National Institute of Environmental Health Sciences
Superfund Research Program

2020–2025

STRATEGIC PLAN

Strategies to Attain Superfund Research Program Objectives and Goals

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

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In 2020, the National Institute of Environmental Health Sciences (NIEHS) Superfund Hazardous Substance Research and Training Program, also known as the Superfund Research Program (SRP), engaged stakeholders from academia, environmental health agencies, and not-for-profit organizations to review and refine the SRP strategic plan.

The 2020 Strategic Plan builds on the 2010 and 2015 SRP Strategic Plans that provided summaries of objectives and goals for the program, and outlined strategies to achieve them. The 2010 Strategic Plan was prepared with significant input from an external advisory panel and stakeholders. The 2015 Strategic Plan was updated to address emerging needs and program goals. In the 2020 update, SRP reaffirms its commitment to the objectives presented in these previous iterations, while focusing SRP research through a systems approach lens to accommodate emerging complexity, and research and training opportunities of the program.

Three overarching objectives provide direction to both SRP grantees and program staff to:

1. Address issues of high relevance.
2. Maximize the impact of program investments.
3. Foster innovations.

The objectives are both responsive to the program's mandates, as outlined in the Superfund Amendments and Reauthorization Act of 1986, and critical to the SRP mission of seeking solutions to the complex health and environmental issues associated with the nation's hazardous waste sites, with the goal of improving public health. The SRP Strategic Plan is also well aligned with the 2018-2023 NIEHS Strategic Plan.

As part of its 2020 Strategic Plan, SRP includes new goals that adapt a systems approach concept, which provides a framework to understand how scientists can work together to understand and prevent environmentally influenced human disease. SRP defines a systems approach as a way to integrate diverse fields and capture the complex and interdisciplinary elements involved in an interconnected network.

Research teams at each SRP center work together to address specific questions as part of a larger system (Figure 1). A system is a set of elements whose connections and interdependencies determine their behavior and the behavior of the whole system. Leveraging a systems approach can advance SRP science that converges across disciplines, while building the foundation for researchers to

Figure 1: SRP-funded centers combine biomedical research, environmental science and engineering, research translation, community engagement, training, and data science to understand and address a specific problem. A systems approach offers a framework to understand how center teams can integrate diverse fields to answer questions that could not be answered by a single project or core.




address difficult emerging environmental health problems. For more information about adapting a systems approach framework for SRP, see the commentary, "Greater Than the Sum of Its Parts: Focusing SRP Research Through a Systems Approach Lens" (Suk et al., 2020).

To accommodate the complexity of environmental health problems, SRP acknowledges the importance of thoughtful strategic planning to provide programmatic direction for multidisciplinary, translational research. The SRP Strategic Plan aims to build a foundation for researchers to address difficult environmental health problems, understand links between chemical exposures and diseases, establish a research infrastructure to support the various activities necessary to pursue the program's mandates, and support applicants and grantees to maximize the outcomes of SRP-funded research and training.

The objectives and goals in the next section represent key themes from previous SRP strategic plans that are still relevant today, as well as updates to address emerging needs and program goals. The 2020 Strategic Plan re-emphasizes the importance of basic research and how it can lead to application and impact. The plan also expands on goals to enhance coordination and collaboration both among grantees and with a variety of stakeholders to leverage resources. The intent of the updated strategic plan is to ensure that SRP continues to support a cutting-edge program that is responsive to its mandates and relevant to its stakeholders.

Objective One
Address issues of high relevance

Goal: Encourage problem-based, solution-oriented research

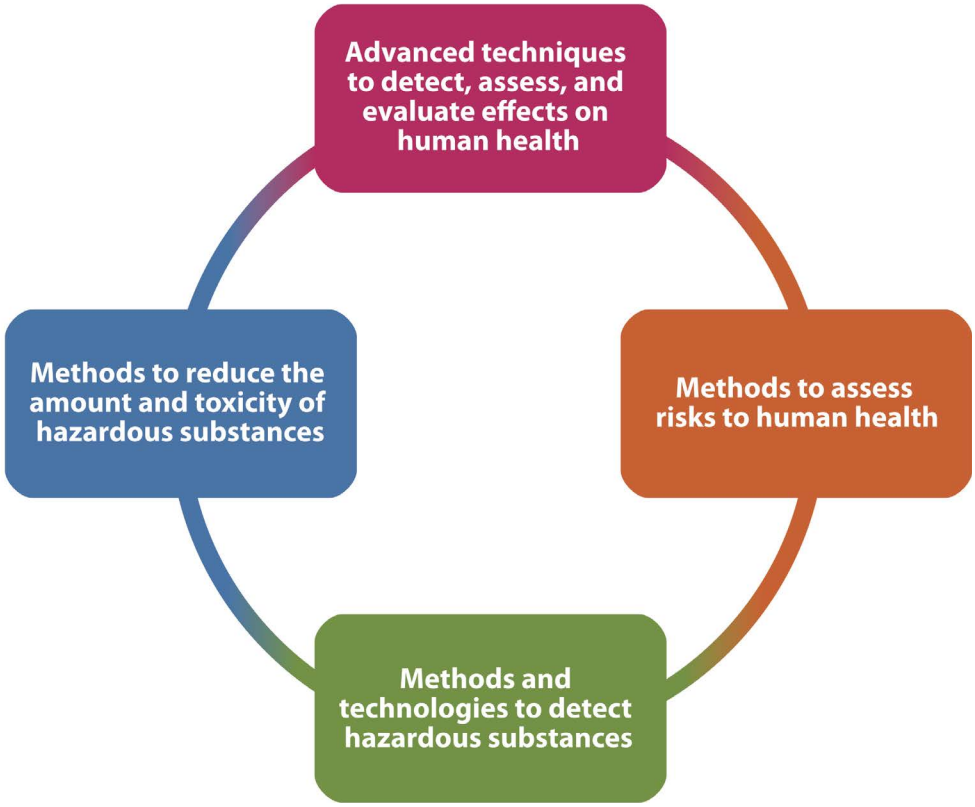
Basic science is a critical foundation on which transdisciplinary SRP centers are built. SRP basic research aims to achieve a fundamental understanding of biological, environmental, and engineering processes and apply this knowledge to address hazardous waste-related issues. SRP's mandates (Figure 2) encompass broad transdisciplinary research, which occurs when perspectives from two or more disciplines converge to form a new research approach, broadened further by integrating research translation, community engagement, training, and data science.

The scope of the program's mandates and its structure provide the framework for SRP research to address complex environmental problems related to hazardous substances. In addition to addressing these problems, SRP recognizes the importance of research to continually achieve greater relevance.

- SRP will challenge applicants to design problem- based, solution-oriented research proposals that aim to advance fundamental research questions, understand and reduce exposures, and ultimately improve public health. Applicants will create opportunities to solve issues relevant to the SRP stakeholders' needs.
- In consultation with stakeholders, program staff will seek to improve processes for identifying research needs and incorporating these needs into the SRP research agenda.

Figure 2: SRP mandates include the development of:

1. Advanced techniques for the detection, assessment, and evaluation of the effects on human health of hazardous substances.
2. Methods to assess the risks to human health presented by hazardous substances.
3. Methods and technologies to detect hazardous substances in the environment.
4. Basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances.



Goal: Promote interaction between SRP and its stakeholders

SRP recognizes that ongoing interaction with a variety of stakeholders promotes research relevance and leverages crucial resources to ensure that research dollars are used efficiently. Because of the broad scope of research disciplines within the program, SRP collaborations span from biomedical and human health agencies and programs to environmental science and engineering agencies (Figure 3).

Figure 3: As part of NIEHS within the National Institutes of Health, SRP facilitates partnerships with a wide range of stakeholder groups that span and intersect environmental science, engineering, and public health.

SRP will challenge applicants to seek input from stakeholders as they develop a proposal, and to keep stakeholders apprised of progress throughout the life of the grant. Seeking input applies to research and community engagement activities.

- SRP will encourage applicants and grantees to look beyond stakeholders at the U.S. Environmental Protection Agency (EPA) and Agency for Toxic Substances and Disease Registry (ATSDR), to identify potential partners or end users at other federal agencies, such as the National Science Foundation, National Oceanic and Atmospheric Administration, U.S. Geological Survey, U.S. Department of Defense, U.S. Department of Energy, and other institutes and centers within the National Institutes of Health (NIH). SRP will also encourage applicants and grantees to partner with state and local agencies; tribal governments; nonprofit and non-governmental organizations; and communities impacted by hazardous substances.
- SRP will encourage applicants and grantees to look broadly for partners to tackle global, systemic problems and find equitable solutions to complex environmental health issues that can be applied to hazardous waste sites across the U.S.
- Program staff will help foster these interactions by creating opportunities for stakeholders and grantees to network. Program staff will also work directly with other agencies and programs that are aligned with SRP research goals to foster collaborations.
- Program staff will investigate mechanisms to enhance research collaboration opportunities for grantees and stakeholders.

Goal: Prioritize critical research areas

SRP researchers strive to answer complex questions about environmental health. Maximizing relevancy requires SRP to cover all mandate areas, such as health effects, risk, detection, and remediation, and address the most critical current and emerging needs.

SRP researchers investigate co-exposures to multiple contaminants and other stressors that encompass the exposome. This research includes how exposure burdens combined with non-environmental factors, such as age, sex, education, and income lead some populations to be more susceptible to health risks. Researchers explore gene-environment interactions that make some individuals more susceptible to environmental insults, and critical windows of exposure or periods where people are more vulnerable to environmental insults. Research teams seek to understand the role of underlying health conditions and comorbidities that influence the relationship between the environment and health, and long latencies between exposure and disease. They also study geological or meteorological factors that control exposures, and the use of cutting-edge devices and tools to measure and remove hazardous substances.

- While SRP researchers have been leaders in these fields over the last 30 years, disentangling the complex interrelationships that contribute to the total accumulated stress on the body, or allostatic load, remains a challenge. Systems thinking offers a useful multidirectional framework to link diverse perspectives and continually gain new insight.
- SRP grantees are encouraged to move away from one-size-fits-all approaches in environmental health research and incorporate more comprehensive research approaches that draw on different methods. For example, emerging precision approaches for prevention consider individual variability in genes, environment, and lifestyle for each person.
- SRP will be proactive in achieving coverage across mandate areas, contaminants, and exposure scenarios, placing emphasis on stakeholders' critical needs. Program staff will take steps to effectively communicate these priorities to applicants, grantees, and peer reviewers.
- When preparing applications, researchers should, in turn, assemble teams to address research challenges within a given mandate area, contaminant, or exposure scenario that may have the greatest potential for supporting the SRP goal to protect human health and the environment from hazardous substances.

Objective Two
Maximize the impact of program investments

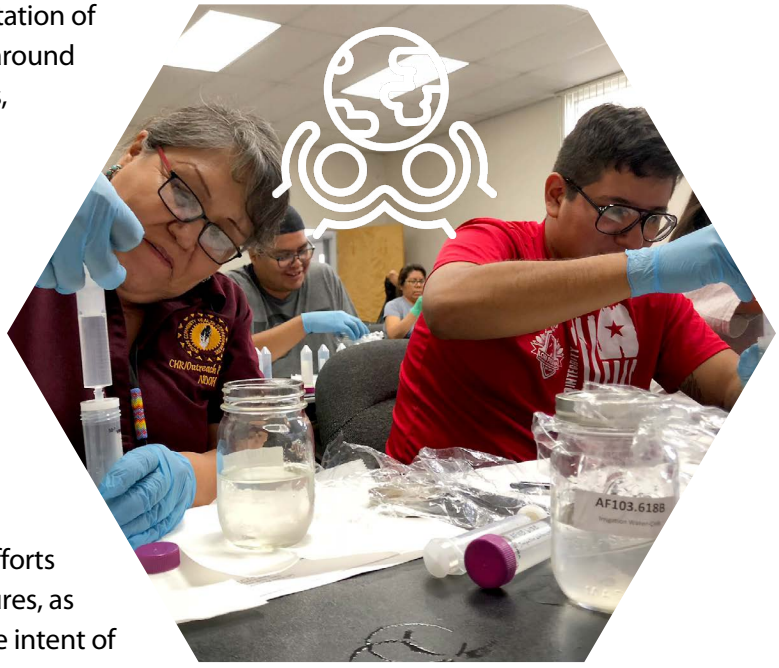
Goal: Encourage investigator-initiated research translation

It is critical that grantees assume responsibility for developing connections that accelerate the application of their SRP-funded research advances, where application encompasses a range of outcomes, including the transfer of information to enhance stakeholder knowledge, implementation of new technology, and reduced exposure to hazardous substances.

- SRP will encourage investigators to take increased responsibility for research translation of their findings. This iterative process will require ongoing, proactive efforts by grantees to effectively target appropriate end users.
- Program staff will facilitate efforts to build connections among grantees and stakeholders, and highlight grantees who have been successful in implementing new research and technologies to end users.
- SRP will seek investigators who share an interest in effectively translating discoveries to stakeholders.

Goal: Focus Community Engagement Cores to engage in prevention and intervention activities

SRP is interested in approaches that prevent exposures or reduce the toxicity of hazardous substances beyond just the implementation of technologies. Multidisciplinary teams incorporate research around a common system to study one or more chemical exposures, associated health impacts, and related detection and remediation technologies that are critical for understanding and reducing exposures. This approach helps researchers identify the feedback, interdependencies, and dynamics driving the research and its translation. SRP's focus on problem-based, solution-oriented research can help inform opportunities to implement prevention and intervention approaches and improve health.



- SRP will expect Community Engagement Cores within the Multiproject Research Centers (P42 grants) to focus their efforts on prevention and intervention activities to reduce exposures, as called for in Mandate 4 (methods to reduce exposures). The intent of these interventions is to decrease or prevent exposures to, or toxicity from, hazardous substances that result in measurable and verifiable impacts on public health.
- SRP program staff will facilitate community engagement prevention and intervention activities through appropriate support mechanisms, including an emphasis on understanding and addressing environmental health concerns among communities more likely to be exposed to hazardous substances.

Goal: Track SRP research and innovation and disseminate program successes and research findings

Communicating research findings to multiple audiences is critical to maximizing program investments. SRP will continue to track new ideas and knowledge from SRP grantees as they move through the translational research process. Documenting the benefits of SRP research investments provides insight into how basic research is translated to real-world applications.

- Program staff will continue to work closely with grantees to help identify societal benefits of basic SRP research, including identifying research that has yielded significant cost savings or had a significant impact on science and health.
- Program staff, in coordination with grantees, will develop and facilitate the use of tools to support enhanced dissemination of program advances.
- SRP encourages grantees to develop position pieces, reviews, and nontraditional communication methods, to make the significance and applicability of SRP-funded research discoveries more accessible to the program's broad range of stakeholders. Grantees are encouraged to communicate new ideas and knowledge from their research projects, including describing how basic research has led to application, implementation, practice, and impact.

Goal: Enhance impact of training activities

SRP will continue to emphasize the training of graduate and postdoctoral students in cross-disciplinary and interdisciplinary research. SRP's approach to research allows early career scientists to gain experience in problem-based, solution-oriented research across multiple scientific fields and to conduct research in a highly collaborative environment.

- SRP encourages grantees to identify ways to involve trainees in stakeholder interactions and community engagement, projects that promote coordination and collaboration among grantees, and research translation.
- SRP will continue to evolve its training component by tracking and analyzing outcomes from its trainees, providing opportunities for trainees to collaborate with scientific leaders outside their home institution, and increasing opportunities for trainees interested in research that goes beyond U.S. boundaries and expands to the areas of expertise needed to advance environmental health sciences.
- Program staff will foster networking among trainees, and between trainees and stakeholders, to broaden cross-disciplinary opportunities and enhance interdisciplinary research.

Objective Three
Foster innovation

Goal: Promote transdisciplinary science

SRP firmly supports transdisciplinary research as a mechanism for introducing innovative solutions to problems. Research across disciplines helps to address critical barriers in the understanding of the physical, chemical, and biological properties of hazardous substances in the environment.

- SRP will encourage applicants to propose novel solutions to existing, relevant problems by adapting technologies and approaches from one field and applying them to other fields.
- SRP also supports studies that identify barriers to, and enablers of, effective prevention and intervention activities and recognize more equitable solutions to environmental health problems.
- SRP has and will continue to foster opportunities for transdisciplinary research.

Goal: Support integration of multidisciplinary environmental health research data

Addressing complex challenges posed by environmental contamination requires an integrated, multidisciplinary approach. SRP has fostered such research for more than 30 years and acknowledges that integration of data from a broad range of scientific disciplines will be critical to understanding the link between exposures and disease. By integrating these different types of research from different disciplines and sharing data within and across centers, researchers are better positioned to generate new discoveries and answer complex questions that could not be answered otherwise.

- SRP grantees should make their data publicly available when possible to enhance opportunities for data sharing and convergence across disciplines and research projects. Data sharing and integration among center projects is facilitated by Data Management and Analysis Cores.
- SRP grantees are encouraged to integrate and reuse SRP data to leverage previous findings and accelerate the pace of research.
- SRP will facilitate the development of coordination and data management infrastructure to enhance grantee capacity to integrate diverse data from multidisciplinary research across multiple platforms (Heacock et al. 2020).
- SRP program staff will continue to facilitate implementation through appropriate support mechanisms.

Goal: Define research scope within the SRP mandates

SRP-funded research aligns with the mandates, which also gives researchers an opportunity to begin defining the scope of their research and the boundaries of their system of interest. As an institution of the NIH and part of NIEHS, disease and dysfunction and the role of hazardous substances in the environment are essential components that also define the system.

- SRP will encourage applicants to develop centers with research projects and cores that complement each other to answer questions that a single project or core could not answer alone. Looking to and collaborating with institutions beyond the center's university may be necessary to assemble the right team, expertise, and technical capabilities to address the multidimensional components that connect exposure to disease.
- SRP grantees incorporate research around a common system to study one or more chemical exposures, associated health impacts, and related detection and remediation technologies that are critical for understanding and reducing exposures. This framework helps researchers identify the feedbacks, interdependencies, and dynamics driving the research and its translation to identify new opportunities to intervene.

Goal: Enhance coordination and collaboration between grantees

By sharing knowledge and data, and working together, grantees leverage resources, maximize productivity, and accelerate scientific advancement. Coordination and collaboration can foster innovation that each center may not be capable of accomplishing alone.

- Grantees should seek opportunities to coordinate with each other and, when appropriate, pursue collaborative projects.
- Program staff will, in turn, identify appropriate mechanisms to facilitate coordination and support of such collaborations.

Goal: Encourage new technologies and challenge existing paradigms

Forward-looking, or anticipatory, research is critical to identifying and addressing future stakeholder needs. This research may include utilizing cutting-edge tools, developing new risk frameworks, developing computational and modeling approaches to predict exposure risk or toxicity, or devising more sustainable and equitable solutions to address Superfund-related issues.

- Grantees are developing high-throughput tools to more closely mimic human biology and computational methods that can predict and prioritize potentially hazardous substances for further study. Broader adoption of systems approaches can also help researchers predict outcomes and prioritize intervention and remediation approaches to improve health.
- Program staff will continue to foster opportunities that encourage new technologies and challenge existing paradigms.

Moving forward

The SRP Strategic Plan is a living document. The refinements presented here strengthen the program's approach to improving human health and the environment, through reducing or eliminating the negative impacts of exposure to hazardous substances from waste sites. Thoughtful strategic planning will optimize the research and training provided through this program.

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www.niehs.nih.gov/research/supported/centers/srp

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