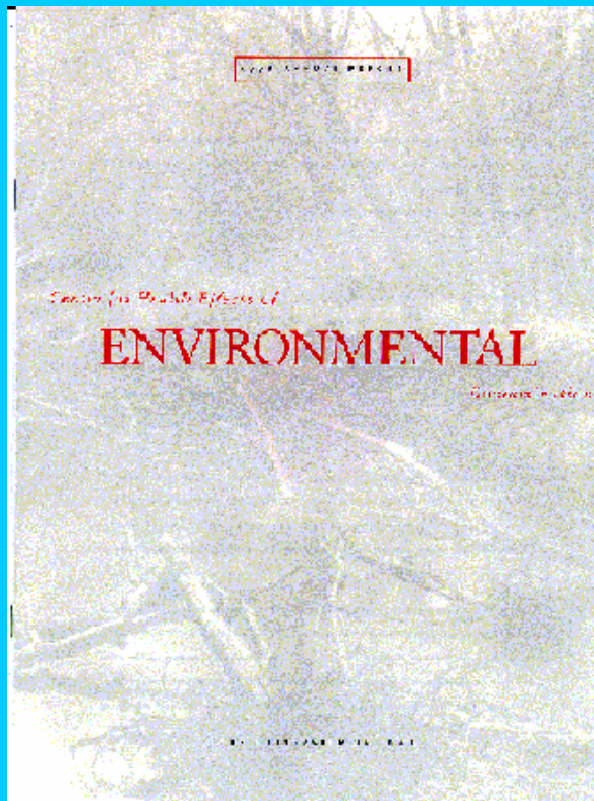


Center for Health Effects of Environmental Contamination | CHEEC

## 1998 Annual Report





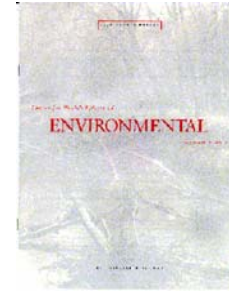
During 1998, CHEEC continued a variety of research activities on exposure to water contaminants and health effects. Working with researchers from the National Cancer Institute and the Agency for Toxic Substances and Disease Registry, CHEEC staff studied possible relationships between nitrate and cancer, disinfection by-products (and other organic compounds) and cancer as well as birth defects, and water treatment processes and heart disease. This annual report for 1998 focuses on two research projects completed during 1998, both of which were funded by the CHEEC Seed Grant Program.

The first project was an ecological analysis of municipal water softening and community-based mortality rates of heart disease, which evaluated different softening processes. The UI Department of Civil and Environmental Engineering took the lead role in this analysis, with the CHEEC Data Management Center and State Health Registry of Iowa playing major supporting roles. While results of this study were inconclusive, there has been a great deal of interest in the project from the water treatment industry.

The second project looked at the incidence of cancers in a group of more than 16,000 Iowa women who had consumed municipal water with detectable levels of nitrate over a long term. This was a prospective cohort study, a cooperative effort between CHEEC, the UI Department of Preventive Medicine, the University Hygienic Laboratory, and the University of Minnesota School of Public Health. The nitrate exposure classification developed for this project will be used to evaluate possible relationships between nitrate in drinking water and various cancers.

Water research activities will continue to be strong in 1999. Collaborative projects are planned with the U.S. Geological Survey, the University Hygienic Laboratory, the Iowa Department of Natural Resources, and the EPA, which will look at microbial contamination of drinking water, possible impacts of disinfection byproducts, and potential health implications from nitrate and ammonia in municipal water supplies. In addition to water quality research, CHEEC will be supporting research on radon, air quality in livestock operations, and environmental risk factors for asthma.

Pete Weyer  
Program Coordinator



## **Table of Contents**

[CHEEC Data Management Center](#)

[Educational Activities](#)

[Seed Grant Program](#)

[Who We Are](#)



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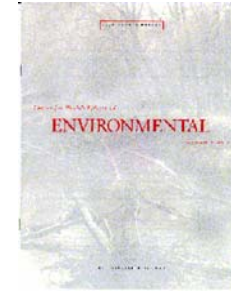
## Date Management Center

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The CHEEC Data Management Center (CDMC) continues to expand its database of analytical results and data collection abilities used in environmental health research, regulatory compliance studies, and public service offerings. In addition, the CDMC provides full system support for programming, local area network administration, database design and administration and applications development. Databases are designed and managed on the Oracle database management system. The CDMC continues to utilize a fee for service mechanism for several state and federally funded research projects.

Since its inception, CHEEC has sought and acquired environmental data that are used for health effects research. As an ongoing function of CHEEC, historical water treatment data and analytical water quality data are continually updated for municipal drinking water supplies serving communities over 400 in population. These data are used to study disease and health outcomes by linking to statewide health effects registries and special epidemiologic studies. How is this accomplished? Two completed CHEEC studies demonstrate how these databases can be utilized and linked to State Health Registry of Iowa databases.

An ecologic study titled Municipal Water Softening and Mortality Rates of Heart Disease in Iowa explored the possible relationship between different municipal water softening treatment processes and rates of heart disease in those communities. The Iowa Historical Community Water Supply and Treatment database was used to determine the water treatment history of select Iowa towns. These data are available for towns above 400 in population, and offer records dating back to the early 1900's. Analytical water quality results measuring water hardness were utilized from the CHEEC Municipal Water Quality database. The hypotheses in this study were: 1) mortality rates of heart disease are elevated in communities using ion exchange softening treatment (ion exchange technologies introduce sodium into the water, a risk factor for heart disease), 2) communities using lime softening treatment have lower mortality rates of heart disease compared to communities using ion exchange (studies have suggested that calcium and magnesium are protective against heart disease), and 3) drinking water hardness may be protective against heart disease. The State Health Registry



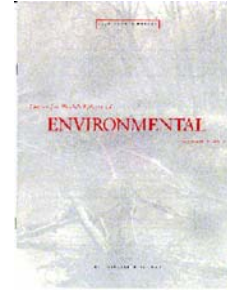
provided cause of death information at the community level, which was linked to drinking water treatment information and analytical water quality data to evaluate any risks associated with municipal water softening. While other studies had suggested water hardness was protective against heart disease and that ion exchange may contribute to heart disease, results from this study did not confirm those findings.

A study titled A Prospective Cohort Study of Municipal Drinking Water Nitrate Level and Cancer Risk: The Iowa Women's Health Study linked community water supply nitrate data to information on the Iowa Women's Health Study (IWHS) cohort. The IWHS cohort consists of almost 41,000 post-menopausal Iowa women who have been followed for a number of health outcomes since 1986. In the nitrate study, disease outcomes of interest included non-Hodgkin's lymphoma, colon cancer, bladder cancer, and other GI tract cancers. This prospective cohort study adjusted for dietary nitrate intake, factors which impact endogenous nitrosation (vitamin C intake and smoking), and other site-specific confounders. Because cancer often has a long latency period, it was necessary to build a nitrate exposure record of 20-30 years. Researchers were able to utilize historical nitrate data from the mid-1950s to the present to reconstruct nitrate exposures for study participants. Sources of nitrate data (all on the CHEEC system) included the Safe Drinking Water Act, USGS QWDATA, special water quality studies, and paper files from the Iowa Department of Natural Resources and the University Hygienic Laboratory. In this study, an association was found between nitrate in drinking water and bladder cancer, which was dose-related.

These studies and others continue to demonstrate how both drinking water treatment information and analytical water quality data can be applied in studying human health effects outcomes. Analytical water quality data are updated yearly from Safe Drinking Water Act reporting data, and additional historic sources are continually being identified, quality control checked, and entered into CHEEC electronic water quality records. In 1998, CHEEC completed a cooperative project with the Iowa Department of Natural Resources - Geological Survey Bureau updating the Well Identification Table (WIT). The WIT establishes common identifiers for municipal drinking water wells across many agencies, making it easier to share data and collaborate with other agencies (e.g. U.S. Geological Survey) interested in water quality research. A data entry project from historic paper files of water quality records began in 1998 - anticipated completion will be 1999.



Continuing CDMC research activities include systems and applications support for the Agriculture Health Study (UI Department of Preventive Medicine and Environmental Health) which is funded by the National Cancer Institute (NCI). This study entered its second 5-year contract period. CHEEC has provided computer support and database management for this project since its inception. Other activities included working with the CADMUS Group, Inc., to evaluate compliance and sampling frequency for federal Safe Drinking Water Act requirements under review by EPA, and providing water quality data to 1) the Agency for Toxic Substances and Disease Registry for an ongoing study of birth defects and water contaminants, and 2) NCI for a study on drinking water disinfection by-products and cancer outcomes.



## Education

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### SEMINARS

CHEEC sponsors a continuing seminar series on current environmental health issues and new research. These seminars feature topics of interest to a wide variety of disciplines. Seminars often highlight the interdisciplinary nature of the CHEEC Seed Grant Program with grant recipients presenting their findings. The following seminars were held on the University of Iowa campus in 1998:

**"Municipal drinking water nitrate level and the risk of non-Hodgkin's lymphoma, colon cancer, and other GI tract cancers: The Iowa Women's Health Study"**

*Speaker:* Peter Weyer, Ph.D., Program Director, Center for Health Effects of Environmental Contamination, The University of Iowa

*Co-sponsor:* UI Environmental Health Sciences Research Center

**"Municipal water softening and mortality rates of cardiovascular disease in Iowa"**

*Speaker:* Matt Phoenix, M.S., Department of Civil and Environmental Engineering, The University of Iowa

*Co-sponsor:* UI Department of Civil and Environmental Engineering

**"CHEEC: 10 years after the Groundwater Protection Act"**

*Speaker:* Peter Weyer, Ph.D., Program Director, Center for Health Effects of Environmental Contamination, The University of Iowa

*Co-sponsor:* University Hygienic Laboratory



**"Pesticides in ambient air and precipitation in Iowa"**

*Speakers:* David Larabee-Zierarth and Beth Hochstedler, University Hygienic Laboratory

*Co-sponsor:* University Hygienic Laboratory

**OUTREACH**

CHEEC staff participated in both professional and public environmental health education activities in 1998. A presentation for county sanitarians and environmental health specialists titled Health Effects of Groundwater Contamination was given at the Non-public Water Well Systems training sessions for the Sanitarian Training Institutes, a program developed by Kirkwood Community College and The Iowa Department of Public Health. Additionally, CHEEC staff presented a primer on epidemiology for the Belin Blank International Center program on Education and Talent Development for Gifted Students. This program was established with matching funds from the Iowa State Legislature.

CHEEC staff provided technical expertise as committee members for a number of programs in 1998. The Iowa Land Recycling and Remediations Standards Act (Brownfields) mandated a representative from CHEEC serve on the Technical Advisory Committee (IDNR) in rules development for this legislation. That process was completed in the fall of 1998 when the Iowa Environmental Protection Commission approved draft rules. Work on the Iowa Comparative Risk Assessment Project was completed in 1998 as well. That document concluded water quality ranks high compared to other environmental health risks. CHEEC staff also participated on the planning committee for the Watershed Partnerships: Protecting Our Water Resources conference, hosted by Iowa State University Extension.

During 1998, CHEEC responded to information request from state and county health departments, the National Cancer Institute, the EPA, engineering consulting firms, university researchers and students, water treatment plant operators, the media, environmental activist groups, and the public.





## CONFERENCES

During 1998, CHEEC co-sponsored the Watershed Partnerships: Protecting Our Water Resources conference. Conference objectives were to 1) develop an appreciation for how activities in a watershed affect water sources, 2) learn what Safe Drinking Water Act requirements mean for municipal water suppliers, farmers, and natural resource managers, 3) learn how the Safe Drinking Water Act will affect watershed management, 4) learn how to develop and implement successful watershed partnerships, and 5) learn techniques to fund watershed projects by developing grant writing skills. The conference included both urban and rural non-point source issues. It was sponsored by 19 organizations from government, non-profit organizations and agribusiness.



## Seed Grant Program

CHEEC awards approximately one-third of its annual state allocation as grants for pilot studies on exposure or risk assessment of environmental contaminants. Since the fall of 1988, the CHEEC Seed Grant Program has funded 66 research projects. In keeping with the goal of the Seed Grant Program, more than 40% of CHEEC-funded projects have gone on to receive additional funding from federal or private sources, bringing in over \$5 million in research monies to Iowa universities over the past ten years.

The following research projects were awarded seed grants during fiscal year (FY)1998.

### **Analysis of volatile organic contaminants in drinking water using a surface- acoustic wave microsensor**

*Investigators:* W. Groves, P. O'Shaughnessy, A. Grey, Department of Preventive Medicine and Environmental Health, The University of Iowa

*Summary:* Exposure to volatile organic chemicals (VOCs) in drinking water has been linked to a number of adverse health effects including cancer, liver, and kidney damage. However, the large number of potential contaminants and the cost and complexity of existing analytical methods limits the extent to which water quality is routinely characterized. This project focuses on the development and evaluation of an instrument for field analysis of VOCs in drinking water. The instrument will be based on an array of six polymer-coated surface-acoustic-wave microsensors. A test set consisting of dichloromethane, chloroform, 1,1,1-trichloroethane, perchloroethylene, and m-xylene will be used in a series of experiments designed to: 1) select and optimize the preconcentration system; 2) calibrate the instrument over the concentration range of 0.2-2 times the EPA Maximum Contaminant Level (MCL); and 3) compare results to those of a recognized laboratory. The primary goal is to develop a cost-effective alternative for on-site evaluation of VOCs in water.



### **Effects of bacterial DNA on expression of hypersensitivity pneumonitis**

*Investigators:* G. Hunninghake, G. Gudmundsson, Department of Internal Medicine, The University of Iowa

*Summary:* The goal of this study is to determine the role of bacterial DNA in the development of hypersensitivity pneumonitis (HP), an environmental lung disease caused by contamination of hay by thermophilic bacteria. Previous studies have shown that Th1 responses with activation of Interleukin-12 are important in HP. Studies have shown that bacterial DNA is a powerful inducer of IL-12. The role of bacterial DNA in triggering the inflammatory response of HP is not known. To study this, a murine model of HP will be used, where mice will be intranasally installed with thermophilic bacteria. Groups of mice will be treated with thermophilic bacteria that have had the DNA destroyed and compared to groups treated with bacteria with intact DNA. The inflammatory response will be evaluated with histopathology, lung lavage cellularity and lung index. Cytokine responses will be evaluated in lung preparations. Less inflammatory and cytokine responses are expected in mice where DNA has been destroyed.

### **Evaluation of solanesol as a tracer for environmental tobacco smoke**

*Investigators:* S. Reynolds, C. Achutan, W. Groves, Department of Preventive Medicine and Environmental Health, The University of Iowa

*Summary:* The health risks to smokers from inhaling mainstream cigarette smoke are well known. In addition, there is growing evidence of risks posed to the health of non-smokers due to involuntary (passive) inhalation of environmental tobacco smoke (ETS). However, epidemiological studies that investigate the relationship between ETS and health effects are seriously hindered for lack of a specific and sensitive tracer for ETS. The goals of this project are to evaluate the use of solanesol as a suitable tracer for ETS in various indoor settings and compare it to nicotine, a widely used specific but not sensitive tracer for ETS.



### **Prevalence and environmental risk factors for pediatric asthma**

*Investigators:* R. Wallace, B. Chrischilles, L. Fuortes, K. Phillips, Department of Preventive Medicine and Environmental Health, The University of Iowa

*Summary:* Bronchial asthma is a common clinical problem in the U.S., affecting about 10 million people, or about 4% of the population. The occurrence of childhood asthma has increased in frequency, severity and rate of admission to U.S. hospitals. This is in part due to greater recognition of asthma by families and health care professionals, but also appears to represent a true increase in disease, likely due to increased environmental pollution and allergens. This project will be the first effort in Iowa to identify prevalence, geographic distribution and seasonal patterns of childhood asthma, and will use an asthma registry. Rates of specific treatments will be calculated based upon health care claims from three major insurers in Iowa. Secondary data representing environmental, climatological, socioeconomic and other patient factors will be analyzed to characterize their influence upon the prevalence and severity of childhood asthma in Iowa communities.

### **Solid state NMR studies of the photodegradation of air pollutants on TiO<sub>2</sub>**

*Investigator:* S. Larsen, Department of Chemistry and Center for Global and Regional Environmental Research, The University of Iowa

*Summary:* Photocatalysts, such as TiO<sub>2</sub>, can be used to degrade a wide range of organic contaminants found in polluted air. TiO<sub>2</sub> photocatalysts are active at ambient temperatures and pressures in the presence of UV irradiation and oxygen and have been shown to oxidize toluene, trichloroethylene (TCE), methanol/ethanol and many other organic compounds. In this study, solid state MAS NMR (magic angle spinning nuclear magnetic resonance) techniques will be utilized to identify surface species formed during heterogeneous photocatalytic oxidation reactions on TiO<sub>2</sub>. These surface species may be reaction intermediates, surface poisons or partial oxidation products. Spectroscopic studies of TCE enhancement of toluene photo oxidation will be conducted to determine the origin of the enhancement for deactivation. This study will provide insight into the role of surface species in photocatalytic oxidation reactions on TiO<sub>2</sub> that could lead to the development of improved photocatalysts.



### **Swine hepatitis E virus contamination of surface water: A possible zoonotic risk**

*Investigators:* S. Naides, Department of Internal Medicine, M. Gilchrist, University Hygienic Laboratory, The University of Iowa

*Summary:* Human hepatitis E virus (HEV) is a zoonotic infection that can be passed from swine and rodents to humans. A swine HEV-like virus has been shown to be endemic in swine herds in the Midwestern U.S. Recently, the first human case of HEV infection acquired in the U.S. has been identified; the isolate demonstrated sequence homology closer to swine HEV than to known human HEV isolates. There is increasing public concern about the risks of waste products of intense hog farming operations. The long-term goal of this project is a better understanding of the role of animal reservoirs in human infectious diseases, how humans are exposed to animal viruses, and the ability of animal viruses to be transmitted through the environment to humans. The specific goal of this project is to develop an epidemiologic model of environmental cross-species transmission of swine HEV infection.



## Who We Are

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### CENTER STAFF

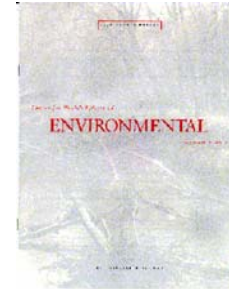
Jiji Kantamneni, Senior Systems Analyst  
Mark LeRette, Senior Programmer Analyst  
Dave Riley, Program Assistant  
Samantha Van Nyhuis, Secretary  
Pete Weyer, Ph.D., Program Coordinator

### EXECUTIVE COMMITTEE

Gene Parkin, Ph.D. Center Director  
George Breuer, Ph.D.  
Cheryl Contant, Ph.D.  
Charles Lynch, M.D., Ph.D.  
Jeffrey Murray, M.D.  
Nancy Sprince, M.D.  
Peter Thorne, Ph.D.  
Richard Valentine, Ph.D.

### ADVISORY COMMITTEE

JoAnn Benda, M.D., UI Department of Pathology  
Trudy Burns, Ph.D., UI Department of Preventive  
Medicine and Environmental Health  
Kelley Donham, D.V.M., UI Institute for Rural and  
Environmental Health  
Lois Dusdieker, M.D., UI Department of Pediatrics  
Bill Field, Ph.D., UI Department of Preventive  
Medicine and Environmental Health  
Daryl Frey, Iowa Department of Agriculture and Land  
Stewardship  
Richard Kelley, University Hygienic Laboratory (Chair)  
John Kelly, Iowa Department of Public Health  
Donald Paulin, Iowa Department of Natural Resources  
Wayne Paulson, Ph.D., UI Department of Civil and  
Environmental Engineering  
Thomas Tephly, M.D., Ph.D., UI Department of  
Pharmacology  
Frank Weirich, Ph.D., UI Department of Geology



**CENTER PARTICIPANTS**

***The University of Iowa:***

- Department of Civil and Environmental Engineering
- Department of Pediatrics
- Department of Preventive Medicine and Environmental Health
- Graduate Program in Urban and Regional Planning
- Iowa Birth Defects Registry

- State Health Registry of Iowa
- University Hygienic Laboratory

***Iowa State Agencies:***

- Department of Natural Resources
- Department of Public Health
- Department of Agriculture and Land Stewardship



**The Center for Health Effects of Environmental Contamination**

The University of Iowa  
100 Oakdale Campus #N202 OH  
Iowa City, IA 52242-5000  
(319) 335-4550  
Fax: (319) 335-4077  
cheec@uiowa.edu  
www.cheec.uiowa.edu