National Institute of Environmental Health Sciences

ADVANCING ENVIRONMENTAL JUSTICE

Contributions of the National Institute of Environmental Health Sciences Division of Extramural Research and Training to Environmental Justice: 1998–2012

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DEDICATION

We would like to dedicate this report to Steve Wing, Ph.D., for his tireless work to promote environmental justice. He has nurtured relationships with communities in North Carolina to address their environmental health concerns and has inspired young students and professional colleagues to pursue careers dedicated to the advancement of environmental justice.

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ACKNOWLEDGEMENTS

Compiling and writing the "Advancing Environmental Justice" report has been a truly collaborative process. For more than three years, we have worked with NIEHS program staff, contractors, and grantees to develop, review, and revise this report. In particular, both academic and community-based grantees provided critical input. They have spoken with us, shared their experiences as well as outcomes from their projects, and edited summaries of their work. Thanks again to all who have contributed their time and talents.

This report represents the beginning of a living document to capture the work of grantees who are trying to understand and address the disproportionate exposures and health outcomes that communities are facing across the United States. We envision that this report will serve as a foundation to build upon and that will allow us to share future accomplishments of environmental justice and environmental health disparities projects.

INTRODUCTION

This report is the first to highlight the contributions to Environmental Justice (EJ) by the National Institute of Environmental Health Sciences (NIEHS) Division of Extramural Research and Training (DERT). Since DERT first announced targeted funding opportunities to address EJ in 1994, it has helped to address the challenges and complexities of EJ through initiatives concerned with research, education and training, community engagement, and informing policy.

This overview of DERT's investments in EJ initiatives provides a brief history of the EJ movement and the role of DERT, the approach for assessing DERT contributions to EJ, and an analysis of those contributions. The goal is to present a broad view across DERT's entire grant portfolio. The report concludes with recommendations on how DERT can continue to advance its commitment to EJ.

Brief History of Environmental Justice

EJ is defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[1] In the early 1980s, certain community leaders noted with growing alarm that some residents in low-income and minority communities suffered adverse health effects from pollution to a greater extent than the general population. On the heels of the civil rights movement and growth of the environmental movement, advocates began speaking out against the disproportionate environmental burdens faced by these marginalized communities. Their actions led to the birth of the EJ movement.[2]

The concept of EJ attained national attention in 1982 when the National Association for the Advancement of Colored People and residents in Warren County, North Carolina publicly demonstrated against the dumping of soil contaminated with polychlorinated biphenyls (PCBs) in a landfill near a low-income, predominantly minority community. Following that event, the U.S. General Accounting Office (GAO, now known as the U.S. Government Accountability Office) and the United Church of Christ conducted investigations on environmental inequity to determine whether and to what extent certain communities faced disproportionate environmental burdens.

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1 EPA (U.S. Environmental Protection Agency). 2009. Environmental Justice Homepage. Available: http://www.epa.gov/environmentaljustice/ [accessed 25 September 2012].

2 Bullard RD, Johnson GS, Torres AO. 2011. Environmental Health and Racial Equity in the United States: Building Environmentally Just, Sustainable, and Livable Communities. Washington, DC: American Public Health Association.

Their reports, issued in 1983[3] and 1987[4] respectively, documented that commercial hazardous waste facilities were more frequently located in communities with a preponderance of racial and ethnic minorities.

In response, community leaders and the federal government began to address environmental inequity through research, community empowerment, and policy change. As the government body most closely involved in enforcing pollution laws and mitigating environmental risk, the U.S. Environmental Protection Agency (EPA) was tasked to lead and coordinate EJ activities within the federal government. EPA created an Environmental Equity Workgroup in 1990, which led to the establishment of its Office of Environmental Justice (originally called the Office of Environmental Equity) in 1992. In 1993, the agency created the National Environmental Justice Advisory Council with representatives from academia, community groups, industry/business, nongovernmental environmental organizations, state/local governments, and tribal governments/ indigenous groups to provide independent advice, leadership, and strategic planning to ensure that EJ is incorporated into EPA operations. In 1994, NIEHS, the National Institutes of Health (NIH) Office of Minority Health Research, EPA, U.S. Department of Energy (DOE), and the National Institute for Occupational Safety and Health, Agency for Toxic Substances and Disease Registry, and

Key EJ Milestones

1982	Protest of Warren County, North Carolina, landfill brings national attention to EJ
1983, 1987	GAO and United Church of Christ document environmental inequities
1992	EPA establishes Office of Environmental Justice
1993	EPA creates National Environmental Justice Advisory Council
1994	NIEHS and other federal bodies host Symposium on Health Research and Needs to Ensure Environmental Justice (leads to creation of the Environmental Justice: Partnerships for Communication program and the Minority Worker Training Program)
1994	President Clinton issues Executive Order 12898
1994	NIEHS issues Request for Applications for minority worker training and education programs
1994	NIEHS issues Request for Applications for Hazardous Materials Worker Health and Safety Training program.
1995	Launch of Interagency Working Group on Environmental Justice
1995	HHS issues initial Environmental Justice Strategy
2008	NIEHS establishes the Partnerships for Environmental Public Health program
2010	President Obama hosts first White House Forum on Environmental Justice
2011	Memorandum of Understanding on Environmental Justice and Executive Order 12898
2012	HHS releases "2012 HHS Environmental Justice Strategy and Implementation Plan"
2012	HHS Environmental Justice Stakeholders Implementation Meeting

3 GAO (U.S. General Accounting Office). 1983. Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities. Washington, DC: U.S. General Accounting Office.

4 United Church of Christ Commission for Racial Justice. 1987. Toxic Wastes and Race in the United States: A National Study on the Racial and Socio-Economic Characteristics of Communities Surrounding Hazardous Waste Sites. New York: United Church of Christ.

National Center for Environmental Health—which are three agencies within the U.S. Centers for Disease Control and Prevention—organized the *Symposium on Health Research and Needs to Ensure Environmental Justice*. It was the first meeting to bring federal agencies, researchers, health care professionals, and community residents together to discuss EJ issues and outline a path forward.

A federal commitment to EJ was codified in 1994, when President Clinton issued Executive Order 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.*" The executive order required all federal agencies to incorporate EJ into their missions and develop strategies to ensure that their activities related to human health and the environment are carried out equitably. It also called for the creation of the *Interagency Working Group on Environmental Justice (EJ IWG)* to provide guidance and facilitate coordination among agencies. Initiated and still coordinated by the EPA, the EJ IWG today comprises 17 federal agencies and several White House offices. It is the hub of EJ activities in the federal government. The EJ IWG holds monthly meetings, organizes regional listening sessions, and helps agencies update and maintain their EJ strategies. In addition, the U.S. Department of Health and Human Services (HHS) and other federal agencies coordinate and carry out their own agency-specific EJ strategies. NIEHS actively participates in the HHS Environmental Justice Working Group.

President Obama acted to ensure EJ remains a priority for all federal agencies.[5] The first White House Forum on Environmental Justice was held Dec. 15, 2010, which was attended by five Cabinet secretaries and more than 100 EJ leaders. Panels at the forum focused on incorporating EJ into environmental policies and enforcement, investments in the clean energy economy and green job opportunities, planning related to climate change, and efforts to address environmental and health disparities.[6]

5 The White House. 2009. Our Environment. Available: http://www.whitehouse.gov/energy/our-environment [accessed 17 January 2013].

6 The White House Council on Environmental Quality. 2010. Obama administration convenes environmental leaders at historic White House Environmental Justice Forum. Press Release: 15 December. Available: http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/December_15_2010 [accessed 17 January 2013].

ENVIRONMENTAL JUSTICE ACTIVITIES AT NIEHS

The environment is a central determinant of human health and well-being. The concept of EJ recognizes that all people have the right to live, work, learn, and play in a healthy environment. However, the reality is that people of color, low-income, and tribal populations in the United States have been, and continue to be, disproportionately exposed to environmental conditions that can adversely affect their health or exacerbate existing health disparities. NIEHS defines environmental health disparities (EHD), in the context of the Healthy People 2020 definition of health disparities, to emphasize that disparities "often occur as a result of the effects of multiple stressors (including environmental) over time, on vulnerable communities when such exposures amplify or increase existing health disparities." As such, EJ becomes the actionable component for addressing EHD by focusing on exposure inequities, adverse health outcomes, and prevention/mitigation services for vulnerable populations. EJ promotes fair treatment and meaningful involvement of traditionally underserved populations in decision-making processes that affect community environmental conditions.

Advancing EJ remains a vital part of the NIEHS mission as it seeks to address EHD. As described in its *2012–2017 Strategic Plan*, NIEHS is firmly committed to addressing disadvantaged, low-income, and minority communities through its research and community engagement programs. NIEHS supports projects that work closely with affected communities to develop research approaches and interventions to understand and reduce the potential adverse health effects of environmental exposures. In its intramural and extramural research programs, NIEHS strives to ensure that research examining the role of environmental factors in human health and disease is applicable to people across all racial, ethnic, and socioeconomic backgrounds.

Over the past two decades, NIEHS has supported numerous research programs, scientific conferences, and public health interventions aimed at reducing EHD and promoting EJ. Two grant programs that explicitly addressed EJ include the Environmental Justice: Partnerships for Communication program and the *Minority Worker Training Program* (MWTP). These programs developed from the 1994 Symposium on Health Research and Needs to Ensure Environmental Justice.

Integral to NIEHS EJ efforts, DERT plans, directs, and evaluates grant programs that support research and research training in environmental health. Building on the success of the MWTP, and the Environmental Justice: Partnerships for Communication program to bring together community partners with academic researchers, NIEHS implemented new grant programs with requirements to engage with community residents. The level of community engagement varied across programs—some called for outreach and education, while others required community-based participatory research (CBPR) approaches.

In 2008, NIEHS established the *Partnerships for Environmental Public Health (PEPH)* program to provide an overarching structure for its initiatives and to coordinate all projects related to environmental public health including EJ. Common themes throughout PEPH activities are increasing communities' capacity to address environmental health problems, raising awareness of the connection between environmental exposures and health, advancing community-engaged research (CEnR), and improving communication with affected community members. Through the PEPH and other programs, DERT brings together stakeholders at the federal, state, local, and community levels to address EJ concerns across the country through research, communication, capacity building, and evaluation.

PURPOSE

Through a description of DERT's EJ-related grant portfolio and select project profiles that detail outputs and outcomes, this report should increase awareness of the value of EJ-related projects at NIEHS. It is also intended to advance an understanding of the opportunities for future EJ and environmental health disparity projects that will meet the goals of the NIEHS 2012–2017 Strategic Plan.

St. Lawrence Island Yupik youth collecting stickleback fish samples in the Suqitugheneq River, Northeast Cape, St. Lawrence Island, Alaska

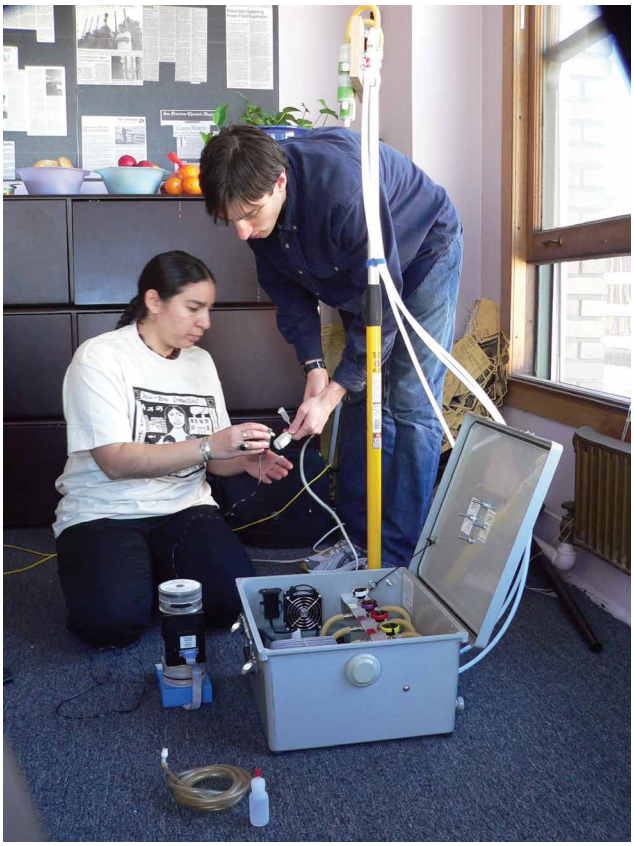
METHODOLOGY

The assessment of DERT's contributions to EJ involved a multistep, mixed-methods approach, as follows.

1. Defining DERT-supported initiatives that demonstrate a primary focus on addressing EJ concerns as one that meets the following criteria:
    - The project completion is after Jan. 1, 1998, a date marking the end of the first set of projects initially funded by NIEHS in 1994.
    - The initiative specifies a focus on addressing adverse health impacts among low-income, minority, and/or tribal populations resulting from disproportionate environmental (physical, and/or social) exposures.
    - The initiative promotes "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."
2. Developing 30 key EJ terms and searching NIEHS databases to identify potential EJ-focused projects. We searched the electronic Scientific Portfolio Assistant (eSPA) database using 30 key EJ terms (see Appendix B) and found 300 active and 1,100 inactive projects that referenced one or more of those terms.
3. Reviewing project abstracts and other information provided by eSPA. We reviewed project abstracts to identify projects with an EJ context.
4. Confirming EJ-focused classification with NIEHS program officials by asking the following:
    - Did the project include an EJ focus?
    - Was the project among the program official's most significant EJ-focused projects in terms of impacts and outcomes?

    Responses to the second question were subsequently used to identify 35 projects for a more in-depth analysis of outputs and outcomes.

5. Creating a matrix of all identified and confirmed EJ-focused projects, including characteristics of each project as follows:
    - Data collection
    - Education and training
    - Environmental hazards/stressors
    - Health research
    - HHS region
    - Interagency coordination
    - Populations served
    - Public partnership
    - Publications
    - Routes of exposure
    - Services
6. Obtaining more information about accomplishments (e.g., outputs and outcomes) in a select sample of EJ-focused projects. We successfully contacted 24 of the 35 grantees identified in step 4 and formed a convenience sample from which we obtained information in the categories listed above as well as health outcomes.
7. Analyzing the EJ matrix. We identified quantifiable characteristics in DERT's 155 EJ-focused grant projects – the DERT Environmental Justice Project Portfolio.
8. Conducting a qualitative analysis. We determined project outputs and outcomes for the 24 grantees sorted out in step 6.



Silent Spring Institute researchers trained Communities for a Better Environment staff to collect air samples to test for pollutants from sources ranging from a nearby refinery to everyday consumer products.

To summarize, a quantitative content analysis of the abstracts of 155 EJ grant projects identified characteristics, and a qualitative analysis determined and illustrated project outputs and outcomes in a select sample of 24 grants. The qualitative analysis took the assessment beyond a general quantitative description based solely on project abstracts.

LIMITATIONS

While the report identifies many positive outcomes resulting from DERT-supported projects, we acknowledge several limitations in the analysis.

1. Key words. It is possible that projects that are part of larger program grants were missed because the titles or abstract did not contain EJ-focus key words.

2. Time period. Many projects ended several years ago and current NIEHS staff did not necessarily have requisite historical knowledge to aid the analysis. It is possible that some projects were not included as a result.
3. Comprehensiveness of project abstracts. Some project abstracts offered detailed descriptions while others offered scant specific information.

Other DERT activities not included in this assessment may also offer less direct, but important, contributions to addressing EJ concerns. For that reason, we believe it is important to note that DERT's contributions to EJ are not limited to the projects identified in this assessment. For example, research on human health effects from specific environmental exposures, irrespective of the cohort's income or minority status, may develop knowledge applicable to addressing issues in EJ communities. While the outputs and outcomes of these kinds of initiatives can support EJ goals, they do not directly address an EJ concern and do not appear in this report.

CHARACTERISTICS OF THE ENVIRONMENTAL JUSTICE PROJECT PORTFOLIO

This section provides an overview of quantifiable characteristics of the 155 EJ-focused grant projects. We determined where the projects were located and segmented them according to HHS region, the types of populations served, routes of exposure, environmental hazards/stressors, and health outcomes addressed. We also investigated other aspects of the projects that are compatible with and contribute to EJ goals, such as use of public partnerships and/or CEnR methods. This section also reveals contributions made to EJ through publication, education and training, and policy development.

Funding Mechanisms

Between 1994 and 2012, DERT used 23 different grant mechanisms to provide funding to projects with a focus on addressing EJ concerns (see Appendix C). The majority of projects (98 of the 155 grants) were funded through R01 (discrete and specific research project), R25 (education, training, or technical assistance projects), and U45 (worker training and evaluation project) grant mechanisms, as follows:

- R25 – 46 grants
- R01 – 35 grants
- U45 – 17 grants

The remaining 57 grants were spread across 20 other types of funding mechanisms.

Geographic Spread

EJ-focused projects supported by DERT can be found in all 10 HHS regions, which for visual reference are displayed in the map below.

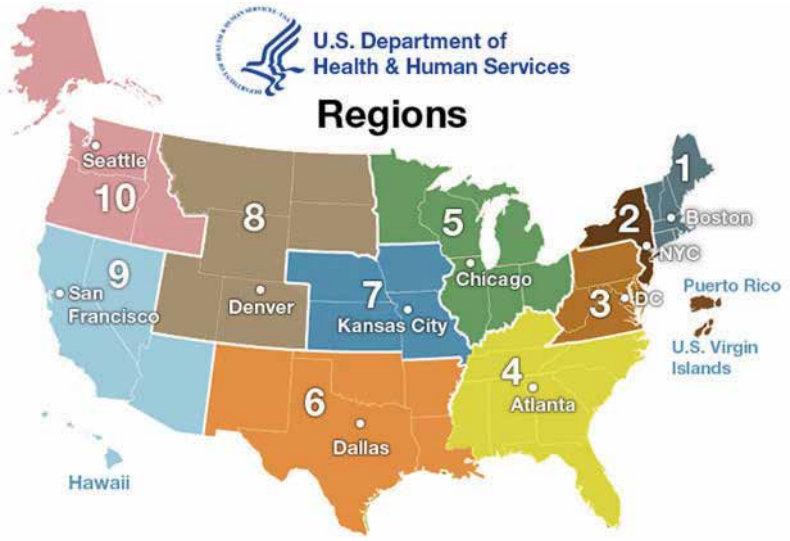
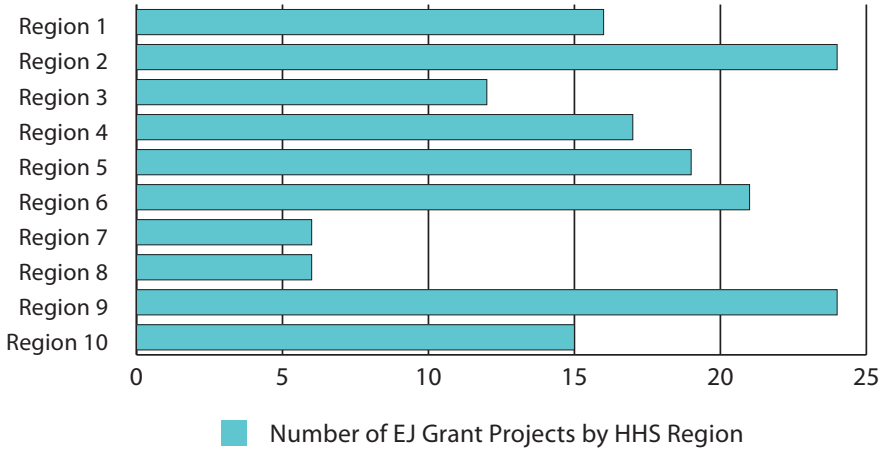


Figure 1: *Map of HHS Regions*

As shown in Figure 2, Regions 2 and 9 had the most EJ-focused projects supported by DERT. Conversely, Regions 7 and 8, which contain some vast rural states, have much fewer projects. A few projects span multiple regions. Other projects that are national, or even international, in scope or for which the specific localities could not be determined from the abstract were not included in the count.



(N=160 due to projects that were in multiple regions)

Figure 2: *DERT-Supported EJ Grant Projects by HHS Region*

The relationship between population density and habitat is important to environmental health for many complex reasons. Urban environments can present concentrated environmental health hazards but also opportunity for serving many people in a smaller geographic scale. Some rural areas offer distinct environmental health challenges. Developing a broad conceptualization of how EJ affects environmental health requires understanding the socioeconomic, infrastructure, and logistical issues related to particular settings.

We also looked at whether grant projects concerned urban or rural settings, as shown in Figure 3. Urban locations included cities such as Baltimore, Boston, Chicago, Detroit, Los Angeles, and New York City. Rural projects tended to concern farmworkers or Native Americans living on tribal lands. Some projects that did not specify a type of geographic area were national or regional in scope. Other unspecified projects concerned health disparities without regard for urban or rural setting, such as a project that examined carcinogens and socioeconomic factors in African-American women with breast cancer.

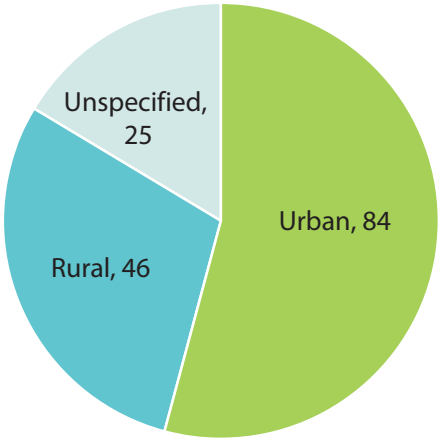


Figure 3: *DERT EJ Projects by Urban or Rural Location Setting (N=155)*

Populations Served

Grants addressing EJ concerns involved people with varied ethnicities, including:

- Hispanic and Latino (45 percent)
- African-American (38 percent)
- Tribal (14 percent)
- Asian and Pacific Islander (3 percent)
- Arab-Americans (less than 1 percent)

Many projects served more than one target population resulting in some overlap in the distribution listed above. Additionally the population served was not specifically identified in some grants.

Project Spotlight

The *Dine' Network for Environmental Health* project helped to identify and map contaminated water sources on Navajo tribal lands. A team from the University of New Mexico found that more than 30 percent of the Navajo people did not have access to regulated drinking water, and many residents obtained drinking water from wells with unsafe levels of contamination related to uranium mining. The efforts also helped inform public policy related to uranium mining on Navajo lands.

Routes of Exposure

Examining routes of exposure is integral to identifying and addressing EJ issues because they aid understanding of how certain environmental contaminants enter the body and can affect health. Understanding routes of exposure informs interventions aimed at addressing specific environmental health concerns. The 155 EJ-focused projects supported by DERT primarily concerned the three major recognized routes of exposure: inhalation, ingestion, and absorption/direct contact. Inhalation exposures received the most attention, about 40 percent of projects. Projects that identified direct contact or absorption exposure made up about 20 percent, and about 13 percent of projects examined ingestion exposures. Remaining projects were unspecified as to route of exposure.

Community Engaged Research

CEnR increases the role of community members in the research process and recognizes opportunities for multidirectional learning between academics and community stakeholders. The CEnR framework reflects the values of EJ by encouraging community stakeholder participation in decision-making regarding the research process, and by using community stakeholder expertise in determining effective mechanisms of outreach and intervention.

Project Spotlight

At the first Iron King v and Humboldt Smelter Superfund site community meeting in August 2008, community members expressed concern about whether it was safe to consume vegetables grown in their gardens. They were worried about arsenic and lead, and they looked to the University of Arizona for information. Households from Dewey-Humboldt, Arizona, participated in a co-created citizen-science program titled *Gardenroots: The Dewey-Humboldt, Arizona Garden Project*. In addition to formal publications from the scientific study, citizens now have almost 30 instructions developed for them on topics such as how to reduce arsenic through garden preparation, as well as a user-friendly *website and blog*.

CEnR is a valuable approach for addressing EJ issues, and is an integral part of DERT's EJ-focused projects. Community-engaged projects usually include coordinated or collaborative efforts between two or more organizations (e.g., universities, community groups, health care, political organizations, labor unions, or government agencies) to address EJ issues. This coordination creates opportunities to leverage knowledge, expertise, and other resources to advance shared goals.

CEnR reflects a spectrum from unidirectional education and outreach strategies to bidirectional communication to shared leadership. As Figure 4 illustrates, projects further along the continuum seek to ensure that community members have the means to provide input on research priorities and design and have the ability to be meaningfully involved throughout the research process. CBPR is one type of CEnR that maximizes the participation of community members in decisions related to research priorities and design. CBPR involves partnerships where academic and community partners have equitable control over project management.

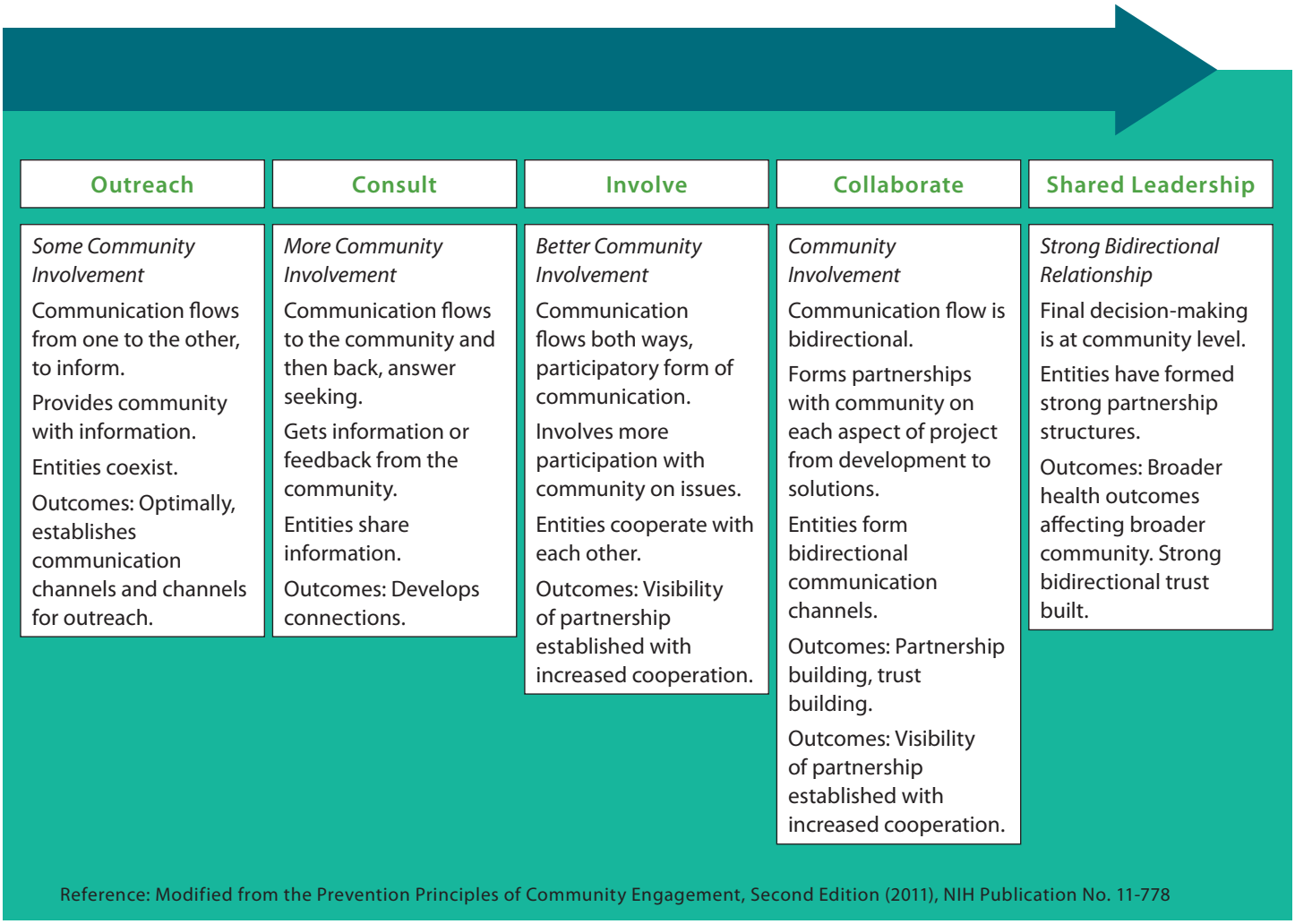


Figure 4: *Community Engagement Continuum*

Community engagement is measured and defined in different ways – the meaning may differ depending on what and who is being examined. Coordinated partnerships among public organizations can be crucial to achieving an engaged community, and we used public partnerships as a proxy for examining the presence of community engagement among DERT-funded EJ projects. Our analysis revealed more than 90 percent of the EJ-focused projects included a community engagement component, as shown in Figure 5. In some cases, the grant program required inclusion of community engagement efforts, while in other cases project leaders voluntarily incorporated it into their project design.

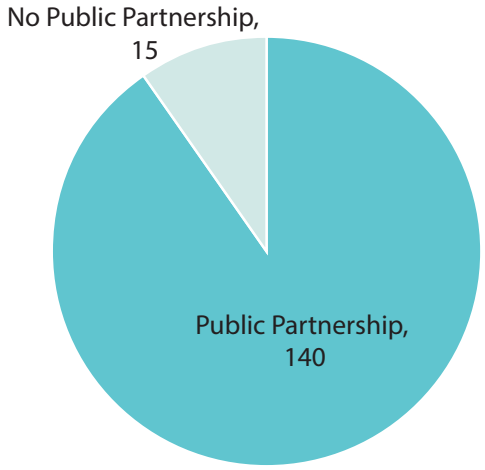


Figure 5: EJ-Focused Projects with Community Engagement (N=155)

PUBLICATIONS REVIEW

Ancillary to the review of the EJ project portfolio, we used the grant numbers of EJ-focused projects to generate a list of publications, yielding 2,146 peer-reviewed journal articles. DERT-funded research centers and community outreach cores produced most of these publications. As such, we believe that they have contributed significantly to the advancement of scientific knowledge about EJ issues.

Other formal publications generated by projects—such as the *Linking Breast Cancer Advocacy and Environmental Justice* project—also demonstrate research contributions made to EJ. These publications further expand the scientific knowledge base about environmental exposure, contamination, and remediation and provide source materials for training future scientists and environmental public health practitioners.

Many peer-reviewed articles also informed the development of plain language outreach materials and other gray literature geared toward lay audiences (e.g., the Gardenroots project). The 24 EJ-focused projects also revealed examples of how formal publications and plain language materials have effectively informed environmental health decisions and related policy.

SIGNIFICANT ENVIRONMENTAL JUSTICE-FOCUSED PROJECTS

Since the abstracts reviewed for the 155 EJ-focused projects offered little detail on health outcomes studied, approaches used, and accomplishments, we examined a convenience sample of 24 projects to add context and to identify project outputs and outcomes. Profiles for each project are in Appendix A.

Findings from the 24 EJ-focused projects supplement and support much of what was found in the broader analysis of 155 EJ-focused projects. For example, the 24 projects span urban, rural, and tribal areas in several HHS regions, and they illustrate the scope of the EJ-focused projects with respect to a wide range of environmental hazards and/or stressors affecting both natural and built environments.

Environmental Hazards, Stressors, and Health Outcomes

The 24 projects addressed a range of environmental hazards and/or stressors in natural and built environments, with the most common being inorganic substances (e.g., lead, arsenic, mercury); hydrocarbons (e.g., particulate matter, polycyclic aromatic hydrocarbons); pesticides (e.g., organophosphates, pyrethroids); various dioxins (e.g., 2,3,7,8-Tetrachlorodibenzo); and PCBs.

We found projects that addressed health outcomes related to all major systems of the human body. Some of the more common health outcomes addressed included asthma, bone cancer, brain development, diabetes, kidney disease, obesity, physical development, occupational injuries, and sexual development.

Education and Training

All 24 projects noted public outreach and education activities as a major component of their efforts, which is an essential element to achieving EJ goals. Public outreach and formal trainings for workers such as those facilitated through the Worker Training Program (WTP) help raise awareness about environmental health hazards and build the capacity of individuals and communities to address EJ concerns.

Donald Dickerson participating in Hazaradous Waste Operations and Emergency Response (HAZWOPER) hands-on exercise

The WTP includes five program areas to fulfill its mission: the Hazardous Waste Worker Training Program, DOE Nuclear Weapons Cleanup Training Program, HAZMAT Disaster Preparedness Training Program, the MWTP, and the Advanced Training Technology Program.

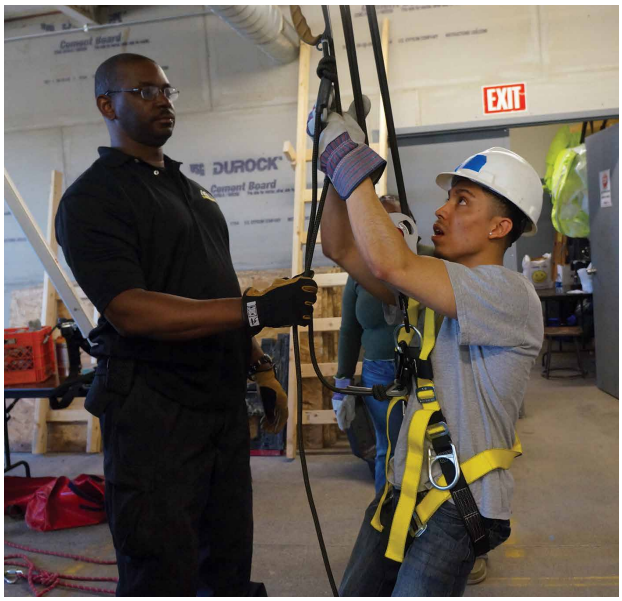
The WTP funds a national network of more than 100 nonprofit safety and health training organizations. Organized into 20 consortia, training is provided to thousands of workers annually who handle hazardous materials, hazardous waste, or are involved in emergency response to hazardous materials incidents. The key objective of the WTP is to prevent the occurrence of occupational injury and illness by assisting in training workers on how best to protect themselves and their communities from harmful exposures during hazardous waste operations, materials transportation, environmental restoration of nuclear weapons facilities, chemical emergency response, and brownfields assessment and cleanup.

The primary focus of the MWTP is to recruit and train underserved and disadvantaged people who live in communities affected by contaminated properties so that they can access construction and environmental remediation jobs in their communities. MWTP-supported training programs are developed within the context of the social and health needs of each target community. The program acknowledges and is designed to address the significant barriers to accessing and obtaining long-term employment often faced by disadvantaged populations. Barriers can include educational deficiencies, underdeveloped life skills and job readiness, ex-offender status, other physical and social health conditions, and socio-economic circumstances that can negatively affect an individual's ability to secure employment.

Thus, the MWTP provides support for pre-employment job training, including literacy, math, and life skills, in addition to environmental worker training, such as hazardous waste, asbestos, and lead abatement training, and

general safety and health training. The programs also help to enhance participants' problem-solving skills, self-esteem, and appreciation for teamwork in applying technical knowledge to environmental problems. Training providers maintain strong partnerships that help to streamline trainees into employment after completing the training program.

The MWTP has provided funding for approximately 10,000 individuals to receive basic instruction to equip them with the skills needed to compete for jobs and prepare them for sustainable employment. Graduates of the program have enjoyed a job placement rate of nearly 70 percent. Workers have obtained union and nonunion jobs in various positions, including laborers, construction workers, environmental technicians, tank cleaners, asbestos workers, and energy conservation and efficiency technicians. Wages averaged $12-$18 per hour, sometimes reaching more than $30 per hour for union jobs. Training has occurred in more than 20 communities through funding to the Center for Construction Research and Training (CPWR), Western Region Universities Consortium, Dillard University Historically Black Colleges and Universities Consortium, Rutgers-New Jersey/New York Hazardous Materials Worker Training Center, and Opportunity Advancement Innovation, Inc.



Brian Sostenez ready to be hoisted in confined space class by instructor fire fighter Jamar Sullivan

While the MWTP is the most robust program focused on job training, there have been other projects that have emphasized skill building and training of community residents, researchers, and health care professionals. For example, the *Environmental Health and Justice in Norton Sound, Alaska*, project produced a series of educational materials for the public and health professionals alike. Their environmental health "toolkit" includes a hands-on booklet that provides information for health care professionals and their patients. The toolkit is designed to promote proper diagnosis, treatment, and prevention of health effects associated with environmental contaminants. Project personnel also organized several seminars addressing environmental contamination and health impacts to increase their understanding of environmental health issues. In addition, the project has helped to build community capacity to establish ongoing independent contaminant monitoring programs. Furthermore, the project has led to the collection of valuable data and the publication of insightful findings.

Community-Engaged Research Projects

As shown in the 24 projects, CEnR approaches can inform research design to reflect community priorities, values, and consider sociocultural experience. Furthermore, these approaches empower communities, demonstrate respect for community expertise, foster trust between researchers and communities, strengthen environmental health literacy, and improve the environmental conditions and health of local residents.[7] A key outcome noted in many of the 24 projects is how data can be used to help inform decisions that affect public health. Some of these projects and approaches are described in the following paragraphs.

7 Heaney CD, Wilson S, Wilson O. 2007. The West End Revitalization Association's community-owned and managed research model: development, implementation, and action. Prog Community Health Partnersh 1(4):339-349.

Land Use, Environmental Justice, and Children's Health exemplifies how community-engaged approaches can build awareness, affirm local knowledge, and reduce disproportionate environmental exposures. The Environmental Health Coalition and its partners effectively united to address respiratory health issues in low-income Latino communities in the Barrio Logan community in San Diego and the west sides of National City and Chula Vista, California. Through the development and implementation of culturally appropriate training materials and the use of local skills and knowledge, the partnership's efforts resulted in the adoption of new community plans and multiple ordinances and policies to address the EJ concern.

Communities Organized Against Asthma and Lead combined the efforts of a neighborhood-based social service/health promotion provider, a Harris County Hospital District comprehensive health care clinic, the University of Texas Medical Branch (UTMB) NIEHS Center in Environmental Toxicology, Texas Southern University's Thurgood Marshall School of Law, and Texas Environmental Justice Advocacy Services to identify and characterize risks of lead poisoning and asthma in children and reduce overall home environmental risks in the community. As the project evolved, close collaboration with the City of Houston Health and Human Services Childhood Lead Poisoning Prevention Program ensured that project findings and recommendations informed public policy. Their results also helped researchers understand the need to consider alternate methods to measure asthma prevalence within the Hispanic population.

Richmond, California, residents participated in a community meeting to learn about study results for air pollutants in homes near industry and transportation corridors. They discussed ways to use results to negotiate health protections from the local oil company and strategies to reduce exposures from consumer product chemicals.

Traffic-Related Particle Exposures Among New York City Youth demonstrates the value of CBPR methodologies. Community members (249 young people living and going to school in Northern Manhattan and the South Bronx in New York City) participated in an exercise that monitored and compared diesel particulate and fine particulate exposures levels in two parts of the city and one suburb. The participants also kept symptom diaries. This CBPR project produced new data and helped to expand the understanding of the relationships between higher rates of exposures to vehicle-related particles and adverse respiratory symptoms among children living and attending school near heavily-trafficked roadways. The data has helped to produce formal publications, and has offered important evidence to influence policies to reduce acute asthma morbidity.

In *Healthy Food, Healthy School, and Healthy Communities: Project Community Action on Food Environments*, participants conducted school and community food assessments that identified and characterized food access, affordability, and availability in target neighborhoods and schools. Residents mapped more than 1,000 places where food was sold and surveyed a sample of stores to determine price, quality, and selection of key ingredients for a healthy diet. Participating in this Los Angeles-area project were: the Healthy School Food Coalition, the community-based organization affiliated with the Urban and Environmental Policy Institute at Occidental College (the grant recipient), and subcontracted organizations Esperanza Community Housing Corporation and Blazers.

The *Community Health Effects of Industrial Hog Operations* project used CBPR to quantify community exposures to pollutants from industrial hog operations (IHOs) and their effect on adjacent low-income communities of color. Data about emissions and health effects were used to raise awareness about EJ and to inform actions.

Informing Policy

CEnR efforts can contribute to an increased understanding of the connection between environmental exposures and health. This knowledge can encourage and empower individual behavior changes that may lead to the reduction or prevention of environmental exposures, which, in turn, may result in improved health. However, in the context of EJ, the reduction and prevention of environmental exposures may be outside the power of individual behavior change. For example, individual behavior changes have little impact on reducing disproportionate exposures to particulate matter suffered by children living in and going to school near heavy-traffic roadways. Conditions such as these often need to be addressed at a governmental level through policy development.[8]

As noted in the 2009 article "Partnerships for Environmental and Occupational Justice: Contributions to Research, Capacity and Public Health"[9] and the 2008 University of California, Berkeley, School of Public Health/PolicyLink report "Promoting Healthy Public Policy Through Community-Based Participatory Research,"[10] EJ projects can help inform policy that may lead to improved environmental public health. Summaries of the 24 projects support these findings by describing how the projects helped to inform numerous significant policy changes at multiple levels of government that support EJ goals. Here are some brief examples:

- The *Community Health and Environmental Reawakening* CBPR project helped to shape the adoption of a statewide moratorium and ban on the construction of new IHO facilities that employ the lagoon-and-sprayfield system of manure management.
- The *Dine' Network for Environmental Health* project helped to inform the Navajo Law Banning Uranium Mining and Milling in 2005 to protect tribal drinking water sources.
- Support for the *Healthy Food, Healthy School, and Healthy Communities: Project Community Action on Food Environment*s project in Los Angeles, California, led to the passage of the Los Angeles Unified School District's Cafeteria Improvement Motion in 2005. This policy set stronger nutrition standards for meals eaten by hundreds of thousands of children every day.

8 Hutson MA, Wilson S. 2012. The role of community-based strategies in addressing metropolitan segregation and racial health disparities. Community Dev (Columb) 42(4):476–493. Available: http://www.thecyberhood.net/documents/papers/hw2012.pdf [accessed 07 November 2013].

9 Baron S, Sinclair R, Payne-Sturges D, Phelps J, Zenick H, Collman GW, O'Fallon LR. 2009. Partnerships for environmental and occupational justice: contributions to research, capacity and public health. Health Policy and Ethics 99(S3):S517-S525.

10 University of California, Berkeley, School of Public Health, PolicyLink. 2008. Promoting Healthy Public Policy through Community-Based Participatory Research: Ten Case Studies. Available: http://beta.policylink.org/sites/default/files/CBPR_PromotingHealthyPublicPolicy_final.pdf [accessed 24 July 2014].

CONCLUSIONS AND NEXT STEPS

This analysis reveals that DERT has made significant contributions to EJ through its support for a wide range of EJ-focused research, public outreach, and job training projects and programs. Since 1998, DERT has provided funding to 155 EJ-focused initiatives across 23 NIEHS grant mechanisms that have helped to address a wide range of EJ issues affecting various low-income and minority communities across the United States.

These projects have increased public awareness about the connection between environmental exposures and health, added to the scientific literature, advanced understanding of EJ issues and concerns, and fostered and strengthened community-academic partnerships. Moreover, these efforts have helped build capacity of researchers, health care professionals, government agencies, and community residents to address disproportionate environmental exposures and adverse health effects.

Even though the projects have contributed to ongoing efforts to understand, reduce, and prevent disproportionate exposures that may lead to disparate health outcomes, there are still many opportunities for DERT to continue advancing EJ and EHD initiatives. Possible next steps include:

1. **Highlight contributions.** Create a more robust Web page that highlights ongoing and historical contributions to EJ and EHD, and provides links to resources that can be used by researchers and community groups. As HHS continues to implement its 2012 Environmental Justice Strategy and Implementation Plan, and NIEHS implements its 2012-2017 Strategic Plan, a public website will help inform and involve more stakeholders in EJ and EHD efforts.

Disseminating results broadly: Monica Ramirez–Andreotta presenting the summary of results to Yavapai County residents.

2. **Use tracking tools to capture accomplishments.** Encourage program administrators to use the High Impact Tracking Systems to flag EJ-related outcomes and report those as part of their annual progress reviews. As a starting point for future work, this analysis indicates an opportunity to improve tracking of EJ-focused outcomes across the NIEHS portfolio. If NIEHS and DERT program staff continue to capture the accomplishments of ongoing projects that have an EJ focus, it will be much easier to conduct future analyses that build on the findings of this document.
3. **Develop reporting guidelines.** Establish reporting guidelines to help capture details about EJ-focused projects across the DERT grant portfolio. A challenge of this analysis was applying a framework to projects that may not have been implemented with an eye toward EJ. There is an opportunity for DERT to work with the HHS Environmental Justice Working Group and NIEHS to develop improved reporting guidelines for EJ-focused projects to highlight their environmental hazards, stressors, and health outcomes.
4. **Establish an EJ training module.** Assist with the development and implementation of an EJ training module for HHS staff. NIEHS can continue to partner with the HHS Environmental Justice Working Group as it develops and implements a new EJ training module for HHS staff. EJ training for DERT staff and grantees would ensure increased understanding of pertinent issues and provide them with strategies and tools to address them effectively.

5. **Examine and address research gaps.** Further analyze the geographic distribution of research funds that address community concerns to explore ways to build institutional and individual capacity to successfully apply for federal funding to help their communities. While NIEHS provides research funding in many EJ communities across the U.S., some communities remain underserved. These "research deserts" are often due to the lack of institutional and individual capacity to apply for funding.
6. **Advance environmental health literacy.** Promote and evaluate efforts that increase people's understanding of environmental contributions to health, and build skills to use that knowledge to reduce potentially harmful exposures. While environmental health literacy is not specifically addressed in this report, its benefits were captured in the review of grants, providing the impetus for suggesting more work be undertaken. As community members, health care professionals, and decision-makers increase their environmental health literacy, they are better able to improve environmental public health.

APPENDIX A: ENVIRONMENTAL JUSTICE PROJECT PROFILES

1. Air Pollution Outreach, Education, and Research Capacity Building in Alaska Native Villages
2. Assessment of a Novel Environmental Justice Community-University Partnership
3. Asthma and Demolition in Chicago Public Housing
4. Brown University's Environmental Justice Partnerships
5. Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS)
6. Community Engagement Core: U.S.-Mexico Transborder Collaboration
7. Community Health Effects of Industrial Hog Operations (CHEIHO)
8. Community Health and Environmental Reawakening (CHER)
9. Communities Organized Against Asthma and Lead (COAL)
10. Dine' Network for Environmental Health (DiNEH) Project
11. Environmental Health and Justice in Norton Sound, Alaska
12. Gardenroots: A Co-Created Citizen Science Program to Empower Communities
13. Hazardous Material Worker Health and Safety Training: Alabama Fire College
14. Hazardous Materials Worker Health and Safety Training: CPWR
15. Healthy Food, Healthy School, and Healthy Communities: Project CAFÉ
16. Improving Public Housing to Build Healthier Communities
17. Land Use, Environmental Justice, and Children's Health
18. Linking Breast Cancer Advocacy and Environmental Justice
19. Local Health Impacts of Land Application of Sewage Sludge
20. Minority Worker Training Program: OAI, Inc., Innovative Workforce Development
21. Research Translation Community Engagement Core: University of Washington Superfund Research Program
22. The Little Hocking That Could: Community Exposure to Perfluorooctanoate
23. Traffic-Related Particle Exposures Among New York City Youth
24. Worker Health and Safety Training Cooperative Agreement

1. Air Pollution Outreach, Education, and Research Capacity Building in Alaska Native Villages

Project Investigator: *Tony Ward, Ph.D., University of Montana (tony.ward@umontana.edu)*
Grant Number: *RC1ES018400*
Project Duration: *Sept. 26, 2009 – June 30, 2011*

Summary

By working with schools, the mission of the Air Toxics Under the North Star program is to reduce health disparities of Alaska Native people living in remote communities. The project raises awareness of air quality issues affecting respiratory health and empowers students and environmental health personnel residing in these areas to improve air quality and the health of community members. An educational intervention and health surveys are two main components of this project.

Educational intervention: The Air Toxics Under the North Star team implemented the project in 10 rural/remote schools in Alaska during the 2010–2011 and 2011–2012 school years. The team developed curriculum that:

1. Addressed air quality issues within rural Alaskan communities.
2. Included culturally-appropriate content.
3. Incorporated Alaska state content standards.
4. Integrated a middle school curriculum.
5. Incorporated a community outreach component.

Since 2003, students in the University of Montana's Air Toxics Under the Big Sky program (known as Air Toxics Under the North Star in Alaska) have developed scientific skills through independent, self-designed, inquiry-based research projects. As part of this ongoing program in schools throughout Montana, Idaho, and Alaska, classrooms received monitors for PM2.5 (particular matter 2.5 microns or less in diameter), radon, and carbon monoxide, which enable students to collect indoor samples within their schools and homes. In addition, for the upcoming 2014–2015 school year, the Air Toxics Under the North Star in Alaska program will include nine schools (10 teachers), with a focus on educating students about PM2.5, radon, and carbon monoxide.

Health survey: The research team distributed air quality and respiratory health surveys in Alaska Native communities. The goal was to identify air pollution issues (both indoor and outdoor) of greatest importance to each community, while also identifying the occurrence of respiratory diseases in children (e.g., lower respiratory tract infections and asthma). A total of seven rural/remote communities participated in the survey.

Highlighted Impacts

Outputs

Culturally-appropriate lesson plans
Created lesson plans that incorporated Alaska Native cultural content and addressed local communities' air pollution concerns, including road dust, mold, and trash burning.

Curriculum integration
This process included three parts.

Workshop: The workshops provided teacher training with curricular materials, labs/activities, and operation of the air sampling equipment. Sixteen teachers from each of the 10 participating schools attended workshops in Anchorage, Alaska.

Follow-up kickoff: Researchers traveled to each community to kick off the program with a presentation on air quality and human health.

Integration: Teachers then integrated the program into their existing classes.

Student research
Students completed research projects focused on air quality and respiratory health. They presented their findings to teachers, peers, and community members. This program impacted approximately 270 students in rural/remote areas.

Air quality and health surveys
The University of Montana developed air quality and respiratory health surveys for deployment within seven rural/remote communities. These surveys identified air pollution sources (both indoors and outdoors) and the occurrence of asthma and lower respiratory tract infections in children.

Community coordinators
To assist with the distribution of the air quality and respiratory health surveys, seven community coordinators were hired in three communities in the Yukon-Kuskokwim region and in four communities in the Copper River region. They were invaluable resources as they provided feedback on survey instruments, assisted with data collection, ensured cultural appropriateness, and served as liaisons between the communities and the University of Montana. Three hundred twenty-eight households participated in the air quality surveys, and 564 children were represented by the respiratory health surveys.

Community information sessions
After completing the air quality and respiratory health surveys, the team held community information sessions to discuss the results. These meetings brought together members from the community, as well as tribal administrators and tribal council members.

Publications

Ware D, Lewis J, Hopkins S, Boyer B, Noonan C, Ward T. 2013. Sources and perceptions of indoor and ambient air pollution in rural Alaska. J Community Health 38(4):773-780.

Ware D, Lewis J, Hopkins, S, Boyer B, Montrose L, Noonan C, Semmens E, Ward T. 2014. Household reporting of childhood respiratory health and air pollution in rural Alaska Native communities. Int J Circumpolar Health 73:1-10.

Outcomes

Students participate in hands-on scientific research
Students moved beyond the textbook and implemented the scientific method in the "real world." Some students reported considering health science careers.

Promoted awareness that air pollution affects rural populations too
Community members learned that air quality was not an issue that concerned only urban residents. They learned about the effects of idling engines, wood burning stoves, and burning trash. Community members offered suggestions on interventions to improve indoor and outdoor air quality in their communities.

Prompted a sustainable education/outreach effort
The Air Toxics Under the North Star program continued in the 2012–13 and 2013–14 school years. Each year, a new group of students was educated on the importance of good air quality and the steps they can take to improve their community's respiratory health.

2. Assessment of a Novel Environmental Justice Community-University Partnership

Co-Principal Community Investigator: *Omega Wilson, West End Revitalization Association (wera1usa@earthlink.net)*
Co-Principal University Investigator: *Sacoby Wilson, Ph.D., University of Maryland, College Park (swilson2@umd.edu)*
Grant Number: *R03ES017357*
Project Duration: *Sept. 22, 2008 – Aug. 31, 2011*

Summary

This NIEHS-funded project assessed the benefits of the community-owned and -managed research (COMR) model and the use of a collaborative problem solving (CPS) partnership model in EJ communities in Mebane, North Carolina.

The board and staff of West End Revitalization Association celebrate the 50th anniversary of the Martin Luther King Jr. march on Washington for civil and human rights

The predominantly African-American communities of West End, White Level, and Buckhorn/Perry Hill in Mebane (Alamance County and Orange County), North Carolina, live in environmental conditions that negatively impact their health and property values. The residents have long struggled to rectify the infrastructure disparities they endure as a result of a lingering legacy of racially discriminatory public policies. These infrastructure disparities have resulted in limited access to municipal drinking water, sewer services, and paved streets in these low-income and minority communities.

In 1994, residents organized the West End Revitalization Association (WERA) to address these civil rights and EJ concerns. In 1999, WERA effectively challenged government plans to demolish West End and White Level communities to make way for an interstate highway without providing a means for public input, relocation assistance, or fair compensation for homes and churches. WERA's administrative complaints at the U.S. Department of Justice, under Title VI of the Civil Rights Act of 1964 and Executive Order 12898, resulted in the 119-highway construction being placed on moratorium in 1999. Legal mitigation helped leverage millions of dollars that modified the planned highway corridor as well as multiple infrastructural improvements, including installment of first-time sewer lines, access to safe drinking water, paved streets, housing rehabilitation, and the removal of leaking underground storage tanks of petroleum and other chemicals.

WERA attributes much of its success to the use of its COMR model. COMR's key principles include "funding equity," "management parity," and "science for compliance" for community-based organizations when partnering with university and other federally-funded researchers. COMR emphasizes community ownership and management at each stage of the research process, and essentially placing community members into the role of principal investigator. For Mebane-area EJ communities, WERA's COMR model promotes the highest degree of public participation and meaningful involvement in the decision-making process, supports trust building between the

community and government, and leverages legal actions for compliance and enforcement under federal civil rights laws and public health statutes.

To improve the quality of life in historic African-American communities, WERA formed CPS partnerships with legal, public health, university, foundation, and government partners to install first-time sewer and safe drinking water services, pave dirt streets, and remove underground storage tanks leaking petroleum and cancer-causing benzenes and xylenes. WERA's CPS model was developed during a three-year EJ grant from the EPA Office of Environmental Justice (2004–2007).

Highlighted Impacts

Outputs

Assessment of COMR effectiveness
The project assessed the education and training core and career development components of the COMR model. These key elements focus on improving community member environmental health literacy, and spurring community interest in pursuing careers related to environmental health.

Evaluation of COMR's CPS element
The team measured impacts of the model on collaboration, equitable partnership, and trust building.

Publications

Wilson O. 2011. Lack of basic amenities: indicators of health disparities in low-income minority communities and tribal areas. NC Med J 72(2):145-8.

Heaney C, Wilson S, Wilson O, Cooper J, Bumpass N, Snipes M. Use of community-owned and -managed research to assess the vulnerability of water and sewer services in marginalized and underserved environmental justice communities. J Environ Health 74(1):8-17.

Wilson, O. 2012. Are you getting the basic amenities your taxes paid for? Environmental Justice in Action Blog. U.S. Environmental Protection Agency. Available: http://blog.epa.gov/ej/2012/12/1005/ [accessed 25 July 2014].

Outcomes

Increased public participation and meaningful involvement
Assessments and evaluations of the COMR model reveal that it is a valuable mechanism to promote increased public participation and meaningful involvement in the decision-making process.

Created trust building
The project demonstrates the COMR model helps to build trust between government and the community, ensuring research efforts are community-driven and acknowledge resident's most prevalent concerns.

Demonstrated value of trained community monitors
Community members possess an unparalleled knowledge of their communities. This project shows that training community monitors may increase this local awareness of environmental health issues, strengthen resident capacity to become involved in the decision-making process, and further support effective COMR.

COMR can build community capacity to promote government response
Research showed that COMR can help to generate valuable information with the help of community members that can be leveraged to attract government attention to EJ concerns (e.g., filing official complaints, applying for grants, providing testimony at public hearings, and producing scholarly publications).

3. Asthma and Demolition in Chicago Public Housing

Project Investigator: *Samuel Dorevitch, M.D., University of Illinois at Chicago (sdorevit@uic.edu)*
Grant Number: *K08ES011302*
Project Duration: *May 2, 2002 – June 15, 2007*

Summary

Residents in urban areas are susceptible to asthma exacerbations due to air pollutants such as particulate matter. Nationally, asthma prevalence rates have increased over recent decades, and prevalence is higher among African-Americans than other groups. More dramatic are the disparities between African-Americans and other groups in terms of asthma death rates, asthma hospitalizations, and asthma emergency department visits.

Cities have been demolishing public housing developments, which may increase local concentrations of airborne particulate matter. This activity may have an impact on asthma severity.

This project took place in Chicago between 2002 and 2006 and focused on the demolition of high-rise public housing buildings in the Robert Taylor, Stateway Gardens, and Addams-Brooks-Loomis-Abbott developments. Investigators installed air monitoring equipment near the demolition sites to characterize concentrations of particulate matter attributable to demolition.

The team investigated air quality and respiratory health among residents of public housing developments during the demolition of adjacent public housing buildings. It found that people living near sites of public housing demolition are at risk for exposure to high particulate concentrations, characterized by relatively large particles and high short-term peaks in particulate matter concentration. The exposure took place over several weeks using heavy equipment, such as the wrecking ball, pneumatic jack, and excavator. This method, compared with near-instantaneous implosion, resulted in elevated concentrations of particulate matter during a much longer period of time.

Researchers characterized the exposure by environmental sampling. They studied asthma symptoms, peak expiratory flow rate, and exhaled nitric oxide, an indicator of pulmonary inflammation. To determine the health effects of the particulate matter exposure, researchers used a time-series analysis, potential confounders and effect modifiers, such as ambient air pollutants, pollen counts, and meteorological factors.

Outreach to residents of the community (asthmatics and members of their households), which included training in asthma self-management, was central to this project. Six community health educators received training about asthma symptoms, triggers, air pollution, self-management, community resources, and research ethics.

Outputs included published research, communications with the City of Chicago Department of Buildings about poor air quality during demolition, additional efforts to suppress dust, and testimony to public officials in a hearing about clean construction practices.

Highlighted Impacts

Outputs

Three-site study of airway inflammation
Enrolled 42 participants at three sites in the study. Approximately 100 people participated in community meetings that provided educational information about asthma and air pollution.

Publications
Two peer-reviewed publications were produced as part of this study:

Dorevitch S, Demirtas H, Perksy VW, Erdal S, Conroy L, Schoonover T, Scheff PA. 2006. Demolition of high-rise public housing increases particulate matter air pollution in communities of high-risk asthmatics. J Air Waste Manag Assoc 56(7):1022-32.

Dorevitch S, Demirtas H, Scheff PA, Persky VW. 2007. Bias and confounding in longitudinal measures of exhaled monoxides. J Expo Sci Environ Epidemiol 17(6):583-90.

Testimony on air quality impacts of demolition
Dorevitch testified at a Chicago City Council hearing regarding clean construction practices.

Outcomes

Increased public participation in research
Residents and health educators living in areas affected by the demolition received asthma education and were inspired to get involved in the research project.

Improved demolition methods
As a result of input from the researchers, the City of Chicago Department of Buildings took additional steps to suppress dust, such as spraying water on the buildings during demolition. In one case, the input informed a temporary cessation of demolition activities.

Increased principal investigator capacity in biostatistics and environmental science methodologies
The principal investigator took formal coursework at the University of Illinois at Chicago School of Public Health and learned through field experience under the mentorship of two leaders who have substantial experience in air pollution monitoring.

4. Brown University's Environmental Justice Partnerships

Project Investigators: *Phil Brown, Ph.D. (p.brown@neu.edu), David Ciplet, Bindu Panikkar, Ph.D., Brown University; Amelia Rose, Julian Rodriguez-Drix, Environmental Justice League of Rhode Island*
Grant Number: *P42ES013660*
Project Duration: *April 1, 2005 – March 31, 2014*

Summary

Brown University's community engagement activities, through the Superfund Research Program (SRP) and the Children's Environmental Health Center, have played a major role in advancing EJ in Rhode Island. To help coordinate the activities, a student Community Engagement Core was created as an effective way for students to become involved in EJ community projects, while building core leadership skills. The partnership has fulfilled a critical role of bridging Providence youth, community organizations, local, state and federal decision-makers, and the Brown University community.

The partnership's youth programs provide high school students with year-round opportunities to develop leadership capabilities, build knowledge about environmental health and justice, gain access to mentorship for applying to college, and engage in projects that have direct and tangible impacts in the community. The work with neighborhoods, community partner organizations, and state agencies to improve remediation efforts of contaminated sites has led to increased participation and coordination across various stakeholders.

Brown University's partnerships with the Environmental Justice League of Rhode Island (EJLRI), Woonasquatucket River Watershed Council (WRWC), and Environmental Neighborhood Awareness Committee of Tiverton have resulted in successful projects involving youth and the broader Rhode Island community on environmental health and justice issues and the remediation of environmentally contaminated sites.

Furthermore, collaborative work with the Rhode Island Department of Environmental Management on EJ policy development has provided innovative policy models for other cities.

Rhode Island Governor Chaffee signs Environmentally Challenged Home Ownership bill, becoming the first in the nation to provide state housing authority loans to homes in contaminated communities.

Healthy Corner bus - Community Environmental College students loading bus to deliver food in Healthy Corner Store Initiative

Highlighted Impacts

Outputs

Community Environmental College
This eight-week summer program coordinated with EJLRI to develop critical environmental thinking skills and educate local youth on EJ issues. The program has educated nearly 200 students over six years. The program is free to participants in the greater Providence area, and uses interactive activities, field trips, stewardship, and projects to turn knowledge into action.

ECO Youth
This program offers a year-round environmental education after-school program that builds youth capacity to address environmental pollution through youth-run public education workshops, demonstration projects, and multimedia productions. Youth involved in the project are primarily low-income and people of color, and benefit from educational opportunities and resources to become community educators, leaders, and EJ stewards.

Healthy Corner Store Initiative (HCSI)
The HCSI is a youth-driven project promoting the availability of healthy food and fresh produce in small, racially and ethnically diverse food stores in Providence and Pawtucket. In 2011, students worked with 15 stores to carry healthier snacks including fresh fruit cups in barrel coolers that students helped design. ECO Youth members also led over 18 community-based workshops during the spring and summer, reaching 675 high, middle, and elementary school-age youth.

Publications
In 2008, the team published an article on achieving the nation's first state-run home equity loan program for homeowners in contaminated communities. In 2011, the team published a peer-reviewed article about developing and implementing EJ curricula for the WRWC, and an article on school siting.

Outcomes

Gorham site remediation effort
The partnership worked extensively with the EJLRI to support residents living next to the former Gorham Silver Manufacturing site in Providence. The effort led to the long-awaited agreement to complete the remediation of the site; quarterly stakeholders meetings; subslab air testing and installation of ventilation systems in four homes near the most contaminated part of the site; and a provision to educate neighborhood residents, as well as students, parents, and staff at Alvarez High School about the cleanup.

Supporting statewide legislation
The partnership has supported statewide legislation to ensure safe and responsible siting of schools in Rhode Island. Environmental Cleanup Objectives for Schools became state law in June 2012. The law prohibits the construction of public schools on contaminated sites, and creates a public involvement process for cities and towns when considering building a school on a contaminated site. Rhode Island is now the first state in the United States to enact such a law. The partnership also helped to pass the Polluter Fines Bill in 2009, raising maximum daily fines from $1,000 to $25,000 for companies violating state cleanup orders.

Tidewater site public involvement process
Brown University also supported the EJLRI in their efforts to ensure safe cleanup of the former Tidewater Coal Manufactured Gas Power Plant in Pawtucket. The EJLRI recently set into motion a public involvement process, which requires the site manager to host interviews with residents concerned about the site cleanup process.

Environmental Neighborhood Awareness Committee of Tiverton
The partnership worked to help this low-income neighborhood effect cleanup of manufactured gas plant waste, to get a bill passed to set up the nation's first state-run home equity loan program for homeowners in contaminated communities, and to generate support for the legislation noted above on raising penalty levels in the Polluter Fines Bill.

WRWC
The partnership has provided technical support to WRWC. They assisted in the contractor selection for an EPA technical assistant grant, reviewed EPA's proposed plan for remediation, participated in stakeholder meetings with the EPA, and provided training assistance for high school teachers at Ferri Middle School in Johnston. They also performed a walk-through of the area to determine community use of the Oxbow area and to help identify any potential unexpected alterations in water course.

Hospitals for a Healthy Environment in Rhode Island (H2ERI)
H2ERI is a statewide coalition of hospitals, professional associations, nursing schools, unions, academic institutions, government agencies, local food groups, and environmental groups promoting cost-effective, healthy, and sustainable health care institutions. The coalition was started by the Brown University Children's Environmental Health Center, and subsequently the Brown University SRP joined in as a leader. Under the guidance of the community advisory board, efforts expanded from a focus on removing phthalate and polyvinyl chloride (PVC)-based medical equipment from its Neonatal Intensive Care Unit to encompass a comprehensive approach to environmental sustainability in health care settings. Four annual conferences have been held, and hospital partners have developed extensive "green teams."

5. Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS)

Project Investigator: *Brenda Eskenazi, Ph.D., University of California, Berkeley (eskenazi@uclink.berkeley.edu)*
Grant Number: *P01ES009605*
Project Duration: *Oct. 1, 1998 – July 31, 2014*

Summary

Farmworker families often experience disproportionate exposures to pesticides and other agricultural contaminants, including those found in fungicides. Significant exposures among this population have been correlated with living close to agricultural fields that use these contaminants, and/or when farmworkers unknowingly bring contaminant residue home on shoes and clothing, exposing other family members. Farmworker families also tend to be vulnerable to a series of other exposures as a result of living conditions, including substandard housing.

CHAMACOS participant community forum

Pregnant women and children are of particular concern since fetuses and children are in the process of developing mentally and physically. Children are also especially susceptible because proportionally they consume more air, food, and water, and they engage in exploratory behavior that puts them in direct contact with contaminants.

The CHAMACOS study has focused on addressing the adverse health effects of disproportionate pesticide and other chemical exposures on farmworker families in Salinas Valley, California. Much of the CHAMACOS effort has centered on longitudinal research that recruited and followed primarily low-income, Mexican immigrant farmworker women and their children living in the agricultural Salinas Valley over a span of 12 years to document the impacts of the exposures on growth, health, and development. The project has also involved a series of outreach initiatives and interventions aimed at reducing exposures to pesticides and other contaminants among farmworker families.

Highlighted Impacts

Outputs

Birth cohort study
The initial study enrolled 601 primarily low-income, Mexican-born, Spanish-speaking mothers and followed through to the birth of 536 infants. Eighty-four percent of the mothers lived with a farmworker while pregnant and 44 percent were farmworkers themselves while pregnant. Another 300 children were enrolled when they were 9 years old.

Farmworker intervention
The intervention involved 130 strawberry workers and aimed to reduce exposures to pesticides through education, providing protective equipment (e.g., gloves and protective clothing), and providing access to hand-washing stations. Findings showed that hand washing, wearing coveralls, and not eating strawberries in the field reduced pesticide exposures.

Center for Environmental Research and Children's Health (CERCH) website materials on the CHAMACOS project
The CERCH website offers several educational resources including research, findings, and other outreach materials related to the CHAMACOS project, including a thorough description of the study. Bilingual resources are designed specifically for health professionals, child health care providers, parents and families, community groups, and the media.

Project newsletter
Updates and findings are published in Spanish and English in the annual La Semilla (The Seed) Newsletter. This publication is sent out to study participants and community stakeholders.

The Prenatal Environmental Health Kiosk
This free online Spanish interactive, self-guided computer program advises pregnant women on reducing environmental exposures. CERCH continues to update the kiosk with information on new exposures.

Community presentations
The study led to the development of eight presentations and trainings covering issues such as household safety and pesticide exposure prevention. Annual community and youth forums also share results, educate, and answer community questions.

Youth Community Council
This three-year extracurricular leadership training program educates and trains Latino high school students in Salinas to promote positive health changes in the community. Interactive activities for younger children include educational puppet shows, online games about environmental health and food, and online kids clubs.

Publications
The study has produced nearly 100 publications on the impact of pesticides and other chemicals on health. All publications are available the CERCH website. Along with other bilingual outreach materials, the team has created an Integrated Pest Management Toolkit as well as a report on pest management and pesticides.

Outcomes

Increased public participation in research
The CHAMACOS study has enrolled approximately 1,300 community members. More than 30 community workers have worked as research staff. The initiative has also led to the establishment of a community advisory board made up of a diverse array of local leaders, including elected officials, representatives from the local health department, farmworkers, growers, lawyers, and community organizers. They have educated over 30,000 farmworkers and their families about how to protect themselves from pesticide exposures.

Increased public awareness on pesticides and other contaminants
The involvement of community members in research and interventions has resulted in increased awareness about exposures and how to reduce them. Awareness efforts have reached over 19,000 people.

Behavior changes among farmworkers that reduce pesticide exposures
Education and interventions providing workers with protective equipment (e.g., gloves and protective clothing) and access to hand-washing stations led to an increased adoption of practices that reduce pesticide exposures.

Informing local, state, and federal policymakers
The research compiled through the CHAMACOS project has allowed CERCH to make several informative presentations to Salinas City Council, and state and federal representatives.

Important in the health of mothers and children
The research, program intervention, outreach, and publications disseminated will result in improved health outcomes for the mothers and children of Salinas.

6. Community Engagement Core: U.S.-Mexico Transborder Collaboration

Co-Project Investigators/Key Community Partners: *Keith Pezzoli, Ph.D. (kpezzoli@ucsd.edu); Wael Al-Delaimy, M.D., Ph.D.; Ilya Zaslavsky, Ph.D., University of California, San Diego, with community partners, Oscar Romo and Jennifer Hazard, Alter Terra*
Grant Number: *P42ES010337*
Project Duration: *07/01/2000 – 03/31/2017*

Summary

The Community Engagement Core (CEC) of the University of California, San Diego (UCSD) Superfund Research Center (SRC) improves collaborative watershed management, ecological sustainability, and environmental public health in the San Diego-Tijuana city-region along the U.S.-Mexico border using a CBPR approach.

The CEC concentrates much of its efforts on Los Laureles Canyon, a 4.6 square mile sub-watershed of the Tijuana River Watershed, which lies on both sides of the international border, and empties into the Tijuana River Estuary and Pacific Ocean on the U.S. side of the border. The canyon is rapidly urbanizing under conditions of poverty, haphazard settlement, and inadequate infrastructure. An estimated 75,000 people now live in the area. Erosion is a major problem. Seasonal heavy rain storms send mega-tons of eroded soil—mixed with untreated sewage, hazardous substances, and solid wastes from factories, hospitals, and households—through the canyon and into the U.S. where it impacts farmland, the estuary, and the binational coastal zone with high concentrations of coliform bacteria, sediment, trace metals, PCBs, and other urban, agricultural, and industrial pollutants.

Governments on both sides of the border recognize the gravity of the environmental problems and are acting jointly to address them, through initiatives such as the EPA's U.S.-Mexico Border 2020 Program. At the same time, a growing number of community-based organizations are working together across the border to jointly address socio-ecological problems and to promote sustainable development. Since 2005, the CEC has leveraged this momentum to identify, prioritize and address environmental health hazards and issues in the border region to minimize exposures, enhance ecosystem resilience, and improve environmental public health.

Oscar Romo, director of Alter Terra, instructs students March 3, 2013 on how to collect field data in neighborhoods of Los Laureles Canyon (https://flic.kr/p/ePU3af), where the UCSD SRC has been doing environmental public health surveys. Alter Terra is a nonprofit organization that runs a community science center in the canyon.

Wael Al-Delaimy presents research findings April 18, 2013 to the California Border Health Consortium. The slide on the screen (http://flic.kr/p/ePVsLU) shows the Los Laureles Canyon, Tijuana subwatershed outlined in blue.

Highlighted Impacts

Outputs

Transborder Bioregional Network (TBRN) and Global Action Research Center (Global ARC)
Over the past five years, the CEC has developed a collaborative transborder network of community-based organizations, universities, government agencies, and industry groups. The TBRN (led by the Global ARC in partnership with UCSD's SRC) has utilized CBPR to establish new collaborative models for education, learning, and workforce development linking knowledge to action, such as Bioregionalism and One Border, One Health.

The Global Action Research Database
The CEC collaborated closely with Global ARC to create a website for scholarship of engagement. The interactive database uses social media to enable networking among various stakeholders.

Ongoing study tracking solid and hazardous waste transport across the U.S.-Mexico border
Alter Terra, the CEC's community partner in Mexico, embedded 2,000 traceable sensors in a sample of the 87 illegal dumpsites along Los Laureles Canyon. The sensors are tracked as they migrate through the canyon – mainly propelled by storm water flows.

Toxicant soil analysis in Los Laureles Canyon
Identified and quantified concentration levels of heavy metals and organic pollutants in soil samples near illegal dumpsites in six different locations within Los Laureles Canyon, as a first step in determining sources of toxicant exposure to residents.

Health Survey of Los Laureles Canyon
Utilizing a community-based participatory process, in collaboration with UCSD, Alter Terra and a Mexican University (UABC) conducted a 388 household survey covering four neighborhoods to characterize self-reported symptoms of ill health among residents of low socio-economic status living in haphazardly constructed settlements, to determine if living in close proximity to illegal dumpsites is causing more illness.

Dust and Urine Pilot study
In determining sources and levels of toxicant exposure, working with Alter Terra and community leaders, CEC collected and analyzed household dust and urine samples from 46 residents, residing in two neighborhoods in Tijuana, to identify if specific endocrine disrupting compounds (EDCs) and heavy metals were present in dust and urine samples, while establishing data collection procedures and methodology.

New Community Science Center (CSC)
CEC's community partner in Mexico, Alter Terra, built a new CSC in Los Laureles Canyon. Between 2010 and 2014, the center grew to include a building and open areas to accommodate community meetings and workshops, environmental monitoring/data collection equipment, and administrative space for planning and managing projects.

Outcomes

Increased social and intellectual capital
The TBRN, including the Global ARC, brings together diverse partners to address transborder environmental challenges by co-producing/sharing knowledge—including publications—through binational networks (e.g., the *Border Health Consortium of the Californias*, among other groups). The Global ARC facilitates science communication, fundraising, education and training by easing the burden on organizers who need to assemble, analyze, visualize, and share spatial information pertinent to improving environmental health and justice. The effort builds on lessons learned by the CEC in the creation of the NIEHS Environmental Health Sciences Data Resource Portal.

Increased awareness through first field study to track the region's transborder waste flows
The effort has received significant media coverage, helping to increase awareness about sources and transportation of hazardous substances, and underscore the importance of binational collaboration.

Increased capacity for risk assessment and healthy city planning through field research and data collection with resident involvement
From 2012 to 2014, the CEC worked with Alter Terra and other partners from both sides of the border to gather data on toxicants in soil, dust, and urine, and to relate this data to concerns residents have expressed about neighborhood conditions and environmental public health

Increased capacity for community-based education
CSC is a vital resource for community-based education and training. Hundreds of local residents, and hundreds of university students from Tijuana and San Diego have gained ecological literacy through hands-on instruction in data collection, recycling, and green infrastructure.

Material Transfer Agreement Supports Tribal EPA Lab
The CEC, in collaboration with the UCSD SRC Research Translation Core, established a Material Transfer Agreement between UCSD and the 29 Palms Tribe enabling the 29 Palms Tribal EPA to use UCSD's P450 HRGS to test soil and sediment samples from the U.S.-Mexico border, among other sites.

PEPH Webinar
"Communicating Science for the General Public," February 22, 2011.

UCSD TV video documentary
The CEC organized a diverse team to produce "Los Laureles Canyon: Research in Action," a documentary highlighting the CEC's partnerships to integrate watershed management, planning, and environmental health sciences along the border. The documentary is available in English or Spanish. It has been featured on a wide range of media outlets and has been viewed by more than 100,000 people.

Publications

Pezzoli K, Tukey R, Sarabia H, Zaslavsky I, Miranda ML, et al. 2007. The NIEHS Environmental Health Sciences Data Resource Portal: Placing advanced technologies in service to vulnerable communities. Environ Health Perspect 115(4): doi:10.1289/ehp.9817.

Pezzoli K, Kozo J, Ferran K, Wooten W, Rangel G., Al-Delaimy WK (forthcoming). One Bioregion/ One Health: An Integrative Framework for Civically Engaged Research, Education and Governance in the US-Mexico Border." *Global Society*.

Al-Delaimy WK, Larsen CW, Pezzoli K. (In press) Differences in Health Symptoms among Residents Living Near Illegal Dump Sites in Los Laureles Canyon, Tijuana, Mexico: A Cross Sectional Survey. *Int. J. Environ. Res. Public Health*.

Community Leadership Development
During the 2011-2012 period, 40 residents participated in a series of 12 leadership development and training workshops (one of which the CEC conducted) focused on building community capacity to participate meaningfully in decision making, and developing an ecologically sustainable community design to promote health in a binational watershed. The program generated a community needs assessment and "project catalog" of high priority prospective solutions-based endeavors. This effort strengthens the "Building Assets through Community Mobilization" program while helping local residents improve ecosystems and environmental public health simultaneously.

7. Community Health Effects of Industrial Hog Operations (CHEIHO)

Project Investigator: *Steve Wing, Ph.D., University of North Carolina at Chapel Hill (steve_wing@unc.edu)*
Grant Number: *R01ES011359*
Project Duration: *Sept. 30, 2001 – July 31, 2009*

Summary

Since 1990, industrial production of swine has expanded rapidly in eastern North Carolina and occurs disproportionately in low-income communities of color. This CBPR project was undertaken to quantify community exposures to pollutants emitted by IHOs; to evaluate associations between pollutant levels, malodor, physical symptoms, mood, and quality of life; and to build the capacity of communities affected by IHO pollution to participate in research and improve environmental health.

Confined animal feeding operations in eastern North Carolina showing fecal waste pits (foreground), confinement structures (left and right middle), spray fields, and neighboring homes

Highlighted Impacts

Outputs

Data collection
Researchers collected environmental data in residential areas close to IHOs. In addition, study participants provided health-related data using both instruments and diaries, and they also participated in interviews that provided a larger historical and social context to the investigation.

Study reports
Participants received reports showing the environmental and health data collected regarding the effects of nearby IHOs.

Publications
Researchers published several peer-reviewed journal articles, reporting the results of the project.

Discussion in other media
The CHEIHO project was one of 10 case studies in a *National Science Foundation-funded report*, and it was featured in an *Institute for Agriculture and Trade Policy webinar* (which, in turn, was *covered by a Wired blogger*).

Outcomes

Raised awareness about EJ
Community members participated in an EJ workshop, which allowed them to think about their own circumstances in a new (and larger) context. They also became aware of the possibility of social and political change as it related to their particular circumstances.

Informed policy development
Researchers reported their findings to local communities, and activists used the findings in their efforts to alter land use policies.

Developed strong relationship between researchers and community activists
Community organizers recruited study participants, helped build trust in researchers, and helped community members consider the possibility that research might help them improve their lives.

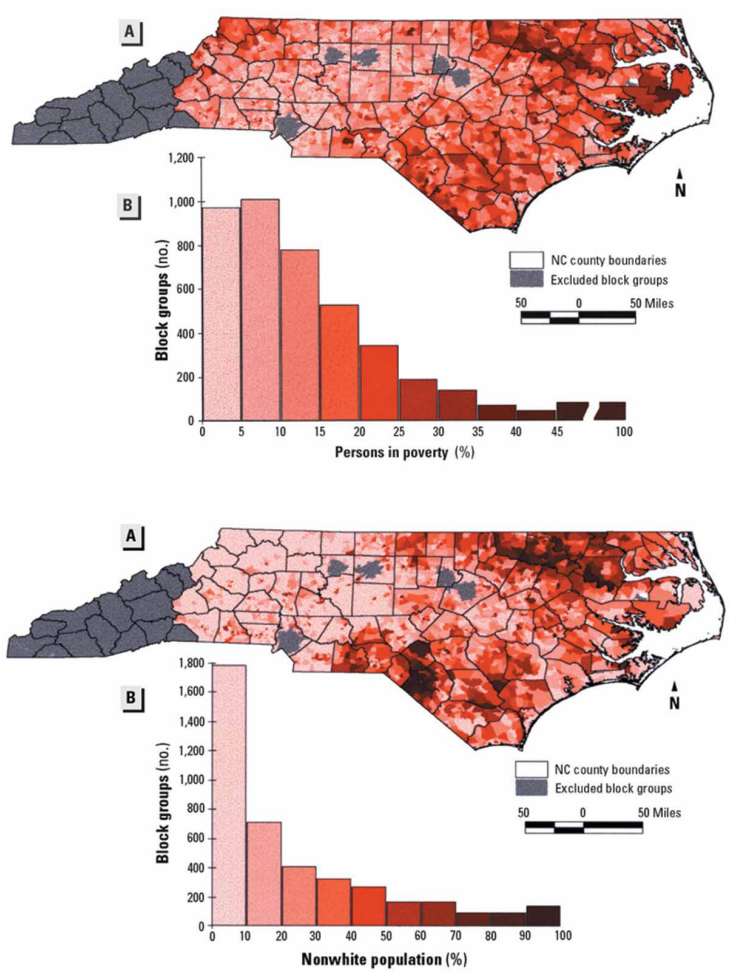
8. Community Health and Environmental Reawakening (CHER)

Project Investigator: *Steve Wing, Ph.D., University of North Carolina at Chapel Hill (steve_wing@unc.edu)*
Grant Number: *R25ES008206*
Project Duration: *Sept. 1, 1996 – April 30, 2009*

Summary

The long-term objective of CHER has been to improve environmental health in the rural South by supporting grassroots leadership and community empowerment. Isolated rural areas of the South have high levels of poverty and unemployment.

This project aimed to address troubling patterns of environmental contamination by building capacities of rural African-Americans to be partners in research, to engage in community education, and to organize around environmental health issues. The project used a CBPR approach by building on a community-academic partnership among researchers at the University of North Carolina School of Public Health; several medical provider organizations; and the Concerned Citizens of Tillery, a strong grassroots community organization in Halifax County, North Carolina.



Distributions of poverty and minority residents in North Carolina as of 1998–2000.

Source: *Wing S, et al. Environmental injustice in North Carolina's hog industry. Environ Health Perspect 108(3):225–231 (2000).*

Highlighted Impacts

Outputs

Door-to-door surveys
Researchers and community members collaboratively designed surveys to measure health and water-quality issues.

Analysis of the location of IHOs
Researchers worked with community members to determine whether IHOs were disproportionately located in low-income communities of color. Results showed that IHOs were concentrated in areas of higher poverty and percentages of people of color and areas that relied on well water that can be contaminated by hog waste.

Publications

Stingone J, Wing S. 2011. Poultry-litter incineration as a source of energy: reviewing the potential for impacts on environmental health and justice. New Solut 21(1):27-42.

Norton J, Wing S, Lipscomb HJ, Kaufman JS, Marshall SW, Cravey AJ. 2007. Race, wealth, and solid waste facilities in North Carolina. Environ Health Perspect 115(9):1344-1350.

Donham K, Wing S, Osterberg D, Flora J, Hodne C, Thu K. 2007. Community health and socioeconomic issues surrounding concentrated animal feeding operations. Environ Health Perspect 115(2):317-320.

Griffith M, Tajik M, Wing S. 2007. Patterns of agricultural pesticide use in relation to socioeconomic characteristics of the population in the rural US South. Int J Health Serv 37(2):259-277.

Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. 2006. Asthma symptoms among adolescents attending public schools located near confined swine feeding operations. Pediatrics 118(1):e66-e75.

Mirabelli MC, Wing S. 2006. Proximity to pulp and paper mills and wheezing symptoms among adolescents in North Carolina. Environ Res 102(1): 96-100.

Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. 2006. Race, poverty, and potential exposure of middle school students to air emissions from confined swine feeding operations. Environ Health Perspect 114(4):591-596.

Avery R, Wing S, Marshall S, Schiffman S. 2004. Odor from industrial hog operations and suppression of mucosal immune function in nearby residents. Arch Environ Occup Health 59(4):101-108.

Wilson S, Howell F, Wing S, Sobsey M. 2002. Environmental injustice and the Mississippi hog industry. Environ Health Perspect 110(Supp 2):195-201.

Wing, S. 2002. Social responsibility and research ethics in community driven studies of industrialized hog production. Environ Health Perspect 110(5):437-444.

Wing S, Freedman S, Band L. 2002. The potential impact of flooding on confined animal feeding operations in eastern North Carolina. Environ Health Perspect 110(4):387-391.

Cole D, Todd L, Wing S. 2000. Concentrated swine feeding operations and public health: a review of occupational and community health effects. Environ Health Perspect 108(8):685-699.

St. George DM, Wing SB, Lewis DL. 2000. Geographic and temporal patterns of toxic industrial chemicals released in North Carolina, 1988-1994. N C Med J, 61(1):396-400.

Wing S, Cole D, Grant G. 2000. Environmental injustice in North Carolina's hog industry. Environ Health Perspect 108(3):225-231.

Wing S, Wolf S. 2000. Intensive livestock operations, health, and quality of life among eastern North Carolina residents. Environ Health Perspect 108(3):233-238.

Wing S. 1998. Whose epidemiology, whose health? Int J Health Serv 28(2):241-252.

Wing S, Grant G, Green M, Stewart C. 1996. Community based collaboration for environmental justice: south-east Halifax environmental reawakening. Environ Urban 8(2):129-140.

Outcomes

Established foundation for collaboration between researchers and community activists to engage in research
Investigators and activists worked closely to design appropriate research questions and to garner a high level of community participation.

Supported ability to attain supplementary EPA grant
Community members were able to use data from this project in order to apply for an EPA hardship grant for a new sewer line.

Informed legislation regarding IHOs
CHER's research and education efforts contributed to the adoption of a statewide moratorium on construction of new IHOs, renewal of this moratorium, and eventually, a permanent ban on construction of new facilities that employ the lagoon-and-sprayfield system of manure management.

Increased public awareness about IHO-related issues
This project shined a light on the major health and environmental problems associated with IHOs and also encouraged others to pursue research projects in this area.

9. Communities Organized Against Asthma and Lead (COAL)

Project Investigator: *Jonathan Ward, Ph.D., University of Texas Medical Branch (UTMB) (jward@utmb.edu)*
Grant Number: *R25ES012595*
Project Duration: *Sept. 1, 2003 – Dec. 31, 2008*

Summary

Residents in the predominantly Latino area near the north side of a Houston, Texas, community, face various challenges, including high rates of poverty, lack of access to health care and recreational exercise facilities, food insecurity, crime and violence, and immigration issues. The aging stock of pre-1978 housing poses an additional threat to children's health: exposure to biologically-available lead and various environmental triggers implicated in asthma pathogenesis.

Project COAL sought to identify and characterize risks of lead poisoning and asthma in children and reduce overall home environmental risks in the community. The effort involved a wide range of strategic partners, including de Madres a Madres, a neighborhood-based social service/health promotion provider; Casa de Amigos, a local comprehensive health care clinic; investigators and personnel from UTMB NIEHS Center in Environmental Toxicology (CET) Community Outreach and Engagement Core (COEC); the Environmental Justice Law Clinic at Texas Southern University's Thurgood Marshall School of Law; and Texas Environmental Justice Advocacy Services, a grassroots EJ advocacy group. As the project evolved, close collaboration with the City of Houston Health and Human Services Childhood Lead Poisoning Prevention Program (CLPPP) ensured that project findings and recommendations informed public policy.

Project COAL used an overarching CBPR approach to guide the effort. Using a *promotoras* outreach model, de Madres a Madres conducted a survey of neighborhood housing and developed customized educational interventions based on assessment outcomes for each home. Recruiting health promotion actors from local neighborhoods, de Madres a Madres and NIEHS CET COEC personnel created an interactive grassroots *teatro* to communicate project findings and risk guidelines to the community.

Assessment results identified one-third of the homes as significantly contaminated with lead. A probabilistic model of asthma prevalence estimated that up to 30 percent of children surveyed showed signs associated with a diagnosis of asthma, despite relatively few who had been formally diagnosed with reactive airway disease. This was an important finding, especially because it helped researchers understand the need to consider alternate methods to measure asthma prevalence within the Hispanic population. Asthma symptoms were also associated with an increased risk of exposure to lead paint and dust, cockroaches, and pesticides. Educational interventions stressed low-cost solutions to limit exposures in the home, and generally increased community understanding of environmental health, exposure pathways, risk and possible health outcomes of lead and asthma trigger exposures, and available state and city of Houston services.

Highlighted Impacts

Outputs

Training for community-based organizations
Personnel from de Madres a Madres trained to administer a healthy homes survey, take environmental lead samples, and deploy air monitoring instrumentation. The City of Houston CLPPP and the UTMB Children's Asthma Program provided specific training modules on lead poisoning, blood lead level screening, and asthma pathogenesis for de Madres a Madres staff and community teatro.

De Madres a Madres initiated stronger relations with City of Houston CLPPP to ensure community received full benefits of screening/abatement services
De Madres a Madres, CLPPP, and UTMB NIEHS CET shared information to maximize the impact of the pre-existing de Madres a Madres lead education efforts in the public school system and the CLPPP residential lead abatement program.

Used community *teatro* as an interactive communications tool for the project
Neighborhood residents with no prior acting experience received training in Augusto Boal's Theatre of the Oppressed methodology and lead/asthma public health principles, and launched a series of performances throughout neighborhoods served by de Madres a Madres. *Teatro* performances and workshops spanned 2 ½ years of the project, and the group became a neighborhood institution.

Development of process to expedite lead control and abatement services
City of Houston CLPPP (Brenda Reyes, M.D.) and de Madres a Madres developed a family consent process to transmit Healthy Homes survey results to CLPPP to expedite lead control and abatement services.

Outcomes

Survey produced useful data characterizing housing-based environmental health risks to support outreach
Home environmental and lead exposure surveys demonstrated the prevalence of lead risk factors, an estimate of asthma incidence, and environmental risk factors associated with asthma. Project survey data was communicated to Casa de Amigos, City of Houston CLPPP, and was integrated into the de Madres a Madres teatro outreach.

City of Houston Bureau of Children's and Community Environmental Health received an additional $4 million EPA grant for its home-based asthma intervention program
Project BREATHE incorporates a Healthy Homes survey similar to COAL. Findings from COAL served as pilot data for the development of a demographically more significant, citywide program.

***El Teatro Lucha por la Salud del Barrio* intervention model**
The interactive feature of *teatro* was used to co-create a culturally-fluent home visit intervention model, develop and prioritize community environmental health issues, and to consider the impacts of cultural, socio-economic, and demographics as barriers to environmental health.

***Teatro* techniques used as a progress evaluation tool at the project midpoint**
Project partners convened a participatory action research project/discussion of communications problems and power dynamics that developed throughout the assessment and intervention phases of COAL. These techniques have been incorporated into the NIEHS CET COEC outreach and the CBPR instructional repertoire of the UTMB Clinical and Translational Sciences Award Community Engagement and Research Key Resource.

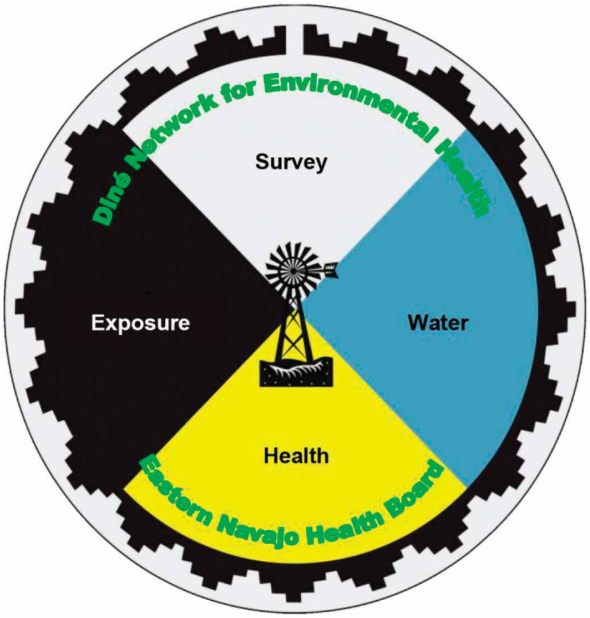
***El Teatro Lucha por la Salud del Barrio* became an autonomous entity**
Teatro Lucha offers performances and workshops on environmental/occupational health issues throughout the Houston metro. *Teatro Lucha* kicked off the Community/Campus Partnerships for Health national conference with a performance and workshop (April 2012).

10. Dine' Network for Environmental Health (DiNEH) Project

Project Investigator: *Johnnye Lewis, Ph.D., University of New Mexico (jlewis@cybermesa.com)*
Grant Number: *R25ES013208; R01ES014565*
Project Duration: *Sept. 10, 2004 – April 30, 2009; July 18, 2006 – June 30, 2011*

Summary

The disproportionate uranium exposures that have adversely affected the health of the Navajo Nation can be traced back to the prominence of uranium mining in the 1940s. Although these last uranium mines were closed in 1986, many were abandoned without proper remediation. As a result, the Navajo people have lived amidst more than 1,000 hazardous waste sites scattered across the Navajo Nation for more than 65 years.



In 2000, 20 Navajo Nation chapters requested assistance to investigate the relationship between the uranium mine sites and instances of kidney disease among nearby Navajo residents. A team from the University of New Mexico, who later adopted the name "DiNEH," responded to the request for help. The team collected and analyzed a series of samples from every drinking water source relied on by the tribal communities, conducted surveys on behavior, and performed health assessments. The team discovered that more than 30 percent of Navajo residents lacked access to water, and more than twice as many people hauled water, often from unregulated sources. They documented use patterns and also analyzed metals contamination in all 150 unregulated water sources used by community members. Their data showed that approximately 20 percent of wells exceeded arsenic maximum contaminant levels.

DiNEH project efforts have helped to identify and map contaminated water sources on Navajo tribal lands, and have implemented effective outreach efforts to raise awareness about the health impacts of the contaminated water sources, as well as cost-efficient actions to reduce exposure to the contaminants. The efforts have also helped to inform public policy related to uranium mining on Navajo lands.

Highlighted Impacts

Outputs

First community health assessment in uranium-impacted communities
DiNEH conducted the first community health assessment in uranium-impacted communities, surveying 1,304 people in 20 Navajo chapters. The research demonstrated a dose-response relationship between disease and contact with mine site contaminants.

Outcomes

DiNEH research demonstrated contamination relationships used to inform policy
DiNEH's research efforts, funded by NIEHS, provided the first real evidence of a connection between contamination and the Navajo Nation residents' health, thus providing a basis for decision-making. Findings instigated a series of important political hearings.

Medical monitoring program
DiNEH assisted in facilitating a medical monitoring program implemented by the Navajo Area Indian Health Service (IHS) for residents concerned about uranium exposure. Analyzing blood and urine samples from participants in both programs, the DiNEH Project identified early indicators of uranium-associated health effects and potential mechanisms of action, which they are continuing to follow.

Mine runoff assessment at Northeast Church Rock
Northeast Church Rock Mine, the nation's largest underground uranium mine, was shut down in 1984—five years after the largest release of radioactive material in U.S. history from the associated mill site. DiNEH characterized contaminants in soils and drainages in the neighboring community, and used a mobile field station to provide health screens for every community member during an EPA emergency removal action in the community.

Developed innovative research models
DiNEH's efforts have led to the development of valuable research models that help to identify strong relationships between environmental exposures and effects on human health.

Produced and distributed GIS maps of contaminated water wells

DiNEH's approximately 150 water samples and analyses of source contamination across 20 Navajo chapters revealed arsenic and uranium concentrations that exceed safe limits. DiNEH has produced and posted maps of contaminated areas and water sources in all 20 chapters to bring awareness to residents. The maps and associated photographic warning signs are also accessible online at *HealthyVoices.org*. As a result of hearings initiated by former Rep. Henry Waxman, these signs were adopted by a consortium of federal agencies for use across all Navajo Nation chapters to provide consistent warnings wherever residents travel.

Provided trainings for tribal community health representatives, university health professionals, and clinicians
DiNEH regularly hosts environmental health training sessions for tribal community health representatives, staff at the University of New Mexico Center for Development and Disabilities, and clinicians. Trainings have reached all 110 Navajo community health representatives every year for three years. Furthermore, DiNEH researchers periodically provide the 20 Navajo chapters with binders of information including pictures of the contaminated wells, water quality reports, and other basic environmental health information.

DiNEH, with Navajo EPA, developed safe water hauling guidance for individual haulers
The guidance was distributed to the community on informational cards. A documentary was also produced on the subject and is currently being screened at international film festivals to improve awareness of the problems globally.

Helped to inform Waxman hearings, five-year remediation plan
Former Rep. Henry Waxman convened hearings in 2007 in response to the publicized health impacts in the Navajo Nation. DiNEH team members provided testimony on health effects to the committee at these hearings and regularly update staff. The hearings resulted in a five-year remediation plan and the implementation of a medical monitoring program by IHS.

Free health assessments to residents
More than 500 people across the Navajo Nation have participated in the medical monitoring program that also provides residents with information to help reduce exposures.

Stimulated removal action at Northeast Church Rock Mine community
DiNEH's publication of geochemical characterization of severe contamination at this site, and long-term collaborations with the EPA, resulted in an EPA follow-up investigation and emergency removal of 18 inches of contaminated topsoil.

Reduced water hauling from contaminated water sources
DiNEH public outreach and education initiatives have helped to inform local residents about water source contamination. Increased awareness resulted in the decreasing number of people hauling water for drinking from these sources.

Improved health care assistance to residents
DiNEH-led trainings for tribal community health representatives, university health professionals, and Navajo Area clinicians have helped to inform their assistance to residents with health concerns related to uranium exposure.

Informed Navajo law banning uranium mining and milling
In 2005, Navajo Nation President Joe Shirley, Jr., signed the Dine' Natural Resources Protection Act — the first Native American tribal law banning uranium mining and milling. DiNEH research and testimony was used by residents to inform and generate support for the legislation.

Demonstrated capacity and need for a Navajo birth cohort study
DiNEH findings informed the Waxman committee's support for a new study to look at the health impacts of uranium exposures on a cohort of Navajo infants. Previous relationships developed during the DiNEH project paved the way for this collaborative research with Navajo Area IHS, Navajo Division of Health, Centers for Disease Control and Prevention Agency for Toxic Substances and Disease Registry, and support from EPA and Navajo EPA.

11. Environmental Health and Justice in Norton Sound, Alaska

Project Investigator: *Pamela Miller, Alaska Community Action on Toxics (pamela@akaction.org)*
Grant Number: *R25ES014308*
Project Duration: *Sept. 15, 2005 – July 31, 2011*

Summary

Alaskan Native communities of the Norton Sound region are affected disproportionately by contamination from formerly used defense sites (FUDS) and from the accumulation of persistent organic pollutants (POPs) in the Arctic that are transported via atmospheric and oceanic currents. To address the human health effects from these contaminants, this CBPR effort established partnerships with 15 communities in the Norton Sound region, predominantly populated by Inupiaq and Yupik native peoples. This initiative worked to facilitate greater public understanding about the presence of environmental contamination in the Norton Sound region, the human health implications, and ways of reducing exposures. Collaborators included the University at Albany, the University of Alaska, Clarkson University, and the Norton Sound Health Corporation.

Participants in summer college-credited Community-Based Research Institute in Alaska.

The project partners worked to:

- Develop a database of contaminants found in the region's FUDS.
- Facilitate information exchanges among communities about effective cleanup strategies.
- Train and support the region's health care professionals to improve diagnosis and treatment of ailments that might be associated with environmental exposures.
- Document health outcomes of concern.
- Provide cleanup oversight training to village leaders.
- Train and support village environmental health research technicians to work with the project team in collecting independent data regarding environmental and health effects from contamination associated with military sites.
- Establish independent contaminant monitoring programs.

Highlighted Impacts

Outputs

Environmental health toolkit

Alaska Community Action on Toxics (ACAT) and its partners developed a hands-on booklet that provides information for health care professionals and their patients. It is designed to promote proper diagnosis, treatment, and prevention of health effects associated with environmental contaminants. ACAT and its partners also developed a Protecting Our Health poster to accompany the toolkit and distributed it to health clinics, tribal offices, schools, and other public places in villages throughout rural Alaska. With colorful original watercolor designs, the poster graphically illustrates and describes how people are exposed to contaminants, which chemicals they are exposed to, ways to limit exposure, and safer alternatives. It identified local and distant sources of contaminants, giving special attention to sources unique to Alaska's rural villages (i.e., open dumpsites, all-terrain vehicles, and mining and military sites).

Publications

This project generated three peer-reviewed articles:

Hoover E, Cook K, Plain R, Sanchez K, Waghiyi V, Miller P, Dufault R, Sislin C, Carpenter DO. 2012. Indigenous peoples of North America: Environmental exposures and reproductive justice. Environ Health Perspect 120(12):1645-9.

Welfinger-Smith G, Minholz JL, Byrne S, Waghiyi V, Gologergen J, Kava J, Apatiki M, Ungott E, Miller PK, Arnason JG, Carpenter DO. 2011. Organochlorine and metal contaminants in traditional foods from St. Lawrence Island, Alaska. J Toxicol Environ Health A 74(18):1195-214.

Carpenter DO, DeCaprio AP, O'Hehir D, Akhtar F, Johnson G, Scrudato RJ, Apatiki L, Kava J, Gologergen J, Miller PK, Eckstein L. 2005. Polychlorinated biphenyls in serum of the Siberian Yupik people of St. Lawrence Island, Alaska. Int J Circumpolar Health 64(4):322-35.

Additional publications

Scrudato RJ, Chiarenzelli JR, Miller PK, Alexander CR, Arnason J, Kamzow K, Zweifel K, Gologergen J, Kava J, Waghiyi V, Carpenter DO. 2012. Contaminants at Arctic formerly used defense sites. J Local Glob Health Sci 2012(2); doi:10.5339/jlghs.2012.2.

Monthly seminars

ACAT organized a series of 52 monthly teleconference seminars for health care professionals to present new research and information on environmental health science and policy issues as part of the Alaska Collaborative on Health and the Environment. Thirty to 90 people participated every month, including community health aides and tribal leaders throughout Alaska, physicians, nurses, professors and students, and state and federal officials.

Research training

ACAT staff and University of Alaska faculty sponsored four university-credited Community-Based Environmental Research Field Institutes, providing intensive field, laboratory, and classroom training for 75 tribal environmental leaders and community health workers. The institutes provided participants with tools to conduct their own independent community-based assessments of the effects of contaminants on water quality, air, sediments/soils, fish, and human health.

Outcomes

Increased Norton Sound health care system's capacity to address environmental health concerns

Project personnel increased the environmental health capacity of hospital staff and community health aides by organizing several seminars with recognized experts.

FUDS

The project improved regulatory oversight, prioritization of community concerns, and effective cleanup of FUDS in the region.

Informed statewide chemical policy

The project helped to inform proposed statewide policy to prevent exposures to harmful flame retardant chemicals.

Informed national policy

Project personnel and community leaders provided testimony to inform officials in Washington, D.C., in regards to military cleanups and national chemicals policy.

International impact

The partnership has worked with colleagues from the International POPs Elimination Network to ensure the listing of additional pesticides and industrial chemicals under provisions of the Stockholm Convention.

12. Gardenroots: A Co-Created Citizen Science Program to Empower Communities

Project Investigator: *Monica Ramirez-Andreotta, University of Arizona (mdramire@email.arizona.edu)*
Grant Number: *P42ES004940*
Project Duration: *March 5, 1990 – March 31, 2015*

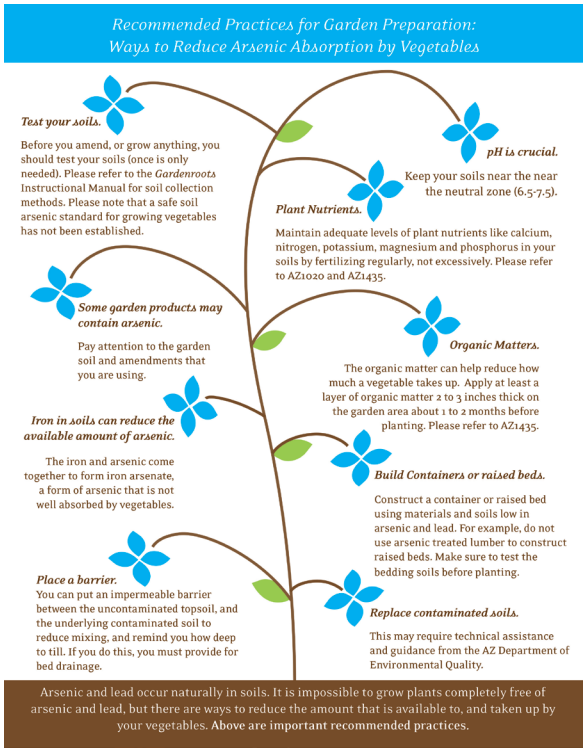
gardenroots
The Dewey-Humboldt, Arizona Garden Project

Summary

Dewey-Humboldt, Arizona, is a rural community adjacent to the Iron King Mine and Humboldt Smelter Superfund (IKMHSS) site. In August 2008, community members attended a public meeting to learn more about the Superfund site and expressed serious concerns regarding the safety of growing and consuming vegetables from their gardens. They posed the following questions: Are my soils safe? Is it safe for me to consume the vegetables from my garden? If so, how much? In response, Ramirez-Andreotta worked together with Dewey-Humboldt, Arizona, residents to investigate the uptake of arsenic in commonly grown vegetables, and to evaluate the possible health risks to the local population.

The project developed into a co-created citizen science program called Gardenroots: The Dewey-Humboldt, Arizona Garden Project. Using low-cost sampling kits, community members collected soil, water, and vegetable samples from their household gardens and together characterized the uptake of arsenic by their homegrown vegetables near a Superfund site. Twenty-five households participated in the Gardenroots program. Participants were between 40 and 70 years old; 61 percent were female and 33 percent held a bachelor's degree or higher.

There is a growing need to accurately evaluate the human health risks posed to resident food gardeners neighboring contaminated environments and the effects of a citizen science project on a community. According to the National Gardening Association, in 2013, 37 million households participated in food gardening at home, 3 million grew food at a community garden, and 76 percent of the households grew vegetables, an increase of 17 percent since 2008. These facts, in combination with the current estimate of 45 billion tons of mine waste in the U.S. (USEPA 2004), illustrated the importance of the issue. The community concern and posing of the research question, combined with the research need and national interest in gardening, made Gardenroots an excellent community-academic partnership and way to co-generate site-specific data relevant to the community.



One of Gardenroots' informal publications: Recommended Practices for Garden Preparation: Ways to Reduce Arsenic Absorption by Vegetables

Conclusions: A community-academic, co-created citizen science program can address complex problems that arise in communities neighboring a contaminated site. Public participation in research can increase the community's involvement in risk communication and decision-making, which ultimately has the potential to help mitigate exposure and thereby reduce associated risk.

Highlighted Impacts

Outputs

Trained community members for sampling exercise
More than 40 community members received a 1.5-hour training on how to properly collect soil, water, and vegetable samples from their home gardens for laboratory analysis. Participants received a home instructional manual and toolkit with all supplies to properly collect samples from their home gardens. Samples were collected throughout 2011.

Additional trainings and presentations
In 2012, Ramirez-Andreotta held a series of trainings and presentations for community leaders and residents throughout the state of Arizona.

May 2012 – "Protecting Communities Neighboring Contamination: A Transdisciplinary Approach to Determine the Accumulation of Arsenic in Vegetables" (Gila County, Arizona)

June 2012 – "Protecting Communities Neighboring Contamination: A Transdisciplinary Approach to Determine the Accumulation of Arsenic in Vegetables" (Yavapai County, Arizona)

June 2012 – "Gardenroots: A Complete Overview of the Dewey-Humboldt, Arizona Garden Project"

Meetings and seminars
In May 2011, the University of Arizona (UA) conducted a gardening seminar to provide introductory instruction to beginner vegetable gardeners. In June, UA hosted a community health talk to discuss health concerns. In August, UA staff served as an EPA panel/presenter at a community meeting.

Sampling laboratory tour
In November 2011, UA organized "Science Behind Gardenroots: A University of Arizona Tour." Community members were invited to lab tours to see how their soil, water, and vegetable samples were prepared for analysis and what analytical instruments were used.

Personalized sampling results booklets
UA hosted "Results for Lunch: Your Soil, Water and Vegetable Outcomes" to distribute personalized booklets containing individual household sampling results. UA staff conducted presentations to illustrate how to interpret results. Over 45 participants and community members attended this luncheon.

Publications
Ramirez-Andreotta MD, Brusseau ML, Artiola JF, Maier RM. 2013. A greenhouse and field-based study to determine the accumulation of arsenic in common homegrown vegetables. Sci Total Enviro 443:299-306.

Outcomes

Individual learning outcomes: what community members learned and new research questions posed
Via surveys and group discussions, the majority of the community stated that they would continue to eat home-garden vegetables, but would modify their gardening practices. This demonstrates that the scientific findings were understood and that the community could put into action behavioral changes necessary to reduce their arsenic exposure from water and soil. Analysis of individual learning also showed that Gardenroots prompted curiosity and an increased understanding of soil contamination, food quality, and the scientific process. For example, participants asked to have their chicken eggs sampled to determine the concentrations of arsenic and heavy metals. Another inquired whether cinder blocks in a raised garden bed contributed arsenic to their soil, and if samples from the local river or the soil from a local farm had been tested.

Programmatic outcomes
Participants from the Gardenroots project have contributed to the fields of environmental science, environmental health, and research translation. This project has improved our understanding of: (1) the uptake of arsenic in common homegrown vegetables grown in soils near a mining site; and (2) the amount of arsenic introduced to an individual via the ingestion of homegrown vegetables, soils (incidental), and water, and potential risks posed by those exposure routes. These publications demonstrate that trained community members with non-science backgrounds can successfully collect data and contribute to scientific investigations. Lastly, Gardenroots participants reviewed a manuscript to ensure the integrity of the project and representation of the partnership.

Community-level outcomes: redefining the question and policy implications
Gardenroots increased social capital and community capacity by serving as a platform for participants to learn more about environmental contamination generally and the Superfund site specifically, and providing a catalyst to generate communication amongst themselves. Participants increased their community networking in resource-related issues, participated in other resource-related projects, and leveraged the results to encourage government officials to take action and be more stringent in their cleanup efforts. For example, the Gardenroots project revealed that the local public water system was serving water that exceeded the arsenic drinking water standard (0.010 mg/L). Gardenroots participants worked together to identify and notify additional households that were connected to the public water supply.

Ramirez-Andreotta MD, Brusseau ML, Beamer P, Maier RM. 2013. Home gardening near a mining site in an arsenic-endemic region of Arizona: assessing arsenic exposure dose and risk via ingestion of home garden vegetables, soils, and water. Sci Total Environ 454-455:373-82.

Ramirez-Andreotta MD, Brusseau ML, Artiola JF, Maier RM, Gandolfi AJ. In press. Building a co-created citizen science program with gardeners neighboring a Superfund site: the gardenroots case study. Int Public Health J.

Informal publications

Results, recommendations/resources, and educational materials listed below are available on the *Gardenroots website:*

Ramírez-Andreotta MD, Artiola JF. 2011. Gardenroots Instructional Manual.

Ramírez-Andreotta MD. 2012. Recommended Practices for Garden Preparation: Ways to Reduce Arsenic Absorption by Vegetables.

Ramírez-Andreotta MD. 2012. Recommended Practices for Safe Consumption of Homegrown Vegetables: Ways to Reduce Dietary Arsenic and Lead Ingestion.

Ramírez-Andreotta MD. 2012. Recommended Practices for Safe Gardening: Ways to Reduce Incidental Soil Ingestion and Inhalation.

Gardenroots Overview and Summary of Results.

Twenty-five individualized results booklets for each participant: Results: Your Soil, Water and Vegetable Outcomes.

Newspaper articles and blogs

Tone S. 2012. Project cultivates effort to test for contamination: scientists analyze samples from Dewey-Humboldt gardens. Prescott Valley Tribune (Prescott Valley, AZ) 3 July.

2012. Learn about metal content of vegetables. Payson Roundup (Payson, AZ) May 15:3B.

NIEHS (National Institute for Environmental Health Sciences) Superfund Research Program. 2013. Arsenic Uptake in Homegrown Vegetables from Mining-Affected Soils. Research Brief 219. Available: *http://tools.niehs.nih.gov/srp/researchbriefs/view.cfm?Brief_ID=219* [accessed 27 July 2014].

Mishamandani, S. 2013. Wetterhahn awardee discusses community project on arsenic in vegetables. NIEHS Environmental Factor. Available: *http://www.niehs.nih.gov/news/newsletter/2013/3/science-wetterhahn/index.htm* [accessed 27 July 2014].

Lockwood, D. 2012. Crowdsourcing chemistry. Chemical and Engineering News, 12 November: 30-32. Available: *http://cen.acs.org/articles/90/i46/Crowdsourcing-Chemistry.html* [accessed 27 July 2014].

Sierra Club Yavapai Group (Grand Canyon Chapter). 2012. Dewey-Humboldt Gardens: safe arsenic levels. Sierra Club Yavapai Group Newsletter.

They also reported their test results to the EPA, advocating that this issue needed to be addressed (Gardenroots also notified and sent the results to the EPA). As a result, the municipal water supplier was issued seven notices of violation by the ADEQ, including one for exceeding the arsenic drinking water standard. In the words of a Gardenroots participant, "The people in Humboldt served by Humboldt Water System are deeply indebted to Mrs. Ramirez-Andreotta's study which served to reveal a serious problem with the municipal water." Additionally, arsenic concentrations in water exceeded the drinking water standard for several participants who rely solely on their private wells for potable water. Gardenroots personnel worked closely with those households to provide information regarding water treatment technologies that could be implemented to reduce their arsenic concentrations. Now, the community is reporting that they are regularly testing their private wells, and are pressuring ADEQ to ensure that water entering their home is at or below the arsenic drinking water standard.

Gardenroots built trust between the UA scientists and the Dewey-Humboldt, Arizona, community. This trust has set the groundwork for a long-term community-academic partnership. Due to the efforts discussed above, three additional research projects have been initiated to address pressing remediation and characterization challenges posed by the IKMHSS site. Two former Gardenroots participants were hired as UA employees to be part of the local field team to determine the levels of metal exposure in children ages 1–11 years. This is evidence that the Gardenroots community-academic partnership has enhanced social capital and community capacity and has even had a small economic impact in the community.

Informed decision-makers

The Town of Dewey-Humboldt Environmental Issues Advisory Committee, Arizona Department of Environmental Quality (ADEQ), Arizona Department of Health Services, Agency for Toxic Substances and Disease Registry, and EPA project managers, toxicologists, and community involvement coordinators are using the products and results of Gardenroots to inform their work and use in community outreach materials.

13. Hazardous Material Worker Health and Safety Training: Alabama Fire College

Project Investigator: *Kenneth Oldfield, Alabama Fire College (koldfield@alabamafirecollege.org)*
Grant Number: *U45ES006155*
Project Duration: *Sept. 16, 1992 – July 31, 2015*

Summary

The Workplace Safety Training Program (WST), a division of the Alabama Fire College, provides emergency preparedness and response training with funding from a cooperative agreement with the NIEHS WTP. WST provides this training to two populations of workers: (1) Native American tribal members and employees, and (2) public safety personnel. WST helps to reduce the likelihood of worker exposures during hazardous material emergency response operations by providing specialized training in topics related to Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response standard (29 CFR 1910.120).

Ofa Taimani, Sonya Craighead, and Ian Perkins review the layout for decontamination during their hazardous waste operations and emergency response (HAZWOPER) training class.

Since 2000, WST has partnered with the Native American Fish and Wildlife Society to provide training at no cost to Native American tribes throughout the United States, a population of 2.4 million. The training targets tribal members and employees who may be first to respond to releases of hazardous materials, mass casualty incidents, clandestine drug laboratories, or other events involving hazardous materials. Such personnel include tribal police officers, conservation officers, firefighters, environmental officials, emergency planners, and public works employees. The project also provides training to public safety personnel within the southeastern United States, a population of 171,390 fire and rescue service and law enforcement personnel.

People who participate in the training are encouraged to share the information with other members of their tribe or agency. WST instructors offer guidance and encouragement to trainees during the initial training. WST provides direct access to training materials including PowerPoint presentations, lesson plans, exercise descriptions, and worksheets that the peer trainers might need to train their peers. The peer trainers provide information about their training activities to WST for inclusion in WST's annual progress reports.

Highlighted Impacts

Outputs

Curriculum developed for several specific areas of hazardous materials training
The WST has developed curriculum for a range of topics, including Hazardous Materials Awareness and Operations; Incident Command Systems; Hazardous Materials Air Monitoring; Confined Space Rescue; Respirator Fit Testing; Mass Casualty Incident Triage; Clandestine Drug Lab Awareness; Radiological/Nuclear Awareness; Weapon of Mass Destruction/All Hazards Awareness, National Incident Management Systems; and Responder Safety Awareness.

Outcomes

Over 107,000 people trained
Since 1987, the WST program has trained over 107,000 people directly and through peer trainers.

Native American peer trainers share information with thousands more secondary trainees
WST has helped train 3,600 Native American peer trainers since 2000. These peer trainers have also reported taking health and safety information to over 2,300 secondary trainees in tribes throughout the U.S.

Increased capacity and capabilities among Porch Creek Indians to respond to chemical releases
Members of the Porch Creek Indian tribe in Atmore, Alabama, have developed their capacity and capabilities to respond to chemical releases after attending the WST hazardous materials and Incident Command System courses. The Porch Creek Indians have assumed a hosting role for other WST training courses that have helped to build awareness among the Porch Creek and other Native American tribes.

Assistance in Hurricanes Katrina and Rita response efforts
The Porch Creek tribe used the WST Incident Command System training to organize the delivery of aid and supplies to a tribe in southern Louisiana not assisted by federal response efforts. The tribe credits the NIEHS-funded training for providing them with the knowledge and capacity to assist the fellow tribe.

Thousands of public safety responders trained
WST has provided health and safety training to 6,300 public safety responders who may be exposed to hazardous materials while performing work-related tasks.

Nearly 1,000 union workers trained
WST has also provided hazardous materials training to 920 union workers working in various occupations that may involve exposures to hazardous materials.

Health and safety benefits extend beyond the trained
The benefits of the training program likely extend beyond those trained to include the communities that the trained serve with the awareness and knowledge achieved through the training.

Informed Emergency Support Function (ESF) #8 plans
State health department workers have noted using the information acquired through WST training to inform the development of Federal Emergency Management Agency ESF #8 plans providing public health and medical services during emergency situations.

14. Hazardous Materials Worker Health and Safety Training: CPWR

Project Investigator: *Erich "Pete" Stafford, CPWR: Center for Construction Research and Training (pstafford@cpwr.com)*
Grant Number: *U45ES006185*
Project Duration: *Sept. 30, 1991 – July 31, 2015*

Summary

The Center for Construction Research and Training (CPWR) develops training primarily for the workers represented by the 11 building and construction trades unions that comprise the center's Hazardous Waste Worker Training and the U.S. Department of Energy (DOE) Weapons Complex Program Construction Consortium. The workers trained through the consortium perform a variety of activities involving hazardous materials and toxic waste at DOE restoration sites and EPA Superfund sites.

The consortium provides training under the NIEHS HWWT Program, DOE Weapons Complex Program, HAZMAT Disaster Preparedness Training Program, and MWTP.

These NIEHS-funded trainings help to achieve EJ goals in multiple ways. First, they help to reduce disproportionate exposures and adverse health impacts resulting from occupational hazards related to this area of work. Secondly, MWTP serves as a mechanism to promote economic development, a vital component to achieving EJ. MWTP achieves this by helping underrepresented minorities to improve their academic and life skills to prepare them for sustainable employment in the environmental and/or construction trades industry. CPWR administers the MWTP in three urban centers located across the country.

Highlighted Impacts

Outputs

Five hundred trainings annually
CPWR hosts more than 500 training courses each year through its HWWT Program, DOE Weapons Complex Program, HAZMAT Disaster Preparedness Training Program, and MWTP. Training curriculum combines hands-on training, written, verbal, and physical exercises to reinforce student learning and information retention.

MWTP Basic Life Skills curriculum
The purpose of the MWTP basic life skills component is to help underrepresented minorities to improve their academic and life skills to prepare them for sustainable employment. GED training and testing are also provided to students, when needed. Acquiring or improving these skills helps to increase the employability of unemployed or underemployed minorities.

Developed innovative evaluation process of training effectiveness
CPWR regularly organizes focus groups of all stakeholders, including former and current trainees to ascertain the perception of training and the trainers regarding effectiveness. CPWR also facilitates bimonthly conference calls with program coordinators to share lessons learned, best practices, and quality improvements. Testing before, during, and after the course allows trainers to shift attention to where it is needed most throughout the training. In addition, students are provided with individual performance evaluations from the instructors after completing a course. The student evaluations assess job readiness, trade-related math and vocabulary, carpentry, and other trade skills.

Outcomes

Thousands trained and certified annually through CPWR's various training courses
The CPWR HWWT Program, DOE Weapons Complex Program, HAZMAT Disaster Preparedness Training Program, and MWTP provide training to and certify more than 6,000 people each year to work in construction and with hazardous materials.

Fifty to 75 students trained annually
The numbers of students training through the MWTP change from year to year. However, the MWTP has benefited approximately 50 to 75 annually in recent years.

Increased minority capacity to acquire meaningful careers in the community
Trainees who have completed the MWTP become empowered to acquire meaningful, long-term careers in communities' economic redevelopment activities.

Streamlined employment for underrepresented
The St. Paul, Minnesota, MWTP program staff continued to work closely with Minnesota Department of Transportation (MN/DOT) to increase the number of women and minorities working on state-funded highway projects. The longstanding, mutually beneficial relationship developed with MN/DOT and the St. Paul MWTP success, yielded a $400,000 two-year contract between MN/DOT and Merrick Community Services (MCS) to administer a fund that supplements the salary of graduates with contractors who are doing heavy highway construction. The success of the MWTP was a catalyst to enable CPWR's program partner, MCS, to train an additional 35 minorities and women with funding from MN/DOT.

Increased capacity and capabilities among workers to protect themselves from hazardous exposures
The CPWR worker training programs have provided thousands who may come into contact with hazardous materials in the workplace with sufficient knowledge to reduce their exposure to materials with the potential to cause adverse health effects.

Health and safety benefits extend beyond the trained
The benefits of the training program likely extend beyond those trained to include the communities that the trained serve with the awareness and knowledge achieved through the training.

New alliances strengthen consortium impact
CPWR's NIEHS-funded training programs have helped to bring about the formation of new alliances of community members, unions, and government agencies to support the consortium and enhance the training programs.

15. Healthy Food, Healthy School, and Healthy Communities: Project CAFÉ

Project Investigator: *Robert Gottlieb, Occidental College (gottlieb@oxy.edu)*
Grant Number: *R25ES012578*
Project Duration: *Sept. 1, 2003 – June 30, 2009*

Summary

The social and built environments affect food consumption patterns that influence disease occurrence and public health. Health disparities arise when environmental factors make it difficult for some to access healthy food choices. Access factors that influence dietary choices include cost, availability, and physical accessibility of healthy foods. Residents of neighborhoods that lack access to affordable sources of healthy food may experience higher rates of overweight and diabetes, resulting from differences in the consumption of fresh fruits, vegetables, and whole grains versus foods that are high in calories, added fat, and sugars, and low in other nutrients.

From 2004 to 2006, Project Community Action on Food Environments (CAFÉ) aimed to facilitate community-driven changes in nutrition environments in three low-income, predominantly Latino Los Angeles communities that suffer disproportionately from diet-related health conditions. The Healthy School Food Coalition, the community-based organization affiliated with the Urban and Environmental Policy Institute at Occidental College (the grant recipient), worked in central Los Angeles near Pico-Union and MacArthur Park, while the subcontracted organizations, Esperanza Community Housing Corporation and Blazers, each worked in neighborhoods in south Los Angeles.

Through a process of community engagement, participants conducted school and community food assessments that identified and characterized food access, food affordability, and food availability in target neighborhoods and schools. Residents mapped over 1,000 places where food was sold and surveyed a sample of stores to determine price, quality, and selection of key ingredients for a healthy diet. The knowledge gained from the assessments was used to initiate community and policy-level changes to improve access to healthy and affordable foods in the participating communities.

These interventions contributed to Project CAFÉ's goal of reducing risk factors for overweight and diabetes by improving the food environment through a process that involves and empowers local residents.

Highlighted Impacts

Outputs

Assessment and mapping of neighborhood access to affordable healthy foods

Project CAFÉ surveyed 90 stores and five schools, and facilitated the mapping of more than 1,000 food sources. The assessment found that convenience/liquor stores were among the most prevalent food establishments in the three communities, while full-service supermarkets comprised less than 2 percent of the total number of food stores. The study also noted that foods in the convenience/liquor stores were more expensive than those at full-service supermarkets. Furthermore, the study found that foods needed to make up a healthy diet (according to the U.S. Department of Agriculture) were generally not available. Additionally, many of the foods that were available were rated as poor in quality or beyond the expiration date.

Publications

Project CAFÉ led to two peer-reviewed journal articles:

Azuma AM, Gilliland S, Vallianatos M, Gottlieb R. 2010. Food access, availability, and affordability in 3 Los Angeles communities, Project CAFE, 2004-2006. Prev Chronic Dis 7(2):A27.

Azuma AM, Gilliland S, Vallianatos M, Gottlieb R. 2006. Changing the food environment: community engagement strategies and place-based policy tools that address the influence of marketing. Loyola Los Angel Law Rev 39:647-682.

Also drawing from Project CAFÉ findings, the Urban and Environmental Policy Institute at Occidental College developed the article "Food Access in Central and South Los Angeles: Mapping Injustice, Agenda for Action" in 2007, and the book "Food Justice" in 2010.

Outcomes

Increased community knowledge and capacity to participate meaningfully in decisions related to food access

Project CAFÉ effectively recruited and trained approximately 100 students, parents, and other community members to conduct community and/or school food assessments, and to engage in food access advocacy.

Increased community awareness of food access issues

Project CAFÉ outreach efforts reached between 5,000–10,000 community residents.

Informed proposed stronger nutrition standards impacting hundreds of thousands of children across the Los Angeles Unified School District (LAUSD)

The information compiled by Project CAFÉ helped to inform the LAUSD's proposed Cafeteria Improvement Motion in 2005. The policy set stronger nutrition standards for meals eaten by hundreds of thousands of children every day.

The creation of the Los Angeles Food Policy Council

The attention on food access generated by Project CAFÉ helped to build support for the creation of the Los Angeles Food Policy Council.

Informed proposed policy restricting new fast food restaurants in south Los Angeles

Project CAFÉ findings helped to inform the decision of the city of Los Angeles to pass new restrictions on new stand-alone fast food restaurants in low-income council districts in south Los Angeles.

Provided a foundation for additional food justice studies and efforts

Project CAFÉ provided a foundation for the Urban and Environmental Policy Institute at Occidental College to examine the connection between food accessibility and transportation in south Los Angeles, helping to inspire an ongoing campaign to legalize healthy mobile vending in Los Angeles.

16. Improving Public Housing to Build Healthier Communities

Project Investigator: *James Krieger, M.D., University of Washington (james.krieger@kingcounty.gov)*
Grant Number: *R25ES012584*
Project Duration: *Sept. 30, 2003 – Dec. 30, 2007*

Summary

In 2004, Seattle's Public Housing Authority broke ground on an ambitious effort to redevelop High Point, the city's largest public housing community. The homes in High Point had been in use for more than 60 years and had severely deteriorated over time. Roach infestations, mold, cracked walls, and other factors had made the housing hazardous to the health of its residents.

The Seattle Housing Authority sought to transform High Point into a clean, safe, and sustainable community. NIEHS and the U.S. Department of Housing and Urban Development provided funding to support collaborations among scientists, developers, and community members to conduct research and create development plans to provide a healthy living environment for all residents. Living conditions can affect a person's susceptibility to respiratory problems (e.g., asthma), injuries, brain development, and mental health problems, as well as having other health effects.

Today, High Point is home to a diverse, mixed-income community living in 1,600 new and refurbished units. The new High Point neighborhood promotes residents' health through a carefully-designed physical and social environment. Homes were constructed with high-quality materials to reduce indoor air pollution and moisture buildup, and 60 of the homes use special "breathe-easy" design features to minimize allergic triggers for residents with asthma. The neighborhood as a whole incorporates features that encourage physical activity, healthy eating, social interaction, and personal safety.

Highlighted Impacts

Outputs

Established resident-led community action teams
The teams were trained in environmental health awareness and applied this knowledge to facilitate home visits, which revealed special environmental health needs, and helped researchers and community members to develop culturally-appropriate solutions.

Integrated neighborhood features to promote healthy living, environmental quality, and community engagement
High Point residents have access to walking trails, safe social gathering spaces, tobacco-free zones, community gardens, sources of healthy foods, and public transportation.

Collaboration with community partners
This collaboration addressed the challenges of working in a multicultural and multilingual neighborhood, such as bilingual/bicultural staffing, interpretation at meetings and community activities, and translated materials. Researchers and community action teams joined forces to empower residents throughout the redevelopment process. Community-led groups organized projects to promote the use of walking trails, successfully petitioned local officials to better ensure pedestrian safety in the neighborhood, and organized community groups and events to build social capital.

Media exposure
In 2008, the research team's work was featured on the PBS show "Unnatural Causes" in a segment called "Place Matters."

Outcomes

Breathing easier
The project was able to acquire additional funding to support research and construction of 60 "breathe-easy" homes that reduce allergic triggers for young residents with asthma. The homes use special materials and features that improve ventilation, reduce dust, and cut exposure to emissions from paints, finishes, and adhesives.

Walking more
Research showed that the design improvements, combined with social support from walking groups, increased walking activity among group participants. And walking among all residents increased during the second phase of the High Point redevelopment.

Additional funding
The principal investigator received additional NIEHS funding to build on the work initiated in this project.

17. Land Use, Environmental Justice, and Children's Health

Project Investigator: *Joy Williams, Environmental Health Coalition (joyw@environmentalhealth.org)*
Grant Number: *R25ES010010*
Project Duration: *Aug. 15, 2000 – April 30, 2008*

Summary

Mobile and industrial air emissions place unfair burdens on low-income Latino communities in the Barrio Logan community of San Diego and the west sides of National City and Chula Vista, California. Emissions cause severe respiratory problems in children whose homes and schools are adjacent to truck-driving schools, freeways, and auto body shops.

The Land Use, Environmental Justice, and Children's Health project focused on air quality, land use, and respiratory health in these disadvantaged communities. Plans for development in these areas could increase these risks, or, if done with community input, produce healthier environments for children. By coupling local community assets with research, Environmental Health Coalition (EHC) and its partners used a CEnR approach to advance EJ by promoting precaution, examining cumulative impacts of air pollution, and supporting meaningful participation in land use planning issues that affect the health of families and neighborhoods.

EHC and its partners continue to work to inform policy to advance EJ.

Highlighted Impacts

Outputs

Influential publications and materials
In 2007, EHC released a report on green energy options to demonstrate how Chula Vista can move to renewable energy choices and reduce emissions of nitrogen oxides, fine particulate, and greenhouse gases from fossil-fueled power plants. Other materials include the "Burden of Disease" fact sheet on Barrio Logan for health care providers, a "Burden of Disease" report for National City and Chula Vista, and SALTA (Salud Ambiental, Lideres Tomando Acción) curricula on energy, land use, and clean ports.

Cumulative impact assessment
The California Environmental Protection Agency's Environmental Justice Advisory Committee implements EJ policies through a series of pilot projects. One of the pilot projects was the development of a model for cumulative impact assessment. EHC has helped develop a draft model and has also participated actively in the development of another cumulative impacts model developed by California researchers, the Environmental Justice Screening Model.

Environmental health and justice toolkit for activists
EHC has trained more than 1,500 community residents through its leadership development program. EHC's toolkit and guides are based on its Social Change for Justice Model and consist of Web-based versions of EJ trainings on public decision-making, leadership, and community planning. The guides include "SALTA" and "A Healthy Place to Live: A People's Guide to Community Planning."

Outcomes

Empowering communities
Community action teams (CATs) participate in SALTA training developed by EHC. CATs are the principal means of community involvement and education. CATs facilitate community work on land use, air quality, and children's health and form the backbone of EHC's "Toxic Free Neighborhoods, National City Land Use, and Green Energy Good Jobs" campaigns. EHC also empowers youth through education and outreach to high school and college students on air pollution and EJ.

Land use "vision" integrated into community plan
EHC and the Logan community have prompted the integration of the community's "vision" into the official community plan to ensure that land use planning reduces community exposure to emissions and provides affordable housing. EHC helped to secure $1.5 million for the city to update the Barrio Logan Community Plan.

Supported adoption of Clean Ports Plan
EHC and partners successfully persuaded the Port of San Diego to adopt the Clean Ports Plan. The plan aims to reduce diesel emissions from ships, trucks, and related equipment at cargo terminals. EHC's research on diesel particulates was instrumental in informing this policy.

Supported adoption of West Side Specific Plan
EHC supports the City Council's implementation of the West Side Specific Plan, which will enforce freeway and industry buffer zones, remove auto body shops from the community, provide affordable housing, and promote sustainable new development. These efforts will reduce exposure to emissions of car paint, metals, and solvents in a community of 1,000 residents and schoolchildren.

Ordinance reduces diesel exhaust
EHC staff and National City community residents persuaded the City Council to adopt an ordinance that prevents diesel trucks from practicing driving maneuvers in front of schools. This has reduced exposure to diesel exhaust for students and staff at Kimball Elementary School, which is located next to a truck driving school.

"Healthy Homes" ordinance requiring inspections
In 2006, EHC staff and residents supported the City Council adoption of the National City "Healthy Homes" ordinance. The ordinance requires annual inspections of rental properties, ensuring that rental units are free of mold, moisture problems, and similar asthma triggers.

Advocacy shuts down power plant
EHC and residents effectively advocated to shut down the South Bay Power Plant, an antiquated, polluting, and inefficient plant on Chula Vista's waterfront. Plant demolition and bayfront redevelopment is in progress.

Adoption of Airborne Toxics Control Measure (ATCM)
The California Air Resources Board has adopted the ATCM for metal plating operations that prohibits new hexavalent chromium plating facilities within residential or mixed use zones, and more stringent control measures for existing facilities. EHC supported new requirements for High-Efficiency Particulate Air (HEPA) filters for smaller platers, and other improvements to protect communities from hexavalent chromium emissions.

Improved Chula Vista's General Plan
EHC's efforts led to the incorporation of EJ and air quality policies and a required 1000-foot buffer zone for hazardous waste facilities into the Chula Vista General Plan Update. This planning document guides land use planning in the city for the next 10 to 20 years.

18. Linking Breast Cancer Advocacy and Environmental Justice

Project Investigator: *Julia Brody, Ph.D., Silent Spring Institute (brody@silentspring.org)*
Grant Number: *R25ES013258*
Project Duration: *Sept. 10, 2004 – June 30, 2009*

Summary

This project linked breast cancer and EJ advocacy through a variety of approaches conducted by Silent Spring Institute, a community-based breast cancer research organization; Communities for a Better Environment (CBE), an EJ organization; and partners from Brown University and the University of California, Berkeley. The collaborators conducted home environmental exposure assessments, collecting air and dust samples to assess indoor levels of pollutants, especially EDCs that are potentially linked to breast cancer, reproductive and neurological development, and other health outcomes. The project added measurements of pollutants from nearby industry and transportation in response to community concerns.

Data collection, analysis, community education, and organizational linkages occurred in two locations: Cape Cod, Massachusetts, a region of unexplained high breast cancer incidence that has been the focus of prior work by the Silent Spring Institute; and a site in Richmond, California, that is largely composed of people of color and impacted by industrial facilities. The research team shared study results in both an aggregate format (for community meetings, news media, and the Internet) and as individual reports for study participants. Using both approaches, this study sought to maximize understanding of exposure data (and their limitations) and to address the ethical issues of ensuring community and individual autonomy, the right to know, and ultimately the right to act on scientific information (by reducing exposures).

Highlighted Impacts

Outputs

Publications

The principal investigator published an analytic essay on reporting individual monitoring results to study participants in 2008 (see *example*). The research team also interviewed researchers involved in personal exposure studies about their report-back practices and views, and published a manuscript of the interviews. In addition, the research team interviewed study participants in California and Massachusetts who received their own results, and published two peer-reviewed articles about participants' experiences. The research team also published articles about institutional review board (IRB) challenges and evaluation strategies to help other teams practicing CBPR.

Brown P, Morello-Frosch R, Brody JG, Altman RG, Rudel R, Senier L, Perez C, and Simpson R. 2010. Institutional review board challenges related to community-based participatory research on human exposure to environmental toxins: a case study. Environ Health 9:39; doi: 10.1186/1476-069X-9-39.

Brown P, Brody JG, Morello-Frosch R, Tovar J, Zota AR, Rudel RA. 2011. Measuring the success of community science: the northern California Household Exposure Study. Environ Health Perspect 120(3):326–331.

Outcomes

Increased support for CBPR

Prior to beginning data collection, the partners obtained IRB coverage for all members in the team from the Brown University IRB. Developing this agreement represents a significant advance in support from an academic institution for CBPR, particularly given that a community-based organization was the principal investigator for the project. Presentations at professional conferences and a journal article highlighted this innovative agreement.

Cutting-edge research

The study was the first to show that levels of thyroid-disrupting flame retardants polybrominated diphenyl ethers (PBDEs) were much higher in California homes than elsewhere, likely due to the state's stringent furniture flammability standard (see *summary*). Results contributed to a 2014 revision in the California rules.

High media visibility
This project received high visibility in the local and national news media. CBE representatives were featured in a *National Geographic* (October 2006) article on personal exposure. The project was also covered by the Boston and Cape Cod National Public Radio stations; the *Cape Cod Times*, the *Sacramento Bee*, the *Los Angeles Times* (October 2008) and other local newspapers; *Consumer Reports* (March 2011); *Ms. Magazine* (October 2006); *The Green Guide*; *WebMD*; *The Wall Street Journal*'s *MarketWatch*; *Forbes*; and other outlets.

Conference presentations
Presentations at the annual meetings (2006) of the American Public Health Association and the American Sociological Association highlighted links between breast cancer advocacy and EJ. In April 2007, a Massachusetts Breast Cancer Coalition conference on breast cancer and African-American women was held. In addition, the project team held a *symposium* at the 2011 American Association for the Advancement of Science Annual Meeting to discuss the best way to inform study participants of personal results.

Also in the California location, the research team discovered higher levels of nickel and vanadium (chemicals associated with heavy oil combustion) in homes neighboring a refinery and marine port compared with a rural community, which demonstrates that outdoor air pollution is an important determinant of indoor exposures (see *summary*). There were very few differences in the EDC levels in the data collected at the two California sites (one urban, fence-line community and one rural community) or in Massachusetts homes. This illustrates that consumer products contribute substantially to indoor air quality and indicates the need for prevention strategies to reduce the use of EDCs.

Two Cape Cod homes had elevated PCBs. The researchers identified a commercial product that they hypothesized may be the source and developed a sampling plan to test this hypothesis (see *summary*).

Increased awareness of the toxics found in consumer products
Study participants learned about toxics in consumer products, and exposure results (see *article summary*).

Facilitated community environmental action
During the California study, the local oil refinery proposed permit changes that would potentially increase harmful pollutant emissions. CBE used the data collected in this study to inform local government of the health implications of such a change. Study participants used their individual data and aggregate results in their testimony (vividly demonstrating how the study helped increase community engagement in EJ issues). The community thus explored other ways to use the results to negotiate health protections from the oil company.

Developed new partnerships
This project represents the first sustained effort to link breast cancer and EJ constituencies, an effort that will bring new resources and perspectives to both groups.

Developed new models for reporting chemical exposures to study participants
While earlier research typically returned individual results only if they were "clinically relevant," this CBPR project wanted to be more responsive when study participants asked for their own data. The report-back methods developed in response have now been adopted by many other studies (see *handbook*).

19. Local Health Impacts of Land Application of Sewage Sludge

Project Investigator: *Steve Wing, Ph.D., University of North Carolina at Chapel Hill (steve_wing@unc.edu)*
Grant Number: *R01ES015469*
Project Duration: *Sept. 12, 2007 – July 31, 2012*

Summary

Approximately 16,000 municipal wastewater treatment plants in the U.S. produce over 7 million tons (dry weight) of residual sludge each year; most is applied to agricultural lands as free fertilizer. This sludge, also known as biosolids, consists of sediments resulting from the treatment of wastewater from homes, streets, schools, hospitals, and industries. In addition to nutrients useful for agriculture, sludge contains pathogens, allergens, metals, industrial chemicals, and pharmaceuticals.

As land application of sludge has increased, neighboring rural residents have reported health problems and impaired quality of life. Residents whose concerns have been dismissed by government officials have low trust in authorities and in health research conducted by government agencies and university researchers with ties to sludge generators and industries that profit from sludge disposal. Many affected communities are in low-income, rural areas, making land application of sludge an EJ issue.

In 2002, the National Research Council Committee on Toxicants and Pathogens in Biosolids Applied to Land recommended studying human exposure and illness; however, little research into the experiences of people living near land application sites has been conducted since then. One goal of this project is to estimate exposures and document odors in communities where sewage sludge is permitted to be spread on land and to examine whether exposure to sewage sludge affects the health of neighbors living within 1 mile of land application sites.

Highlighted Impacts

Outputs

Door-to-door survey
The researchers conducted a door-to-door survey with individuals living in rural and semi-rural areas within one mile of permitted land application sites and with individuals living in rural and semi-rural areas with no known permitted land application sites. Over 400 individuals completed the survey questionnaire. The researchers used marker analytes and geospatial modeling to estimate potential exposures to sludge pollutants. The team is analyzing survey and exposure data.

Semi-structured interviews
The researchers conducted in-depth semi-structured interviews with 34 individuals living within a mile of sludge application sites to learn about perceptions of health and quality of life and to understand local and individual factors that may influence a person's experience.

Publications
Environmental Health Perspectives recently published the researchers' manuscript reporting the results of the semi-structured interviews as they relate to the broader context of EJ.

Lowman A, McDonald MA, Wing S, Muhammad N. 2013. Land application of treated sewage sludge: community health and environmental justice. Environ Health Perspect 121(5):537–542.

Published manuscript
The researchers published a paper in the *North Carolina Medical Journal*, critiquing the suitability of the state's records for evaluating health impacts of sewage sludge.

Outcomes

Increased community EJ awareness
The in-person meetings allowed community organizers and researchers to educate community members about EJ and, more specifically, the potential for land application of treated sewage sludge to affect their health and quality of life. Some meeting attendees reported sharing what they learned with family, friends, and neighbors.

Community capacity building through EJ education
Researchers reached 50–60 people through EJ education and awareness meetings across multiple communities. Presentations and discussions primarily centered on the potential environmental health impacts of applying treated sewage sludge to farmland upon nearby residents. The brochure "Spreading the Word About Spreading Sludge" was also produced for educational purposes.

Sustained Partnerships
Researchers continue to share the survey and exposure data results and analysis (as they become available) with participants.

20. Minority Worker Training Program: OAI, Inc., Innovative Workforce Development

Project Investigator: *Tipawan Truong-Quang Reed, OAI Inc. (treed@oaiinc.org)*
Grant Number: *U45ES007850*
Project Duration: *Sept. 30, 1995 – July 31, 2015*

Summary

Many of Chicago's low-income communities are concentrated in areas surrounded by landfills, sewage treatment plants, abandoned factories, and steel mills. These communities are disproportionately affected by air and water pollution. Research has shown that although pollution generally has declined, low-income and minority areas continue to be hit hardest.

People in these communities face some of the nation's highest risks of lung disease, cancer, and other conditions linked to industrial pollution. For example, the air just two blocks from Washington High School (on Chicago's southeast side) has been recorded as having the state's highest levels of chromium and cadmium, as well as sulfates that trigger asthma attacks.

HAZWOPER exercise with Brotus Mitchell and Charles Hampton

As an MWTP awardee since 1995, OAI seeks to meet the changing health and safety training and employment needs of underserved individuals. OAI has made efforts to integrate innovative community-support strategies into its program design, generating sustainable employment opportunities and positively impacting trainees' behaviors and decisions.

Highlighted Impacts

Outputs

Community Toxic Tours
Twice a year, OAI MWT students participate in the Toxic Tour hosted by the Little Village Environmental Justice Organization in Chicago. MWT students traverse the guided 2-mile path taking them by industries responsible for pollution in the community, including a storage drum manufacturer, plastics recycler, chemical sites, brownfields, and a Superfund site in the Little Village community.

Great Green Scavenger Hunt
Twice a year, OAI divides students into teams to conduct research and physically locate green-friendly companies, hotels, restaurants, and nonprofits in Chicago. The scavenger hunt helps trainees to develop team-building, city navigation, online research, time management, and communication skills, while learning about the "green" resources throughout the city.

MWT radio show
Trainees learn to produce, edit, and star in their own radio show focusing on a theme related to sustainability. Trainees perform research, conduct interviews with individuals working in green industries, educate the public through street interviews, and develop commercials that promote a green theme. The finished recordings are distributed to the public on CDs as public service media or made available online for free.

Argonne National Laboratory Sustainability Tours
Argonne National Laboratory is one of the DOE's largest labs for scientific and engineering research. Twice a year, MWT trainees take a guided tour of the lab and learn about using science and engineering to foster sustainable energy and a healthy environment.

Outcomes

Increased trainee knowledge of environmental issues
Trainees learn about alternative energy, sustainability, green jobs, and environment-friendly organizations. They also share this information with the public.

Increased awareness of EJ
Through the Toxic Tours, trainees learn to identify EJ concerns in their communities and become more meaningfully involved in decision-making.

Skills development and increased employability among trainees
The OAI MWT program curriculum supports development of basic and other skills such as city navigation, online research, interviewing, and public speaking. Trainees are able to leverage these skills to access job opportunities.

Leveraged funds to sustain MWT programs
Each consortium seeks additional funds and services to support program implementation. For example, Chicago Tribune Charities awarded a grant to enhance the Carpentry Shop component of OAI's Chicago-based program. This grant has allowed OAI to acquire more training time and materials for students to complete more projects to refine their skills.

The Lloyd A. Fry Foundation provided funds to continue to support a full-time academic and life skills manager to oversee soft skills training and other pre-employment programs at OAI's Chicago-based program.

Funding from the Illinois Department of Commerce and Economic Opportunity's Eliminate the Digital Divide program helped to provide computer training and access to OAI's Community Technology Center.

United Way of Metropolitan Dallas, Thomson Family Foundation, Texas Capital Bank, and individual donors funded CitySquare, OAI's Dallas-based program operator, to support direct staff time, administrative costs, additional support services, and training.

Workforce Partnership, YWCA, City of Independence, Missouri, and Wesley Heights United Methodist Church provided OAI's Kansas City program with in-kind services in the form of facilities use for informational sessions, trainee try-outs, and graduation. Connections to Success, Children's Mercy Hospital, the Federal Deposit Insurance Corporation, EPA Region 7, Kingston Industries, and AT Industries provided life skills, EJ, and career guidance training. The city of Independence, Missouri, leveraged funds for the hands-on work experience project.

21. Research Translation Community Engagement Core: University of Washington Superfund Research Program

Project Investigator: *Thomas Burbacher, Ph.D., University of Washington (tmb@uw.edu)*
Grant Number: *P42ES004696*
Project Duration: *Sept. 30, 1987 – March 31, 2014*

Summary

For over a decade the University of Washington (UW) SRP Research Translation Community Engagement (RTCE) Core has partnered with communities, state and federal agencies, and other SRPs to address regional waste site cleanups, along with air and water pollution as health and EJ issues. The RTCE Core leverages opportunities to create alliances with regional community organizations and EPA Region 10 on identified EJ concerns. Successes include a regional outdoor air quality workshop for communities and an EPA public meeting for the proposed cleanup plan held in Spanish (with translators available for other languages, including English).

One area of UW SRP research focus is environmental contaminants such as mercury, copper, manganese, pesticides, and PCBs. These metals and chemicals accumulate in the bodies of marine and freshwater fish that are often consumed by humans. Certain populations and cultures consume more fish (including Asians, Pacific Islanders, tribal populations, and low-income and subsistence fishers), and are therefore at risk for being disproportionately exposed and impacted by these environmental contaminates.

Today, EPA Region 10 (Alaska, Idaho, Oregon, and Washington) recognizes the EJ implications of fish consumption. The effectiveness of current water quality standards in each state are being reviewed and revised, to better inform the public about safe fish and seafood consumption levels. UW SRP research and initiatives contribute to this effort.

Highlighted Impacts

Outputs

Regional impacts

Academic partners (including RTCE Core) and EJ community organizations were invited to have meetings with the EPA federal director for the Office of Environmental Justice in Seattle (2014).

Duwamish River Cleanup Coalition and UW SRP engaged the EPA in the development of a meeting held in Spanish (2013).

A three-way partnership developed the "Northwest Regional Outdoor Air Quality Workshop for Communities," with 60 participating community members from three states. Agency participation included the EPA, the Agency for Toxic Substances and Disease Registry, Public Health Seattle/King County, and regional air consortia from three states (2012).

The "*Tribal Rights and Fish Consumption Workshop: Issues and Opportunities for the Pacific Northwest*" successfully brought together 64 participants, including 27 participants from 14 tribes, and 20 speakers from diverse sectors to discuss relevant studies, share lessons learned for the Pacific Northwest, and determine key issues in Washington state related to tribal fish consumption rates (2009).

Outcomes

Reflection of value

EPA public meeting on Lower Duwamish Waterway cleanup plan, held in Spanish (2014).

Video recording of EPA public meeting on Duwamish Waterway proposed cleanup plan, held in Spanish (2013).

Resources, including video recordings, from the "Northwest Regional Outdoor Air Quality Workshop for Communities" (2012).

UW SRP addressed an EPA request for assistance to create a workshop to meet tribal and community interest in the topic.

Community-led efforts

The RTCE Core worked with the youth group Marine Resources for Future Generations to develop the "Good Food from the Sea" cookbook (2003), including information on balancing nutrition and reducing exposure. The books were disseminated at public health fairs.

The International District Housing Alliance led Project WILD, in which youth participated in intergenerational health education trainings. Youth leaders demonstrated fish cleaning and cooking techniques at community meal sites where Asian Pacific Islander elders gather.

Informational materials

"Fish Consumption Rates—Technical Support Document—A Review of Data and Information about Fish Consumption in Washington" (2012) was developed by the Washington State Department of Ecology in support of their process for re-evaluating water quality standards for Washington state.

Protecting health, contributing to public policy

EPA Science Advisory Board. 2011. Review of Draft National-Scale Mercury Risk Assessment. Washington, DC: U.S. Environmental Protection Agency.

National Research Council. 2000. Toxicological Effects of Methylmercury. Washington, DC: National Academy Press.

Studies on fish consumption: peer-reviewed publications

Tsuchiya A, Duff R, Stern AH, White JW, Krogstad F, Burbacher TM, Faustman EM, Mariën K. 2012. Single blood-Hg samples can result in exposure misclassification: temporal monitoring within the Japanese community (United States). Environ Health 11:37; doi:10.1186/1476-069X-11-37.

Schmidt A. 2011. An Evaluation of Fish Consumption and Environmental Concern in Low-Income and Food Insecure Populations in Seattle. Seattle: University of Washington. The RTCE Core director helped supervise this master's degree student project and RTOC staff consulted on survey design. A paper on this study is in preparation for submission by Anna Schmidt.

Cleland B, Tsuchiya A, Kalman DA, Dills R, Burbacher TM, White JW, Faustman EM, Mariën K. 2009. Arsenic exposure within the Korean community (United States) based on dietary behavior and arsenic levels in hair, urine, air, and water. Environ Health Perspect 117(4):632-8.

Tsuchiya A, Hinners TA, Krogstad F, White JW, Burbacher TM, Faustman EM, Mariën K. 2009. Longitudinal mercury monitoring within the Japanese and Korean communities (United States): implications for exposure determination and public health protection. Environ Health Perspect 117(11):1760-6.

Tsuchiya A, Hinners TA, Burbacher TM, Faustman EM, Mariën K. 2008. Mercury exposure from fish consumption within the Japanese and Korean communities. J Toxicol Environ Health A 71(15):1019-31.

Tsuchiya A, Hardy J, Burbacher TM, Faustman EM, Mariën K. 2008. Fish intake guidelines: incorporating n-3 fatty acid intake and contaminant exposure in the Korean and Japanese communities. Am J Clin Nutr 87(6):1867-75.

The current RTCE Core director worked with the Washington State Department of Health supervising a master's degree research project titled "Japanese and Korean Women – Fish Consumption Study in the Puget Sound Region" (2005–2006). The project studied fish consumption of Japanese and Korean women.

Judd NL, Drew CH, Acharya C, Mitchell TA, Donatuto JL, Burns GW, Burbacher TM, Faustman EM, Marine Resources for Future Generations. 2005. Framing scientific analyses for risk management of environmental hazards by communities: case studies with seafood safety issues. Environ Health Perspect 113(11):1502-8.

Sechena R, Liao S, Lorenzana R, Nakano C, Polissar N, Fenske R. 2003. Asian American and Pacific Islander seafood consumption—a community-based study in King County, Washington. J Expo Anal Environ Epidemiol 13(4):256-66.

Community educational activities increase awareness and capacity to address EJ

The Marine Resources for Future Generations program was established to promote safe use and harvesting of seafood via outreach among Asian Pacific Islander communities and others with low-English language proficiency (see *Judd et al. 2005*).

The unique project garnered support and acclaim with state education networks, and county and city agency staff. The youth also joined with Seattle/King County and City of Seattle Public Utilities to implement an Environmental Justice Needs Assessment project (2003).

The RTCE Core director was contributor to this *support document* in partnership with Washington State Department of Ecology (2013).

Data collection helps to inform public policy

The RTCE Core director served on an EPA Science Advisory Board to review the EPA's technical report on lowering emission standards for mercury from coal fire plants (2011).

The RTCE Core director was a member of a National Academy of Sciences panel charged with reviewing the EPA Reference Dose (RfD) for methylmercury. This measure is used to provide fish consumption guidance for women of childbearing age and children (2000).

RTCE Core-supported studies have helped to generate data for estimating fish consumption. The studies revealed that these targeted communities consume significantly more fish than the EPA default value for the general U.S. population (i.e., 28 percent). The state of Washington used this data in conjunction with other information for *revising water quality standards*.

22. The Little Hocking That Could: Community Exposure to Perfluorooctanoate

Project Investigator: *Edward Emmett, M.D., University of Pennsylvania (emmetted@mail.med.upenn.edu)*
Grant Number: *R25ES012591; P30ES013508*
Project Duration: *Sept. 1, 2003 – June 30, 2008; April 1, 2005 – March 31, 2015*

Summary

In 2002, environmental researchers at the University of Pennsylvania learned that residents living in the area of the Little Hocking Water Association District (LHWAD) in southeastern Ohio were experiencing significant exposures to perfluorooctanooic acid (PFOA or C8) from a production facility in nearby West Virginia. Despite the EPA's recognition of C8 as a probable carcinogen and expressions of concern that it may also delay childhood development, concerned residents of the relatively low-income community in southeastern Ohio struggled to get the attention of policymakers and regulators.

In response, the University of Pennsylvania, the local community through the Decatur Community Association, and local physician Hong Zhang formed a partnership which obtained funding from the NIEHS to conduct an independent CBPR study to determine: (1) if levels of C8 were elevated in the blood of LHWAD residents; (2) whether the source of C8 was from air, water, or elsewhere; and (3) if there were any short-term health effects.

The partnership studied a stratified random sample of 343 residents from 169 households in the LHWAD using a questionnaire, blood tests for C8 levels and for biomarkers of possible short-term health effects that had been observed in animal testing of C8, and developed a unique community-first communication model to disseminate the results.

The study found that C8 levels in residents were far above normal, highest in children and the elderly, and identified residential drinking water as the major source of exposure. While no short-term health effects related to C8 were found, the initial study was not designed to address long-term effects such as cancer or developmental delays.

In late 2006, the partnership performed a follow-up study of approximately 65 percent of the original participants. Over 90 percent had made some change in their water supply, and C8 levels had fallen an average of 25 percent. The community was empowered by the research findings. The findings were subsequently used to help protect other communities.

Highlighted Impacts

Outputs

Newsletters
Throughout the study, periodic newsletters were sent to each of the approximately 4,500 households in the LHWAD. When study results became available, they were disseminated, along with recommendations, to avoid exposures through the newsletter. Newsletters were also supplied to attendees at community meetings.

Website
A website was developed to highlight details of the study, announcements, community advisory committee meeting minutes, the newsletters, study results, and answers to frequently asked questions. Community stakeholders regularly visited the site.

Presentations at community meetings
Project leaders gave presentations at quarterly community advisory committee meetings throughout the project. These meetings were open to the public, and were attended by as many as 40 residents in addition to the committee members.

The study results were presented in the local high school auditorium
Over 400 people attended, including TV and media, the local member of the U.S. House of Representatives, and other officials. Study physicians also offered private meetings and a toll-free number for community members with health questions they preferred to keep private.

Presentations to authorities and scientific meetings
Study results were presented to several different government agencies, including NIEHS, the EPA, state-level officials in multiple states, the Ohio Health Department, as well as international groups also concerned with C8 contamination of water sources. Furthermore, results were shared at several national scientific meetings. A poster focusing on the study presented at the EPA Science Forum won a first place award.

Publications
The project has resulted in six publications in peer-reviewed journals. These publications have been cited in over 150 scientific publications. In 2007 and again in 2010, publications from the study were awarded the Alfred G. Kammer Merit in Authorship Award from the American College of Occupational and Environmental Medicine for the best scientific paper in the previous year in *Occupational and Environmental Medicine*.

Outcomes

Increased availability of clean drinking water
A recommendation generated from the study encouraged residents in the water district to consider an alternate drinking water source (e.g., bottled water) if their primary residential water source contained C8. On the day the results from the study were released, the DuPont Corporation provided free bottled water to all residents of the LHWAD—initially by reimbursement for water purchases and later through home water delivery. Over 78 percent of water district households participated. In addition, although not as a direct result of this study, a new water filtration system was introduced to the public water supply to remove all C8 two years after the results were made public.

Increased awareness of exposures and influence on changes in drinking water consumption behavior
A follow-up study revealed that awareness of the initial study findings influenced approximately 95 percent of follow-up study participants to make some change in their water consumption behavior in an effort to lower exposure to C8. Within 15 months of the release of the initial study findings, approximately 88 percent of participants had shifted to using bottled water. A significant majority made the change within three months of the announcement of the initial study results. Another 8 percent adopted other measures to reduce exposure to C8.

Reduced C8 levels in blood
The follow-up study found C8 levels in the blood of participants averaged 26 percent lower than they were originally.

Community-first communication method serves as a model for other studies
The community-first communication method developed during this study has been adopted as a model for other ongoing community-based research, including research looking at exposures through consuming seafood contaminated as a result of the Gulf oil spill.

Study results serve as a basis for policy development in communities across America
Study findings served as the basis of a consent decree between the EPA and the DuPont Corporation to provide bottled drinking water to residents in other communities with C8 levels greater than 0.5 parts per billion in their drinking water. The findings have been used by several states, including Minnesota and New Jersey, to set new or revise safe drinking water standards for C8.

The Seventh Community Campus Partnerships for Health Award

The Decatur Community Association and The University of Pennsylvania received the prestigious Community Campus Partnerships for Health Award in 2008. This international award recognizes partnerships striving to overcome root causes of health, social, and economic inequalities. This award has helped promote the partnership's methods and success internationally.

Biomonitoring data awareness inspires research on the approach

Several other research groups are currently studying the methods used and the results achieved in an effort to better understand how community awareness of biomonitoring and other data can lead to exposure reduction and policy changes.

23. Traffic-Related Particle Exposures among New York City Youth

Project Investigator: *Patrick Kinney, Sc.D., Columbia University (plk3@columbia.edu)*
Grant Number: *R01ES011379*
Project Duration: *Sept. 30, 2001 – July 31, 2009*

Summary

The impact of vehicle exhaust on respiratory health continues to be a major concern in urban areas.

Exposure to traffic-related PM2.5 — especially diesel exhaust particulate (DEP)—has been associated with adverse respiratory health outcomes, particularly in children. However, available data clearly demonstrating the relationship between exposure levels and respiratory health impacts remains limited.

To address the data shortage, Columbia University Health Sciences implemented this community-driven research project to expand the understanding of the relationships between urban traffic sources and personal exposures to vehicle-related particles among young people living and going to school in urban core neighborhoods of Northern Manhattan and the South Bronx in New York City.

The team monitored and compared DEP and PM2.5 exposure levels and associated respiratory health impacts among asthmatic and nonasthmatic high school students at three schools located in New York City, and one located in the nearby suburbs. Students were among the active community participants in the study, keeping symptom diaries to assist in data collection.

The research findings have helped to substantiate the relationship between higher rates of exposure to vehicle-related particles and adverse respiratory symptoms among children attending schools in urban areas near heavily trafficked roadways.

Highlighted Impacts

Outputs

New data on the impact of traffic-related particulates and respiratory symptoms

The study led to the development of new data demonstrating the relationship between higher rates of exposure to vehicle-related particles and adverse respiratory symptoms among children attending schools in urban areas near heavily trafficked roadways. The research also revealed that fine PM from diesel emissions creates a greater risk for respiratory symptoms than PM 2.5 in general, and that all traffic may be an important source of pollutants associated with respiratory symptoms.

Development of formal publications

The new data helped to generate two formal publications discussing relevant issues:

Patel MM, Chillrud SN, Correa JC, Feinberg M, Hazi Y, Kc D, Prakash S, Ross JM, Levy D, Kinney PL. 2009. Spatial and temporal variations in traffic-related particulate matter at New York City high schools. Atmos Environ (1994) 43(32):4975-4981.

Patel MM, Chillrud SN, Correa JC, Hazi Y, Feinberg M, Kc D, Prakash S, Ross JM, Levy D, Kinney PL. 2010. Traffic-related particulate matter and acute respiratory symptoms among New York City area adolescents. Environ Health Perspect 118(9):1338-43; doi:10.1289/ehp.0901499.

A third publication is under review.

Outcomes

Encouraged active community member participation in research

Two hundred forty-nine adolescents 13–20 years of age (71 percent female, 40 percent Hispanic, 35 percent black) from three New York City high schools and one suburban high school participated in the study. Students, including 57 asthmatics and 192 nonasthmatics, kept diaries to record their symptoms each day over a period of four to six weeks.

Increased awareness regarding linkage between traffic-related particulates and respiratory symptoms

Together with findings from other school-based studies, this study's findings indicate that recurrent exposures during the school day may be independent risk factors for adverse respiratory health effects and provide rationale for policies to reduce children's exposures to traffic-related pollutants by limiting time spent outdoors or limiting new school construction adjacent to major roadways.

Increased evidence to inform policy to address asthma morbidity

The research has helped to generate accumulating evidence of health risks associated with exposure to traffic-related pollutants among asthmatics. This information has important implications for efforts to reduce acute asthma morbidity and other associated public health consequences through policy.

24. Worker Health and Safety Training Cooperative Agreement

Project Investigator: *James Frederick, United Steelworkers (jfrederick@usw.org)*
Grant Number: *U45ES006175*
Project Duration: *Sept. 30, 1990 – July 31, 2015*

Summary

The United Steelworkers' Tony Mazzocchi Center for Health, Safety, and Environmental Education (USW/TMC) received supplemental NIEHS funding under the American Recovery and Reinvestment Act (ARRA). This project provided pre-employment, green-economy training to low-income residents through a partnership with the A. Philip Randolph Institute, the Housing Authority of the City of Pittsburgh, and the Urban Green Jobs Alliance. After the ARRA grant's completion, the A. Philip Randolph Institute obtained support from foundations and the Pennsylvania Department of Labor and Industry to continue the Breaking the Chains of Poverty training program, which helps participants find living-wage jobs and encourages union membership among minorities.

Highlighted Impacts

Outputs

Additional workforce development
Through the ARRA funding and the Breaking the Chains of Poverty program, the USW/TMC has provided OSHA 30-hour construction training; 40-hour HAZWOPER training; and mold remediation, carbon footprint, green chemistry, and weatherization training. In addition, the program provides remedial reading and math instruction, job search assistance, and life skills development to low-income residents.

Outcomes

Trained participants for green jobs in the Pittsburgh area
The program has graduated 184 men and women. So far, 118 (64.1 percent) have found jobs.

Increased participants' awareness about the environment and related employment opportunities
Students learned about different facets of environmental protection, how environmental protection relates to our daily lives, and the growing need for employees with "green economy" skills.

Leveraged funding
The A. Philip Randolph Institute obtained support from foundations and the Pennsylvania Department of Labor and Industry to continue the Breaking the Chains of Poverty training program.

Began addressing the problem of multigenerational poverty
The ARRA-funded program and its subsequent offshoot have started to help some of the marginalized in Pittsburgh find independence.

APPENDIX B: KEY ENVIRONMENTAL JUSTICE TERMS

1. **Environmental Justice (EJ)**
2. **Community Engagement/Community Participation**
3. **Community-Engaged Research (CEnR)/Community-Based Participatory Research (CBPR)**
4. **Public Outreach**
5. **Community Capacity Building**
6. **Health Disparities**
7. **Equitable Development**
8. **Minorities/Minority Populations**
9. **Tribal Populations**
10. **Asthma**
11. **Goods Movement**
12. **Worker Training Program (WTP)**
13. **Green Job Training**
14. **Hazardous Waste**
15. **Brownfields**
16. **Superfund Site**
17. **Land Remediation**
18. **Climate Justice**
19. **Food Deserts/Food Justice**
20. **Obesity**
21. **Historically Black Colleges and Universities (HBCUs)/Minority Serving Institutions (MSIs)**
22. **Chemical Exposures**
23. **Pesticides**
24. **Farmworkers**
25. **Housing Retrofit**
26. **First Responders**
27. **Personal Protective Equipment (PPE)**
28. **Disproportionate Adverse Impacts**
29. **Inequity**
30. **Disproportionate Exposures**

APPENDIX C: NIEHS GRANT MECHANISMS SUPPORTING ENVIRONMENTAL JUSTICE-FOCUSED PROJECTS

Mechanism	Description	Distribution EJ-Focused Projects
F 31	**Predoctoral Individual National Research Service Award** To provide predoctoral individuals with supervised research training in specified health and health-related areas leading toward the research degree (e.g., Ph.D.).	1
F 32	**Postdoctoral Individual National Research Service Award** To provide postdoctoral research training to individuals to broaden their scientific background and extend their potential for research in specified health-related areas.	1
K 08	**Clinical Investigator Award (CIA)** To provide the opportunity for promising medical scientists with demonstrated aptitude to develop into independent investigators, or for faculty members to pursue research aspects of categorical areas applicable to the awarding unit, and aid in filling the academic faculty gap in these shortage areas within health profession's institutions of the country	1
K 18	**Career Enhancement Award** Provides either full-time or part-time support for experienced scientists who wish to broaden their skills and capabilities, or to make changes in their research careers by acquiring new research skills or knowledge. Career enhancement experiences supported by this award should usually last no more than one year.	1
K 23	**Mentored Patient-Oriented Research Career Development Award** To provide support for the career development of investigators who have made a commitment to focus their research endeavors on patient-oriented research. This mechanism provides support for a 3-year minimum up to 5-year period of supervised study and research for clinically-trained professionals who have the potential to develop into productive, clinical investigators.	2
L 40	**Loan Repayment Program for Pediatric Research** To provide for the repayment of the educational loan debt of qualified health professionals involved in research directly related to diseases, disorders, and other conditions in children. Qualified health professionals who contractually agree to conduct qualified pediatric research are eligible to apply for this program.	1
P 01	**Program Project Grants** For the support of a broadly based, multidisciplinary, often long-term research program which has a specific major objective or a basic theme. A program project generally involves the organized efforts of relatively large groups, members of which are conducting research projects designed to elucidate the various aspects or components of this objective. Each research project is usually under the leadership of an established investigator. The grant can provide support for certain basic resources used by these groups in the program, including clinical components, the sharing of which facilitates the total research effort. A program project is directed toward a range of problems having a central research focus, in contrast to the usually narrower thrust of the traditional research project. Each project supported through this mechanism should contribute to or be directly related to the common theme of the total research effort. These scientifically meritorious projects should demonstrate an essential element of unity and interdependence, i.e., a system of research activities and projects directed toward a well-defined research program goal.	5

Mechanism	Description	Distribution EJ-Focused Projects
P 20	**Planning Grants** To support planning for new programs, expansion or modification of existing resources, and feasibility studies to explore various approaches to the development of interdisciplinary programs that offer potential solutions to problems of special significance to the mission of the NIH. These exploratory studies may lead to specialized or comprehensive centers.	2
P 30	**Center Core Grants** The NIEHS uses this mechanism for its EHS Core Centers Program. Its purpose is to support shared resources and facilities for categorical research by a number of investigators from different disciplines who provide a multidisciplinary approach to a joint research effort or from the same discipline who focus on a common research problem. The core grant is integrated with the center's component projects or program projects, though funded independently from them. This support, by providing more accessible resources, is expected to assure a greater productivity than from the separate projects and program projects.	4
P 42	**Hazardous Substances Research Grants Program (NIEHS)** The NIEHS uses this mechanism for its Superfund Research Program. This mechanism is used to support basic research directed towards understanding and attenuating the public health effects resulting from exposure to hazardous substances, including 1) advanced techniques for detection, assessment, and evaluation of the effects on human health of hazardous substances, 2) methods to assess risks to human health presented by hazardous substances, 3) methods and technologies to detect hazardous substances in the environment, and 4) basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances. This special program, authorized under Superfund legislation, is for a broadly-based, multi-disciplinary research effort which must include biomedical research components and which may include research components related to engineering, hydrogeology, ecology, and epidemiology so long as they are linked to basic biomedical science. Each research project is generally under the leadership of an established investigator. The grant can provide support for certain basic resources used by the groups in the program (cores), including an administrative structure for effective coordination.	4
P 50	**Centers of Research Translation** To support any part of the full range of research and development from very basic to clinical; may involve ancillary supportive activities such as protracted patient care necessary to the primary research or R&D effort. The spectrum of activities comprises a multidisciplinary attack on a specific disease entity or biomedical problem area. These grants differ from program project grants in that they are usually developed in response to an announcement of the programmatic needs of an Institute or Division and subsequently receive continuous attention from its staff. Centers may also serve as regional or national resources for special research purposes.	3
R 01	**Research Project Grants** To support a discrete, specified, circumscribed project to be performed by the named investigator(s) in an area representing his specific interest and competencies.	35
R 03	**Small Grant Program** To provide research support specifically limited in time and amount for studies in categorical program areas. Small grants provide flexibility for initiating studies which are generally for preliminary short-term projects and are non-renewable.	6
R 13	**Support for Conferences and Scientific Meetings** To support recipient sponsored and directed international, national, or regional meetings, conferences, and workshops.	6

Mechanism	Description	Distribution EJ-Focused Projects
R 21	**Exploratory/Developmental Research Grants** To encourage the development of new research activities in categorical program areas. (Support generally is restricted in level of support and in time.)	7
R 25	**Education Projects** For support to develop and/or implement a program as it relates to a category in one or more of the areas of education, information, training, technical assistance, coordination, or evaluation.	46
R 56	**High Priority, Short Term Project Award** To provide limited interim research support based on the merit of a pending R01 application while applicant gathers additional data to revise a new or competing renewal application. This grant will underwrite highly meritorious applications that if given the opportunity to revise their application could meet IC recommended standards and would be missed opportunities if not funded. Interim funding ends when the applicant succeeds in obtaining an R01 or other competing award built on the R56 grant. These awards are not renewable.	1
RC 1	**Recovery Act Limited Competition: NIH Challenge Grants in Health and Science Research** American Recovery and Reinvestment Act (ARRA) funding to this new program will support research on topic areas which address specific scientific and health research challenges in biomedical and behavioral research that would benefit from significant 2-year jumpstart funds. NIH Institute and Centers have selected specific Challenge Topics within each of the Challenge Areas. The research in these Challenge Areas should have a high impact in biomedical or behavioral science and/or public health.	6
RC 2	**Recovery Act Limited Competition for NIH Grants: Research and Research Infrastructure "Grand Opportunities" (GO Grants)** ARRA funding supported projects that address large, specific biomedical and biobehavioral research endeavors that benefit from significant 2-year funds without the expectation of continued NIH funding beyond two years. The research supported by the "GO" grants program should have high short-term impact, and a high likelihood of enabling growth and investment in biomedical research and development, public health, and health care delivery.	1
RC 4	**Recovery Act Limited Competition: Methodology Development in Comparative Effectiveness Research** ARRA funding aiming to enhance, develop, or evaluate methodologies to improve the efficiency, validity, and credibility of comparative effectiveness research (CER) studies. CER encompasses a wide array of methodologies, including technology assessment, meta-analysis, systematic reviews, observational studies, and experimental trials. Each of these methodologies suffers from substantial weaknesses that limit their ability to rapidly provide information sought by patients, clinicians, and other stakeholders to make robust evidence-based decisions on clinical practice and public policy. Research is needed to develop better methods for measuring or reducing these weaknesses, which include, for example, confounding bias in observational studies and selection bias in randomized trials.	2
S 11	**Advanced Research Cooperation in Environmental Health (ARCH)** To promote increased faculty and interdepartmental collaboration through programs that focus on specific research themes or scientific disciplines at developing minority institutions. These grants are intended to strengthen the biomedical research capability in defined areas and to attract other competent biomedical scientists through an improved research environment.	1

Mechanism	Description	Distribution EJ-Focused Projects
U 01	**Research Project—Cooperative Agreements** To support a discrete, specified, circumscribed project to be performed by the named investigator(s) in an area representing his specific interest and competencies.	**1**
U 45	**Funding Opportunities for Worker Training** To develop, implement, and evaluate programs to train workers who are or may be engaged in activities related to hazardous waste removal, containment, or emergency response	**17**

APPENDIX D: LIST OF ACRONYMS

ACAT	Alaska Community Action on Toxics
ADEQ	Arizona Department of Environmental Quality
ARRA	American Recovery and Reinvestment Act
ATCM	Airborne Toxics Control Measure
C8	Perfluorooctanooic Acid
CAFÉ	Community Action on Food Environments
CAT	Community Action Teams
CBE	Communities for a Better Environment
CBPR	Community-based Participatory Research
CEC	Community Engagement Core
CET	Center in Environmental Toxicology
CEnR	Community-engaged Research
CERCH	Center for Environmental Research and Children's Health
CHAMACOS	Center for the Health Assessment of Mothers and Children of Salinas
CHEIHO	Community Health Effects of Industrial Hog Operations
CLPPP	Childhood Lead Poisoning Prevention Program
COAL	Communities Organized Against Asthma and Lead
COEC	Community Outreach and Engagement Core
CHER	Community Health and Environmental Reawakening
COMR	Community-Owned and -Managed Research
CPWR	Center for Construction Research and Training
CPS	Collaborative Problem Solving
CSC	Community Science Center
DEP	Diesel Exhaust Particulate
DERT	Division of Extramural Research and Training
DiNEH	Dine' Network for Environmental Health
DOE	U.S. Department of Energy
EDC	Endocrine Disrupting Chemical/Compound
EHC	Environmental Health Coalition
EHD	Environmental Health Disparities
EJ	Environmental Justice

EJ IWG	Interagency Working Group on Environmental Justice
EJLRI	Environmental Justice League of Rhode Island
EPA	U.S. Environmental Protection Agency
ESF	Emergency Support Function
eSPA	Electronic Scientific Portfolio Assistant
FUDS	Formerly Used Defense Sites
GAO	U.S. Government Accountability Office
Global ARC	Global Action Research Center
H2ERI	Hospitals for a Healthy Environment in Rhode Island
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCSI	Healthy Corner Store Initiative
HEPA	High-Efficiency Particulate Air
HHS	U.S. Department of Health and Human Services
IHO	Industrial Hog Operation
IHS	Indian Health Service
IKMHSS	Iron King Mine and Humboldt Smelter Superfund Site
IRB	Institutional Review Board
LAUSD	Los Angeles Unified School District
LHWAD	Little Hocking Water Association District
MCS	Merrick Community Services
MN/DOT	Minnesota Department of Transportation
MWTP	Minority Worker Training Program
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
NYC	New York City
OSHA	Occupational Safety and Health Administration
PBDE	Polybrominated Diphenyl Ethers
PCB	Polychlorinated Biphenyl
PEPH	Partnerships for Environmental Public Health
PFOA	Perfluorooctanooic Acid
PM2.5	Particulate matter 2.5 microns or less in diameter
POP	Persistent Organic Pollutant
PVC	Polyvinyl Chloride

RfD	Reference Dose
RTCE	Research Translation Community Engagement
SALTA	Salud Ambiental, Lideres Tomando Acción
SRC	Superfund Research Center
SRP	Superfund Research Program
TBRN	Transborder Bioregional Network
TMC	Tony Mazzocchi Center for Health, Safety and Environmental Education
UA	University of Arizona
UCSD	University of California, San Diego
USW	United Steelworkers
UTMB	University of Texas Medical Branch at Galveston
UW	University of Washington
WERA	West End Revitalization Association
WRWC	Woonasquatucket River Watershed Council
WST	Workplace Safety Training Program
WTP	Worker Training Program