# **2.62 Community Public Health & Well-being**

**Project Number & Title**

2.62 - Community Public Health & Well-being

**Project Lead and Deputy**

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**Project Period**

FY16- FY19

**Project Summary**

An essential component for advancing community sustainability and resilience is access to built and natural environments that protect and promote good health and well-being. Progress towards sustainability at the community level should include community decisions that minimize contaminant exposure and adverse health impacts, while recognizing the need to consider non chemical stressors and community/individual vulnerabilities that can also impact public health.

A main goal of this project is to provide actionable science, decision support tools, and training and guidance so communities can use their limited resources in ways that optimize decisions for protecting and promoting public health and well-being. This project focuses both on facilitating community access to health and exposure assessment tools as well as improving the underlying data (e.g., ecological impact and health risk estimates), associations and assumptions that inform SHC and other EPA decision making tools and models. EPA partners and external stakeholders will be able to assess the implications of their decisions (e.g., development decisions, environmental management or pollution prevention strategies) on community health and well-being, and monitor changes in environmental conditions and public health, including tracking trends for a diverse range of health and well-being measures. Actionable research generated by this project can be used by EPA, other federal partners, academia, community decisions makers, and a range of external stakeholders to protect and promote public health and well-being.

**Project Description**

Problem and Decision Context

In most cases, the actual health and well-being benefits or adverse impacts resulting from decisions and actions that have impacts on communities are not well understood or fully considered. Even when estimates are available, they often do not capture the entire scope or long term impacts on human health and well-being, nor are modifying factors or co-benefits considered. Communities need convenient access to high quality information and tools to enable decision makers and others to educate and inform citizens, and help planners evaluate the health impact of alternative development choices; define their environmental problems; compare decision options to optimize approaches to sustainable environmental health and risk mitigation; construct and communicate a sustainability framework; and develop and apply relevant metrics or indicators related to community decisions and actions. This project will seek to provide a better understanding of the associations and causal relationships-- as well as quantitative estimates of the relationships--between public health, well-being and ecosystem goods and services which will inform community decisions and improve existing SHC and EPA tools such as Community-Focused Exposure and Risk Screening Tool and Tribal-Focused Environmental Risk and Sustainability Tool (C/T-FERST), EnviroAtlas (http://enviroatlas.epa.gov/enviroatlas/atlas.html), Health Impact Assessments (HIA), EJSCREEN, and Environmental Benefits Mapping and Analysis Program (BenMap, <http://www.epa.gov/air/benmap/>).

The research and activities in Project 2.62 are designed to:

* Address high priority Program Office and Regional needs related to public health and welfare, such as asthma reduction and mitigation, assessing cumulative impacts, bioavailability research, facilitating training in the use of decision support tools, and evaluating their effectiveness.
* Improve our understanding of the associations and causal relationships between health outcomes, holistic well-being, cumulative risks, the natural and built environments, social and economic conditions at both the individual and community levels.
* Engage and inform Program Office and Regional partners and those making and affected by community-level decisions to reduce environmental health impacts through the application of HIA, Regional Applied Research Efforts (RARE) and Regional Sustainable Environmental Science (RESES) research projects, community interventions, Science to Achieve Results (STAR) grants and training to inform common and impactful decisions, as well as ORD research and tools.
* Improve our understanding of health and well-being-related costs and benefits associated with environmental actions (including improved understanding of causal relationships and cumulative risk).
* Provide human health, exposure and cumulative impact research to improve and expand decision support tools including, but not limited to, HIA, Community Cumulative Assessment Tool (CCAT), C/T-FERST, EnviroAtlas, BenMap, and Decision Analysis for a Sustainable Environment Economy and Society (DASEES).
* Evaluate, ground-truth and provide health context for community indices and models developed in SHC Projects, including the human well-being index and the environmental quality index (EQI) (SHC 2.64) as well as the community typology developed as part of Theme 1 (1.61).

Outputs

2.62.1 Demonstrations of Applying Tools, Methods, and Community Engagement to Mitigate Environmental Health Impacts In At-Risk Communities.

2.62.2 Synthesis of Best Practices Learned from Community Participatory Studies that Address Environmental Health Concerns within Communities.

2.62.3 Methods for cumulative, integrated assessments of chemical and non-chemical stressors and pilot application of these assessments to reduce community environmental health risks and promote community health and well-being.

2.62.4 A report on the state of the practice for integrating ecosystem good and services, human health and human well-being research for assisting communities in decision-making.

2.62.5 Enhanced community public health tools (e.g., C/T-FERST) providing access to information for identifying, prioritizing, and addressing environmental health issues in local decision-making.

Focus Areas

*Focus Area #1: Community engagement, assessment tools and decision support tools -* This focus area includes refinement, development, and enhancement of EPA information and tools to help communities and tribes use their limited resources to identify and prioritize risks based on scientific data and analyses balanced with expert community knowledge. These decision support tools and resources include Community-Focused Exposure and Risk Screening Tool and Tribal-Focused Environmental Risk and Sustainability Tool (C/T-FERST), the Community Cumulative Assessment Tool (CCAT), and Health Impact Assessments (HIAs).

C/T-FERST have been developed as resources for community assessment guidance including GIS maps, reports, fact sheets, best practices, and potential solutions. C/T-FERST focus on providing EPA Regions and Programs, Tribal groups, States, other federal agencies, and risk assessment and public health experts working with community groups enhanced access to scientific information and data to facilitate community-based decision-making that protects and fosters human health and well-being. The Community Cumulative Assessment Tool (CCAT) balances the most current research on Cumulative Risk Assessment (CRA) with the principles of stakeholder participation and Environmental Justice. With these tools, communities and tribes can use their limited resources to identify and prioritize risks based on scientific data and analyses balanced with expert community knowledge. Continued research and development activities build on past efforts refining, testing, and applying these tools through collaborations with other ORD research programs, partners and stakeholders; providing training and outreach to EPA Regions and Programs and other users; integrating information on cumulative risk including environmental, social, and economic stressors; and integrating with the EnviroAtlas and other SHC decision support tools. Near-term advances will include improved guidance; identification of uncertainties; and additional data (e.g., healthy food access, PM2.5 and ozone). Longer term efforts will include incorporation of CCAT; enhanced integration with HIA; summarizing and evaluating place-based case studies; developing an internal (EPA) Steering Committee to identify content and functionality needs; integrating tools for citizen science; integrating cumulative risk and vulnerable populations; “what if scenario” capabilities, incorporating results from environmental and exposure models; and applying decision analysis tools. (Outputs 2.62.5, 2.62.3, 2.62.1)

Health Impact Assessments are a growing community engagement and decision support framework that help provide rapid environmental decision support for various sectors, focusing on systems approaches for health and well-being. The Advisory Committee for the National Health Prevention Council has identified HIA as a tool for use by federal agencies to bring a broader public health lens to plans, policies and decisions. Monitoring and evaluation of the effectiveness of HIAs has been limited to impact of the HIA on the decision, plan or policy. Monitoring post implementation of the decision is necessary to fully evaluate the effectiveness of the HIA process on improving public health. EPA has the ability to extend and complement HIAs by integrating sustainability concepts as part of HIA as well as leveraging and applying SHC tools, indicators and indices. EPA is also uniquely positioned to provide improved quantitative information from human exposure science, assessment and monitoring; ecological impact and ecosystem services evaluation; and human health and cumulative risk assessments, and monitoring to improve and validate the estimates and assumptions of HIA. Case studies will provide an opportunity for community engagement (working through OSWER, Program Offices and Regions), refine SHC tools and methods for use by communities, develop training based on community experiences, and characterize best practices and lessons learned. In addition to community case studies, guidance will be developed that includes best practices for a number of engagement strategies. These best practices can be broadly communicated through the C-FERST HIA roadmap and other SHC tools to inform the HIA community of practice. Important federal partners include the CDC for the development of best practices and guidance for HIA use in the federal sector. (Outputs 2.62.1, 2.62.2)

The key products for this focus area include:

*Title:* Pilot case studies and user guidance and training of C/T-FERST

*Description of contribution, form, and use:* Training developed with and provided to regional partners. Manuscripts describing application and effectiveness of C/T-FERST in case studies and lessons learned.

*How products contribute to specific outputs:* 2.62.1 and 2.62.5 showing how SHC tools are used to help communities make better informed decisions

*Product intended end user:* EPA Project Officers in Regions and Program Offices, Tribes, EPA community project leads, ultimately decision-makers and stakeholders in communities

Title: Health Impact Assessments: Case studies and best practices

Description of contribution, form, and use: HIAs of Plans/Policies Related to Transportation, Water and Wastewater Infrastructure and other areas of focus for SHC including plans for Redevelopment Post Hurricane Sandy in the Communities of Long Island; HIA best practices document

How products contribute to specific outputs: Community engagement and training

Product intended end user: EPA scientists and research planners; EPA Regions; Tribes, and community decision makers

*Title:*  Synthesis and summary of community health engagement

*Description of contribution, form, and use:*  Report summarizing results, best practices and guidance for community engagement

*How products contribute to specific outputs:* Contributes to Synthesis of Best Practices Learned from Community Participatory Studies that Address Environmental Health Concerns within Communities; supports 2.63

*Product intended end user:* Regional and Program staff who work with communities.

*Focus Area #2: Environmental drivers of community health and well being -* This research focus area will improve the understanding of the associations and causal relationships between community health and well-being, ecosystem goods and services and community environmental (including non-chemical) stressors and conditions. Results from this research area will enable EPA to devise, evaluate and advise on effective intervention and prevention strategies, improve risk assessments, inform risk management, and improve public health. The results of this research will also be used to inform SHC tools including EnviroAtlas and C/T-FERST; and BenMAP (Office of Air and Radiation, OAR).

EPA researchers and risk assessors seldom incorporate community stressors such as high levels of poverty, violence, and degraded ecosystem goods and services into assessment of environmental health impacts due to lack of data and/or methods for quantifying impacts of non-chemical stressors on health outcomes. The strain of chronic stress can result in changes at multiple levels including: molecular (e.g., methylation changes in genes), neurological (e.g., hyperactivation of the hypothalamic-pituitary-adrenal axis), systemic (e.g., immune modulation), metabolic (e.g., hormonal changes) and psychiatric (e.g., learning problems). With results from this research it may be possible to reverse some epigenetic changes, avoid metabolic syndrome; and, reduce stressors associated with health by improving the built environment (e.g., green areas to improve walkability and reduce obesity). This research shares objectives with the SHC Project “Assessing Environmental Health Disparities in Vulnerable Groups” (2.63) on the social, environmental, economic, and biological factors that influence vulnerability and health disparities, and research activities evaluating these factors will be coordinated across these two projects. (Outputs 2.62.1, 2.62.2, 2.62.3, 2.62.4) and with the Human Health Risk Assessment (HHRA) research program work on advancing cumulative risk methods.

Sustainability-focused approaches require understanding of the range of cumulative impacts experienced by individuals and communities. Further, individuals respond differently to stressors and vary in susceptibility to environmental insults. Cumulative exposures and individual and community variability are not adequately considered in current exposure and toxicity methods, often due to lack of relevant data. Emerging evidence indicates that social and contextual factors may enhance the toxic effects of both single and multiple environmental contaminant exposures. Conversely, factors of the built and natural environment can advance well-being and mitigate adverse health factors, for example, access to trees and green space can speed healing and diminish anxiety and reduce blood pressure. Research will consider the interrelationship of diet, behavior, lifestyle, and susceptibility of the cardiovascular, respiratory, and neurological systems to air pollutants. This focus area will integrate results from animal models and observational (epidemiological) studies for cumulative stressors (e.g., obesity) to characterize causal mechanisms and associations for key health endpoints (e.g. diabetes, cardiovascular disease, and asthma). These associations will be further evaluated with population based studies and statistical evaluations. Cumulative risk assessment (CRA) evaluations will be incorporated into C/T-FERST and other SHC tools for community decision making. This focus area shares objectives with SHC 2.63 on factors that influence vulnerability and health disparities, especially long-term effects from early life exposures, and research activities evaluating these factors will be coordinated across the two projects. (Output 2.62.3; 2.62.5)

Establishing generalizable associations between public health and Ecosystem Goods and Services (EGS) can be challenging because communities with degraded EGS are often also adversely impacted by numerous other social and environmental factors. Research will include conceptual diagrams, case-studies, best practices, and identification of data gaps. Findings from EGS-health associations should be replicated in diverse communities for application in cumulative risk assessments (CRA), and to develop meta-analyses to support quantitative effect estimates. Research examples include near-road pollution abatement by tree cover; green space associations with developmental and cognitive effects; severe climatic events (flooding, drought, linkages to ACE and SSWR); and contaminated water (recreational and drinking). Results and findings can be integrated with numerous SHC tools including EnviroAtlas and C/T-FERST; BenMAP (OAR); and community typology (SHC Theme 1). This focus area will integrate closely with the SHC Project “Community-Based Final Ecosystem Goods and Services” (2.61) (Output 2.62.4).

This focus area will include contribution from STAR grants focused on cumulative risk and community impact assessments; and the health impacts and co-benefits (both health and ecological) of land use activities (e.g., urbanization, deforestation, energy production).

The key products for this focus area include:

*Title:* Case studies linking ecosystem goods and services to community public health

*Description of contribution, form, and use:* Manuscripts describing approaches, data requirements and quantitative assessments linking EGS to community public health

*How products contribute to specific outputs:* 2.62.4 (EGS and health)

*Product intended end user:* OSWER, OEJ, EnviroAtlas, Tribes, SHC (C/T-FERST)

*Title:* Cumulative risk case studies

*Description of contribution, form, and use:* Manuscripts assessing changes in response to chemical stressor in the presence or absence of non-chemical stressor(s).

*How products contribute to specific outputs:* 2.62.3 (cumulative risk)

*Product intended end user*: Integration to C-FERST, OAR, HHRA, OEJ

*Title:*  Summary of research on methods for assessing combined effects of chemical and non-chemical stressors

*Description of contribution, form, and use:*  Report highlighting research developed under seven cumulative risk assessment grants.

*How products contribute to specific outputs:* 2.62.3, methods for cumulative, integrated assessments of chemical and non-chemical stressors.

*Product intended end user:* Regional and Program Office risk assessors, risk managers, OEJ, and community decision makers.

*Focus Area #3: Improving community health, well-being and exposure assessments -* Activities in this focus area will provide improved access to health and exposure data, inform and ground-truth existing SHC tools, as well as explore innovative approaches to better understand and assess environmentally driven community health and well-being conditions.

An immediate research need identified by OSWER is for data on the bioavailability of toxicants in soils. ORD is addressing this by developing approaches to remediate soils used in urban gardening and bioavailability screening tools. Research in this area will continue with the development of rapid, reliable, and inexpensive methods for assessing the bioavailability of metals from contaminated soils and other exposure matrices. This research will evaluate technologies and the bioavailability of metals to determine sustainable remediation technologies that support the efforts of Regions and communities and reduce economic impacts. Sustainable remediation technologies will reduce volumes of contaminated soil sent to hazardous landfills and reduce clean-up costs through efficient use of less intrusive remedial options while ensuring public health-protective cleanups. Research will be used to inform designing urban gardens to safely address healthy food concerns/food deserts in EJ communities. This will help risk managers and risk assessors make better informed decisions about cleanup and safe site reuse in communities, Brownfield sites, and other sites. The focus area will also include working with other SHC projects and ORD programs to refine and apply multimedia environmental and human exposure models, and integrate outputs into C/T-FERST, EnviroAtlas, HIAs and community decision support tools. (Outputs 2.62.1; 2.62.5)

Accurate, quantitative descriptions of environmentally-driven health and well-being conditions are essential in order to understand the impact of national, regional and local community decisions and actions on communities. Activities will include health and well-being data acquisition and descriptions in the form of risk-surfaces, such as local and regional level morbidity and mortality rates related to environmentally associated health outcomes (birth defects, asthma, cardiovascular disease, diabetes) to enhance EPA’s existing tools and equip communities and decision makers with better information about the relative costs and benefits associated with community-level decisions. This research area will generate community level health outcome data for incorporation into C/T-FERST and EnviroAtlas and allow improved tracking, modeling and scenario assessment for areas such as climate change, environmental justice, and health disparities. Research will also include evaluation and assessment of health linkages for models, indicators (e.g., Human well-being index, Environmental Quality Index, Community Typology), indices and educational tools (such as the Healthy Heart: http://www.epa.gov/healthyheart/). As EPA’s education programs, indicators and models evolve there is a need to test their impact in shaping decision making and outcomes. Further research may improve the understanding of community actions or EPA regulations on health and well-being. This research will provide a better understanding and quantification of these benefits and will provide inputs for HIAs and Health impact/benefit functions for potential linkage to policy tools such as BenMap. (Outputs 2.62.1, 2.62.2, 2.62.3, 2.62.5)

Innovative surveillance approaches for measuring environmental conditions, exposures, and health and well-being are needed to improve our understanding of chemical and non-chemical stressors on ecosystem and community public health. Application of citizen science, simple indicator-based measures, sensors, or other venues will be explored as a way to inform community exposure and health conditions. These assessment techniques can then be coupled with information about environmental, social, and economic conditions, thereby allowing a holistic assessment of these impacts (both positive and negative) on public health and well-being. There is an important role for biomarkers of exposure/effect to enhance the objectivity and credibility of community health evaluations. Examples include cost-effective and more rapid disease monitoring tools and methods using non-invasive samples (e.g., saliva) to identify the etiologic agents and physiological based measures that identify stress reactions. (Outputs 2.62.1, 2.62.3)

The key products for this focus area include:

*Title:* Evaluation of sustainable remediation technologies related to bioavailability of metals in soils for use in communities.

*Description of contribution, form, and use:* Data and reports will be developed with and provided to Regional and Program office partners on sustainable remediation technologies. Reports and/or manuscripts describing results will be provided for inclusion in C-FERST.

*How products contribute to specific outputs:* 2.62.1 and 2.62.5 showing how SHC tools are used to help Regional/Program offices and communities make better informed decisions.

Product intended end user: decision support tools for EPA Regions and Program Offices.

**Nature of the Work**

The transdisciplinary research proposed in this project includes medical and health expertise; computing resources and software development; spatial and statistical modeling expertise and resources; data use agreements and purchases; sociology and social science expertise; community engagement experience. The nature of the work also includes epidemiology (through existing data analysis, surveys and community biomarker evaluation); exposure modeling and assessment; risk assessment; animal and human toxicology; laboratory science (bioavailability; biomarker assessment); clinical research (enrollment of subjects at the Environmental Public Health Division’s nursing station and clinical evaluations); statistical and geospatial analysis (modeling, visualization). This intramural research (and the associated non-STAR funds) will focus on these areas where ORD scientists have particularly significant experience, expertise and interest. The project will be complemented with a significant STAR component in areas where ORD expertise and experience is less (social sciences, community engagement), with 60% of the total budget allocated to STAR research.

Under the STAR research program, a number of research projects are funded outside of EPA that focus on community public health research and are relevant to Project 2.62. These efforts include ongoing work as well as planned and projected Request for Application (RFAs) and are also captured under the focus areas described above. The ongoing research on methods for cumulative risk/community impacts assessments are specifically linked to outputs 2.62.1 and 2.62.5, and generally relevant to outputs for assessing environmental health disparities and vulnerable populations. The FY15-20 STAR community public health research projects are the results of collaboration across programs and research areas (e.g., ACE and SSWR) to provide the science needed to support community-based decisions. Most communities face complex environmental and public health decisions that may have significant adverse or beneficial impacts on community health, the environment/resources and local and regional economy. The research targets some of the challenges communities face: multiple stressors and their cumulative impacts on human health and ecosystems; integrating community health and ecosystem goods and services and assessing the human health impact and benefits of non-traditional agricultural water resources in rural communities. These community-engaged research projects will contribute collectively to the systems-based knowledge to inform community-level development decisions.

**Collaboration**

Other federal/state/local agencies: CDC (Disease surveillance, biomarkers, burden of disease, and HIA); USDA Forest Service (ecosystem goods and services and health); USDA (community water and health STAR collaboration); local and state health departments (health data acquisition);

Universities: University of Chicago (health data); University of Southern California (asthma); University of California, Berkeley (recreational water, epidemiology, community health); University of South Australia (bioavailability); University of North Carolina (clinical studies, epidemiology and community health); Columbia University (asthma, community health); University of Puerto Rico (asthma); US Department of Housing and Urban Development (asthma, indoor air, mold).

EPA (outside of SHC): EPA Regions (RARE, RESES, HIA; bioavailability); OSWER, OEJ (Cumulative risk, C/T-FERST; bioavailability); OP (community impacts and needs); OAR/OAQPS (BenMap, NATA); OW (NCER RFA, water-reuse, climate change); NCEA & HHRA (Cumulative risk, CCAT, risk assessments, HIAs); SSWR (Risk assessment; virtual beach; EGS benefits assessment); CSS (chemical risks, pathways, human exposure and dose models); EPA Technical Review Workgroup Bioavailability Committee

Planned and/or anticipated collaborations within SHC include: SHC 2.63 (Assessing Environmental Health Disparities in Vulnerable Populations and Lifestages); SHC 2.61 (Community-based Final Ecosystem Goods and Services); SHC 1.62 (EnviroAtlas, integration of air quality modeling with green spaces); SHC 3.61 (Contaminated Sites); SHC 2.64 (Indicators, Indices); SHC 3.61 and 3.62 (linking multimedia environmental and exposure models to decision support tools); SHC 3.62 (Fuel and oil spills, vapor intrusion); SHC 3.63 ( Sustainable materials management, ingestion and dermal exposures); and SHC 4.61-4.62 (system-based assessment methods).

NCER/STAR:

“Understanding the Role of Nonchemical Stressors and Developing Analytic Methods for Cumulative Risk Assessments” – Ongoing and work to be completed in 2015 related to cumulative risk (<http://www.epa.gov/ncer/cra/recipients/index.html>)

“Human health impact of non-traditional agricultural water resources in rural communities”-new STAR RFA, in collaboration with United States Department of Agriculture (USDA)

“Integrating community health and well-being and ecosystem goods and services” -new STAR RFA

**Assumptions/Constraints**

Ability to obtain OMB (where needed), IRB and ethical approvals to collect community exposure, human health data, information on community application/impacts of SHC tools, and conduct human health research; Continuation of University of North Carolina cooperative agreements with Centers for Asthma Medicine and Lung Biology; Ability to enroll community participants of sufficient sample size where needed; Ability to obtain community and local health, ecological and environmental data; Approvals to obtain, work with and analyze individually identifiable data when needed; Approvals to access social media data if needed; Expense funding for laboratory work and supplies; Ability to obtain approvals and necessary programming for public web-release of C/T-FERST and other web-based tools; Solicitation and award of NCER grants and RFAs; Key staff with required social science, computational, analytical and community engagement skills

**Project Charter Team Members**

NERL: Barzyk, Timothy; Bradham, Karen; Creed, Jack; Fulk, Florence; Isakov, Vlad; Oshima, Kevin; Quackenboss, James; Schultz, Brad (retired); Vesper, Stephen; Tulve, Nicolle; Xue, Jianping; ; Zartarian, Valerie (MI representative)

NHEERL: Crooks, James; Darney, Sally; Diaz-Sanchez, David; Dye, Janice ; Gallagher, Jane (retired); Gavett, Stephen; Gordon, Christopher; Jackson, Laura; Kodavanti, Urmila; Lobdell, Danelle; Moore, Tanya; Thomas, David; Royland, Joyce; Wade, Tim; Ward, Marsha

NRMRL: Dean, Timothy; Scheckel, Kirk

NCEA: Gwinn, Maureen (Associate NPD); Jarabek, Annie; Lorber, Matthew

NCER: Michaud, Jayne; Payne-Sturges, Devon (retired from EPA)