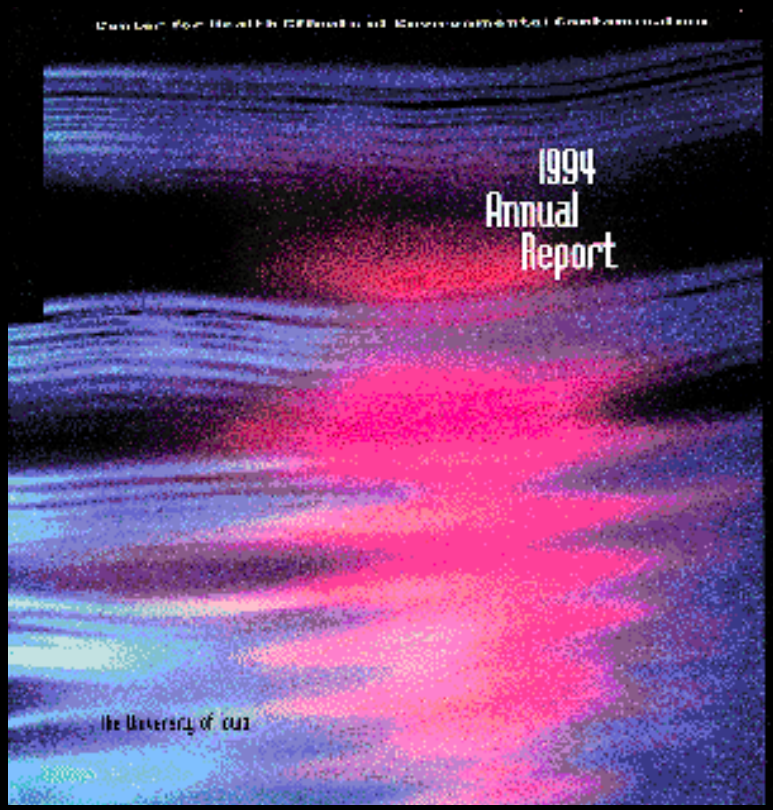
Center for Health Effects of Environmental Contamination | CHEEC

1994 Annual Report



The Center for Health Effects of Environmental Contamination (CHEEC), established by the Iowa Groundwater Protection Act of 1987, has a general mission "to determine the levels of environmental contamination which can be specifically associated with human health effects." CHEEC is an interdisciplinary research, education and service organization whose major activities include 1) developing and maintaining environmental databases to be used in conducting health effects research, 2) managing a seed grant program to support health effects research, and 3) providing a variety of education and service programs to the citizens of the state, region, and nation.

The Data Management Center within CHEEC has expanded its operation signficiantly. In addition to ongoing activities such as participation in the *Agricultural Health Study* and the *Residential Radon and Lung Cancer Case-Control Study*, we have begun new activities this past year compiling historical nitrate and fluoride data for use in health effects research, and are also participating in the national *Mammography Surveillance Pilot Project*. In fact, agencies such as the National Cancer Institute now seek us out for expertise in data management in support of health effects research.

Our Seed Grant Program continues to flourish. Through fiscal year 1994 we have invested approximately $540,000 (about one-third of our budget) in seed grants. Results from these seed grants have been used to help generate over $3.4 million in external funds. Up to six new projects will be funded in fiscal year 1995.

Our education and service programs this year included participation in local and regional water education efforts such as *WaterWatch '94*; continued support of our seminar series; response to information requests by legislators, Iowa state agencies, and a variety of federal agencies, among others; and sponsoring two conferences on *The Media's Role in Communicating Health Risks: What's in the Water?* and *Safe Drinking Water - Iowa's Future*.

We in CHEEC continue to be proud of our accomplishments and appreciate the support given us by the Iowa Legislature and the Iowa Departments of Natural Resources, Public Health, and Agriculture and Land Stewardship. We are developing a reputation for excellence here in Iowa and nationally. We look forward to continuing to serve the citizens of Iowa by improving our understanding of human health as it is affected by environmental contamination. Please, enjoy our report!

Gene Parkin, Director

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Data Management Center

The CHEEC Data Management Center (CDMC) has a staff of three full time database analysts who provide 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.

CDMC staff continue to maintain databases of Iowa municipal water supply source information and treatment characteristics, as well as water sample analyses from historical state and national surveys of municipal supplies. An ongoing agreement with the Iowa Department of Natural Resources-Geological Survey Bureau (IDNR-GSB) provides student support to update existing data and add new information to the municipal database via the IDNR-GSB's Well Identification Table. Private well-water data from the Statewide Rural Well Water Survey (SWRL) and repeated sampling data from that population are also maintained by CDMC staff. Efforts are underway to electronically access more recent municipal water sample analyses from the IDNR's Safe Drinking Water database, in cooperation with the University Hygienic Laboratory (UHL).

Systems and applications support continues for the *Agricultural Health Study*, which is jointly funded by the National Cancer Institute (NCI), the U.S. Environmental Protection Agency (EPA) and the National Institute for Environmental Health Sciences (NIEHS), and systems support is ongoing for the NIEHS sponsored *Residential Radon and Lung Cancer Case-Control Study*. CDMC support is provided on a regular basis for in-house studies, including an investigation of municipal water softening treatment and municipal rates of heart disease and cancer. CDMC staff cooperated during the past year with researchers at Iowa State University to develop an application for using health outcome data and environmental exposure data in a Geographic Information System (GIS) framework.

CDMC staff began work on two new NCI-funded projects in 1994:

A compilation of historical nitrate and fluoride data for Iowa municipal and private water supplies is being conducted by CHEEC in collaboration with the UHL and the IDNR-GSB. Estimates of exposure levels for specific populations in Iowa will be developed for a variety of time periods in order to study exposure to nitrate in drinking water supplies and the possible development of non- Hodgkin's lymphoma (NHL - a cancer of the lymphatic system). Previous research in Nebraska reported an association of NHL in populations with high nitrate levels in drinking water.

The *Mammography Surveillance Pilot Study* being conducted by the University of Iowa Department of Preventive Medicine and Environmental Health (PMEH) will look at a sample Iowa population to determine the completeness and effectiveness of mammography screening for breast cancer. Recent studies have implicated potential environmental factors such as xenoestrogens and residential magnetic fields in the development of breast cancer. The Iowa pilot project will provide data needed to develop a proposal for a statewide mammography surveillance system. CDMC staff will design and manage the database for the pilot project.

Seed Grant Program

Since the fall of 1988, the CHEEC Seed Grant Program has funded forty-five pilot studies on exposure assessment, risk assessment and related areas involving environmental health. The following projects were awarded seed grants during 1994.

Expression of toluene dioxygenase under various redox and substrate conditions

Investigators: NA Lynch, Preventive Medicine and Environmental Health; PJ Alvarez, Civil and Environmental Engineering, The University of Iowa
Summary: Bioremediation (the enhancement of microbial activity to degrade environmental pollutants within aquifers) shows great promise to reduce health risks associated with groundwater contamination. The success of bioremediation can be limited by the availability of electron acceptors (e.g., oxygen) and by the expression of appropriate catabolic enzymes (e.g., toluene dioxygenase). This study will investigate the dissolved oxygen concentration threshold for the expression of toluene dioxygenase, and the ability of various target contaminants and other substrates to induce this enzyme. Toluene dioxygenase is an ideal enzyme for the study of bioremediation because of its ability to catalyze the aerobic biotransformation of a wide variety of ubiquitous priority pollutants including benzene, trichloroethylene and the xylenes.

Development of exposure databases for nitrate contamination of private drinking water/ groundwater supplies

Investigators: GR Hallberg, University Hygienic Laboratory; KD Rex, Iowa Department of Natural Resources-Geological Survey Bureau
Summary: Nitrate is the most common chemical contaminant in groundwater and drinking water in Iowa. This study will provide a cost effective method for the surveillance of nitrate contamination of private drinking water supplies that can be used for exposure assessment, epidemiological studies and monitoring of contamination over time. The UHL database of private well-water analyses

(approximately 10,000 nitrate analyses/year) will be related to the Iowa Groundwater Vulnerability Regions using the IDNR-GSB's Geographic Information System. This will provide a sensitive analytical tool to assess spatial and temporal differences in water quality. It is proposed that this approach be used jointly with CHEEC to develop an annual report of water quality trends in Iowa, summarizing exposure and resource implications.

Effect of poplar trees on microbial populations important to hazardous waste bioremediation

Investigators: JL Jordahl, LA Licht, PJ Alvarez, Civil and Environmental Engineering, The University of Iowa
Summary: Phytoremediation (the use of plants to remove pollutants from the environment) is an underutilized technology; its successful application on a large scale requires continued input from basic research. Poplar trees could enhance site remediation via contaminant uptake and in-plant degradation, by minimizing off-site migration, or by enhancing microbial degradation in the soil surrounding plant roots. This project will characterize the microbial community below seven year old poplars at a research site near Amana, Iowa. The hypothesis is that poplar roots exert selective pressure for the proliferation of microorganisms important to bioremediation, including those capable of removing nitrate and those which can degrade benzene and atrazine.

The use of an automated PCR/ELISA technique to detect indicators of fecal contamination

Investigators: LDSutton, Pathology; GR Hallberg, University Hygienic Laboratory; NA Lynch, Preventive Medicine and Environmental Health, The University of Iowa
Summary: Fecal contamination of water supplies is a major cause of infectious disease with consequences ranging from minor illness to death. Current culture-based detection methods are decades old and take days to complete. Once coliforms are detected, further culture is necessary for positive identification of specific pathogens. This project will develop an automated protocol for detection of coliforms and E. coli using polymerase chain reaction (PCR)-based techniques. The PCR methodology allows rapid turnaround time of hours instead of days, permits adjustable sensitivity and specificity, enables rapid subsequent analysis of positive samples to identify pathogens, and identifies hard to culture pathogens. Such a system will help minimize exposure to contaminated water sources, thus reducing potential morbidity and mortality.

Status of the Seed Grant Program

CHEEC awards about one-third of its annual operating budget as seed grants, which amounts to nearly $90,000 yearly. A total of forty-five projects have been funded to date, at an average award of $13,180. Following is a summary of CHEEC seed grant allocations by fiscal year:

Fiscal Year	State support	Seed Grant allocations	% of total State support
1989	$191,219	$61,799	32.3
1990	275,355	130,465	47.4
1991	285,709	100,448	35.2
1992	279,289	78,952	28.3
1993	294,995	80,455	27.3
1994	294,325	87,062	29.6
1995 *		53,999 *	
totals (through FY 1994)	$1,620,892	$539,181	33.3

* final figures for FY 1995 are not yet available

The Seed Grant Program was designed and implemented by the CHEEC Executive Committee as part of the organizational plan submitted to the Iowa General Assembly in January, 1988. The Committee felt this Program would ensure that a significant portion of the Center's budget be directed towards innovative research on a variety of areas related to environmental health. The Program has supported projects focusing on biodegradation of toxic substances and bioremediation of contaminated environments, laboratory measurement, sampling methods design and on-site monitoring, database development, health survey design, statistical analyses of environmental exposures and health outcomes and other appropriate environmental research.

A majority of projects funded to date have looked at water quality and include studies on pesticides, nitrate, radon, various synthetic organic compounds, water treatment processes, and other areas addressing both rural and urban water supply problems. Air quality projects have involved agricultural issues such as contaminants in grain dust, bioaerosols in grain storage units and ambient air surrounding livestock confinement facilities. Indoor air studies have concentrated on radon, lead dust, and "sick building syndrome". CHEEC grants have supported research on a variety of other environmental health concerns including ultraviolet radiation levels and mycotoxins in food supplies. In addition, funds have been awarded to design exposure databases and address environmental health policy issues.

Projects have been funded in the University of Iowa Departments of Chemical and Biochemical Engineering, Civil and Environmental Engineering, Geology, Ophthalmology, Pathology, Pediatrics, Pharmacology, Preventive Medicine and Environmental Health, the University Hygienic Laboratory, The Institute for Health, Behavior and Environmental Policy, and the College of Nursing. Seed grants have been awarded to researchers in the Departments of Agricultural and Biosystems Engineering, Food Nutrition and Technology, the Pesticide Toxicology Laboratory, and the Veterinary Diagnostic Laboratory at Iowa State University, to the Iowa Department of Natural Resources-Geological Survey Bureau and to the Institute for Environmental Studies at the University of Illinois.

Results and methods produced by CHEEC-supported pilot studies have been used in proposals developed by University researchers to acquire federal and private sector support for more detailed research. The table below summarizes the return (to date) from funds CHEEC has invested in the Seed Grant Program. These grants and contracts have not been awarded to CHEEC directly, but to researchers from the University of Iowa or Iowa State University.

CHEEC project status	Total CHEEC investment	Resulting grants/contracts	Total additional funds
29 completed (proposals completed, awards announced)	$363,707	17	$3,401,756
6 completed (proposals in progress or awards pending)	89,851	pending	-
10 in progress	139,622	-	-

Agencies funding research projects include the Environmental Protection Agency, the Centers for Disease Control, the National Institute for Dental Research, the National Cancer Institute, the National Institute for Occupational Safety and Health, the National Institute of Environmental Health Sciences, the Department of Energy, the American Water Works Association Research Foundation, the National Mine Land Reclamation Center, the U.S. Air Force Office of Scientific Research, the Great Plains/Rocky Mountain Hazardous Substance Research Center, the Iowa State Water Resources Research Institute, and CIBA Agricultural Division.

Education

As described in the Iowa Groundwater Protection Act, a goal of CHEEC is to implement public education programs to inform persons of research results and to provide professional education and training in the causes and prevention of environmentally-induced disease.

CHEEC participated in a wide variety of educational programs on water quality during 1994, including the Midwest Regional Youth Environmental Summit, the 1994 Nebraska Water Resources Midwestern Tour, the first ever Environmental Water Festival held in Iowa and an ongoing water education project, WaterWatch '94, sponsored by the citizens of Johnson County. In addition, CHEEC acted as facilitator and provided a satellite downlink for a videoconference titled "A National Town Meeting on Groundwater Protection: Looking at Solutions" sponsored by the League of Women Voters.

CHEEC cooperated with a number of research centers at the University of Iowa on identifying, contacting and bringing nationally and internationally known environmental and public health scientists to Iowa City to give seminars on a variety of topics. These cooperative efforts ensure that the people of Iowa will be kept current on the latest research and policy developments in the environmental arena. Seminars co-sponsored by CHEEC during 1994 included:

Soil and water quality: an agenda for agriculture - National Research Council, Board on Agriculture Report
George Hallberg, Chief, Environmental Research, University Hygienic Laboratory
co-sponsor: UI Center for Global and Regional Environmental Research

The current status and future of environmental and public health in Hungary
Ferenc Bojan, Professor and Head, Department of Social Medicine, University Medical School of Debrecan, Hungary
co-sponsors: UI Center for International Rural and Environmental Health; UI Environmental Health Sciences Research Center

Pesticide bioremediation by exploiting the rhizosphere effect
Joel Coats, Professor of Entomology, Pesticide Toxicology Laboratory, Iowa State University
co-sponsor: UI Department of Civil and Environmental Engineering

Microbiological quality of public drinking water supplies
Edwin Geldreich, Senior Research Microbiologist, Drinking Water Research Division, U.S. EPA
co-sponsor: University Hygienic Laboratory

During 1994, CHEEC administrative staff responded to information requests from Iowa legislators, Iowa state agencies, the Environmental Protection Agency, the National Cancer Institute, the U.S. Geological Survey, the Minnesota Commission on Natural Resources, the State Council of Governments, private companies including FDL Foods, Pioneer Hybrids, DuPont Chemical and Iowa Select Farms, water treatment plant operators, university researchers and students, engineering consulting firms, environmental activist groups and the general public.

Conferences and Symposia

CHEEC sponsored two conferences in 1994 on water quality and public health issues.

The Media's Role in Communicating Health Risks: What's in the Water?, held on the University of Iowa campus on October 5, was co-sponsored by CHEEC, the UHL, the UI School of Journalism and Mass Communication, and the R.I.S.K. Project. This conference provided a forum for debate of issues related to the accuracy and reliability of risk communication of the possible health impacts from exposure to toxic substances in drinking water. Panel discussions focused on how the public's perception of health risk is shaped by the media's reporting on water contamination episodes, and on how the media's interpretation of the seriousness of a situation is affected by how well scientific experts communicate the problem to reporters. Panelists included editors and environment reporters from regional newspapers, water treatment officials, public health experts, water scientists and risk communication experts. Keynote presentations addressed the current state of health risk communication, outlined the history of drinking water research and described

ongoing problems in public health related to water quality, and presented a case study of the cryptosporidium contamination of Milwaukee's drinking water supply in 1993. Approximately 100 people attended the conference, including public health officials, policy makers, water treatment plant operators, environmental activists, students and the public. Copies of the conference proceedings are available upon request.

On November 4, a conference titled *Safe Drinking Water - Iowa's Future* was held on the campus of Kirkwood Community College in Cedar Rapids. Co-sponsors with CHEEC for this event were the Leopold Center for Sustainable Agriculture and the Iowa State Water Resources Research Institute at Iowa State University, and the Department of Environmental Sciences at Kirkwood Community College. The impetus for this meeting came from concerns regarding proposed rules tied to reauthorization of the federal Safe Drinking Water Act. Faculty from the University of Iowa and Iowa State University, representatives of the Iowa Departments of Natural Resources and Agriculture & Land Stewardship, state and local policy makers and water scientists made presentations on various aspects of public health, engineering, water treatment technologies, source pollution prevention and potential socioeconomic impacts related to proposed drinking water regulations. In addition, panel discussions on rural water quality and on national concerns related to municipal drinking water quality were conducted. Portions of the program were shown on a delayed broadcast via the state's fiberoptic network to sites in Johnston, Mason City and Sioux City. Over 125 people from a wide variety of backgrounds and disciplines attended the conference at Kirkwood. Conference proceedings are currently in press. CHEEC and the Leopold Center, sister centers established through the 1987 Iowa Groundwater Protection Act, intend to cooperate in the future on educational programs in Iowa on issues related to environmental health and agricultural and rural populations.

Several planning sessions were held in 1994 to develop a scientific workshop to discuss possible environmental, health and social impacts of large scale livestock confinement facilities in Iowa. This workshop, to be held in June, 1995, will be conducted by the Iowa Center for Agricultural Safety and Health and will be co-sponsored by the UI Environmental Health Sciences Research Center, the North Central Regional Center for Rural Development at Iowa State University, the Farm Foundation and CHEEC.

Directions

The University of Iowa has recently revised and updated its strategic plan. Achieving Distinction 2000 presents goals, objectives and related strategies designed to carry the University into the next century. As part of this process, research centers were required to develop their own strategic plans, which describe specific objectives closely tied to the broader goals outlined in the overall University plan. Following are examples of opportunities which have developed over the past year which will allow CHEEC to make great progress towards attaining the goals presented in the Center's strategic plan.

Data Management Opportunities

In July, 1994, CHEEC relocated its administrative offices and Data Management Center to the second floor, north wing, of Oakdale Hall on the University of Iowa's Oakdale Research Campus. This wing has been designated by the University as an area dedicated to environmental health research. Projects located in this area include the Department of Preventive Medicine and Environmental Health's Agricultural Health Study, Residential Radon and Lung Cancer Case- Control Study, and Mammography Surveillance Pilot Study. The CDMC has established itself in this new research wing as the computer systems and database development experts, and can provide system services and consulting as requested. Pesticide-related research being conducted by the UI Institute of Agricultural Medicine and Occupational Health has been designated office space in the area, and additional space exists for future projects.

Research Opportunities

The CHEEC Executive Committee has a strong interest in the use of Geographic Information Systems (GIS) for environmental health research applications, and has funded a GIS pilot project in the Department of Agricultural and Biosystems Engineering at Iowa State University (1993), and another project being conducted jointly by the UHL and the IDNR-GSB (see Seed Grant Program). Future resource allocation towards GIS will depend on the results of these projects and other efforts studying the applicability of GIS to

health research. Other groups at the University of Iowa, including the Department of Geography and the Center for Global and Regional Environmental Research, are currently utilizing GIS for a variety of spatial applications. CHEEC has been meeting with faculty and staff affiliated with these GIS shops to discuss technical issues as well as concerns related to confidentiality of health outcome data.

Education/Outreach Opportunities

During 1994, CHEEC diversified its educational activities and became more involved with efforts to provide special programs to primary and secondary schools. In addition, staff worked with local and regional grassroots organizations, elected officials and technical experts to develop public awareness programs on water quality and environmental health. Sponsoring professional conferences and workshops will continue to be a priority for CHEEC. Discussions are being held with the Leopold Center and University of Iowa environmental research centers regarding collaborating on educational programs during 1995 and beyond. Increasing public access to information on CHEEC research and activities is being enhanced through wider distribution of Center publications and development of a home page on the Internet's World-Wide Web.

Who We Are

Executive Committee

Gene Parkin, Ph.D., Center Director
George Hallberg, Ph.D.
Burton Kross, Ph.D., P.E.
Charles Lynch, M.D., Ph.D.
Jeffrey Murray, M.D.
Peter Thorne, Ph.D.
Richard Valentine, Ph.D.

Center Staff

Melinda Cartwright, Programmer Analyst
Kerry Sesker, Senior Systems Analyst
Gloria Wenman, Secretary
Peter Weyer, Program Coordinator
Rodney Wittich, Senior Programmer Analyst

Center Participants

The University of Iowa

Department of Civil and Environmental Engineering
Department of Pediatrics
Department of Preventive Medicine and Environmental Health
Institute of Agricultural Medicine and Occupational Health
State Health Registry of Iowa
University Hygienic Laboratory

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., Institute of Agricultural Medicine and Occupational Health
Lois Dusdieker, M.D., UI Department of Pediatrics
Daryl Frey, Iowa Department of Agriculture and Land Stewardship
Richard Kelley, University Hygienic Laboratory
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
John-Mark Stensvaag, J.D., UI College of Law
Thomas Tephly, M.D., Ph.D., UI Department of Pharmacology (Committee Chair)
Frank Weirich, Ph.D., UI Department of Geography
Nancylee Siebenmann, Iowa Environmental Protection Commission (ad hoc)

Design: Patti O'Neill, The University of Iowa Printing Department
Published May 1995
57962/5-95

Center for Health Effects of Environmental Contamination
The University of Iowa
100 Oakdale Campus #N204 OH
Iowa City, IA 52242-5000
(319) 335-4550
FAX: (319) 335-4077
e-mail: cheec@uiowa.edu