CASE STUDY 1: Dartmouth Toxic Metals Superfund Program

The Dartmouth Superfund Program focuses on arsenic and mercury in the environment, targeting the following **research questions**:

- The natural and man-made sources of arsenic and mercury in the environment and their relative contributions to human exposure;
- How arsenic, mercury, and other metals move through ecosystems;
- How methylmercury is taken up in aquatic ecosystems and how it ends up in the fish that are most commonly consumed by humans;
- Whether arsenic at levels found in drinking water in the U.S. raises the risk of human disease including lung disease, respiratory infections, and premature births;
- Whether arsenic at levels found in food in the U.S. raises the same risks; and
- Precisely how arsenic affects the cellular processes that are known to contribute to cardiovascular, lung and heart disease, and cancer.

Among their **support cores** are the **Community Engagement Core (CEC)** and the **Research Translation Core (RTC)**. The CEC facilitates interaction between community members and the research program, as well as forms partnerships to assist communities and community-serving organizations in accessing pertinent information. The RTC communicates, and facilitates the application of, their research and accomplishments, by communicating effectively within the NIEHS Superfund Research Program; establishing partnerships with government agencies; administering technology transfers; and disseminating information to other end users, including the general public.

Goals: The CEC works to create opportunities for researchers to interact with communities, grass-roots organizations, and those impacted by hazardous waste. The goal of the CEC is to build bi-directional partnerships with diverse communities in Northern New England **to enhance their ability to understand and address the health risks** posed by arsenic, mercury, and other environmental contaminants. This goal is accomplished by working closely with target communities, community-serving organizations, and a community engagement advisory board (CEAB) to identify each community's needs with respect to science, education, information, and expertise. This program targets to:

- Learn about environmental health concerns in local communities;
- Determine how the public prioritizes health risks;
- Discover what forms of risk communication are most effective;
- Develop materials in response to community needs; and
- Keeping the public informed about our research and upcoming events.

Outcomes:

- Community participation in Science Café's
- Fact and datasheets for public use available on website
- Science exhibits at local libraries
- Commuity organizations informing private well users about testing their water

CASE STUDY 2: Oregon State University Tribal-University Partnership

The chief **objective** of the OSU project was to establish a collaborative project that included the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) tribal agencies, tribal and university investigators, and tribal community members to better understand health risks that may be associated with PAH exposures on the Reservation and to assist in human capacity building with tribal partners.

This was achieved by following these steps:

- Assess Polycyclic Aromatic Hydrocarbons (PAH) exposures of concern to the Tribes related to ambient air and traditional and cultural practices
    - Ambient air monitoring on the Reservation at selected sites
    - Testing during traditional smoking of fish and game
    - Collection and analysis of air and urine samples from Tribal members smoking food
    - Develop capacity among Tribal air staff to do sampling, monitoring—on Reservation and at OSU
- Measure PAH concentrations in foods prepared using indigenous smoking preservation methods
- Develop culturally appropriate risk reduction approaches and outreach strategies that engage the community and offer the best opportunity for improved health
    - Using the findings and current literature to estimate overall PAH exposures
    - Developing community definition of health and cultural well-being
    - Engage the community in designing risk reduction strategies
    - Disseminate information both locally and more broadly to regional and national Tribal communities
- Meet on annual basis with interdisciplinary advisory group who will provide overall guidance to project

Results and Outcomes from the collaborative research project:

1. Installed ambient PAH monitors on the CTUIR Reservation, involving CTUIR officials and university researchers.
2. Trained a Tribal Air Quality Technician to collect PAH filters; transferred responsibility for air sampling technology for gas- and particle-phase PAHs to CTUIR.
3. Facilitated collection of personal air sampling data during traditional smoking of salmon, the first study of its kind conducted with tribal members.
4. Collected salmon samples in two types of structures with two different woods: concentrations of PAHs in traditional smoked foods exceed concentrations of PAHs in commercial salmon by factors of 40-400.
5. Sponsored a Tribal Research Symposium focused on Tribal legal issues, research ethics, concepts in indigenous and western science, and integration of socio-cultural health indicators in Tribal risk research.
6. Developed a Material and Data Sharing Agreement, published it in Environmental Health Perspectives, distributed it to regional EPA Tribal Liaisons and regional Indian Health Service, and posted on EPA Partnerships for Environmental Public Health Resource Center for access by other SRPs.

CASE STUDY 3: University of Arizona, Tucson, "Gardenroots" Program

The Gardenroots project was developed in response to home gardening concerns in the Dewey-Humboldt, AZ community over possible metal contamination from the neighboring Iron King Mine and Humboldt Smelter Superfund site. The overall **objective** of *Gardenroots* was to determine whether home garden vegetables grown in Dewey-Humboldt had elevated levels of arsenic. *Gardenroots* combined a home garden experiment with controlled greenhouse studies to meet the following **project objectives**:

- Develop a citizen-science program to inform and engage community members
    - Recruit at the local level
    - Provide training and educational activities for participants
- Characterize arsenic uptake in homegrown and greenhouse-grown vegetables
    - Home gardens (citizen-scientists): collect soil, water, and vegetable samples (of their choice)
    - Greenhouse: grow vegetables in soils with known concentrations of arsenic
    - Analyze water, soil, and vegetable samples for arsenic concentration
- Estimate arsenic exposure and characterize potential risk
    - Combine measured arsenic concentrations with reported U.S. intake rates
    - Use exposure assessment modeling to estimate average daily dose of arsenic from vegetable, soil, and water (assuming the primary source of water for irrigation is also used for drinking) and associated potential risks
- Report results back to participants in an effective and meaningful way
    - Provide personalized results and estimated risks that allow individual participants to make educated choices
    - Provide aggregate overview of community and greenhouse results at US EPA community "open house," 2 local Master Gardeners groups, and at a general community meeting.
    - Develop recommended best practices handouts

Results: The results of this study showed that in general, arsenic concentrations were higher in *Gardenroots* vegetables than store-bought vegetables. Potential exposure routes measured suggested that arsenic exposure was greatest from drinking water (when assuming the primary source of water for irrigation is also used for drinking). The project strongly recommended for Dewey-Humboldt community members to test drinking water yearly and to test soils prior to gardening.

Outcomes:

1. Gardenroots advanced researchers' understanding of soils, uptake of arsenic by vegetables, exposure, and risk. A risk-based estimate of maximum soil arsenic concentration was developed for specific plant families to guide gardeners and farmers.
2. Citizen-scientist participants increased their understanding of soil contamination, food quality, and the scientific process. Surveys showed that after learning their Gardenroots results, the majority of participants will continue to garden, but will change their gardening practices (i.e. following the recommended best practices for gardening handouts).
3. A community-academic partnership was developed and community capacity was increased, resulting in community networking and participation in resource-related issues. For example, following elevated arsenic results for some participants on municipal water, community members worked together to notify authorities and bring attention to the problem, which is now in the process of being resolved.