National Institute of Environmental Health Sciences

Reducing PFAS in Drinking Water

The National Institute of Environmental Health Sciences (NIEHS) funds researchers to work with communities to identify sources of exposure to harmful chemicals like per- and polyfluoroalkyl substances (PFAS) and to prevent these exposures.

PFAS are a large class of manufactured chemicals originally developed in the 1930s. They are used in a variety of industrial and consumer products, including firefighting foams, nonstick cookware, stain repellants, and products that resist grease, water, and oil. PFAS do not break down, so they can build up in the environment over time and contaminate drinking water. PFAS exposure has been linked to many health effects in humans, including cancer.[1,2]

"The science speaks for itself: There is clear evidence that PFAS exposure results in negative health effects," said Susan Pinney, Ph.D., who co-led the study team alongside Frank Biro, M.D.

NIEHS invests in programs that work to understand the effect of PFAS on human health and develop strategies to reduce people's exposure to these chemicals.

In the Greater Cincinnati area, NIEHS-funded researchers discovered high levels of a specific PFAS chemical, called perfluorooctanoate (PFOA), in young girls.[1] The researchers suspected the exposures were likely due to contamination of the water supply. They worked with local water departments to implement water filtering techniques that resulted in a 40-60% reduction in PFOA levels in the girls and other residents.[10] Investing in water filtering technologies can reduce exposure to harmful chemicals, which leads to reduced disease and lower health care costs.

Impacts of PFAS Research in the Greater Cincinnati Area

Understanding Exposures

- Scientists discovered that PFAS exposure – already known to be widespread in the U.S. population over age 12 – was also prevalent in young girls.[1]

Uncovering Health Effects

- PFOA exposure during important developmental time points altered mammary structure and development in mice.[4,5]
- Young girls exposed to PFOA had poor metabolic outcomes, delayed breast development, and lower reproductive hormone levels.[6,7,8]

Reducing Exposures

- Carbon filters can remove PFAS from water, reducing exposures in communities dealing with PFAS-contaminated drinking water.[10]

Sharing Results

- Scientists shared results with affected communities and local water departments so they could take action to reduce exposures.[3]

Changing Clinical Practice

- Researchers created a Continuing Medical Education module to help public health professionals identify patients at risk of exposure to PFAS and provide them with strategies to reduce exposures.[11]

Informing Policy

- NIEHS grantees are providing decision-makers with information about PFAS and what it means for community health.

Then and Now

Then

- PFAS chemicals were present in more than 98% of the U.S. population over age 12, but there was limited data on PFAS exposure in children.[2]
- Scientists did not know the extent to which PFAS exposure affected health, particularly in children.
- Within the Greater Cincinnati area, the Northern Kentucky water department did not use granular activated carbon (GAC) filtration to remove PFOA and other PFAS chemicals from drinking water.[1]
- Many health care providers did not know how to assess patients for PFAS exposures, nor did they know how to advise patients on preventing exposure.

Now

- Scientists documented widespread PFAS exposure in young girls.[1]
- Research showed that exposure to PFAS disrupted normal pubertal development in girls, which can increase breast cancer risk later in life.[6,7,8]
- The Northern Kentucky water department installed GAC filtration, resulting in 40-60% lower PFOA levels in the girls in the study.[9,10]
- Health care providers now have tools to help them recognize patients exposed to PFAS and discuss potential health risks and protective actions with them.[11]

Research Timeline: Cincinnati Study of PFAS in Drinking Water

Fundamental Questions | **Application and Synthesis** | **Implementation and Adjustment** | **Policy and Practice** | **Impact**

2004-2006

Initiated a pilot project to measure PFAS in young girls following a recommendation from the CDC, which discovered widespread PFAS exposure in the U.S. population over age 12.[1,2]

2004-2006

Measured PFAS in girls ages 6-8 enrolled in the BCERP puberty study. Discovered that nearly all girls living in one Northern Kentucky community had PFOA serum concentrations above the 95th percentile for U.S. children 12-19 years.[1]

2006

Identified drinking water as the primary way girls were exposed to PFOA/PFAS.[1]

2007

Researchers shared study results with the community so families could take action to reduce PFAS exposures.[3]

2007-2012

Researchers partnered with city health and water departments to share study results and reduce PFAS exposure through water filtering.

2009

Discovered that prenatal PFOA exposure altered the structure of the mouse mammary gland in early life, and these changes persisted later in life.[4]

2010

Linked PFOA exposure to stimulated mammary development in female mice.[5]

2010s

Identified associations between higher PFOA exposure in girls ages 6-8 and lower body mass index, reduced insulin resistance, delayed breast development, and lower levels of reproductive hormones.[6, 7, 8]

2012

The local water department installed water filters to remove PFOA and other PFAS chemicals from drinking water.[9]

2012

Following the installation of water filters, PFOA levels dropped 40-60% in girls and other community residents.[10]

2019

Researchers briefed Congress on the health effects of PFAS.

2021

Researchers developed a Continuing Medical Education module on PFAS for clinicians.[11]

The Breast Cancer and the Environment Research Program (BCERP)

BCERP researchers studied how exposures to environmental factors before and during puberty might set the stage for increased breast cancer risk in adulthood.

Jointly funded by NIEHS and the National Cancer Institute from 2003 to 2020, the program supported a team science approach by creating a network of multidisciplinary breast cancer research centers. This structure enabled BCERP researchers to collaborate and connect findings from cell and animal studies with a human cohort study of more than 1,200 prepubertal girls from Cincinnati, New York City, and the San Francisco Bay area.[13]

Each BCERP center included a Community Outreach and Translation Core to help researchers translate their findings into educational messages for the community and better understand community perspectives.

Research Challenges and Solutions

Challenge: Researchers knew that PFAS exposures may affect children's health, but they did not understand how.

Solution: The transdisciplinary nature of the BCERP allowed researchers to integrate findings from cohort studies with experiments in animal and cell models to better understand how PFAS exposures affect health. BCERP annual meetings also created opportunities to establish the collaborations that facilitate movement from epidemiological to lab-based studies.

Challenge: Identifying actions that can reduce exposures and improve health at the individual, family, group, or population levels.

Solution: Because BCERP researchers were required to include community-engaged approaches in their activities, they were able to identify ways to translate study results into actions that communities and local water departments could take to reduce PFOA exposures.

Pinney shares findings from her PFAS research with breast cancer advocates and other stakeholders. (Photo courtesy of Susan Pinney)

"I'm a firm believer that people deserve to know what we found about chemicals in their bodies," said Pinney. "We also told the water departments what we found so they could address the source of the problem."

For references, supplementary information, and more on the impact of NIEHS research, please visit **https://niehs.nih.gov/research/programs/translational/examples**.