

Center for Health Effects of Environmental Contamination | CHEEC

## 1992 Annual Report





The Center for Health Effects of Environmental Contamination (CHEEC) was established by the Iowa Groundwater Protection Act of 1987. The Iowa Groundwater Protection Act was developed because of concerns Iowans had with the quality of their groundwater and the potential impact groundwater contamination could have on human health. Three research centers were established as part of the Act: the Leopold Center for Sustainable Agriculture at Iowa State University, the Iowa Waste Reduction Center at the University of Northern Iowa and CHEEC at The University of Iowa.

1992 is our fifth year of operation and this report is a summary of what we have accomplished in those five years. CHEEC was established to "determine the levels of environmental contamination which can be specifically associated with human health effects." Our mission is much broader than this, as you will discover as you read this report.

CHEEC is an interdisciplinary research, education and service organization. Its primary mission is to conduct health effects research in the general areas of exposure assessment and risk assessment. Research in exposure assessment covers a variety of areas. For example, in order to assess the impact on human health, one must first know what levels of environmental contamination the population is exposed to. One must also understand how these chemicals react in the environment. For example, if a herbicide such as atrazine enters the environment, what happens to it? How far will it move from the point of application? And then, what are the possible health effects associated with these levels of contamination? This report contains many examples of the types of work we are doing in the exposure assessment area.

Exposure assessments are in part used to develop risk assessments. As we all know, life involves risk. Our mission in CHEEC is to understand the human health risks associated with various environmental exposures. If we can accurately determine risks, we can begin to evaluate methods for reducing those risks (reducing the exposure). As with exposure assessments, risk assessment research encompasses many areas. Epidemiologists, for example, evaluate associated health outcomes. CHEEC researchers use data from the Iowa Cancer and Birth Defects Registries in these endeavors. Engineers attempt to evaluate risks using health outcome data to develop strategies for reducing the risk along with the estimation of costs associated with a given reduction in risk. Many of the CHEEC-sponsored studies in risk assessment are described in this report.



Environmental data management is a strong point within CHEEC. Systems and data bases developed and maintained by CHEEC on rural and municipal water quality in Iowa are described in this report. These data bases are used for a variety of applications.

We feel that one of our most successful activities is our Seed Grant Program. The general goal is to award small grants to researchers with the idea of generating information that not only helps to answer important health effects and environmental exposure questions, but also is useful in developing larger proposals for submission to outside (primarily federal) agencies. As you read this report you will get an idea of the wide variety of projects that have been funded.

Education is a vital component of the CHEEC program. Over the past five years, educational links have been developed with health researchers in Iowa and other states, with health care professionals including physicians, nurses and other health care providers, and with the citizens of Iowa. This has been accomplished through the publication and dissemination of research papers, monographs and annual reports, through an ongoing seminar series and through research presentations and displays at conferences and meetings. We feel such educational activities are a very important part of our mission.

We in CHEEC are proud of our five year accomplishments and appreciate the support given us by the Iowa Legislature, the Department of Natural Resources, the Department of Public Health and the Department of Agriculture and Land Stewardship. We look forward to continuing to serve the citizens of Iowa by improving our human and environmental health. Please, enjoy our report!

Gene Parkin, Director



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## Mission, Goals, and Structure

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CHEEC's mission, as described in the 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

CHEEC is administratively located in the Department of Civil and Environmental Engineering in the College of Engineering and reports directly to the Office of the Vice President for Research at The University of Iowa. Components within CHEEC include an Administrative Core and an Environmental Data Management Core (EDMC). The goals of these units are to develop and maintain



effective liaison between University researchers and state agencies regarding environmental health issues, provide environmental data and other resource material for faculty and students upon request, and act as a referral service for state agencies regarding questions and concerns expressed by the public.



## Environmental Data Management

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A main goal of CHEEC is to evaluate potential associations between drinking water contamination and adverse health outcomes including cancer and birth defects. In order to accomplish this, an Environmental Data Management Core was established, with Charles Lynch, M.D., Ph.D., serving as director.

For the past five years, the EDMC has been concentrating on accumulating a computerized data base of water sample analyses, supply sources, and treatment characteristics for municipal and private drinking water in Iowa. A concerted effort is made to use compatible software products to maintain all the environmental data that will be linked with health outcome data.

The EDMC manages the following data bases on PC-based systems: water supply data for Iowa municipalities above 400 population; a 1986-87 statewide municipal drinking water survey of pesticides and synthetic organic chemicals; the 1988-89 Statewide Rural Well Water Survey (SWRL); and the 1989 Iowa Rural Radon Gas Survey. Since 1991, the EDMC has updated historical municipal drinking water data for cities over 1,000 population, incorporated Iowa Geological Survey Bureau (IGSB) aquifer data into the EDMC data base, collected historical water supply and treatment data on communities between 400 and 1,000 population, and developed systems for accessing these data for the Iowa Department of Natural Resources (IDNR), the IGSB, the University Hygienic Laboratory (UHL), and CHEEC.

The EDMC has also linked historical water supply sample analysis data obtained from a variety of sources to the Historical Community Water Supply and Treatment data base. These data include raw and finished water quality data retrieved by the IGSB from the United States Geological Survey (USGS) QWDATA System and the USGS WATSTORE water quality file, raw and finished water quality data from the UHL, and finished water quality data from a 1979 National Survey of Environmental and Health Water Supply. In addition to providing support to CHEEC researchers for ongoing environmental studies, EDMC staff respond to requests for data from state and federal agencies, academic institutions, and the private sector.



A computer-based demonstration of EDMC data has been developed and implemented. On several occasions during the past five years, this demonstration has been available at professional meetings and conferences in Iowa. The EDMC has published two monographs, including "Historical Community Water Supply and Treatment Data for the State of Iowa" and "Historical Community Well and Aquifer Data for the State of Iowa."

The EDMC maintains residential radon results from a statewide EPA survey (winter 1989) and from SWRL. Since 1991, the EDMC has been working with IGSB personnel to develop a computerized well identification table, which will provide data that correlates the local well name, year of construction, and depth with several other "unique" municipal well identifiers. IGSB personnel have taken the lead on this project and will continue to update this table as new information and inspection are reviewed.





## Epidemiologic Studies of Environmental Exposures and Health Effects

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CHEEC is participating in a number of studies looking at the potential effects of human exposure to a variety of environmental contaminants. The EDMC either provides data for these projects or is involved in the data collection and management activities.

### **Residential Radon and Lung Cancer Case-Control Study**

A number of lines of evidence indicate that radon gas is a potent carcinogen. Indoor radon has been reported to be a serious health risk in the United States. Advisories have been issued indicating it is the second leading risk factor for lung cancer and may be responsible for up to 20,000 lung cancer deaths per year. While radon might be presumed to be a carcinogen in the home environment, it is unclear whether actual empirical evidence will show an increased lung cancer incidence in those non-occupationally but residentially exposed. A population-based case-control study is being conducted to evaluate the association between residential radon exposure and the incidence of lung cancer among Iowa women. This five-year study will involve 600 cases and 600 controls between the ages of 40 and 84.

The study has three major components: (1) a case-control mailed questionnaire; (2) a residential radon exposure assessment; and (3) independent pathologic review of lung cancer tissue. In order to be eligible for the study, a woman must have lived 20 or more years in the same home at the time of cancer diagnosis (for cases) or at the time of initial contact (for controls).

Although several epidemiologic studies of radon in the home and lung cancer have already been conducted or are currently in progress, this study is better designed to address this important health topic for several reasons: (1) the study group will have resided for 20 years or more in the same home; (2) a high quality, statewide cancer surveillance system (State Health Registry of Iowa) will provide rapid identification of newly diagnosed cancer cases; (3) 70% of Iowa homes have radon levels exceeding 4 pCi/liter (EPA action



level); and (4) multiple year long measurements of radon in a subject's home will yield more accurate estimates of residential radon exposure. CHEEC will act as consultant to data management activities on this study.

The project is a collaborative effort between The University of Iowa Departments of Preventive Medicine and Pathology and the Department of Preventive Medicine at the University of Kansas Medical Center. The five-year study is being funded by a grant from the National Institute of Environmental Health Sciences.

### **Agricultural Health Study**

CHEEC will provide data base design and data management support of an Agricultural Health Study looking for causes of cancer, kidney disease, and neurological disorders associated with farm practices and lifestyles. The study, which is being conducted in cooperation with the Iowa Department of Agriculture and Land Stewardship (IDALS), will be the largest of its kind in the nation. The University of Iowa Departments of Preventive Medicine and Pathology, and Survey Research Associates of Durham, North Carolina, are involved in this collaborative effort.

The IDALS pesticide applicator certification program will ask Iowa farmers, their families, and commercial applicators to participate. IDALS staff will administer questionnaires to approximately 46,000 Iowa farmers and 11,000 commercial pesticide applicators to collect statistical data detailing the nature and frequency of exposures that may threaten a farmer's health.

Although farmers tend to live longer and healthier lives than other people, evidence shows they have higher than normal rates of several cancers, including leukemia, multiple myeloma, non-Hodgkin's lymphoma, and cancers of the brain, prostate, stomach, skin, and lip. Potentially harmful exposure to compounds such as pesticides, chemical solvents, engine exhausts, animal viruses, and other substances may be to blame.

The study is composed of several parts. In the main component, farmers, their dependents, and pesticide applicators will be followed for ten years or longer. Investigators will compare the number of cases of cancer that are expected to appear in this population to the



number that actually appear. They will also compare disease risks in persons exposed to specific substances to risks in unexposed persons. Over the first five years, cancer cases of particular interest will be incorporated into special studies to obtain more detailed data on possible risk factors.

Each participant will provide information on agricultural exposures and diet, as well as a complete occupational history, and family and personal medical histories. The collection of dietary information may provide an opportunity to test current hypotheses about diet and cancer, including how dietary factors might modify risks associated with specific farm chemicals.

The ten-year project will incorporate a total of over 100,000 participants and is being jointly funded by the National Cancer Institute, the Environmental Protection Agency, and the National Institute of Environmental Health Sciences.

### **Statewide Rural Well Water Survey**

The Statewide Rural Well Water Survey was a stratified, systematic sample of private drinking water supplies used by Iowans. Carried out as part of the implementation of the Iowa Groundwater Protection Act, it was jointly conducted by IDNR and CHEEC between April 1988 and June 1989. SWRL sampled water from 686 wells across the state. The survey addressed two questions: (1) what proportion of private rural wells in Iowa are affected by various environmental contaminants? and (2) what proportion of rural Iowa residents are using contaminated water? SWRL results provided the first statewide estimates of the extent of groundwater contamination in rural private wells.

SWRL reported that contamination problems with bacteria and nitrate are particularly widespread: 44.6 percent of wells statewide exhibited the presence of total coliform bacteria, a potentially unsafe condition. Coliform bacteria are not themselves a health concern, but are an indication that other pathogenic microbes may be able to enter the water system. Survey results showed that 18.3 percent of Iowa's private rural wells contain nitrate concentrations that exceed recommended health advisory levels. Adjusting the SWRL data for participants who report they no longer use their wells for drinking water, the findings indicate that almost 130,000 rural Iowans (or about 18 percent of Iowa's rural population) are consuming drinking water that contains unacceptably high levels of nitrate.



A total of eleven pesticides and five pesticide metabolites were detected in SWRL survey wells. From the SWRL findings, it is estimated that 13.6 percent of the private, rural drinking water wells in Iowa are contaminated with one or more pesticides. The concentration of pesticides detected was generally less than one part per billion (ppb). On a statewide basis, 1.2 percent of private rural wells in Iowa estimated to be contaminated with a pesticide exceeding recommended health advisory levels. Atrazine was the most frequently detected pesticide, occurring in almost 8 percent of the wells tested. Other pesticides detected in more than 1 percent of the wells included metribuzin, pendamethalin, metolachlor, cyanazine, and alachlor.

The survey found that all contaminants are more common, and have higher concentrations, in wells less than 50 feet deep. SWRL results have been used to develop several studies on rural well contamination and have provided evidence substantiating public concern regarding pervasive groundwater contamination from agricultural chemicals in the Midwest.

### **Water Quality Research in the Rathbun Lake Area**

Exposure to contaminants in drinking water obtained from surface sources and possible related health effects are being studied by CHEEC researchers in the Rathbun Lake region. Rathbun Lake (located in Appanoose County in south-central Iowa) is the main source of water for the Rathbun Regional Water Association (RRWA), the largest rural water system in the United States. The RRWA supplies drinking water to 13 counties in Iowa and 2 Missouri counties, serving 45 towns with a combined population over 50,000. Water users may hook up to the system on an individual (franchise) basis or entire towns may be supplied (bulk use). Epidemiologists at The University of Iowa have been studying the rates of several categories of birth defects in the Rathbun bulk-use communities.

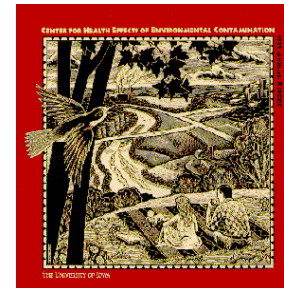
A cooperative effort began in 1990 to conduct surface water quality research in the Rathbun Lake area. Through the efforts of the University Hygienic Laboratory, the RRWA, and CHEEC, a collaborative research program was initiated to analyze raw and finished water from the Rathbun Lake and from the RRWA treatment plant and distribution system. Other agencies in this effort include the Iowa Departments of Natural Resources, Public Health, and Agriculture and Land Stewardship and the Corps of Engineers. There are several reasons why Rathbun provides an excellent opportunity for water quality and health effects research.



- A 1986-87 statewide municipal water survey found elevated levels of atrazine in RRWA water supplies. Regular sampling since that time has confirmed the continued presence of atrazine.
- The population is fairly stable in this area; many people live in the same town for years, allowing accurate exposure assessment.
- Preliminary aggregate analyses of rates of low birth weight in Iowa communities (stratified by size and geographic area) showed elevated rates in the Rathbun bulk-use communities. Low birth weight predisposes an infant to a number of medical problems in the first year of life.
- Rates of intrauterine growth retardation (IUGR - percent weight for gestational age) were also elevated for these communities compared to towns of similar size and location but who were using a different surface source for drinking water.
- Levels of atrazine in the water supply were statistically associated with the incidence of adverse health effects.

These analyses did not take into account a number of possible confounders, including smoking and other lifestyle factors. However, they did indicate that some association between residing in these communities and an increased incidence of these adverse reproductive outcomes might exist. The RRWA has been extremely cooperative in the water sampling programs, has provided assistance with research efforts, and has been very patient regarding the publicity the research has been given by the media.

CHEEC has funded a number of research projects investigating Rathbun water quality and health effects in the communities served by the RRWA. Summaries of these studies are presented in the section on the [Seed Grant Program](#). At the present time, CHEEC researchers are communicating with federal agencies regarding the availability of support for detailed case-control studies in the Rathbun area.



## Environmental Engineering Studies on Degradation and Biotransformation of Toxic Substances

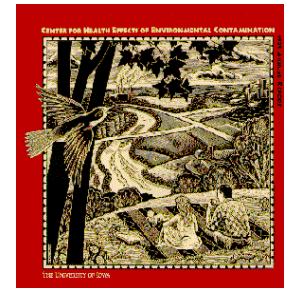
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Researchers in the Department of Civil and Environmental Engineering are conducting a number of studies involving the fate, transport, and bioremediation of contaminants in water and soils. Engineering research being supported by CHEEC is described in the section on the [Seed Grant Program](#). Following are brief summaries of projects currently in progress that will impact efforts to clean up contaminated surface and groundwater supplies in Iowa. All projects are being funded by EPA. CHEEC provided matching funds for the poplar tree research project, which was also supported by grants from the Leopold Center for Sustainable Agriculture at Iowa State University.

### **Formation and Transformation of Pesticide Degradation Products Under Various Electron Acceptor Conditions**

Recent research has shown that while atrazine and alachlor are transformed in the environment under a variety of conditions, their rates of mineralization are much slower than their rates of initial transformation. The objectives of this research are to (1) develop and operate batch and column reactors under four different electron acceptor conditions (aerobic, nitrate reducing, sulfate reducing, and methanogenic) in which alachlor and atrazine are transformed; (2) screen for biotransformation products from these systems; (3) evaluate differences among the electron acceptor conditions in order to determine the degradative pathways for each pesticide; (4) develop rate constants for the formation and transformation of the metabolites; and (5) incorporate the newly developed rate constants into a mathematical model designed to predict the fate of the pesticides under different electron acceptor conditions.

### **Effect of Redox Conditions on Transformations of Carbon Tetrachloride**



Soil and groundwater contamination by carbon tetrachloride (CT) has been documented at several sites within the area served by EPA regions 7 and 8. In order to engineer in situ or above-ground biological treatment systems to remediate these sites, research is needed to understand the transformations of CT under a variety of conditions. The objectives of this project are to (1) determine the effect of redox condition (electron acceptor) on transformation of CT; (2) evaluate the effect of CT and its metabolites on transformation of CT and CT-metabolites; (3) determine the effect of CT and its metabolites on the ability of microorganisms to utilize a primary substrate; (4) develop, verify, and validate a one-dimensional numerical model with the ability to predict the fate and transport of CT in saturated systems; and (5) determine the operational parameters for a conceptual sequential anaerobic-in situ/aerobic-above ground treatment system.

### **Aerobic, Phenol-Induced Biotransformation of Trichloroethylene**

Trichloroethylene (TCE) is a significant environmental pollutant in EPA regions 7 and 8. Thus, there is considerable interest in developing techniques for removal of TCE from contaminated aquifers. One potential method is by phenol-induced biotransformation of TCE by toluene oxygenase enzyme systems. This project has been investigating TCE degradation by mixed and pure cultures of *P. putida F1* under aerobic, non-methanotrophic conditions. Additional research has been proposed to (1) further assess the effect of phenol concentration on TCE removal by a mixed culture of phenol-induced, TCE-degrading organisms; (2) isolate and characterize the active phenol-induced TCE degrading organisms in the mixed culture; (3) evaluate the effect of pyruvate (a carbon source that may not repress the oxygenase enzymes) on TCE degradation and phenol requirements; and (4) further evaluate the intermediate products in TCE degradation by the mixed culture.

### **Deep-Rooted Poplar Trees as an Innovative Treatment Technology for Pesticide and Toxic Organics Removal from Groundwater**

A long-term small plot experimental study is being conducted at Middle Amana, Iowa, on the fate and transport of alachlor and atrazine. The purpose is to determine if poplar trees, deep-planted and deep-rooted in riparian zone buffer strips, can be used as treatment technology for the removal of these pesticides and other toxic organic chemicals. The research is focusing on transport,





sorption, and plant uptake processes. Previous studies demonstrated that poplar trees are a fast-growing efficient way of removing nitrate from soil waters, and they can be deep-rooted to intercept groundwater and remove nitrate as a riparian zone buffer strip before stream recharge occurs. Greenhouse experiments show poplars can also remove pesticides from water, but the mechanism (metabolism, incorporation or volatilization) and the rate have not been quantified. This study is attempting to identify and quantify these processes and demonstrate the technology in a small plot.





## Seed Grant Program

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CHEEC awards seed grants for pilot studies involving exposure assessment, risk assessment, and other investigations of toxic environmental exposures and human health. The CHEEC Seed Grant Program supports a wide variety of research on survey design and data base creation, laboratory methods development, mathematical modeling, monitoring and measurement design and testing, and risk communication and management. Seed grants are awarded to CHEEC scientific staff, to scientists working in collaboration with center scientists, and to other meritorious projects. Qualified researchers affiliated with colleges or universities in Iowa are encouraged to submit proposals.

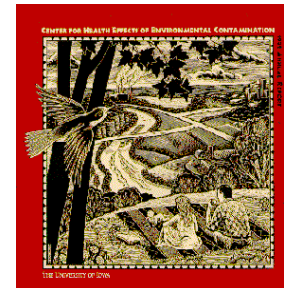
CHEEC allocates one-third of its annual operating budget as seed grants. Since July 1988, the Seed Grant Program has funded 33 projects. Results and methods from CHEEC studies are used in proposals developed by investigators to obtain federal support for more detailed research on exposure to environmental contaminants, development of adverse health effects, and assessment technologies. Seed grant projects have had a major impact on the investigators' success in acquiring federal funds. To date, a CHEEC investment of \$147,000 (13 projects) has resulted in \$1.6 million in federal funds (6 awards) for researchers to continue their work. Several proposals to federal agencies developed from seed grants are pending; 11 pilot studies are in progress.

### **Modeling dissolved oxygen, nitrate, and pesticide concentrations in the subsurface environment**

*Investigators:* JL Schnoor, DR Nair, Civil & Environmental Engineering, The University of Iowa

*Project Period:* November 1988 - October 1989

*Summary* The main goals of this project were to develop a one-dimensional (vertical) time-variable model for the transport and reaction of pesticides and nitrate through the unsaturated zone to surficial aquifers and to test and validate the model with data from laboratory and field studies on alachlor, atrazine, and nitrate. The model performed well and enabled the investigators to acquire funding from the EPA Region 7 Hazardous Substances Research Center to continue the research. If the model continues to be



successful in future tests, it can be used for predicting pesticide concentrations in surficial groundwater for different soil types, application rates, farming practices, soil microbiology/chemistry, site hydrology, and climatic conditions.

### **Development of methods for epidemiologic studies of birth defects and environmental exposures in Iowa**

*Investigators:* RG Munger, EP Isacson, CF Lynch: Preventive Medicine & Environmental Health; JW Hanson, Pediatrics; D Schwartz, Internal Medicine, The University of Iowa

*Project Period:* January 1989 - December 1989

*Summary:* This project created a questionnaire for use in the assessment of environmental exposures, lifestyle factors, and genetic factors that may increase the risk of birth defects. The study also focused on development of methods of subject contact and tracking. The questionnaire has enhanced the usefulness of the Iowa Birth Defects Registry in etiologic studies of birth defects. Questions on residency history and source of drinking water are used in analyses of linked data sets including water quality and other environmental data. The questionnaire is being utilized in a project entitled *Epidemiologic Characterization of Genetic and Environmental Risk Factors for Human Facial Clefts*, funded by the National Institute for Dental Research.

### **Pesticide oxidation by ozone for point-of-use, point-of-entry water treatment systems**

*Investigators:* BC Kross, MI Selim, J Hwang, L Odell, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* January 1989 - December 1989

*Summary:* This project examined the feasibility of ozone oxidation of alachlor, atrazine, cyanazine, metribuzin, metolachlor, and propachlor for drinking water treatment. Tests were conducted in closed and open systems with pesticide challenge concentrations in the range of ambient levels of these pesticides in contaminated groundwater and surface water in agricultural regions of the nation. Pesticide oxidation by ozone at these low concentrations is feasible and is dependent on concentration times contact time (CT). The tests showed that given a large enough CT value, oxidation of the pesticides tested to concentrations below the health advisory levels can be achieved. Support from the EPA Region 7 Hazardous Substances Research Center was obtained to continue the research.



### **Development of a model surveillance program for agricultural health and safety**

*Investigators:* JA Merchant, KJ Donham, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* January 1989 - December 1989

*Summary:* The goals of this project were to review and evaluate available mortality and morbidity data for farm health and safety in order to develop a farm injury surveillance model. A plan was drafted for a population-based surveillance program, data management system, and surveillance network that could be replicated in any agricultural state or region. Results of a pilot study conducted in several rural hospitals were used to develop a proposal to establish an Injury Prevention Research Center at The University of Iowa. This center was established through a four-year grant awarded by the Center for Environmental Health and Injury Control, Centers for Disease Control.

### **Feasibility study of DNA flow cytometry in renal cell and colorectal carcinoma among Iowa residents**

*Investigators:* CF Lynch, Preventive Medicine & Environmental Health; R Robinson, Pathology, The University of Iowa

*Project Period:* July 1989 - June 1990

*Summary:* This study evaluated the possibility of performing DNA ploidy analyses (to determine the degree of repetition of the basic number of chromosomes) on patients who participated in a statewide, cancer case-control study and who had cancerous tissue removed at The University of Iowa Hospitals and Clinics. Eligible cancer sites included the kidney, colon, and rectum. DNA ploidy analysis results were correlated with known pathologic predictors of outcome and with known risk factors for these diseases. Study results showed no strong associations between ploidy status and survival predictors or with dietary and other potential risk factors. Based on these results, no attempts were made to obtain further funding.

### **Collection of historical municipal drinking water data for Iowa municipalities population 750 to 1,000**

*Investigators:* CF Lynch, M Gleaves, M Finn, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* July 1989 - June 1990



*Summary:* This project identified the types of drinking water sources and methods of treatment that have been historically utilized in the 77 Iowa municipal supplies serving towns with a population between 750 and 1,000. Initially, a pilot study of 10 communities was conducted in which water operators were mailed a description of the historical information available on their water supplies and were asked to update it. The results of this study showed that the data collection process was efficient. Operators in the remaining 66 cities were then contacted and the data they provided were added to the existing CHEEC data base on municipal water. These data are being utilized by CHEEC researchers looking at source of drinking water and health effects. (Methods developed in this project were later utilized to collect historical water for Iowa towns population 250 to 749.)

### **Ultraviolet phototoxicity of some non-steroidal anti-inflammatory (NSAIDS) agents on the retina of the eye**

*Investigators:* TK Shires, Pharmacology; JS Pulido, Ophthalmology, The University of Iowa

*Project Period:* April 1990 - March 1991

*Summary:* Progressive global stratospheric ozone depletion and the resulting elevation in ultraviolet radiation presents the prospect of a significant human health hazard. In the eye, the cornea, lens, and retina have well-established UV radiation pathologies. Increased UV exposures may also intensify the UV-phototoxicity inherent in some therapeutic agents widely used by the general public. This study examined a number of anti-inflammatory analgesics known to be UV-phototoxic in the skin but with as yet unreported effects in the eye. Study investigators hypothesize that these widely used drugs compound the risk of retinal damage in people who have outdoor occupations.

### **Teratogenic potential of *Fusarium moniliforme* mycotoxins**

*Investigators:* S Hendrich, P Murphy, Food Science & Human Nutrition, Iowa State University; G Osweiler, Veterinary Diagnostic Laboratory, Iowa State University

*Project Period:* July 1990 - June 1991

*Summary:* The aims of this project were to determine the teratogenicity of *Fusarium* mycotoxins, especially fumonisin B1, in two animal models in order to begin risk assessment related to human exposure. The studies demonstrated a teratogenic potential for



purified fumonisin B1 (FB1), but not for *Fusarium-moniliforme*-contaminated corn. These findings suggest that either *F. moniliforme* in corn is not as bioavailable as purified FB1 or that the crude culture material contains antiteratogens. Both of these possibilities are testable. Potential human exposure to fumonisins in the food supply could reach the range of 0.75 milligram - 7.5 milligrams / 55 kilogram person per day or about 14 - 140 microgram/kilogram body weight. A proposal was submitted to NIH to continue the research, but was not funded.

#### **Development of an immunoassay for the detection of glyphosate in water**

*Investigators:* GM Breuer, SL Berberich, University Hygienic Laboratory, The University of Iowa

*Project Period:* August 1990 - July 1991

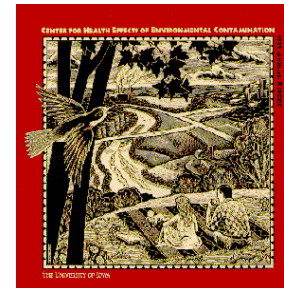
*Summary:* The aims of this study were to create a monoclonal antibody specific for the common herbicide glyphosate (trade name: Roundup) and develop an immunoassay system for rapid detection in water samples at a cost considerably less than currently available by standard analytical procedures. Problems were encountered in retaining the specificity of the antibodies generated when the glyphosate was linked. This problem had been encountered by other scientists attempting to generate antibodies to glyphosate in other studies. The costs associated with attempts to develop another attachment site for glyphosate were prohibitive; therefore, the study was not successful. The investigators have not sought additional funding to continue this line of research.

#### **An assessment of infant exposure to nitrate/nitrite in breast milk and rural well water**

*Investigators:* CI Dungy, LB Dusdieker, Pediatrics; BC Kross, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* August 1990 - July 1991

*Summary:* Nitrate/nitrite contamination of drinking water supplies is a common problem in Iowa. SWRL reported 18 percent of Iowa rural well water exceeded the U.S. EPA Health Advisory Limit of 45 parts per million NO<sub>3</sub>. This study examined the relationship between infant feeding practices and infant exposure to nitrate/nitrite in rural well water by determining if human milk contains levels of nitrate/nitrite unsafe for consumption by infants six months of age. Lactating mothers with infants over six months of age were recruited by the Clinical Research Center at The University of Iowa. The women were provided standardized water samples with



various NO<sub>3</sub> concentrations. Breast milk and urine samples were obtained at the end of each 24-hour period. The data are currently being analyzed.

### **Urban vs. rural differences in cancer incidence and mortality among Iowa residents**

*Investigators:* CF Lynch, LF Burmeister, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* August 1990 - July 1991

*Summary:* Urban-rural differences in cancer incidence and mortality in Iowa residents between 1973 and 1988 were evaluated. Incidence rates for smoking-related cancers were significantly greater in urbanized areas. Lip cancer among males was the only cancer site with a significantly elevated rate in rural areas. Mortality from smoking-related cancers was also elevated in urban areas, while rural areas showed no specific elevations in cancer mortality by type. Cancer mortality rates were generally higher in those urban and rural areas that had higher cancer incidence rates. A grant from the National Cancer Institute was obtained to continue this research to look at occupational differences and trends over time.

### **Biotransformation and transport of monoaromatic hydrocarbons under stimulated denitrifying conditions in soil columns**

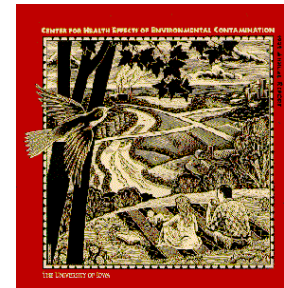
*Investigators:* GF Parkin, ME Vermace, Civil & Environmental Engineering, The University of Iowa

*Project Period:* August 1990 - July 1991

*Summary:* Leaking underground tanks and pipelines may be the largest contributors of point source contamination of groundwater, and to a lesser extent, surface water. These tanks and pipelines store and transport gasoline, diesel fuel, and waste oils, which are composed of the monoaromatic hydrocarbons benzene, ethylbenzene, toluene, and xylene (BETXs). This study examined the role of nitrate as an alternate electron acceptor for biologically mediated reactions important to in situ bioremediation. Batch and column study results showed degradation of toluene was not dependent of the presence of non-degraded BETXs, while no degradation of benzene, ethylbenzene, or xylene was noted. Further research is being funded by the Iowa State Water Resources Research Institute.

### **Birth defects in Iowa: Effects of surface water pollution in the Rathbun Lake area**





*Investigators:* RG Munger, Preventive Medicine & Environmental Health; JW Hanson, Pediatrics, The University of Iowa

*Project Period:* August 1990 - July 1991

*Summary:* A 1986-87 statewide survey of Iowa municipal water supplies reported elevated levels of atrazine in a rural water system supplied by Rathbun Lake in southern Iowa. Rates of birth defects during 1983-89 in 18 Iowa communities served by Rathbun were examined in comparison to all other Iowa communities. Rathbun communities had an excess of cardiac, urogenital, and limb reduction defects. When comparison communities were restricted to southern Iowa and matched on size, the elevated risk of these birth defects remain unchanged. Further studies looking at individual exposures to water contaminants and better control of confounding factors will be required to establish drinking water contaminated with pesticides as a cause of birth defects.

#### **Investigation of the feasibility of adapting immunoassay tests for detection of minute amounts of pesticides in water**

*Investigators:* HM Cowan, SL Berberich, University Hygienic Laboratory, The University of Iowa

*Project Period:* August 1990 - July 1991

*Summary:* This study developed a procedure to detect atrazine and alachlor in water concentrations below 0.1 microgram/liter using immunochemistry. Results showed that determining concentrations of these pesticides by immunoassay analysis are only slightly less reliable than by gas chromatograph analysis. The procedure involved using a sample routinely processed for gas chromatograph analysis and evaluating by immunoassay after evaporating off the solvent and resuspending the sample in water. This procedure is currently being used in a study investigating the levels of atrazine and alachlor in rain water.

#### **Analysis of aflatoxins in grain dust**

*Investigator:* MI Selim, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* September 1990 - August 1991

*Summary:* Aflatoxins are recognized as potent chemical carcinogens, have been associated with liver cancer in animal studies, and may be associated with lung cancer incidence in humans exposed to aflatoxins in contaminated grain dust. This project developed and validated a one-step extraction and analysis technique for the separation and quantitative determination of low levels of aflatoxins in



airborne grain dust samples. In addition, preliminary data on the levels of aflatoxins in grain dust generated during harvest and on-farm grain handling operations were collected. Results from this study were used to acquire a grant from the National Institute for Occupational Safety and Health to expand the research.

### **Development of a water quality data base to assess the factors associated with low birth weight (LBW) and intrauterine growth retardation (IUGR)**

*Investigators:* KL Cherryholmes, WJ Hausler, University Hygienic Laboratory; EP Isacson, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* January 1991 - December 1991

*Summary:* In order to investigate possible relationships between exposures to water contaminants and the development of birth defects in the Rathbun Lake area, water samples were collected and analyzed and the results linked to incidence rates of adverse health outcomes by community. The University Hygienic Laboratory collected and analyzed water samples from Rathbun Lake, from the Rathbun Regional Water Association water treatment plant, and from various points along the water distribution system to assess the seasonal fluctuation of herbicides, nutrients, and total coliforms. A data base containing the results was developed and utilized by CHEEC researchers to continue assessment of factors affecting LBW and IUGR in communities served by the Rathbun Water Association.

### **A preliminary survey of Radon-222, Radium-226, and Radium-228 in private well-water supplies in Iowa**

*Investigators:* RW Field, Preventive Medicine & Environmental Health; KL Cherryholmes, University Hygienic Laboratory, The University of Iowa

*Project Period:* January 1991 - December 1991

*Summary:* This study assessed the levels of Radon-222, Radium-226, and Radium-228 in a subpopulation of private rural wells in Iowa. These radionuclides were measured in the 10 percent repeat well sites (69) that were previously randomly selected from the sampling framework of the SWRL study. Investigators determined the percentage of wells exceeding EPA maximum contaminant





levels for these contaminants, and compared the levels in private wells to levels in public groundwater supplies. Aquifer type, well depth, and aquifer age were also used to predict the occurrence of radon and radium in private well-water supplies. Information collected from this study was used to develop a limited research data base for radon and radium in private water supplies in Iowa.

### **Assessment of exposures to bioaerosols in "sick" and "healthy" building**

*Investigator:* PS Thorne, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* January 1991 - December 1991

*Summary:* This study characterized the levels of bioaerosol contamination of indoor environments. Findings showed that fungal and respiratory bacteria concentrations were significantly higher in basements, and CO<sub>2</sub> concentrations were higher on the main floor. In addition, healthy homes had indoor viable fungal concentrations 30-35 percent of the outdoor, whereas sick homes had levels over 60 percent, and the most common fungal genera identified were *Cladosporium* and *Penicillium*. Tests of association using survey results showed age of occupant and the presence of smokers in the house to be significantly associated with increased self-reported health symptoms, including watery eyes, drowsiness, backaches, muscle/joint pain, indigestion, nausea, and flaky skin.

### **Regional radon exposure index model and epidemiological test of the model**

*Investigators:* L Fuortes, L Weih, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* May 1991 - April 1992

*Summary:* Iowa has one of the highest average in-home radon concentrations in the nation (EPA survey). This exposure becomes important in any epidemiologic study of health effects from environmental contaminants. This study developed a regional radon exposure index model based on a geological model of Iowa radon distribution from the Iowa Rural Radon Survey (IRRS). IRRS data suggest there is a difference in the proportion of homes within geological landform regions which exceed EPA action level of 4 pCi/L radon in the air. Within regions there is a great deal of variability in the levels of radon found in individual homes. Factor analysis was used to evaluate relationships between home construction, geological setting, and radon concentration.



### **Investigation of pesticides and synthetic organic compounds with adverse reproductive outcomes**

*Investigators:* MD Kramer, CF Lynch, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* July 1991-June 1992

*Summary:* This statistical study is looking at possible associations between a pregnant woman's exposure to pesticides in drinking water and resulting fetal intrauterine growth retardation (IUGR) and prematurity. Results showed no significant association between the presence of a number of commonly used pesticides (at various concentrations) and the development of either IUGR or prematurity. Presence of chloroform showed a small but statistically significant elevation in the crude odds ratio for IUGR. Current efforts focus on determining whether an association of atrazine with IUGR or prematurity exists within different levels of chloroform exposure. Following this, an attempt will be made to analyze the pesticide Bladex at various concentrations. Trihalomethanes other than chloroform will also be analyzed.

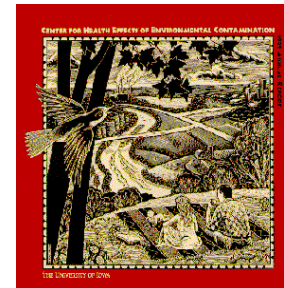
### **Radon and radium release into drinking water from distribution system deposits**

*Investigator:* RL Valentine, Civil & Environmental Engineering, The University of Iowa

*Project Period:* July 1991 - June 1992

*Summary:* Radium-containing deposits likely exist in water distribution systems exposed to radium containing water. These deposits could represent a large reservoir of radium and a major source of radon gas. This study evaluated the significance of these deposits as a source of radon and radium at several cities in Iowa with raw water supplies having a high radium content. Pipe and deposit samples were taken and analyzed within the distribution systems of these cities. Preliminary surveys of radon showed levels in the distribution system were higher than at the water treatment plant, indicating pipe deposits were responsible for increasing the radon load. An EPA grant has allowed research in this area to continue.

### **Development of a database of environmental exposures among infertile couples**



*Investigators:* K Clark, College of Nursing; E Smith, L Fuortes, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* July 1991-June 1992

*Summary:* This project is developing a data base of environmental exposures among infertile couples and identifying potential risk factors including occupation and chemical exposures, and medical, sociodemographic, and lifestyle factors. Information for the study is collected through medical record review and self-report of couples who are currently undergoing evaluation for infertility through The University of Iowa Hospitals and Clinics Gynecology and Endocrinology Clinic. Persons who report they have lived or worked on a farm for at least six months are mailed another questionnaire asking about more specific farm exposures. This data base will be used to generate hypotheses regarding possible environmental and other risk factors for both male and female infertility.

### **The impact of ozone depletion on the flux of ultraviolet radiation in Iowa**

*Investigator:* GR Carmichael, Chemical & Biochemical Engineering, The University of Iowa

*Project Period:* January 1992 - December 1992

*Summary:* This study is conducting a detailed calculation of the solar radiation reaching Iowa's surface as a function of present trends in ozone depletion, which is proceeding at a rate of 3-8 percent per decade. Ultraviolet (UV) radiation is associated with a wide variety of adverse health effects including skin cancer, cataracts, and immune systems depression. The model in use at the Max Planck Institute for Chemistry, Mainz, Germany was developed for a CRAY UNICOS environment. Results are being analyzed in terms of changes in radiation fluxes weighted by action spectrums for DNA damage, sunburning, and material damage. Calculation of the present condition and 50 years from present will provide the critical basis for detailed health impact assessments.

### **Validation of family history information obtained through parental interview**

*Investigators:* TL Burns, PA Romitti, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* January 1992 - December 1992

*Summary:* Family history information is important for epidemiologic investigations of birth defects and other health outcomes. In



particular, family history information is used to investigate an individual's genetic susceptibility to environmental contaminants. Evaluating the accuracy of information obtained from maternal interviews by assessing the effects of age, education, income, marital status, and other variables is the goal of this study. The study population includes mothers who have completed participation in the UI Craniofacial Anomalies Research Center case-control study of facial clefts. Study findings may suggest future investigations of family histories of individuals with specific birth defects.

### **Pilot studies of the possible relationship between intrauterine growth retardation, birth defects, fish kills, and the genotoxic properties of herbicides following plant activation**

*Investigators:* EP Isacson, Preventive Medicine & Environmental Health, The University of Iowa; MJ Plewa, Institute of Environmental Studies, The University of Illinois, WJ Hausler, University Hygienic Laboratory, The University of Iowa; T Jennings, M Mason, Iowa Department of Natural Resources

*Project Period:* February 1992 - January 1993

*Summary:* The purpose of this project is to determine whether plant-activated mutagens can be identified and possibly quantified from the water sources used by a regional rural water system in southern Iowa. Plant activation refers to the process by which a non-mutagenic agent is transformed by the biological action of a plant into a mutagen. This process may help in explaining separate but possibly related health outcomes which have been associated with drinking water derived from Rathbun Lake in Appanoose County, Iowa. Results from this pilot study will be used to determine whether analysis of drinking water for the presence of plant-activated mutagens is feasible and useful for future epidemiologic investigations.

### **Improving and expanding computerized municipal water-supply and water-quality data in the state of Iowa**

*Investigators:* P VanDorpe, R Talcott, Iowa Department of Natural Resources-Geological Survey Bureau (DNR-GSB)

*Project Period:* February 1992 - January 1993

*Summary:* This project involves assembling and updating a Well Identification Table (WIT) for Iowa's Municipal Water-Supply Inventory (MWSI). The MWSI combines municipal well and water supply data from the Environmental Protection Division of DNR



with geological and aquifer data from the GSB and raw water quality data obtained from the UHL and the U.S. Geological Survey. To date, every municipality and rural water supply in the MWSI has been updated through communication with DNR field offices, consultants, municipalities, and others. Historical and current water-quality analyses are being linked with information on active and abandoned municipal wells. The WIT will provide scientists with an interactive data base to conduct water-quality research.

### **Comparison of sampling methods for lead in dust**

*Investigators:* SJ Reynolds, MI Selim, PS Thorne, Preventive Medicine & Environmental Health, The University of Iowa

*Project Period:* August 1992 - July 1993

*Summary:* Childhood exposure to lead is a significant public health problem. The relationship between environmental exposure and blood lead concentrations in children is complicated by the lack of standardized sampling methods. This project evaluates and compares the efficiency and reproducibility of three methods for sampling lead in house dust. Lead-containing dust is being generated in the laboratory and deposited onto a variety of surfaces typically found in housing. Surface samples are collected using the OSHA and HUD wipe methods and vacuum-filter method. The effects of lead concentration and type of surface sampled will be examined. Study results will be used to select a dust sampling method for use in a case-control study of childhood lead exposure in rural Iowa.

### **The potential use of vegetation for bioremediation of surface soils contaminated with pesticide wastes: implications for Iowa**

*Investigators:* JR Coats, TA Anderson, Pesticide Toxicology Laboratory, Entomology, Iowa State University

*Project Period:* August 1992 - July 1993

*Summary:* The effectiveness of using vegetation to remediate surface soils contaminated with pesticide wastes is being studied at a site near Hospers, Iowa. Current research with vegetation suggests that plants could be managed to provide a cost-effective cleanup method and minimize the environmental impact of contamination through retardation of contaminant movement. Numerous sites in Iowa could benefit from this technology. By facilitating the natural microbial degradation of these compounds to less toxic metabolites, this technique would reduce migration of contaminants into groundwater, a potential pathway for human exposure. This study has applications for sites contaminated with hazardous organic compounds such as chlorinated solvents and petroleum wastes.



### **Source of drinking water and cancer incidence in Iowa**

*Investigators:* CF Lynch, MD Zhang, D Olson, Preventive Medicine & Environmental Health; PJ Weyer, KD Sesker, Civil & Environmental Engineering, The University of Iowa

*Project Period:* January 1993-December 1993

*Summary:* A 1982 University of Iowa study found increased rates of certain cancers in Iowa towns associated with source of drinking water supply. These results were not explained by any specific drinking water contaminant. This project expands on the previous study by using existing CHEEC historical community water supply and treatment data and State Health Registry of Iowa municipal cancer incidence data to (1) calculate cancer incidence rates for 16 common cancers by municipality for 1969-1990; (2) evaluate variations in cancer incidence by size of municipality; (3) determine differences in cancer incidence by source of drinking water (surface vs. ground), well depth, and aquifer of ground sources; (4) evaluate time trends in cancer incidence; and (5) compare results to findings from the 1982 study.

### **Chloramine decomposition product studies**

*Investigator:* RL Valentine, Civil & Environmental Engineering, The University of Iowa

*Project Period:* January 1993 - December 1993

*Summary:* Monochloramine, produced from the reaction of free chlorine and ammonia in a process called chloramination, is generally considered to be a leading candidate as an alternative disinfectant to replace free chlorine, which produces a variety of potentially mutagenic and carcinogenic by-products. While chloramination produces fewer organic by-products, recent work has shown at least one unidentified inorganic decomposition product is formed. The existence of an unidentified product is a cause for concern because of potential associated health effects. This study focuses on the characterization, identification, and quantification of the unknown(s) produced in chloraminated drinking water under a variety of reaction conditions.

### **Comparison of trihalomethanes in residential water using surface source water and indoor air with residential water using source groundwater and indoor air**





*Investigators:* SJ May, PA Kostle, GM Breuer, University Hygienic Laboratory, The University of Iowa

*Project Period:* March 1993 - February 1994

*Summary:* This study will examine relationships between high levels of trihalomethanes (THMs) in drinking water derived from surface sources and THMs in indoor air and compare that to THM levels in indoor air of homes with drinking water derived from ground sources. Previous studies suggest inhalation of volatile organic compounds (VOCs) may contribute more to total VOC exposure than ingestion. Other studies describe an association of exposure to THMs in drinking water with an increased incidence of bladder and rectal cancers. Several homes randomly selected in the Iowa City area (surface water source) will be monitored quarterly over one year for THM levels in tap water as well as indoor air. Homes from the surrounding area (groundwater source) will be randomly chosen as controls and will be monitored in the same fashion.

### **Communicating environmental reproductive risks: Policy recommendations**

*Investigator:* JW Hanson, Institute for Health, Behavior, and Environmental Policy, The University of Iowa

*Project Period:* March 1993 - February 1994

*Summary:* A need exists for policies and procedures to ensure the timely, orderly, and appropriate communication of information on environmental health risks to the public and health care providers. This project will develop a coordinated response by CHEEC and the Institute for Health, Behavior, and Environmental Policy to these identified needs. This project will develop a concise position paper on recommended policies, procedures, and best practices to be followed by state agencies and CHEEC in communicating information regarding reproductive risks associated with episodes of environmental contamination. Project personnel will also develop a plan and seek external support for a national workshop to be held at The University of Iowa on risk communication regarding environmental reproductive hazards.



## Educational Programs and Activities

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In order to provide information to Iowans on environmental health issues, CHEEC cosponsors conferences and participates in annual meetings and symposia. Staff present information on CHEEC research and activities at community college workshops and school career days and assist the Iowa Departments of Natural Resources and Public Health in providing expert information for public hearings on environmental health issues. Faculty have made CHEEC research presentations at a number of national conferences.

### **Conferences and Symposia**

CHEEC regularly presents poster displays of current research at professional meetings and conferences in Iowa. These meetings afford opportunities to discuss activities with scientists, health professionals, and the public. Some of the activities CHEEC has participated in include:

- Iowa Groundwater Association spring and fall meetings
- Leopold Center for Sustainable Agriculture annual conferences
- Iowa Public Health Association/Iowa Environmental Health Association annual meetings
- Farm Progress Shows
- North-Central Section Geological Society of America Conference
- Iowa State Fair
- Leadership Iowa - Conference on Environmental Issues
- Council of State Government's Environmental Task Force

CHEEC has cosponsored several conferences through planning, development, providing speakers, and funding support including:





- Iowa Department of Public Health/Agency for Toxic Substances and Disease Registry "Iowa Conference on Toxic Substance: SARA Title III - Planning, Coordination, and Response," Des Moines, 1989
- National Environmental Health Association Conference "Health Risk Analysis: Assessment, Management, Communication," Des Moines, 1991
- Center for Health Effects of Environmental Contamination/Agency for Toxic Substances and Disease Registry "Conference on Water Quality, Agriculture, and Public Health," Iowa City, 1991
- Iowa Department of Public Health/Agency for Toxic Substances and Disease Registry "Iowa Conference on Toxic Substances: Childhood Lead Poisoning," Des Moines, 1992
- Iowa Public Health Association/Iowa Environmental Health Association annual meeting, Des Moines, 1992 Conference on water quality, agriculture, and public health

In May 1991, CHEEC hosted a two-day Conference on Water Quality, Agriculture, and Public Health at The University of Iowa. The conference was attended by county public health officials, representatives of Iowa state agencies and the Iowa Environmental Protection Commission, scientists involved in water quality and pesticide research from The University of Iowa and Iowa State University, representatives of the agricultural chemical industry, members of environmental groups, and interested citizens.

The conference provided an opportunity for academic and industry researchers to discuss the environmental and health effects of agricultural chemicals in water supplies, and also served as a forum for discussion of state water-quality policies and programs. In the months following the conference, cooperative efforts on addressing water-quality problems were initiated. Discussions were held on developing collaborative studies and educational programs - efforts are ongoing in these areas. The importance of water-quality research and the public's access to information on water-quality issues and research findings were addressed, and a protocol for releasing research results that have immediate public health importance is being developed.

### **Publications and Information Dissemination**



CHEEC annually publishes reports describing research projects and educational activities and distributes these widely in Iowa. Technical reports containing environmental data are published as projects are completed and sent to researchers, regulatory agencies, and the general public upon request. To date, the following reports have been published:

- 1989, 1990, 1991, 1992 Annual Reports
- Proceedings of the CHEEC Conference on Water Quality, Agriculture, and Public Health
- Historical Community Water Supply and Treatment Data for the State of Iowa
- Historical Community Well and Aquifer Data for the State of Iowa
- Iowa Statewide Rural Well Water Survey (SWRL) technical reports

CHEEC administrative and data management staff respond to requests for information on a wide variety of subjects. Water-quality and treatment data are provided for university-based researchers and scientists from government agencies and the private sector. Information on possible health effects from exposure to toxic chemicals is requested by concerned citizens, environmental action groups, state and local government officials, and the media. CHEEC acts as a state resource for environmental health information by providing referrals and aiding persons in accessing national health and toxicological computer files.

CHEEC has fielded information requests from the National Cancer Institute, U.S. EPA, the Farmer's Home Administration, the League of Women Voters, Americans for Safe Food, the National Heritage Foundation, the National Farm Medicine Center, the U.S. Geological Survey, Monsanto Company, the Michigan and Arizona Public Health departments, Iowa House Committees and research staffs, the Iowa Attorney General's office, the Iowa Departments of Natural Resources and Agriculture and Land Stewardship, the Des Moines Register, the Boston Globe, Farm Magazine, Water Technology Magazine, researchers at Clemson University, Iowa State University, the University of Northern Iowa and The University of Iowa, Iowa county health departments, the Iowa Association of Municipal Utilities, engineering consulting firms, and others.

### **The CHEEC Seminar Series**



CHEEC sponsors a seminar series on environmental health and related issues. The following seminars have been presented on the campus of The University of Iowa since 1987:

*"The role of hazardous waste cleanup in protecting human health"* J. Winston Porter, Ph.D., Assistant Administrator for Solid Waste and Emergency Response, U.S. EPA, Washington, D.C.

*"Environmental epidemiology: Separating politics and science"* Michael Gough, Ph.D., Project Manager, Environ Corporation, Washington, D.C.

*"Endangerment assessment at Superfund sites"* Jerald Schnoor, Ph.D., Professor of Civil and Environmental Engineering, The University of Iowa

*"Love Canal: At the frontier of science and politics"* John Deegan, Jr., Ph.D., Dean of College of Social and Behavioral Sciences, University of Northern Iowa

*"Trihalomethanes in Iowa municipal drinking water supplies"* Charles Lynch, M.D., Ph.D., Assistant Professor of Preventive Medicine and Environmental Health, The University of Iowa

*"Sustainable agriculture and environmental health"* David Osterberg, State Representative, Mt. Vernon, Iowa; Chair, Agriculture Committee, Iowa House of Representatives

*"Agent Orange: The misuse and abuse of science by the United States government"* Jeanne M. Stellman, Ph.D., Associate Professor, School of Public Health, Columbia University, New York

*"Studies of non-occupational radon exposure and lung cancer"* John Neuberger, M.D., Associate Professor of Preventive Medicine, University of Kansas Medical Center



*"The annual report on carcinogens: A study in science, policy, and the law"* Dorothy Canter, Ph.D., National Toxicology Program, National Institute of Environmental Health Sciences

*"Risk assessment and EPA drinking water standards"* Joseph Cotruvo, Ph.D., Director of Criteria and Standards, Office of Drinking Water, U.S. EPA, Washington, D.C.

*"Fate and transport of alachlor and atrazine in the subsurface environment: Laboratory and field studies"* Gene Parkin, Ph.D., Professor and Chair of Civil and Environmental Engineering, The University of Iowa

*"The Statewide Rural Well Water Survey"* Burton Kross, Ph.D., Assistant Professor of Preventive Medicine and Environmental Health, The University of Iowa

*"The National Alachlor Well-Water Survey: An overview"* Larry Holden, Ph.D., and Andrew Klein, Ph.D., Monsanto Agricultural Company, St. Louis

*"Environmental liabilities in Iowa - and waste reduction solutions"* John Konefes, Director, Iowa Waste Reduction Center, University of Northern Iowa

*"Our environment - Our responsibility"* Ralph Nader cosponsored by: UI Environmental Coalition, Riverfest, College of Law, WORKSAFE IOWA, UI Injury Prevention Research Center, Center for Agricultural Disease and Injury Research Education and Prevention, UI Environmental Health Sciences Research Center

*"The 1990 Clean Air Act Amendments: A panel discussion"* Allan Stokes, Environmental Protection Division, Iowa Dept. of Natural Resources; Peter Thorne, Ph.D., Assistant Professor of Preventive Medicine, The University of Iowa; Jerald Schnoor, Ph.D., Professor of Civil & Environmental Engineering, The University of Iowa; Robert Patrick, Air and Toxics Branch, Office of Regional Counsel, U.S. EPA, Region VII, Kansas City



*"Natural cleansing and bioremediation of oiled shoreline in Prince William Sound"* Hans O. Jahns, Ph.D., Research Manager, Exxon Production Research Company, Houston, Texas

*"Great Lakes Initiative to protect streams from toxics: Too early or too late?"* William Beranek, Jr., Ph.D., Indiana Environmental Institute, Inc., Indianapolis

*"The New Jersey case-control radon study: Policy implications"* Judith Klotz, Ph.D., Environmental Health Service, New Jersey State Department of Health

*"It's healing time on Earth"* David Brower, Chairman, Earth Island Institute; cosponsored by the UI Lecture Committee, the UI Environmental Coalition, and the UI Institute for Agricultural Medicine and Occupational Health

*"Potential health effects of global environmental change"* Janice Longstreth, Ph.D., Technology Policy and Analysis Center, Battelle Pacific Northwest Laboratories, Washington, D.C.

*"Drugs and chemicals in breast milk"* Anthony Scialli, M.D., Professor of Obstetrics and Gynecology, Georgetown University Medical Center, Washington, D.C.

*"Mechanisms of plant activation of environmental chemicals into mutagens"* Michael Plewa, Ph.D., Professor of Genetics, Institute for Environmental Studies, University of Illinois at Urbana-Champaign

*"Public water distribution systems as a source of radon in drinking water"* Richard Valentine, Ph.D., Associate Professor of Environmental Engineering, The University of Iowa.





## Who We Are

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### **The Executive Committee**

The CHEEC Executive Committee is comprised of University of Iowa faculty from the Department of Civil and Environmental Engineering in the College of Engineering and from the Departments of Preventive Medicine and Environmental Health and Pediatrics in the College of Medicine. Brief biographical sketches of committee members are presented below. Research project summaries are provided in the section on the [Seed Grant Program](#).

*James W. Hanson, M.D.*

Dr. Hanson is Professor of Pediatrics and Director of the Institute of Health, Behavior, and Environmental Policy at The University of Iowa. He is Principal Investigator of the Iowa Birth Defects Registry. Dr. Hanson's research interests include the effects of environmental agents on fetal growth and development, patterns of malformation and abnormal fetal development, birth defects epidemiology, and public health aspects of genetics.

Dr. Hanson has been involved in several CHEEC research projects investigating the results of pregnant women's exposure to environmental toxins, including:

- Development of methods for epidemiologic studies of birth defects and environmental exposures in Iowa
- Birth defects in Iowa: Effects of surface water pollution in the Rathbun Lake area
- Communicating environmental reproductive risks: Policy recommendations

*William H. Hausler, Jr., Ph.D.*



Dr. Hausler has been Director of the University Hygienic Laboratory since 1965 and holds a joint appointment as Professor of Preventive Medicine and Professor of Oral Pathology at The University of Iowa. Under his leadership, the Hygienic Laboratory has become one of the finest environmental and public health laboratories in the country. Dr. Hausler has directly participated in the drafting of state and federal legislation on issues dealing with the environment and clinical laboratory regulations.

Dr. Hausler is co-Principal Investigator on CHEEC-funded laboratory projects analyzing surface water samples for pesticides and their metabolites, including:

- Development of a water-quality data base to assess the factors associated with low birth weight and intrauterine growth retardation
- Pilot studies of the possible relationship between intrauterine growth retardation, birth defects, fish kills, and the genotoxic properties of herbicides following plant activation

*Burton C. Kross, Ph.D., P.E.*

Dr. Kross is Associate Professor of Preventive Medicine and Environmental Health with a secondary appointment in Civil and Environmental Engineering, and is Director of the Center for International Rural and Environmental Health at The University of Iowa. Dr. Kross' research interests involve groundwater monitoring, assessment and policy issues, hazardous waste risk assessment, indoor radon gas exposures, and pesticide exposure assessment methods.

Dr Kross was co-Principal Investigator on the SWRL study and has conducted the following CHEEC projects:

- Pesticide oxidation by ozone for point-of-use point-of-entry water treatment systems
- An assessment of infant exposure to nitrate/nitrite in breast milk and rural well water

*Charles F. Lynch, M.D., Ph.D.*





Dr. Lynch is Assistant Professor with a joint appointment in Preventive Medicine and Environmental Health and Pathology at The University of Iowa. He is Principal Investigator of the Iowa Surveillance, Epidemiology and End Results (SEER) Program, and is Director of the CHEEC Environmental Data Management Core. Dr. Lynch's research interests include the pathology of cancer, cancer epidemiology, environmental epidemiology, and adverse reproductive outcome epidemiology.

Dr. Lynch is Principal Investigator or co-Investigator on a number of CHEEC projects, including:

- Collection of historical municipal drinking water data for Iowa municipalities population 250-1,000
- Feasibility study of DNA flow cytometry in renal cell and colorectal carcinoma among Iowa residents
- Urban vs. rural differences in cancer incidence and mortality among Iowa residents
- Investigation of pesticides and synthetic organic compounds with adverse reproductive outcomes
- Source of drinking water and cancer incidence in Iowa

*Ronald G. Munger, Ph.D.*

Dr. Munger is Assistant Professor of Preventive Medicine and Environmental Health at The University of Iowa and is co-Principal Investigator of the Iowa Birth Defects Registry. His research interests include cardiovascular disease in Southeast Asian refugees, sudden death and sleep disorders, surveillance and analytical methods for birth defects, diet and osteoporosis, and international health (Thailand, the Philippines, and Japan).

Dr. Munger has been involved with investigating the association of birth defects with exposures to drinking water contaminants. His CHEEC research includes:

- Development of methods for epidemiologic studies of birth defects and environmental exposures in Iowa
- Birth defects in Iowa: Effects of surface water pollution in the Rathbun Lake area



*Gene F. Parkin, Ph.D.*

Dr. Parkin is Professor and Chair of Civil and Environmental Engineering at The University of Iowa and Director of CHEEC. He has expertise in biodegradation of organic chemicals and in the fate and effects of toxic materials in the subsurface and in above-ground treatment systems. He has served as a consultant to industry for assessing the feasibility of in situ biodegradation for remediation of various hazardous wastes.

As director, Dr. Parkin is involved in the daily management of CHEEC, and works directly with University and State officials on environmental health issues affecting Iowans. His CHEEC research focuses on the degradation of pesticides and other toxic substances, and includes

- Modeling dissolved oxygen, nitrate, and pesticide concentrations in the subsurface environment
- Biotransformation and transport of monoaromatic hydrocarbons under stimulated denitrifying conditions

*Peter S. Thorne, Ph.D.*

Dr. Thorne is Associate Professor of Toxicology in Preventive Medicine and Environmental Health at The University of Iowa. His current research interests include animal models of pulmonary hypersensitivity diseases and pulmonary hyperreactivity, evaluation and control of chemical and microbiological toxicants in agricultural and industrial environments, and methods of sampling and analysis of bioaerosols and aeroallergens.

Dr. Thorne's CHEEC research focuses on exposures to airborne contaminants in homes and other living areas, and includes

- Assessment of exposures to bioaerosols in "sick" and "healthy" buildings
- Comparison of sampling methods for lead in dust



*Richard L. Valentine, Ph.D.*

Dr. Valentine is Associate Professor of Civil and Environmental Engineering at The University of Iowa. He has consulted for industry and government on removing and biodegrading toxic substances in water supplies. His research interests focus on drinking water treatment including chemical oxidation and metal oxide absorbents and oxidation catalysts, chlorine-chloramine chemistry, radium and radon sources and removal, and chemical weathering/dissolution kinetics of natural minerals. Dr. Valentine is Principal Investigator on two CHEEC-funded projects:

- Radon and radium release into drinking water from distribution system deposits
- Chloramine decomposition product studies

*Jerald L. Schnoor, Ph.D.* (Currently on leave of absence from the committee)

Dr. Schnoor is Professor of Civil and Environmental Engineering at The University of Iowa and is co-Director of the UI Center for Global and Regional Environmental Research. His research interests include surface water and groundwater quality monitoring and the physical-chemical treatment of toxic chemicals.

*Peter Isacson, M.D.* (Committee member 1987-1991)

Dr. Isacson is Professor Emeritus of Preventive Medicine, former Chair of the Department of Preventive Medicine and Environmental Health, and served as Director of CHEEC in 1987-88. Dr. Isacson retired in 1991 and remains active in environmental issues in the community.

*James Merchant, M.D., Dr.P.H.* (Committee member 1987-1992)



Dr. Merchant is Professor of Preventive Medicine and Environmental Health and Director of the Institute for Agricultural Medicine and Occupational Health at The University of Iowa. His research interests include occupationally related lung disease, agricultural health and safety, and rural and environmental health.

*Ex-Officio Members*

Cheryl Contant, Ph.D., Associate Professor and Chair, Department of Urban and Regional Planning, The University of Iowa

Derek Willard, Ph.D., Associate Vice President for Research, The University of Iowa

George Hallberg, Ph.D., State Geologist, Iowa Department of Natural Resource-Geological Survey Bureau

**Center Staff**

CHEEC employs two full-time computer programmer/analysts, a full-time program coordinator, and a half-time secretary. In addition, University of Iowa students are employed as needed to assist in data collection and management activities related to the environmental data bases. Staff are involved in the daily activities related to education and service and provide support for research projects.

**The Advisory Committee**

The Iowa Groundwater Protection Act mandated the establishment of an advisory committee for CHEEC, comprised of representatives from the following areas within The University of Iowa:

- Department of Preventive Medicine and Environmental Health
- Department of Pediatrics
- University Hygienic Laboratory



- Institute of Agricultural Medicine and Occupational Health
- Iowa Cancer Center
- Department of Civil and Environmental Engineering
- "appropriate" clinical and basic science departments
- College of Law
- College of Liberal Arts and Sciences

The following Iowa agencies are also represented on the committee:

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

Responsibilities of the committee (which meets twice yearly) include reviewing and approving center operating budgets, advising on research directions CHEEC is pursuing or may be interested in pursuing, bringing to the executive committee's attention questions and problems about environmental exposures and the public health, providing advice and counsel on environmental health issues and on matters relating to the operation of the center, and public communication of center research results.



### **Staff**

Melinda Cartwright, Programmer/Analyst  
Kerry Sesker, Senior Programmer/Analyst  
Gloria Wenman, Secretary  
Peter Weyer, Program Coordinator

### **Executive Committee**

Gene Parkin, Ph.D., Director  
James Hanson, M.D.  
William Hausler, Jr., Ph.D.  
Burton Kross, Ph.D., P.E.  
Charles Lynch, M.D., Ph.D.  
Ronald Munger, Ph.D.  
Peter Thorne, Ph.D.  
Richard Valentine, Ph.D.

### **Advisory Committee (1988-1992)**

Keith Cherryholmes, Ph.D., University Hygienic Laboratory  
(Chair)  
Barrie Anderson, M.D., The University of Iowa (UI) Cancer  
Center  
JoAnn Benda, M.D., UI Department of Pathology  
Trudy Burns, Ph.D., UI Department of Preventive Medicine  
and Environmental Health  
James Combs, Iowa Department of Natural Resources  
Kelley Donham, D.V.M., UI Institute of Agricultural Medicine  
and Occupational Health  
Lon Drake, Ph.D., UI Department of Geology  
Daryl Frey, Iowa Department of Agriculture and Land  
Stewardship  
Jack Kelley, Iowa Department of Public Health  
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  
Mary Waziri, M.D., UI Department of Pediatrics  
Nancylee Siebenmann, Environmental Protection Commission  
(ad hoc)



**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

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