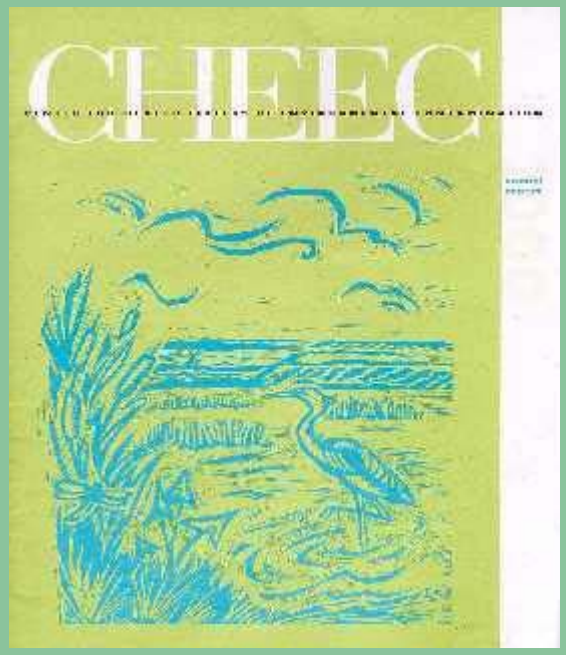
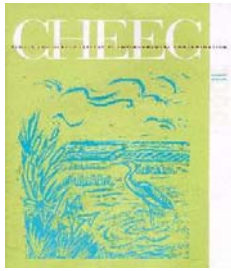
Center for Health Effects of Environmental Contamination | CHEEC

2000 Annual Report





The year 2000 was a memorable one for CHEEC. In April, the Center hosted an international workshop on *Endocrine Disruptors and Pharmaceutically Active Compounds in Drinking Water.* The three-day event was held in Chicago and attracted participants from around the globe, including Europe, the United Kingdom, Australia, Africa, Canada, and many states across the U.S. Funded by the American Water Works Association Research Foundation, the workshop brought experts from a variety of disciplines together to discuss the state of research on these compounds, how they may impact human and ecologic health, and how the drinking water and wastewater industries might respond to public concerns about water contamination. Organizing and conducting this workshop proved a formidable task for the CHEEC staff, but one very well worth the effort. Future collaborative research and education programs on these emerging issues are being discussed among many of the workshop participants.

Research projects on water quality and health continued to investigate drinking water disinfection by-products, nitrate, pesticides, and some naturally occurring compounds such as ammonia. Collaborative efforts with the National Cancer Institute, the University of Colorado, the Iowa Department of Natural Resources, and the Centers for Disease Control and Prevention were fueled by increasing interest in and utilization of CHEEC's municipal water supply database. In addition to conducting research, CHEEC continues to support innovative environmental research at both the University of Iowa and Iowa State University through our Seed Grant Program.

During 2000, CHEEC staff was involved in a variety of educational and service activities, which are detailed in this annual report. Providing expert advice and consultation on various environmental quality committees will continue to be a major focus of CHEEC's mission to the state of Iowa. We look forward to continuing and expanding our research, education and service efforts in 2001.

Pete Weyer, Ph.D.
Associate Director

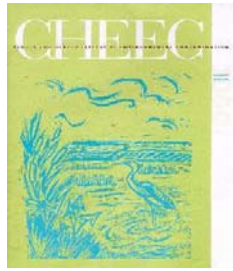
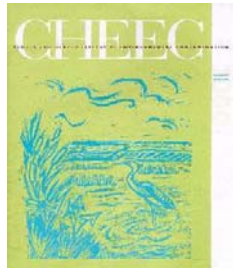


Table of Contents



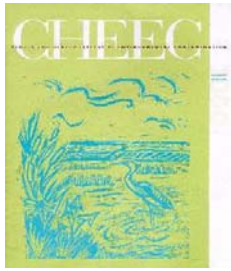
Date Management Center

The CHEEC Data Management Center (CDMC) is the core of research operations. CDMC is a repository for statewide municipal drinking water quality data, which have been gathered from the United States Geological Survey, the Iowa Department of Natural Resources, the University Hygienic Laboratory, and federal Safe Drinking Water Act monitoring data. In addition, CDMC has computerized data from municipal drinking water supplies and special research projects that go beyond current monitoring requirements. These data are complemented by CHEEC efforts to gather information from municipal drinking water utilities on water sources, aquifers, treatments and populations served. The end component is a system that easily links analytical water quality and treatment data to the populations they serve.

CDMC also provides full computer system and applications support for the *Agricultural Health Study*, a multi-year prospective cohort study funded by the National Cancer Institute, the Environmental Protection Agency and the National Institute of Environmental Health Sciences. At the University of Iowa, the Department of Epidemiology in the College of Public Health leads the research effort. An article titled *Retinal Degeneration in Licensed Pesticide Applicators* (American Journal of Industrial Medicine, June 2000, available online) is one example of the breadth of research the *Agricultural Health Study* encompasses.

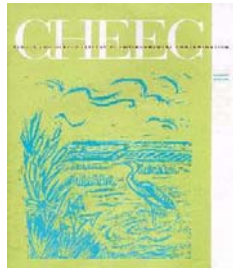
Work continued in Fiscal Year 2000 on a cooperative project with the University of Colorado, the National Cancer Institute and Queen's University (Ontario) in a project funded by the American Water Works Association Research Foundation titled *Improved Exposure Assessment on Existing Cancer Studies*. Center staff have been working one-to-one with municipal utility operators identifying and computerizing data for use in modeling disinfection by-products formation.

The second phase of a collaborative project with the University Hygienic Laboratory and Iowa Department of Natural Resources investigating ammonia in municipal drinking water wells and potential adverse health outcomes was completed in 2000. Preliminary



analyses suggests that no chronic health problems are related to exposure to ammonia in drinking water wells. A final analysis of health outcomes and the effects water treatment has on ammonia in finished water is in progress.

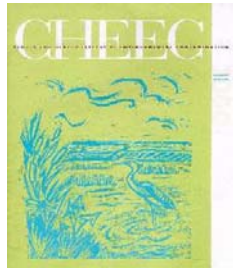
Ongoing work with the National Cancer Institute assessing nitrate exposure from drinking water capped off CDMC research activities in 2000.



Cooperative Research Projects

The CHEEC Cooperative Research Program's goal is to foster and spearhead innovative research of mutual interest to CHEEC and other academic centers, departments, state agencies or federal agencies. Administratively, cooperative agreements involve cost sharing (matching funds or in-kind support) from all participating groups. Members of the CHEEC Executive Committee are either Principal Investigators or co-Investigators on approved projects.

In 2000, CHEEC, the Leopold Center for Sustainable Agriculture at Iowa State University, and the UI Office of Vice President for Research funded a project of interest to Iowans titled *Analysis of Environmental Exposures in Hoop Structures and Conventional Confinement Swine Barns.* The study's principal investigators, Peter Thorne, (UI Department of Occupational and Environmental Health) and Dwaine Bundy (ISU Department of Agriculture and Biosystems Engineering) are quantifying and describing airborne compounds present in both a conventional swine rearing facility and swine hoop structures. The study will characterize potential exposure to workers in these facilities and to surrounding areas. Fieldwork will be complete in 2001. The Leopold Center's webpage on hoops is http://www.ae.iastate.edu/hoop_structures/home.htm



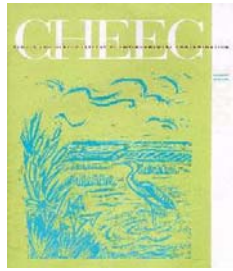
Education

Seminars
CHEEC sponsors a continuing seminar series on environmental issues of interest to the university community, state environmental health specialists, and the general public. Seminars cover a range of environmental health topics, including policy discussions, health study findings, emerging environmental research and exposure assessment. The following seminars were held on The University of Iowa Campus in 2000:

The Effects of Radiation Dose Surrogates in Radon Epidemiologic Studies
Daniel Steck, Ph.D., Director of the Minnesota Radon Project, Department of Physics, St. John's University

The 4 W's of Pesticides in Iowa's Water: What, Where, When, and Why?
Mary Skopec, Ph.D., Iowa Department of Natural Resources-Geological Survey Bureau
co-sponsor: The University Hygienic Laboratory

Developing a Surrogate Water Supply Profile for Cancer Epidemiology Studies
Pete Weyer, Ph.D., Associate Director, Center for

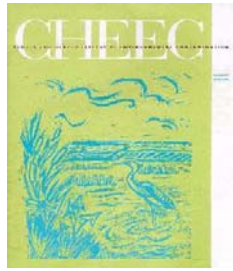


Health Effects of Environmental Contamination,
University of Iowa

Cryptosporidium Antibody Analysis for Paired Cities Study
Rebecca Calderon, Ph.D., Epidemiology &
Biomarkers Branch- Human Studies Division, US EPA;
Floyd Frost, Ph.D., Lovelace Clinic Foundation

Outreach
Since the inception of CHEEC in 1987, center staff has represented the environmental health community through service on state and local committees and service work promoting a clean environment as it relates to health. In 2000, staff participated on the following committees: 1) *Onsite Wastewater Systems on Lots of Less than One Acre* study committee led by the Johnson County Department of Public Health, 2) Planning committee for the *Agriculture and the Environment: A Wake-Up Call for Iowans* conference held in spring of 2000 at Iowa State University, 3) Serving as the environmental health specialist on the *Water Utility/Agribusiness Focus Group* led by the Des Moines Water Works, and 4) Participating on the *Cedar River Watershed Coalition* committee led by the Cedar Rapids Water Department.

During 2000, CHEEC responded to information requests from state and county health departments, the National Cancer Institute, engineering consulting firms, university researchers and students, high school students, water treatment plant operators, the media, environmental activist groups, and the public. Other education activities by CHEEC staff included being a featured speaker for an international internet broadcasting event on endocrine disruptors, and giving talks at a University of Iowa Geoscience Departmental seminar, and Iowa's Center for Agricultural Safety and Health (I-CASH) meeting, and a Cedar River Watershed Coalition meeting.



Endocrine Disruptors and Pharmaceutically Active Compounds in Drinking Water Workshop

In 2000, CHEEC organized and hosted a workshop sponsored by the American Water Works Association Research Foundation (AWWARF), Water Environment Research Foundation (WERF) and WateReuse Foundation titled *Endocrine Disruptors and Pharmaceutically Active Compounds in Drinking Water*. International in scope, the workshop attracted experts from municipal utilities, industry, academia, and government to discuss this emerging environmental health issue. The workshop was a first of its kind effort in the United States organized specifically for the drinking water and wastewater industries.

Research on endocrine disruptors has exploded with new findings being published regularly from many disciplines. Pharmaceutical contamination in the environment is a newly emerging area of study in the United States. Worldwide, the presence of pharmaceuticals in the environment has captured more attention, particularly in Europe. Both endocrine disruptors and pharmaceutically active compounds provide complex and unique problems for the drinking water and wastewater industries-from the ability to detect these compounds to the uncertain implications for human health. This workshop identified and assembled leading international experts to discuss critical issues for drinking water and wastewater professionals. The main objective of the workshop was to examine the potential implications of endocrine disruptors and pharmaceuticals for the drinking water and wastewater communities.

The workshop also generated insightful questions specific to water industry concerns. Prioritizing critical research needs and further focusing research efforts was a major outcome of the workshop. In addition to hosting this event, CHEEC's role included drafting a research agenda for the sponsoring organizations. In turn, these organizations may provide grant support for specific research areas highlighted during the workshop. Research needs were prioritized in the following topic areas:

Identification and occurrence of compounds

- Develop analytical and screening methodologies that are both cost effective and provide scale efficiencies.
- Identify and prioritize substances that are relevant to the industry; identify and focus on chemical mixtures that are appropriate to water utilities.

Treatment

- Assess current removal efficiencies for conventional treatments. What specific degradation pathways do current treatments provide?
- Address whether adopting newer technology truly provides risk reduction.

Human health

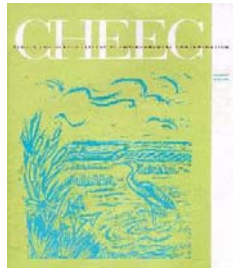
- Consider low dose and non-linear dose response curves; what are the implications for the water industry?
- Consider whether animal models tell us anything about human health. Are these appropriate to use for the water industry?
- Stress quantifiable endpoints for humans.
- Conduct field measurement studies on how compounds enter the environment, the waste stream and (potentially) drinking water.

Communication

- Enhance efforts to develop stronger ties between government agencies, industry researchers, and academic disciplines.
- Enhance efforts to communicate to the customer -both risk communication and risk perception should be considered.

Further benefits of this workshop were realized through the participation of many Iowa-based researchers, public health professionals, and utility operators. By providing an introduction on the subject for Iowa utility operators, addressing research opportunities, and focusing public health needs at state agencies and academic institutions, participation in this workshop will provide a central point for future discussion on these emerging issues. Cooperative research proposals involving CHEEC, state agencies, drinking water utilities, and University of Iowa research units are being developed to continue work in this area.

Workshop proceedings are available at http://www.cheec.uiowa.edu/edc_2000/ .

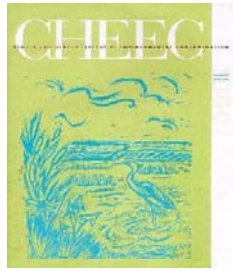


Seed Grant Program

The CHEEC Seed Grant Program is an important component of center operations and serves to fulfill CHEEC's mission " *to determine the levels of environmental contamination which can be specifically associated with human health effects.*" Annually, approximately one-third of CHEEC's state allocation is distributed as research grants. Grants are awarded to pilot studies on exposure and risk assessment, innovative environmental remediation techniques, original monitoring and sampling methods design and testing, laboratory methods development, statistical analysis relating environmental exposures to health outcomes, database design and development, health survey design, and studies based on innovative biochemical or molecular approaches on mechanisms of toxicity relating human exposure to environmental chemicals. Additionally, CHEEC awards partial support for public education projects in environmental health, with an emphasis towards programs on exposure prevention, assessment and awareness. The following projects received CHEEC seed grants during 2000:

Research Grants

Characteristics of BTEX Plumes in Iowa: A survey of Plume Dimensions and Stability
Investigator: P. Alvarez, Department of Civil and Environmental Engineering, The University of Iowa
Summary: Groundwater contamination by petroleum product releases is a common threat to public health. Contaminant plume dimensions and stability are important to characterize for risk management because they determine the areas of influence and the potential duration of exposure. This project will analyze data from about 600 sites to identify central tendencies, variability, and regional trends of hydrocarbon plume characteristics. The data will be obtained from the Iowa Department of Natural Resources electronic database. Statistical analysis will be conducted to answer important questions, such as: What is a typical 'safe' distance down gradient of the source, beyond the reach of the plume?



Comparison of Biological and Chemical Endpoints for Evaluating the Success of phytoremediation of Pesticide-Contaminated Soil

Investigators: J. Coats, J. Belden, Department of Entomology, Pesticide Toxicology Laboratory, Iowa State University

Summary: The objective of the study is to compare biological and chemical endpoints for utility in assessing progress of phytoremediation of pesticide contaminated soils. The proposed endpoints will provide measurements of terrestrial and aquatic toxicity along with thorough evaluation of the pesticides leaching potential. At the end of the study, a better understanding of how phytoremediation may affect bioavailability and the presence of toxic metabolites will be gained.

Enhancing Bioaerosol Exposure Assessment: A Comparison of Three Commercially Available Impingers

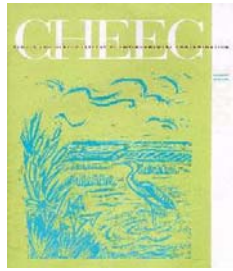
Investigators: T. Pearce, P.Thorne, Department of Occupational and Environmental Health, The University of Iowa

Summary: Currently there are no definitions of acceptable exposure or enforceable standards to hazardous bioaerosols that are associated with a high burden of morbidity and mortality. Emerging airborne diseases intensifies the importance of improving methodology for bioaerosol exposure assessment. Improvements will require characterizing the capabilities and limitations of existing methodology and the development of new techniques. Impinger samples hold promise for current assessments, as they possess high collection efficiency and sample analysis flexibility. The study seeks to characterize the collection efficiencies of three commercially available impinger samplers using culture based and non-culture based methods of analysis. Information and data generated is intended to advance bioaerosol assessment in the present and improve methodology in the future.

Exploratory and Experimental GIS Studies of the Association of Rural Ambient Air Quality with Asthmatic Children of a Small Area Cohort

Investigators: G. Rushton, E. Svendsen, Department of Geography, P. Thorne, Department of Occupational and Environmental Health, The University of Iowa

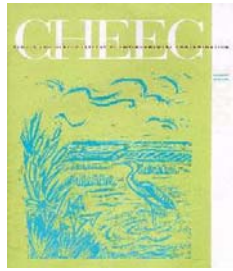
Summary: Ambient air pollution sources are one of the potential environmental exposure sources that have been suggested to influence childhood asthma. Though asthma research has been done in many cities, little is known about asthma risk factors in rural populations. This study will both explore and experiment on the distributions of asthma cases and controls from the Keokuk County Rural Health Study in the context of neighboring point source air polluters such as hog-lots and grain mills. Space, time, space-time interaction, space-time clustering, and spatial regression analyses will be performed using recently developed spatial statistical tools.



The hypothesis will be tested that asthma cases are found to be significantly closer to point source air polluters within the Keokuk Country Area than the control group.

The Role of Surface Precipitates in Remediation Technologies Based on Iron Metal
Investigator: M. Scherer, Department of Civil and Environmental Engineering, The University of Iowa
Summary: Recent work on remediation of oxidized chemicals with permeable reactive barriers (PRBs) containing iron metal (FeO) has shown that remediation performance is strongly affected by the layers of precipitates that form on the iron surface over time, and the quantity and composition of these precipitates vary greatly depending on the composition of the groundwater. Despite the enormous success of FeO PRBs, the identity and significance of this surface precipitate is still unclear. This research proposes to develop a series of experimental protocols to characterize the composition of the surface precipitates forming in the FeO PRBs and evaluate how variations in solution chemistry are linked to changes in the precipitate coatings, which then enhance or inhibit PRB performance. As many conventional remediation technologies are costly and are still unable to meet health based standards, it is prudent to investigate more innovative remediation techniques which may prove more cost efficient and more successful in cleanup efforts.

Changes in Rhizosphere Microbial Populations and Arsenic Speciation as a Result of Phytoremediation of Contaminated Soils
Investigators: J. Simeonsson, Department of Chemistry, P. Alvarez, Department of Civil and Environmental Engineering, The University of Iowa
Summary: Remediation of arsenic contaminated soil is a critically important environment and health problem. Arsenic pollution is widespread-in hazardous waste sites it is the fourth most prevalent toxic agent and the highest ranking carcinogen. This study is designed to evaluate whether the speciation of soil arsenic (As) is altered as a result of phytoremediation and whether microbial communities in the root zone are associated with changes in speciation. It is also of interest to determine whether microbial communities are associated with the volatilization of As compounds. Plant growth experiments will be conducted in controlled environments. Poplar saplings will be grown while exposed to varying amounts of soil based As. Changes in speciation and volatilization will be investigated through measurements of As in soil, plant, and air samples collected from the test chambers. Microbial populations in the rhizosphere of the saplings will be enumerated based on their ability to change the speciation of soil As.

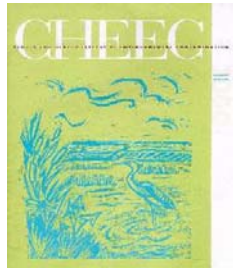


Reactivity of Disinfection By-Products with Distribution System Pipe Deposits and Cast Iron
Investigators: R. Valentine, M. Scherer, Department of Civil and Environmental Engineering, The University of Iowa
Summary: This project will investigate reactions that could potentially reduce Disinfection By-Products (DBP's) in distribution systems. DBP's are reasonably anticipated to be carcinogenic and are by-products of chlorination in drinking water supplies. The researchers hypothesize that the dominant abiotic loss pathways involve reactions with pipe deposit material and with nascent cast iron, especially under reduced conditions. The objective of this research is to characterize the reactivity of selected DBP's with model and collected pipe deposit material, and with cast iron. A special emphasis will be on reactions with unidentified Total Organic Halogen uTOX. This material generally accounts for over 75% of the total halogen incorporated into organic matter.

Education Grants

Partial Support for **Regional Teens Against Tobacco Use (TATU) Training**
In cooperation with Mid Eastern Council on Chemical Abuse (MECCA)
D. Hammes, Prevention Specialist, MECCA

Partial Support for **Public Water Supply Workshop**
In cooperation with the University of Iowa Hygienic Laboratory, and the Iowa Department of Natural Resources
L. Kurimski, University of Iowa Hygienic Laboratory



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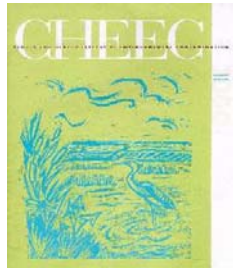

Bernie Hoyer, Iowa Department of Natural Resources - Geological Survey Bureau
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State Health Registry of Iowa
University Hygienic Laboratory

Iowa State Agencies:
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Department of Public Health
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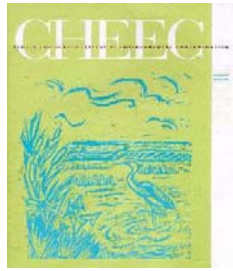

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