

## Puerto Rico Testsites for Exploring Contamination Threats (PROTECT)

**Co-Directors:** Akram N. Alshawabkeh, NU and José F. Cordero, UGA

**Funding Agency:** NIEHS – Superfund Research Program (SRP) – Award #P42ES017198 (04/12/10-03/31/19)

Program Manager: Heather Henry, NIEHS/NIH

### Primary Institutions

Northeastern University (NU), University of Puerto Rico Medical Science Campus (UPR-MS), University of Puerto Rico, Mayagüez (UPRM), University of Michigan (UM), University of Georgia (UGA)

### Research Partners

West Virginia University, Silent Spring Institute, EarthSoft, Inc.

<b>Project 1:</b> Molecular Epidemiology Study of Phthalate Exposure and Preterm Birth in Puerto Rico	John Meeker	Environmental Health Sciences	UM
<b>Project 2:</b> Toxicant Activation of Pathways of Preterm Birth in Gestational Tissues.	Rita Loch-Caruso	Environmental Health Sciences	UM
<b>Project 3:</b> Discovery of Xenobiotics Associated with Preterm Birth.	Roger Giese	Chemistry & Biomedical Science	NU
<b>Project 4:</b> Dynamic transport and exposure pathways of contaminants in karst groundwater systems	Ingrid Padilla	Civil Engineering	UPRM
<b>Project 5:</b> Remediation of contaminated groundwater by solar-powered electrolysis	Akram Alshawabkeh	Civil & Environmental Engineering	NU
<b>Core A:</b> Administrative Core	Akram Alshawabkeh, José Cordero		NU UGA
<b>Core B:</b> Research Translation Core	Phil Brown	Sociology and Health Sciences	NU
<b>Core C:</b> Human Subjects and Sampling Core	José Cordero	Epidemiology and Biostatistics	UGA
<b>Core D:</b> Data Management and Modeling Core	David Kaeli	Electrical & Computer Engineering	NU
<b>Core E:</b> Training Core	Thomas Sheahan	Civil & Environmental Engineering	NU
<b>Core F:</b> Community Engagement Core	Phil Brown Carmen M. Velez-Vega	Sociology and Health Sciences	NU UPR

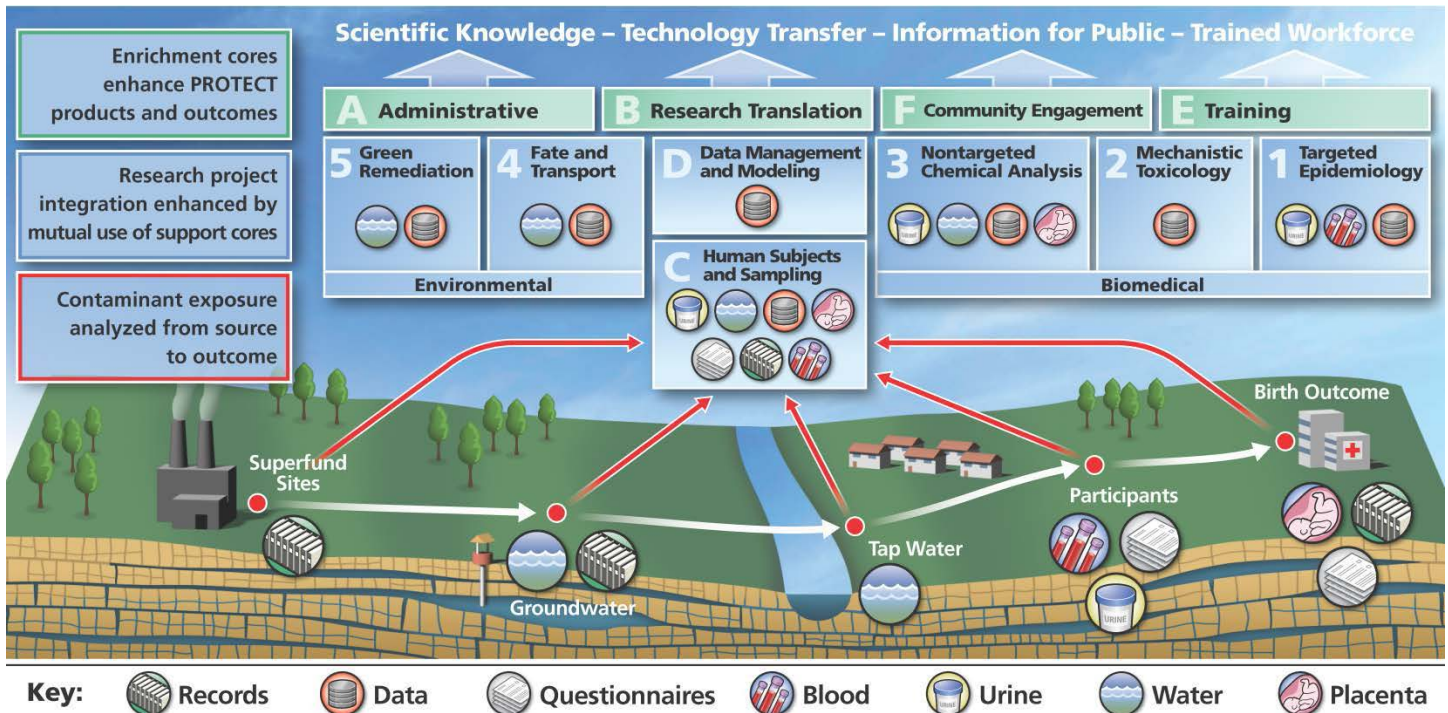
**The central theme of PROTECT is the study of exposure to Superfund hazardous chemicals and their potential contribution to preterm birth, focusing on Puerto Rico with contamination exposure pathways through aquifers in karst regions.**

### Program Objectives

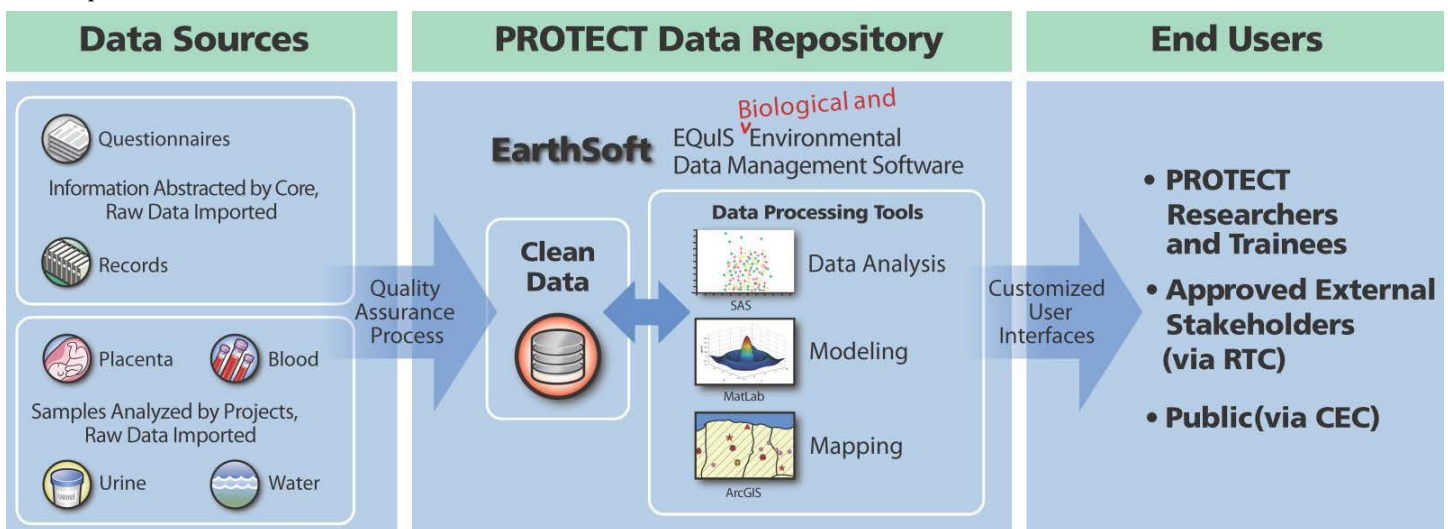
- **Objective 1:** Evaluate the relationship between exposure to Superfund hazardous chemicals and preterm birth (Projects 1, 2, 3); identify the causative chemicals (Projects 1, 2, 3); and learn how to remediate these chemicals in karst aquifers using an environmentally-friendly process (Project 5).
- **Objective 2:** Better understand the potential role (Projects 1, 3), mechanisms (Project 2) and relevance (Projects 1, 2 and 3) of pollution-induced oxidative stress in preterm birth.
- **Objective 3:** Discover and understand risk factors for preterm birth by developing and mining an integrated, centralized, indexed repository for epidemiological (Project 1), hydrogeophysical (Project 4), environmental fate and transport (Project 4), and environmental exposure (Projects 1, 3) data for Puerto Rico.
- **Objective 4:** Determine the effect of episodic transport through aquifers in karst regions (Project 4) on patterns of exposure (Projects 1, 3), and develop adaptable remedial actions (Project 5).
- **Objective 5:** Improve and apply nontargeted chemical analysis (Projects 2,3) to biological (Projects 1, 2, 3) and environmental samples (Projects 3, 4, 5) to identify xenobiotics in addition to phthalates and chlorinated solvents that may have a role in preterm birth.
- **Objective 6:** Engage the PROTECT team and stakeholders (community, industry and government) to support environmental public health practice, innovation and policy; professional development; and awareness around the issues of exposure to Superfund hazardous chemicals and preterm birth.

**PROTECT ORGANIZATIONAL STRUCTURE**

PROTECT uses a holistic system of research, training and stakeholder engagement to study contaminant exposure and its potential contribution to preterm birth in Puerto Rico and beyond.



PROTECT is organized around a “source-to-outcome” flow (white arrows, bottom) of samples and data. Biological and environmental information and samples are collected by the Human Subjects and Sampling Core (C) at each of the points. Researchers and trainees within Projects 1-5 use the information and samples to inform their studies; further integration of biological and environmental data by the Data Management and Modeling Core (D) enables interdisciplinary understanding beyond what any project could individually achieve. This unique scientific knowledge is enhanced by enrichment core activities to accomplish additional PROTECT products and outcomes: technology transfer, information for the public and a trained workforce.



The highly-innovative PROTECT data repository managed by the Data Management and Modeling Core centralizes and indexes environmental and biomedical data from Human Subjects and Sampling Core and the projects. Information is abstracted and data imported directly into the data repository, while samples are analyzed by the projects and data from that analysis is imported as well (left panel). Data processing tools (center panel) that access biological and environmental data simultaneously are available to end-users (right panel).

## The Center for Research on Early Childhood Exposure and Development in Puerto Rico (CRECE)

**Co-Directors:** Akram N. Alshawabkeh, NU and José F. Cordero, UGA

**Funding Agency:** NIEHS by Award # P50ES026049 and the U.S. EPA Assistance Agreement # 83615501.

**Program Managers:** Kimberly Gray (NIEHS) and Nica Louie (EPA)

**CRECE will study the impact of a mixture of environmental exposures and modifying factors on fetal and early childhood health and development in Puerto Rico, an under-served, highly-exposed population.**

### CRECE Projects and Cores

Project 1: Air Pollution Impacts on Neonatal and Early Childhood Development. Project Leader: Helen Suh

Project 2: Toxicogenomics-based Mechanistic Multimedia Exposure Assessment and Child Development. Leader: April Gu

Project 3: Biomarker Epidemiology of In Utero Environmental Exposures and Child Development. Project Leader: John Meeker

Administrative Core. Leaders: Akram Alshawabkeh and José Cordero

Human Subjects and Sampling Core, Leader: José Cordero

Community Outreach and Translation Core (COTC). Leaders: Phil Brown and Carmen M. Velez-Vega

### CRECE Specific Aims

1. Investigate the impact of prenatal and early childhood exposure to air pollution (Project 1) and prenatal exposure to chemicals, including CECs, (Project 3) on fetal/child health and development.
2. Provide evidence for biological mechanisms (Projects 2 and 3) that may mediate the impact of early life exposure to air pollution (Project 1) and chemicals, including CECs, (Project 3) and fetal/child health and development.
3. Evaluate effect modification for individual risk factors including socioeconomic status and maternal stress on the relationship between environmental exposure and fetal/child health and development (Projects 1 and 3).
4. Explore effects (Projects 1 and 3) and relevant mechanistic pathways (Project 2) of early life exposure to mixtures of multiple pollutants in relation to fetal/child health and development.
5. Engage stakeholders (COTC) to support environmental health practice, innovation and policy, professional development; and awareness around our theme.

Figure 1. CRECE will study the impact of a mixture of environmental exposures and modifying factors on early childhood development in an underserved, highly-exposed population on Puerto Rico's northern coast. To do so, it will use data and samples collected from the PROTECT cohort study as well as new samples (air, water and urine), data and measurements of air pollution levels, pollutant mixtures, CECs, neurobehavioral (NNS and BDI-2), health and development (respiratory and physical growth assessments), and parental questionnaires. Integrated knowledge from the projects will be shared with the stakeholder community through the COTC to fulfill the CRECE mission to become a vital, informative children's environmental health resource.

