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 Brown University Superfund Research Center (Brown SRC), to advance this work across the nation.

Research Highlights

Evaluating vapor intrusion exposures and risks

A Brown SRC project collaborator demonstrates a vapor sampling technique using a syringe. (Photo courtesy of Jim Rice)

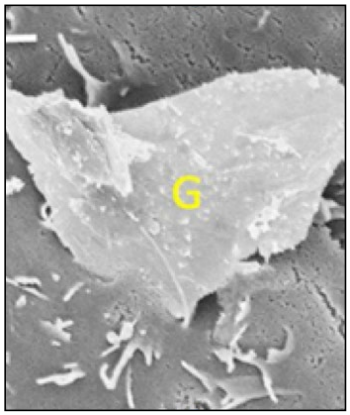
Vapors from contaminated groundwater or soil may contain potentially toxic compounds, such as the chlorinated solvents trichloroethylene (TCE) and tetrachloroethylene (PCE). These vapors can enter the indoor air of buildings, located near polluted sites, through a process known as vapor intrusion.[1] At Brown SRC, researchers are working to find out how these vapors enter buildings and accumulate to levels that may pose safety hazards.

For example, a neighborhood in Somerville, Massachusetts, raised concerns about potential vapor intrusion into their homes from an adjacent industrial site. In response, Brown SRC researchers coordinated an effort to measure the in-home intrusion and discovered the vapors had entered a home through a faulty sewer line. The finding highlighted an important entry pathway that could be corrected. The data gathered from the study are being incorporated into mathematical models, so that exposures and health risks from vapor intrusion may be more thoroughly evaluated.[2]

Creating nanomaterials designed for safety

Brown SRC scientists and engineers study both the implications and applications of nanotechnology in environmental and human health research. They are working to understand the molecular basis for nanotoxicity by creating various nanomaterials and then testing their biological properties.

Researchers are using this information to develop nontoxic nanomaterial-based environmental barriers, such as landfill liners, to inhibit the release and transport of potentially harmful chemicals.[3] They are also studying how nanomaterials interact with human cells, what properties in the materials are responsible for harmful effects, and how those properties can be changed to reduce cellular damage. For example, they found that tiny graphene microsheets, used in small electronic devices and batteries, have jagged edges that can pierce the cell surface of macrophages, cells that are part of the immune system.[4] This insight may help engineers minimize the potential harm caused by graphene.



The bottom corner of a piece of graphene penetrates a cell membrane. Rough edges and sharp corners can make graphene dangerous to human cells. (Photo courtesy of Agnes Kane)

BROWN

Brown SRC researchers focus on environmental health research, technology development, and contaminated land reuse in Rhode Island. They seek to understand human health effects from exposure to nanomaterials, TCE, and PCE. They also work with community groups and local government agencies to help inform safe management of contaminated sites in Rhode Island and other postindustrial states.

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Collaborating with the Narragansett Indian tribe

The Brown SRC Community Engagement Core is working with members of the Narragansett tribe to assess the impacts of environmental contamination on tribal lands. They are working side by side with tribal members to collect fish and harvest mussels from two Narragansett tribal ponds in Charlestown, Rhode Island, to measure land and watershed contamination. They will use these data to assess the potential effects of pollution on the health of the tribe.

Brown SRC students work with tribal members to collect fish at a Narragansett tribal pond. (Photo courtesy of Marcella Thompson)

Brown SRC members launched The Namaus (All Things Fish) Project, to work with the Narragansett people to understand impacts of environmental contamination on the tribe. They are also educating the tribal community about the risks of eating potentially contaminated fish, and providing guidelines on healthy fish consumption.

Research overview

- Determining how vapors from contaminated soil and groundwater leak into homes, schools, and workplaces. (Eric Suuberg, Sc.D., Eric_Suuberg@brown.edu)
- Developing measures to detect and monitor damage to male reproductive organs from low-level exposure to environmental chemicals, such as TCE. (Kim Boekelheide, M.D., Ph.D., Kim_Boekelheide@brown.edu)
- Designing safe nanomaterials with potential applications in environmental sensing and cleanup. (Robert Hurt, Ph.D., Robert_Hurt@brown.edu)
- Evaluating the health hazards of nanomaterials. (Agnes Kane, M.D., Ph.D., Agnes_Kane@brown.edu)

Sharing results

- Brown SRC is sharing environmental engineering and science knowledge with risk assessors, cleanup experts, and the public in Rhode Island and nationwide. (Eric Suuberg, Sc.D., Eric_Suuberg@brown.edu)
- Brown SRC is advancing science through a collaborative and participatory process of community-based engagement, education, research, and advocacy, to improve public health and inform public health policy. (Scott Frickel, Ph.D., scott_frickel@brown.edu)

Other contributions to advance science

- The Brown SRC research support facility provides vital access to expertise, research resources, and state-of-the-art instrumentation for its research projects. (Robbert Creton, Ph.D., Robbert_Creton_PhD@brown.edu)
- The Brown 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. (Agnes Kane, M.D., Ph.D., Agnes_Kane@brown.edu)

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For more information on the National Institute of Environmental Health Sciences, visit **www.niehs.nih.gov**.

For more information on the Superfund Research Program, visit **www.niehs.nih.gov/srp**.

For more information on the Brown University Superfund Research Center, visit **www.brown.edu/research/projects/superfund**.

[1] EPA (U.S. Environmental Protection Agency). 2015. What is Vapor Intrusion? Available: http://www2.epa.gov/vaporintrusion/what-vapor-intrusion [accessed 8 January 2016].

[2] Pennell KG, Scammell MK, McClean MD, Ames J, Weldon B, Friguglietti L, Suuberg EM, Shen R, Indeglia PA, Heiger-Bernays WJ. 2013. Sewer gas: an indoor air source of PCE to consider during vapor intrusion investigations. Ground Water Monit Remediat 33(3):119-126.

[3] Guo F, Silverberg G, Bowers S, Kim SP, Datta D, Shenoy V, Hurt RH. 2012. Graphene-based environmental barriers. Environ Sci Technol 46(14):7717-7724.

[4] Li Y, Yuan H, von dem Bussche A, Creighton M, Hurt RH, Kane AB, Gao H. 2013. Graphene microsheets enter cells through spontaneous membrane penetration at edge asperities and corner sites. Proc Natl Acad Sci U S A 110(30):12295-12300.