

US EPA ARCHIVE DOCUMENT

Overview of The National Health and Environmental Effects Research Laboratory (NHEERL)

Organizational Structure

NHEERL is the largest research organization in ORD, employing nearly 600 employees at various facilities across the country. NHEERL is organized into seven research divisions and a research cores unit. Each Division specializes in a different field of human health or ecological effects research and the research cores unit supports NHEERL’s research with various analytical capabilities (see Table 1). The three human health divisions and the research cores unit are centrally located in Research Triangle Park, NC, while the four ecology divisions are strategically situated in ecologically significant geographic regions across the U.S. (Gulf of Mexico, Great Lakes, Pacific Coast, and Atlantic Seaboard). By coupling the functional roles of the divisions with its multi- disciplinary research philosophy, NHEERL is able to sustain a responsive program that offers specialized skills in many distinct areas while retaining sufficient flexibility to adapt to changing research priorities. The NHEERL Clean Air Research Program is conducted primarily by the Environmental Public Health Division and the Toxicity Assessment Division.

Table 1. Overview of NHEERL’s Health and Ecology Divisions

DIVISION	LOCATION	RESEARCH FOCUS
Environmental Public Health Division (EPHD)	Research Triangle Park and Chapel Hill, NC	The EPHD performs epidemiological, clinical, and animal toxicology research to support risk assessments and evaluate public health outcomes. An integrated approach is used to assess the impact of environmental exposures on human health by developing and evaluating biomarkers of exposure and effects, conducting population-based and human clinical studies and parallel animal and <i>in vitro</i> toxicology studies, and assessing the impact of environmental actions and decisions on public health outcomes.
Toxicity Assessment Division (TAD)	Research Triangle Park, NC	The TAD addresses toxicological mechanisms and responses for target organ systems using multiple strategies related to (1) chemical screening and prioritization, including assessing <i>in vivo</i> predictive value of <i>in vitro</i> tests and test methods development and interpretation; (2) chemical-specific and mixtures toxicity assessment, including hazard identification and dose-response characterization; (3) development and use of animal models of disease; and (4) evaluation of specific assumptions and hypotheses generated by systems biology models.
Integrated Systems Toxicology Division (ISTD)	Research Triangle Park, NC	The ISTD applies a systems biology approach to describe normal biological, homeostatic processes and to identify key events that signal departure from those processes leading to adverse health outcomes. Research seeks to develop an integrated framework across health end points through the identification of toxicological pathways. This approach is accomplished by the use of computational and molecular approaches to identify "key events" for biologically based dose-response and mode-of-action-based models, the development of physiologically based pharmacokinetic models for linkage to biologically based dose-response models, and the application of genetic and epigenetic approaches for understanding differential life stage sensitivities.

DIVISION	LOCATION	RESEARCH FOCUS
Atlantic Ecology Division (AED)	Narragansett, RI	The AED conducts sediment and water quality research in a variety of environments ranging from freshwater to marsh and estuarine to near-shore marine environments along the Atlantic coast from North Carolina to Maine. AED's mission is to develop theory and methods, and analyze data to improve understanding of and quantify environmental effects of human activity on coastal waters and watersheds.
Gulf Ecology Division (GED)	Gulf Breeze, FL	The GED performs research on the large-scale physical, chemical, and biological dynamics of coastal wetlands and estuaries, with emphasis on the Gulf of Mexico. Our research provides information on the condition and functions of ecological resources, the services to society supplied by coastal ecosystems, rates and causes of ecological change and impairment, and predicted future conditions under various alternative scenarios.
Mid-continent Ecology Division (MED)	Duluth, MN and Grosse Ile, MI	The MED focuses on the ecological effects of toxic chemicals, genetically modified organisms, nutrients, habitat alterations, and global climate change. MED research advances scientifically-sound approaches for monitoring trends in ecological condition within the Great Lakes and Rivers, identifying impaired watersheds and diagnosing causes of degradation, and establishing risk-based assessments to support restoration and remediation decisions.
Western Ecology Division (WED)	Corvallis and Newport, OR	The WED performs research on ecological processes that determine the response of biological resources to environmental change and to land and resource use. Priority is given to those ecological systems at greatest risk, with emphasis on the scientific uncertainties that most seriously impede ecological risk assessment.
Research Cores Unit (RCU)	Research Triangle Park, NC	The RCU conducts research to develop new methods and models for enhancing analytical detection, and assessment and analysis of data. The Unit provides support to laboratory research projects through the development and application of analytical chemistry, genomics, proteomics, biostatistical, and bioinformatic technologies. The Unit also serves as a resource to aid in the integration of technologies, data, and modeling efforts throughout the NHEERL research program.

NHEERL's Mission

The National Health and Environmental Effects Research Laboratory is the Agency's focal point for scientific research on the effects of contaminants and environmental stressors on human health and ecosystem integrity. Its research mission and goals help the Agency to identify and understand the processes that affect our health and environment, and helps the Agency to evaluate the risks that pollution poses to humans and ecosystems. NHEERL conducts a multi disciplinary research program that strives to reduce the uncertainties inherent in assessing risk. These uncertainties vary in scope from fundamental scientific questions requiring sustained, long-term research strategies to Congressionally-mandated investigations that demand an immediate response. Accordingly, NHEERL balances long-term and short-term research objectives, combining elements of both basic and applied sciences to provide a unique blend of research capabilities.

NHEERL's mission embraces three objectives that enable NHEERL to secure and expand its position as a premier environmental research institution.

- Perform human health and ecological effects research of the highest scientific quality in support of the risk assessment needs of the Agency
- Demonstrate leadership in identifying, studying, and resolving important environmental health and ecological effects issues and in establishing the environmental research agenda
- Provide scientific and technical assistance to EPA Program and Regional Offices and to local, state, regional, national, and international governments and organizations

Research

Research conducted at the National Health and Environmental Effects Research Laboratory (NHEERL) provides the basis for the formulation of environmental policies and programs that span the breadth of environmental research in the world today. NHEERL provides scientific research on the effects of contaminants and environmental stressors on human health and ecosystem integrity. Its research helps the Agency identify and understand the processes that cause pollution related effects and helps the Agency evaluate risks that pollution poses to humans and ecosystems.

Clean Air Research Capabilities

NHEERL conducts multi disciplinary, problem-driven research to improve the basis of risk assessment in pulmonary, cardiovascular, hepatic, and immuno-toxicology to improve the scientific basis for Agency decision-making. In all cases, both mechanistic and dosimetric information are involved at multiple levels of biological organization from molecular and biochemical, to cellular, tissue and organ, and to whole animal models. The work is conducted in an iterative fashion involving linked epidemiological, experimental clinical and animal studies and modeling, both for hypothesis generation and testing and experimental design, and validation of predictions. Below is a brief summary of select capabilities and facilities that support NHEERL's Clean Air Research program throughout ORD and collaboration within the larger scientific community.

Animal Inhalation Facility: The animal inhalation facility provides support for exposures of laboratory rodents to a wide variety of gas and aerosol air pollutants and combustion sources. The facility provides support for routine exposures and extensive support of compromised animal models including:

- *collection of ambient PM for toxicological studies*
- *real-time exposure to concentrated coarse, fine and ultrafine ambient air PM, and*
- *real-time exposure to combustion source derived materials*

Animal exposures capabilities include:

- *Conventional Exposures:* 1) Whole body (O₃, SO₂, ovalbumin) exposures are routinely conducted; 2) Nose-only exposures are provided to meet specific research or test agent requirements;
- *Specialized Exposures:* Since ambient PM available for use in rodent inhalation exposures is very limited, a generator capable of using very small quantities of PM was developed to conduct nose-only exposures; and

- *Real-Time PM Exposures:* A Concentrated Ambient Particle system (CAPS), designed by Harvard and NERL-EPA to concentrate and deliver real-time ambient PM to a rodent exposure chamber;
- *Satellite combustion exposure facility:* In collaboration with NRMRL, rodent exposures to diluted effluent from diesel sources, commercial oil burner sources, coal ash, and other combustion sources are conducted
- *Atmospheric processing exposure facility:* A portable system is under development to continuously collect source emissions and ambient air which is subjected to photochemical aging. These aged atmospheres provide relevant multipollutant atmospheres that will be used for animal exposure studies.

Clinical exposure capabilities consists of several exposure chambers which have the flexibility of producing a wide range of inhaled pollutants as well as associated medical and recruitment facilities. It is made up of the following elements:

- 8 In-Vivo Exposure Chambers for Human Clinical Studies
- 2 Large (300 sq. ft.) Rochester-style chambers
 - 3 Small (64 sq. ft.) Rochester-style chambers
 - 2 Neurophysiological testing chambers
 - Chambers for studies of concentrated ambient fine ultrafine and coarse aerosols
- In-Vitro Exposure Chambers for Cell Biology Research
- A Medical Station Staffed and Equipped for the following:
 - Physical examinations of subjects
 - Routine clinical laboratory work for subjects
 - Special procedures including:
 - Bronchoalveolar and nasal lavages
 - Nasal, brush, and endobronchial biopsies
 - Induced sputum
 - Test rooms for subject training
- On-site subject recruitment for human clinical and epidemiological studies including medical screening