

Center for Health Effects of Environmental Contamination | CHEEC

1997 Annual Report





Looking back over the ten years that have passed since the signing of the Iowa Groundwater Protection Act, we can see much which has been accomplished with respect to protecting Iowas water sources. We should applaud the countless Iowans who have participated in educational programs, demonstration projects and various grass roots efforts aimed at making us environmentally aware and active in the fight to preserve and protect our resources. These people come from all walks of life: educators, farmers, business people, elected officials, students, homeowners, environmentalists and the general public. Good work! Lets keep it up and remain active and vigilant. Many problems related to water quality in our state have not been adequately addressed; much more work must be done to ensure that Iowas water quality is safe for future generations.

As part of this ongoing effort, CHEEC is involved in the forefront of Iowa-based research on drinking water quality and health effects. Collaborating with researchers from the National Cancer Institute, the Centers for Disease Control and Prevention, and the Environmental Protection Agency, CHEEC staff are examining possible relationships between chemicals in water supplies and the development of cancer, birth defects and other health outcomes. The CHEEC Data Management Center has provided systems and programming support for numerous research projects over the past decade. The CHEEC municipal water analytical and source/treatment databases are perhaps the most extensive and complete statewide water quality databases in the U.S. CHEEC staff continues to identify and assimilate data into this system for research purposes.

In the area of public and professional education, CHEEC has sponsored a seminar series on environmental issues on the University of Iowa campus since 1987, and has hosted four conferences since 1991. We recently began providing support for educational conferences and workshops around the state, and have co-sponsored five such programs over the past three years. With respect to service to the state, CHEEC faculty and staff have served on a number of technical advisory committees for the Department of Natural Resources and the Department of Public Health, and have also provided expert testimony on various environmental issues for legislative committees.

A decade of research, education and service by CHEEC has contributed to the strong foundation of citizen awareness and support for good water quality and environmental health in Iowa. In cooperation with other university research centers and state agencies in Iowa, we look forward to continued progress in studying environmental contaminants in order to answer questions about their possible impacts on human health. The people of Iowa deserve no less.

Gene Parkin, PhD
Director, CHEEC



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Data Management Center

The CHEEC Data Management Center (CDMC) provides full support for systems programming, network administration, database design and administration and applications development for environmental health research. Staff also respond to data requests from academia, regulatory agencies, the private sector and the public. Databases are designed and managed on the ORACLE Database Management System.

The CDMC was established in response to several water quality research needs described in the 1987 Iowa Groundwater Protection Act. Initially, CHEEC was instructed to "assemble all existing data relating to Iowa drinking water supplies, including characteristics of source, treatment, presence of contaminants, precise location and usage patterns to facilitate data retrieval and use in research."

In 1997, the 3rd edition of Historical Community Water Supply and Treatment Data for the State of Iowa was published. These data are current through 1996 and are available both electronically and in a published format. For more information on these data contact CHEEC. Extensive analytical water quality data is housed in the CDMC. These data, along with the Community Water Supply data are being used by researchers ranging from University of Iowa students engaged in Master and Ph.D. level research to epidemiologists at the National Institutes of Health.



Seed Grant Program

CHEEC has funded seed grants for over 10 years- 59 total - amounting to over \$600,000. One criteria for awarding grants is based on the evaluation of the likelihood of projects receiving future support from outside the university. To this end, the seed grant program has flourished. Forty-three percent of seed grant projects have gone on to receive additional funding, averaging \$280,000 per external reward. That translates to a 900% return on the original seed grant investment. It is a track record CHEEC is particularly proud of. As one-third of CHEECs budget annually goes into the seed grant program, it is obviously money well spent.

Bioaugmentation of the poplar rhizosphere with genetically engineered microorganisms

Investigators: PJ Alvarez, JL Schnoor, Department of Civil and Environmental Engineering, The University of Iowa

Summary Phytoremediation, the use of plants to remove environmental pollutants, holds great promise to reduce health risks associated with groundwater and soil contamination. Poplar trees can enhance site remediation by vegetative uptake of the contaminant or by enhancing its microbial degradation in the rhizosphere. This latter mechanism is not very effective for removing nitroaromatic contaminants. This project will evaluate the potential for a nitroaromatic-degrading, genetically-engineered microorganism (E.Coli DH5 [pDTG800]) to enhance bioremediation of 2,4,6-trinitrotoluene (TNT) in the poplar rhizosphere. The fate of both ¹⁴C-labeled TNT and E. Coli DH5 [pDTG800] will be studied in soil and plant bioreactors. The hypotheses are that 1) bioaugmentation of the poplar rhizosphere with this clone will enhance the mineralization of TNT; and 2) the added clone will maintain its nitroaromatic degradation activity and survive for a longer period of time in soil rhizosphere compared to background (control) soil. This research may lead to a better understanding and a more widespread acceptance of bioremediation in the rhizosphere as an additional tool for reducing health risks associated with environmental pollution.

Climate effects on human health in Iowa: Preliminary assessment of health implications of climate change

Investigator: GR Carmichael, Department of Chemical and Biochemical Engineering, The University of Iowa

Summary This project will perform a preliminary assessment of climate effects on human health in Iowa. A database will be compiled which consists of a historical fifty year record of daily meteorological factors (temperature, relative humidity, etc.) consisting of one



site per county, along with meteorological quantities predicted for future climates based on Global Climate Model (GCM) results. Basic health-related weather quantities will be derived (heat stress index), and will be made available for studies relating weather attributes to morbidity and mortality. The data set will then be used in a preliminary assessment of the future risks associated with climate change. This will be accomplished by combining this data set with population and health-related statistics (hospital admissions, deaths by disease/cause, etc.)

Investigating the presence, levels, and fate of aflatoxin B1 in soil and aerosolized soil dust

Investigators: MI Selim, JM Starr, Department of Preventive Medicine and Environmental Health, The University of Iowa

Summary The presence of aflatoxin B1 in agricultural soil poses a potential health risk to farmers from exposure to aerosolized soil dust during plowing and cultivation activities. In addition, aflatoxin B1 may constitute a health risk through contamination of surface water or groundwater. The primary purpose of this project is to investigate the presence and concentrations of aflatoxin B1 in Iowa. Supercritical fluid extraction (SFE), flow injection renewable surface immunoassay (FIRSI) with fluorescence detection, and HPLC/ES/MS methods will be developed and used for the determination of aflatoxin B1 and its transformation products in soil. This study will provide needed data to support external funding of a more detailed regional investigation of the fate and potential health risk of aflatoxin B1, as well as potential control and detoxification mechanisms.

Exploratory studies of an innovative reactor system for the destruction of organic contaminants in water

Investigator: RL Valentine, Department of Civil and Environmental Engineering, The University of Iowa

Summary A need exists for improved methods to destroy organic contaminants in drinking water, industrial waste waters, and to remediate contaminated aquifers. Advanced oxidation technologies, which involve the formation of highly reactive hydroxyl radicals, are an emerging class of technologies finding increasing use to treat a variety of these contaminated waters. Application of currently available processes are limited, however, because they require relatively expensive components, have high operating costs, involve complex reactor configurations and process control, and require a relatively high level of training to operate. A need exists for a simple and inexpensive method of oxidizing contaminants using hydroxyl radicals. Recent work at The University of Iowa has resulted in an improved understanding of the reaction mechanism describing hydrogen peroxide decomposition in the presence of iron coated media, and realization of how to possibly exploit this in an innovative fixed-bed reactor system for the destruction of organic contaminants. This project will evaluate the application of this reactor system to oxidize selected contaminants under a variety of reaction conditions, and will gather preliminary design information of use in estimating its capabilities, limitations, and costs.



A geographic information systems approach for assessing the impacts of chemical hazards on vulnerable populations

Investigators: MP Armstrong, J Chakraborty, Department of Geography, The University of Iowa

Summary Advances in technology have created a multitude of airborne hazards that can affect the health and welfare of the population. Airborne toxic releases occur rapidly and the dispersed hazardous chemicals often present immediate acute health effects. The objective of this research is to develop a practical, workable approach for assessing the population at risk to accidents involving airborne toxic hazards. Methods based on the application of geographic information system (GIS) technology will be developed to achieve this goal. A particular emphasis will be placed on the identification of vulnerable population groups, including institutions (e.g., schools and hospitals) and their relationship to locations of potential hazardous material generation sites. In addition to integrating the key components of hazard analysis, the study will also extend and implement a new approach, known as geographic plume analysis, that accounts for directional biases in the distribution of hazards by using a chemical dispersion model to identify the area that is likely to be exposed to airborne toxic releases. Cedar Rapids, IA, will be used as a test-bed for developing these procedures.

Measuring low level arsenic exposure through drinking water

Investigator: JB Simeonsson, Department of Chemistry and Center for Global and Regional Environmental Research, The University of Iowa

Summary A major limitation to assessing the health related impact of environmental arsenic (As) is the inadequacy of current analytical methods, especially in regards to providing speciation information of environmental As compounds. The lack of information on speciation is problematic as it is well known that different As species have considerable differences in bioavailability, toxicity and presumably in carcinogenicity. The primary objective of this project is to develop analytical procedures suitable for characterizing and speciating low levels of As in drinking water and biological fluid samples. Ultra sensitive laser induced fluorescence (LIF) approaches will be developed to measure ultra trace levels of As in various sample matrices. These studies will establish the efficacy of the LIF approach and demonstrate its utility for characterizing very low levels of As species in a variety of sample materials.

Respiratory health effects of soybean fungal bioaerosols

Investigators: PS Thorne, CJ Roy, Department of Preventive Medicine and Environmental Health, The University of Iowa

Summary Exposures to grain dust aerosols in agricultural work environments have been linked to a variety of respiratory diseases,



including occupational asthma, chronic bronchitis, and hypersensitivity pneumonitis. Agricultural workers are exposed daily to grain dust through combining, grain handling, mixing of feeds, or grain processing operations. Soybeans, which account for 1/4 of the crop value in Iowa, have been damaged increasingly by *Sclerotinia sclerotiorum* or white mold, a fungal pathogen. There has been an increase in health complaints of Iowa soybean farmers following exposure to white mold as the proportion of the soybean crop infected with the mold has increased. Yang (1997) reported a doubling in the extent of white mold infestation since 1995. This project will investigate the respiratory health effects of exposure to *S. Sclerotiorum* and other soybean bioaerosols through inhalation toxicology studies using established animal models.



Conferences, Seminars and Outreach

CHEEC sponsored and hosted *The Iowa Conference on Emerging Environmental Health Issues* September 23-24 in the Iowa Memorial Union. The conference addressed three important health issues:

- Drinking water disinfection by-products
- Synthetic organic chemicals and birth defects
- Endocrine disrupting chemicals

Speakers included researchers and policy makers from across the United States who presented research findings and addressed policy initiatives in these three areas. Speakers also addressed prevention strategies, and emerging technologies. Conference attendees came from around the country and included public health professionals, researchers, environmental experts, drinking water industry representatives, and the general public.

Feedback from both speakers and attendees was favorable and appreciative regarding the importance of conferences of this type being made available to Iowans. While these issues go beyond the borders of Iowa, the conference highlighted the efforts and collaborative roles both CHEEC and other university research groups engage in studying these environmental health problems. The coming years will see CHEEC involved in many of these areas by providing vital data support and expertise in ongoing research efforts.

Conference co-sponsors included the Agency for Toxic Substances and Disease Registry, The University Hygienic Laboratory, The Robert L. Morris Memorial Fund, and the Roy J. Carver Charitable Trust. Conference proceedings are available upon request or through CHEEC's website at WWW.CHEEC.UIOWA.EDU/conf_97/index.htm.

Outreach and Service

In 1997, CHEEC staff participated in a variety of education activities around the state. These include being volunteer organizers for the Johnson County Water Festival in Coralville, volunteer participation in the Iowa Children's Water Festival in Ankeny, planning



and participating in various Year of Water activities, being organizing committee members for the *Iowa's Water Quality: Shaping Our Future Together* conference, and participating in the *Environmental Professionals of Iowafall* conference.

Service activities in 1997 included membership on the Iowa Brownfield's Technical Advisory Committee, the Iowa Water Quality Action Plan Steering Committee, the Iowa Environmental Health Initiative Advisory Committee, and the Technical Committee on Human Health for the Iowa Comparative Risk Project.

Conferences and Workshops

As part of the CHEEC Seed Grant Program, funds are targeted to partially support environmental health educational efforts. In 1997, CHEEC partially supported two conferences.

CHEEC was co-sponsor of the statewide conference *Building Local Partnerships: Water Quality, Watersheds and You*. This conference, hosted by Iowa State University Extension, focused on the themes of:

- learning about the success of local watershed projects;
- facilitating networking of participants to form new partnerships and strengthen existing ones;
- increasing the understanding of agricultural and urban nonpoint source pollution processes, prevention, and economic efficiencies;
- motivating nonpoint source pollution prevention efforts from the demonstration phase to implementation on a broader scale to improve Iowa water quality.

The following groups were also instrumental in supporting this conference: The Leopold Center for Sustainable Agriculture, American Cyanamid, ISU Extension, Iowa Environmental Council, Iowa State Water Resources Research Institute, Iowa Rural Water Association, Iowa Natural Heritage Foundation, Iowa Department of Agriculture and Land Stewardship, Iowa Farm Bureau, Iowa Pork Producers, Natural Resource Conservation Service, Agribusiness Association of Iowa, DuPont, and CIBA.

CHEEC also provided partial support for the *Iowas Water Quality: Shaping Our Future Together* conference, hosted by the Iowa Environmental Council. The conference was the culmination of a year-long initiative to build consensus on policy needs to protect and



enhance Iowas water quality. The efforts focused around four themes highlighted by rural/agriculture, ecosystems, urban/industrial, and human health issues.

Information on the Water Quality Action Plan is available through the Iowa Environmental Council's website at www.earthweshare.org/ .

Other conference sponsors were the Iowa Department of Agriculture and Land Stewardship Division of Soil Conservation, Iowa Groundwater Association, The Iowa Waste Reduction Center, and Leopold Center for Sustainable Agriculture.

Seminars

CHEEC sponsors a continuing seminar series highlighting health and environmental issues important to CHEEC's mission. CHEEC strives to use the seminar series as a means to educate and inform the larger UI community in topics of Environmental Health interests, and to work collaboratively with other research centers to make these seminars possible. In 1997 CHEEC sponsored the following seminars:

Respiratory disease after long-term exposure to cotton dust and endotoxin

David Christiani, Department of Environmental Health, Harvard School of Public Health

co-sponsors: Division of Pulmonary Diseases, Critical Care and Occupational Medicine, Environmental Health Sciences Research Center

Temporal and spatial variation of waterborne point-of-use 222-radon in three water distribution systems

Eileen Fisher, Department of Preventive Medicine and Environmental Health, The University of Iowa

Exposure-sensitization relationships for allergens in the baking industry

Dick Heederik, Department of Epidemiology and Public Health, Agricultural University of Wageningen, The Netherlands

co-sponsors: Environmental Health Sciences Research Center



Air pollution control strategies and public health in Slovenia

Dusan Hrcek, Hydrometeorological Institutes of Slovenia

co-sponsors: The Center for International Rural and Environmental Health, Environmental Health Sciences Research Center

Risk management of arsenic in drinking water

Jerald Schnoor, Department of Civil and Environmental Engineering, The University of Iowa

co-sponsors: Environmental Health Sciences Research Center, University Hygienic Laboratory, Center for Global and Regional Environmental Research



New Publications

Assessment of Iowa Safe Drinking Water Act Monitoring Data: 1988-1995

This collaborative project with the University Hygienic Laboratory and the Department of Natural Resources was a statistical analysis of the Iowa Safe Drinking Water Act (SDWA) database of Iowa public water supplies. This was the first effort in Iowa to analyze SDWA compliance data required under this federal statute. CHEEC staff provided database development, statistical analysis, and table formation for the project.

Historical Community Water Supply and Treatment Data for the State of Iowa: Third Edition

This monograph, compiled by the CHEEC Data Management Center, contains historical data on water supply sources, drinking water treatments, wells and aquifers, and surface water supplies for all municipal Iowa drinking water supplies greater than 400 population. These data are current through 1996 and are used extensively by environmental health researchers in Iowa and at the National Institutes of Health.

Copies of both publications are available upon request.



CHEEC Mission

CHEEC's mission, as described in the Iowa Groundwater Protection Act, is to "determine the levels of environmental contamination which can be specifically associated with human health effects." Activities the center may pursue include the following:

- assemble field data on the presence and concentration of contaminants in environmental media, and develop data retrieval systems to allow correlation with existing health outcomes;
- perform laboratory and field studies on fate and transport of toxic substances in the environment, and develop innovative technologies for the remediation of contaminated environments;
- utilize data from the Iowa Cancer and Birth Defects Registries to develop recording systems for specific organ diseases suspected to be caused by exposure to environmental toxins;
- survey, on a regular basis, the health status of persons known to be exposed to environmental hazards;
- develop biomedical assays which may be used in exposed persons to determine early evidence of adverse health effects;
- perform epidemiologic studies relating the occurrence of a disease to contaminant exposure in order to ensure other factors known to cause the disease in question can be ruled out;
- foster relationships and ensure the exchange of information with teaching institutions and laboratories in Iowa that are concerned with the many forms of environmental contamination;
- implement programs of professional education and training of medical students, physicians, nurses, scientists, and technicians in the causes and prevention of environmentally induced disease;
- implement public education programs to inform persons of research results and the significance of studies.



Who We Are

Executive Committee

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Department of Pediatrics
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Graduate Program in Urban and Regional Planning
Iowa Birth Defects Registry
State Health Registry of Iowa
University Hygienic Laboratory



Iowa State Agencies

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Department of Public Health
Department of Agriculture and Land Stewardship

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