Superfund Research Program

The Superfund Research Program (SRP) supports practical research that creates benefits, such as lower environmental cleanup costs and reduced risk of exposure to hazardous substances, to improve human health. SRP funds colleges, universities, and small businesses, including the Northeastern University Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) Superfund Research Center (SRC), to advance this work across the nation. PROTECT is a multi-project, multi-institution collaboration that involves Northeastern University, University of Puerto Rico Medical Sciences Campus, University of Puerto Rico at Mayaguez, and University of Michigan.

Research Highlights

**Phthalate activation of oxidative stress in placental tissues**
Looking at human placental cells, PROTECT researchers discovered that exposure to di-2-ethylhexyl phthalate (DEHP), a type of phthalate used as a softener in some plastics, triggered an oxidative stress response that may be linked to preterm birth. Oxidative stress is a process in cells that can result in cell and tissue damage and other problems. Rita Loch-Caruso, Ph.D., at the University of Michigan, and her PROTECT team are identifying possible biological explanations to understand how exposure to environmental pollutants, such as phthalates, can lead to early labor and preterm birth.

**Using solar power to clean up contaminants**
Akram Alshawabkeh, Ph.D., at Northeastern University, leads a PROTECT team that is developing a sustainable, solar-powered system for removing trichloroethylene (TCE) and other contaminants from groundwater. TCE, an industrial solvent and degreaser, is one of the most common soil and groundwater contaminants in the U.S., and is linked to cancer. The solar panels produce electric currents that trigger chemical reactions in groundwater, changing TCE into a less toxic form. The researchers have applied for a patent on this device, and are currently testing whether it can be used to clean up other contaminants.

**Developing detection and exposure assessment tools**
Roger Giese, Ph.D., at Northeastern University, and his PROTECT team invented a convenient tool, the Porous Extraction Paddle (PEP), to extract contaminants from a large volume of urine or water at a remote location for later testing in the lab. The PEP device will greatly reduce researcher efforts and costs by simplifying field collection of samples, which can number in the thousands.
The importance of studying Superfund contaminants

- In Puerto Rico, the preterm birth rate is nearly 20 percent of live births, and evidence suggests that exposures to Superfund and related contaminants are contributing factors.
- The racial, ethnic, and socioeconomic status of the community, along with the high risk of exposure to contaminants, highlight the relevance of PROTECT to environmental justice.

Research overview

- Identifying chemicals that contribute to preterm birth.
  (Roger Giese, Ph.D., Northeastern University, r.giese@neu.edu)
- Understanding how contaminants move into and through aquifers, and the impact on exposure risks.
  (Ingrid Padilla, Ph.D., University of Puerto Rico at Mayaguez, ingrid.padilla@upr.edu)
- Applying state-of-the-art methods to study biological mechanisms involved in preterm birth related to environmental factors.
  (John Meeker, Sc.D., University of Michigan, meekerj@umich.edu)
- Creating solar-powered systems to clean up Superfund chemicals from aquifers.
  (Akram Alshawabkeh, Ph.D., Northeastern University, aalsha@neu.edu)
- Studying biological pathways that link exposures to contaminants to preterm birth.
  (Rita Loch-Caruso, Ph.D., University of Michigan, rlc@umich.edu)

Sharing results

- PROTECT serves as a bridge between researchers, communities, government agencies, and stakeholders to foster effective communication and application of research findings and technologies. (Phil Brown, Ph.D., Northeastern University, p.brown@neu.edu)

Other contributions to advance science

- The PROTECT SRC research support facility provides vital access to expertise, research resources, and state-of-the-art instrumentation for its research projects.
  (Jose Cordero, M.D., University of Puerto Rico, jose.cordero6@upr.edu; David Kaeli, Ph.D., Northeastern University, dkaeli@ece.neu.edu)
- The PROTECT SRC integrated, multidisciplinary training experience provides early-career scientists access to teams of diverse professionals, and encourages innovation to develop solution-oriented approaches to complex environmental health problems.
  (Thomas Sheahan, Ph.D., Northeastern University, t.sheahan@neu.edu)