education that applies to fuel spills including those associated with rail transport. The evaluation of disaster plan(s) associated with fuel spills by rail will be used as an example for how we might develop lessons learned during community engagement. Furthermore, the factors involved in time-sensitive research with Native American Communities will be discussed.

COMMUNITY/PARTNER PARTICIPATION: Mosier, OR community Confederated Tribes of the Umatilla Indian Reservation Columbia River Inter-Tribal Fish Commission Northwest Portland Area Indian Health Board

BACKGROUND: PAH contamination from oil spills is of global concern. PAHs in crude oil vary by type but typically range from 0.2 to 7%. In 2015 over 125,000 million barrels of crude oil were transported by US rail, a 20-fold increase over the last decade. Oil spills from railway have increased nearly four-fold from 2010 to 2014, and the overall cost of railway oil spills was over \$30,000,000 USD in 2015. The increase in rail transit of Bakken oil has generated a need for accurate information that addresses rail-adjacent communities' concerns about the health risk posed by rail transit of oil and empower communities to reduce these risks. Oil spills are often located at industrial/urban interfaces and locals often use the surrounding areas as access points for fishing and boating. The site where the oil seeped into the Columbia River is an area of intense recreation (wind surfing and kite boarding) and is a fishing area for locals and the Confederated Tribes of Umatilla Indian Reservation (CTUIR) and other nearby indigenous communities. Due to these activities, human health risk assessments for these sites routinely consider several routes of exposure, including inhalation, and consumption of organisms in exposure pathways. An example from the 2016 Mosier train adjacent to the Columbia River will be used to illustrate the need for a pre-existing disaster research framework and process, to include institutional review board considerations, data sharing agreements and partnerships with Native American organizations/communities. Disasters require engagement of multiple stakeholders (for example: Mosier community, Disaster Managers, CTUIR, and early responders), and to translate data for community stakeholders so that they are informed of the human health risks from environmental and occupational exposure to Bakken oil, and help stakeholders identify opportunities to protect human health from oil spills.

OUTCOMES: Research staff were on site within days of the spill, and were able to collect multiple environmental samples (sediment, water) using passive sampling devices. Paired samples were collected again several weeks following the oil spill. Infographics were created to describe what PAHs are, and used oil spills as an example of finding PAHs in the

environment. Another infographic was created to describe what the passive wristband sampler can and cannot detect. Oregon State University developed an 'umbrella' IRB for the passive wristband samplers, enabling fast recruitment and enrollment of individuals immediately following a disaster. A second IRB, enabling acquisition of survey data (demographics, exposure logs, etc.) is also in development. These IRBs are designed to be used independently or concurrently, dependent upon the needs of the project.

IMPACTS: Interest within our community partners, the Confederated Tribes of the Umatilla Indian Reservation was high, and extended beyond CTUIR to the 43 tribes represented by the Northwest Portland Area Indian Health Board (NWPAIHB). Given the potential interest and scale, staff were unable to address the myriad data sharing, IRB and other issues that would need to be carefully addressed in order to appropriately conduct sampling. Oregon State University SRP had several impactful meetings with the Northwest Portland Area Indian Health Board regarding larger scale projects that would be capable of working with all 43 represented tribes that have interest in disaster preparedness. The Oregon State University Institutional Review Board has developed a 'rapid response' IRB team that has committed to a 48-hour turnaround for revisions to existing, approved disaster IRBs.

LESSONS LEARNED/CHALLENGES/FUTURE OPPORTUNITIES:

- Work pre-emptively with your Institutional Review Board to develop 'umbrella' disaster IRBs- Establish a relationship with your local Indian Health Board and other Native American organizations related to the potential disaster concern (i.e. Inter-tribal Fishing Commission, health organizations, etc.).
- All data collection must occur under a data sharing agreement with EACH indigenous community. Alternatively, data must be run through a secondary, established organization that already has such agreements in place. These relationships must exist prior to disasters.
- Where possible, safe, and of interest in the community, incorporate elements of citizen science into the data collection design (i.e. wristbands on fishermen in potentially contaminated water).
- Discuss the data collection design carefully. Include the tribal legal team to ensure collection does not occur on lands currently under dispute and/or is protected by the tribe as a cultural site. If placing water samples, work with the tribal fisheries department to choose sampling sites.
- When working with indigenous communities, there are multiple factors that must be carefully considered in addition to the factors considered in other communities (data sharing, university IRB, tribal IRB, land use, cultural practices, etc.).

RESOURCES AND PRODUCTS: <http://superfund.oregonstate.edu/image-album/infographics>

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Engaging Diverse Partners: Strategies to Address Environmental Public Health

A joint NIEHS meeting of the Partnerships for Environmental Public Health (PEPH) network
and Disaster Research Response (DR2) program

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