Superfund Research Program

The Superfund Research Program (SRP) has provided practical, scientific solutions to protect health, the environment, and communities since 1987. SRP works to learn more about ways to protect the public from exposure to hazardous substances, such as industrial solvents, arsenic, lead, and mercury, which can cause death, disease, and birth defects. These and other toxic substances are found in contaminated water, soil, and air at Superfund waste sites throughout the United States.[1]

As part of the National Institute of Environmental Health Sciences, one of the National Institutes of Health, SRP funds grants on basic biological, environmental, and engineering processes, to find real solutions to hazardous waste problems. In addition, SRP helps train the next generation of environmental health researchers.

Reducing contamination

SRP conducts research to reduce contaminants or keep them from spreading. For example, SRP research has:

- Used microbes to remove uranium from nuclear waste and groundwater.
- Developed new ways to remove metal contaminants from water without producing toxic sludge.
- Developed tests to screen for hormone-mimicking chemicals that can harm human development.
- Developed green manufacturing processes to remove hazardous chlorinated contaminants from water.

Photo courtesy of University of Washington SRP Center

Protecting human health

As hazardous substances spread through the ground, water, and air, human exposure to them raises risks associated with numerous diseases and serious ailments. SRP-funded research is leading to a better understanding of how these contaminants work, how people are exposed to them, and the dangers they may pose. SRP researchers have:

- Discovered new links between arsenic in drinking water and cancers, as well as other developmental, reproductive, neurological, and immune effects.
- Found that good nutrition may help reduce adverse health effects from exposures to chemicals and pollutants.
- Identified health effects, such as obesity, diabetes, and hardening of arteries, from exposure to polychlorinated biphenols (PCBs).
- Shown how exposures to plastic additives called phthalates, in pregnant women, can lead to preterm births.

Major health consequences studied by SRP

- Cancers
- Cardiovascular disease
- Neurological disorders
- Fetal developmental impairment
- Respiratory disease
- Immune system dysfunction

PO Box 12233 • Research Triangle Park, NC 27709
Phone: 919-541-3345 • **www.niehs.nih.gov**

National Institutes of Health
U.S. Department of Health and Human Services

August 2014

♻ Printed on recycled paper

Making discoveries that make a difference

Dozens of SRP research programs have improved our understanding of the dangers of hazardous substances and led to better ways to protect our health. A few examples include:

- **Child neurological development**: Studies of school children found a link between arsenic in drinking water and diminished intellectual functions.[2] Researchers are now working to encourage testing for arsenic in well water and developing better ways to remove arsenic from groundwater.
- **Cancer:** Trichloroethylene (TCE), an industrial solvent and degreaser, can cause cancer and harm the central nervous system, kidneys, liver, immune system, and developing fetuses. SRP researchers developed a way to clean up TCE and other contaminants from groundwater using solar power.[3]
- **Nervous system:** Dust from mines often contains lead and other metals that, when inhaled, can damage the nervous system. In arid regions, the dust can be blown over thousands of acres. Researchers found ways to use native plants to limit the spread of dust,[4] and they worked with communities to test soil after toxic metals were found in vegetables grown near mines.[5]
- **Lung function:** First identified by SRP researchers, environmentally persistent free radicals (EPFRs) are found in contaminated soil and emissions from industrial facilities, and can impair lung function[6] and blood flow.[7] Researchers are now exploring ways to reduce exposure to EPFRs and remove them from the environment.

Creating partnerships that lead to scientific discoveries

A hallmark of SRP is collaboration. SRP brings together teams of scientists from major research universities and innovative small businesses with a range of expertise. SRP researchers include biologists, chemists, toxicologists, ecologists, epidemiologists, geoscientists, and engineers. They are required to work closely with local, state, and federal agencies, as well as the individuals and communities near hazardous waste sites. This fosters a focus on priorities and community needs, sharing research results and expertise, and maximizing the impact and relevance of SRP studies.

To promote research relevance and maximize the impact of program investments, SRP works closely with its sister programs at the U.S. Environmental Protection Agency (EPA) and the Centers for Disease Control and Prevention Agency for Toxic Substances and Disease Registry (ATSDR). It also partners with the U.S. Department of Energy and U.S. Department of Defense, as well as the National Science Foundation.

SRP contributes to advancing science

- SRP has funded about 1,400 researchers at 125 universities and small businesses.
- SRP grantees have worked at more than 210 hazardous waste sites in 36 states.
- SRP researchers have patented more than 100 inventions to detect and clean up waste.
- More than 9,500 peer-reviewed articles have documented SRP breakthroughs.
- SRP has trained more than 1,500 environmental scientists.

Small business innovation making a unique contribution to public health

While most SRP grants go to university-based centers, SRP recognizes that much of the nation's innovation comes from cutting-edge small businesses. Two programs — Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) — support the commercialization of innovative monitoring, as well as cleanup technologies and products that can be used at Superfund and other contaminated sites.

- A small business invented a way to use bacteria to eliminate a solvent that contaminated water and caused liver and kidney damage. The new technology works without using chemicals or producing secondary waste.

Photo courtesy of Duke University SRP Center

- Another company developed a system using microwaves to reactivate granular activated carbon used to remove volatile organic compounds (VOCs), reducing costs and waste.
- With acid rock drainage from abandoned mines polluting nearby waterways, a company developed a method to profitably recover copper and other valuable metals, creating an economic incentive for cleaning up sites.

Sharing results to keep you informed

SRP research is focused on making a difference. With that goal in mind, SRP teams actively share research results, and make sure cutting-edge breakthroughs and innovations are known and understood by a wide audience. Scientists, policymakers, and the public can easily engage with SRP research.

- **Research briefs**: Monthly summaries of SRP research milestones and findings are emailed to more than 5,600 health and environment experts.
- **Seminars**: Called Risk e-Learning, SRP conducts live, interactive Web-based seminars, with more than 250 participants in a typical webinar. Topics range from introducing new cleanup tools and approaches, to exploring ways to inform and work with communities facing environmental health challenges.
- **Connecting with communities**: SRP regularly interacts with communities near hazardous waste sites, by conducting workshops and training, and providing educational materials and online tools.

Photo courtesy of University of Arizona SRP Center

How SRP works

Recognizing the threat posed by dangerous chemicals and other pollutants left in toxic waste dumps nationwide, Congress created the landmark Superfund program in 1980, to clean up the sites. SRP was created by the Superfund Amendments and Reauthorization Act of 1986, which directs SRP to develop:

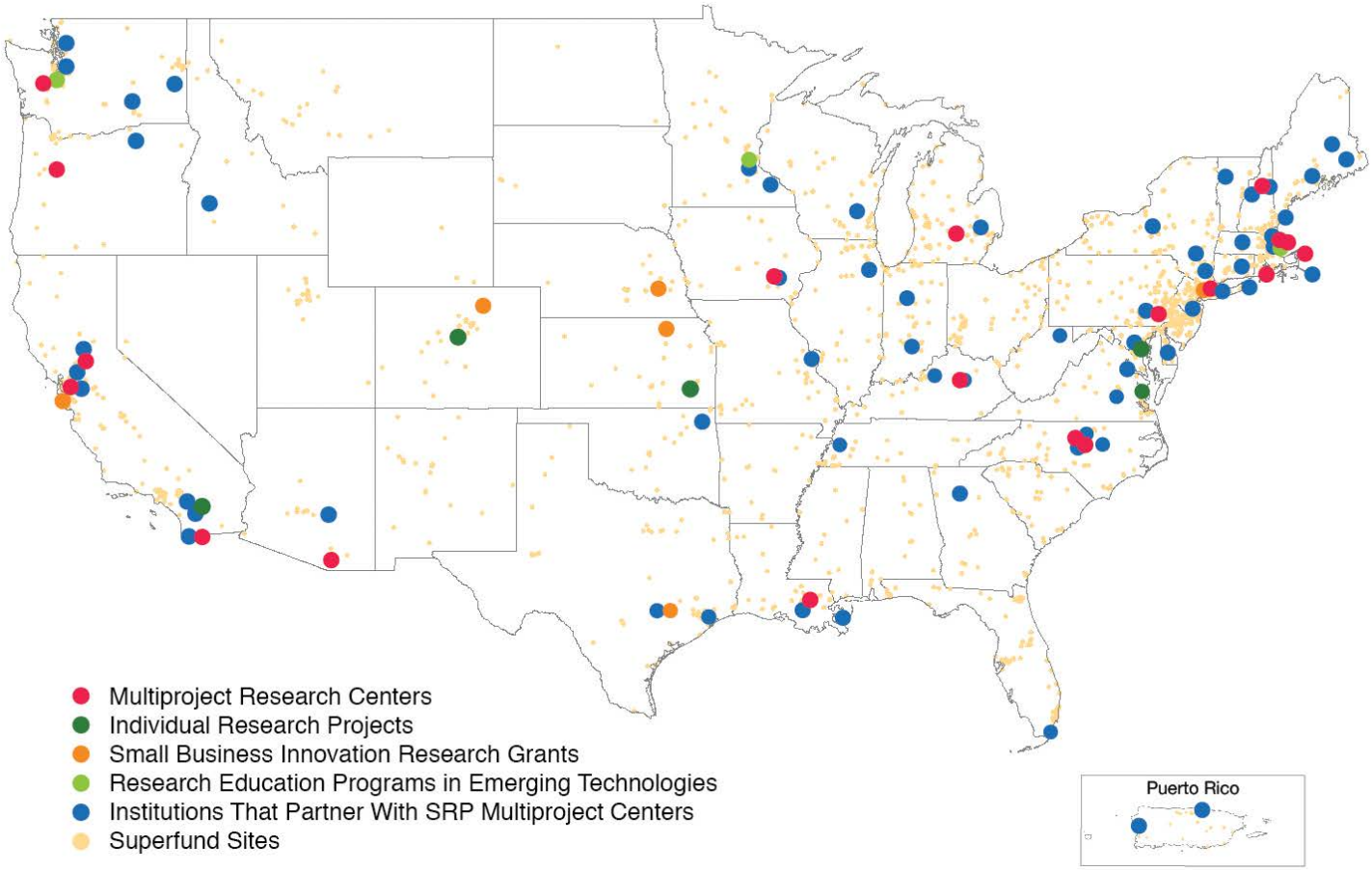
- Advanced techniques to detect, assess, and evaluate the health effects of hazardous substances.
- Methods to assess risks to human health posed by hazardous substances.
- Methods and technologies to detect hazardous substances and their toxicity.
- Basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances.

SRP funds four types of grants to meet research goals

- Multiproject research centers: Where teams of scientists from different disciplines, usually at major universities, address the complex issues related to identifying and cleaning up hazardous waste sites.
- Individual research projects: Compliment multiproject centers with research that meets critical detection and cleanup technology needs.
- Small business grants: Allow cutting-edge firms to develop monitoring and cleanup applications.
- Training programs: Create continuing education for emerging contaminants and technologies related to occupational health and safety.

Superfund sites and related research and training activities

There are about 1,700 hazardous waste sites across the country. This map shows their location, along with locations of SRP grantees and the institutions with which they collaborate.



Map courtesy of the Columbia University Superfund Research Program and Center for International Earth Science Information Network (CIESIN). 2014. U.S. Environmental Protection Agency National Priorities List — Sites Point Data With CIESIN Modifications, Version 2. Palisades, N.Y.: NASA Socioeconomic Data and Applications Center.

For more information on the Superfund Research Program, visit **www.niehs.nih.gov/srp**.
To subscribe to the SRP monthly research briefs, contact **srpinfo@niehs.nih.gov**.

[1] EPA (U.S. Environmental Protection Agency). 2011. Common Chemicals Found at Superfund Sites. Available: http://www.epa.gov/superfund/health/contaminants/radiation/chemicals.htm [accessed 18 July 2014].

[2] Wasserman GA, Liu X, Lolacono NJ, Kline J, Factor-Litvak P, van Geen A, Mey JL, Levy D, Abramson R, Schwartz A, Graziano JH. 2014. A cross-sectional study of well water arsenic and child IQ in Maine schoolchildren. Environ Health 13(1):23.

[3] Yuan S, Mao X, Alshawabkeh AN. 2012. Efficient degradation of TCE in groundwater using Pd and electro-generated H2 and O2: a shift in pathway from hydrodechlorination to oxidation in the presence of ferrous ions. Environ Sci Technol 46(6):3398-3405.

[4] Grandlic CJ, Mendez MO, Chorover J, Machado B, Maier RM. 2008. Plant growth-promoting bacteria for phytostabilization of mine tailings. Environ Sci Technol 42(6):2079-2084.

[5] Ramirez-Andreotta MD, Brusseau ML, Artiola JF, and Maier RM. 2013. A greenhouse and field-based study to determine the accumulation of arsenic in common homegrown vegetables grown in mining-affected soils. Sci Total Environ 443:299-306.

[6] Balakrishna S, Saravia J, Thevenot P, Ahlert T, Lominiki S, Dellinger B, Cormier SA. 2011. Environmentally persistent free radicals induce airway hyperresponsiveness in neonatal rat lungs. Part Fibre Toxicol 8:11.

[7] Mahne S, Chuang GC, Pankey E, Kiruri L, Kadowitz PJ, Dellinger B, Varner KJ. 2012. Environmentally persistent free radicals decrease cardiac function and increase pulmonary artery pressure. Am J Physiol Heart Circ Physiol 303(9):H1135-H1142.