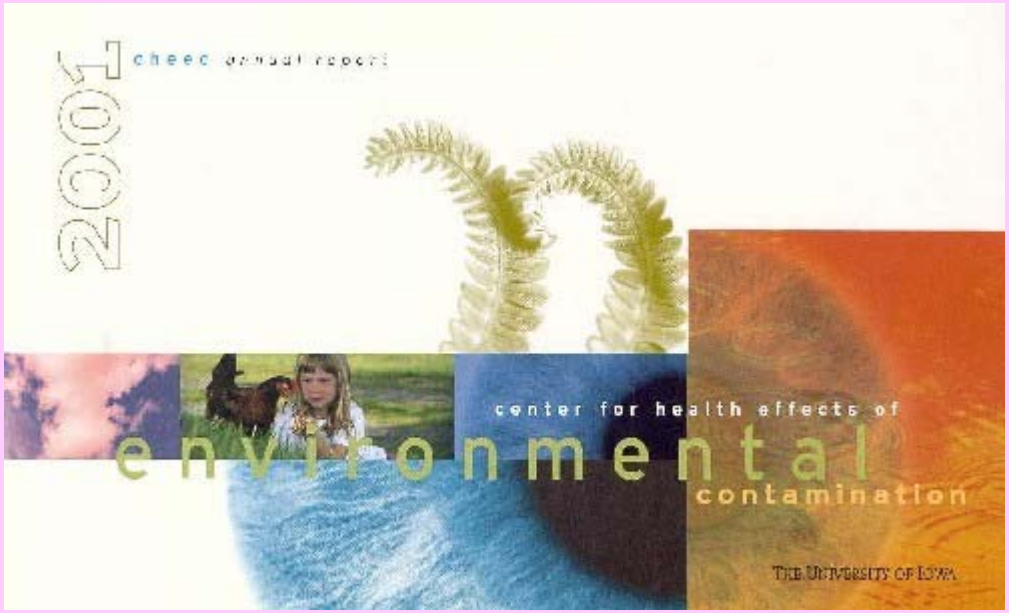
Center for Health Effects of Environmental Contamination | CHEEC

2001 Annual Report



Improved health owes less to advances in medical science than to changes in external environment, and to a favorable trend in the standard of living. We are healthier than our ancestors not because of what happens when we become ill but because we do not become ill: and we do not become ill not because of specific protective therapy but because we live in a healthier environment.

WHO Report
Grundy F,. and Mackintosh, J
Quoted in *Man Adapting*
Rene Dubos, 1965

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The Iowa Groundwater Protection Act

In 1987, the Iowa State Assembly passed the Groundwater Protection Act, a sweeping bill addressing groundwater protection and pollution prevention from many fronts. Language recognized the importance of groundwater for Iowans and proclaims:

- Groundwater is a precious and vulnerable natural resource.
- Protection of groundwater is essential to the health, welfare, and economic prosperity of all citizens of the state.
- Any detectable quantity of a synthetic organic compound in groundwater is unnatural and undesirable.
- Preventing contamination of groundwater is of paramount importance.

Fifteen years later the Groundwater Protection Act continues to be referred to as 'landmark legislation', 'visionary', and 'model for other states'.

The declared goal of the Groundwater Protection Act is a simple one:
The intent of the state is to prevent contamination of groundwater from point and nonpoint sources of contamination to the maximum extent practical, and if necessary to restore the groundwater to a potable state, regardless of present condition, use, or characteristics.

To help reach that goal, the legislation created three research centers at the Regents institutions: the Leopold Center for Sustainable Agriculture at Iowa State University, the Iowa Waste Reduction Center at the University of Northern Iowa, and the Center for Health Effects of Environmental Contamination at the University of Iowa.

CHEEC History

A team of University of Iowa environmental researchers were given the tasks of developing and providing guidance in a new research center whose mission would be to ‘determine levels of environmental contamination which can be specifically associated with human health effects.

The legislation contains guiding principals upon which CHEEC should focus its efforts and activities. Among them are:

- Assemble all pertinent laboratory data on the presence and concentration of contaminants in soil, air, water, and food, and develop a data retrieval system to allow the findings to be easily accessed by exposed populations.

  CHEEC has created a comprehensive municipal drinking water database for the state of Iowa. The database has been used for epidemiologic health studies, environmental assessment, and water monitoring policy development.

  Over 1 million distinct chemical analytical results have been collected in a municipal drinking water database. CHEEC has expended considerable effort in compiling these data from various sources, including state and federal surveys, special studies, and utility-based laboratory information. Much of the historical data were collected with no intention of the impact drinking water might have on human health. For example, inorganic analysis from statewide surveys in the 1930s and 1960s were done in response to drought conditions and water supply questions. Yet these same data have proven invaluable for health studies looking at nitrate in drinking water supplies. The database also contains extensive water source and treatment information. Current ongoing research is considering the relationships between source water contamination and optimizing water treatment techniques. To a lesser degree, CHEEC has also been engaged in supporting soil and air contamination studies. These activities have been through cooperative arrangements with interested academic and state entities, and through the CHEEC seed grant program. Individual projects have looked more closely at site specific locations, or are utilizing geographical analysis to model spatial characteristics of contamination. These projects offer a valuable service component in the development of public policy and contribute to the overall understanding of environmental factors and health effects. Research in food contamination has been more limited. Studies have addressed natural toxins that are part of on-farm food production.

- Foster relationships and ensure the exchange of information with other teaching institutions or laboratories in the state which are concerned with the many forms of environmental contamination.
- Make use of data from the existing cancer and birth defect statewide recording systems and develop similar recording systems for specific organ diseases which are suspected to be caused by exposure to environmental toxins.

  CHEEC has worked closely with the Iowa Department of Natural Resources, the United States Geological Survey, and the University of Iowa Hygienic Laboratory in the development of environmental databases. Much of the early database development involved creating a system in which computers across agencies share data. These entities provide the backbone of water quality data collection and measurement, both in historical records of drinking water and for ongoing surveys. CHEEC's niche has been to create a repository of the data that can be used for human exposure assessments. Working cooperatively has resulted in an easier transfer of both historical data and newly collected data for use in health studies.

  Collecting environmental data is only half the story. CHEEC also works cooperatively with the Iowa Birth Defects Registry, The Iowa Cancer Registry, and with researchers at the National Cancer Institute, and the Agency for Toxic Substances and Disease Registry to link exposure data to health outcomes.

  The puzzle fits together with the help and commitment of many people in a variety of occupations and agencies. It requires the help of drinking water treatment plant operators who collect drinking water samples. At the laboratory analytical chemists measure individual compounds in the water. Across the state abstractors are reviewing medical records that will eventually become part of the cancer or birth defects registries. Pathologists are diagnosing disease. Epidemiologists are statistically analyzing the risk to diseases. These people and many others are vital and necessary components for studies CHEEC conducts.

- Respond as requested to any branch of government for consultation in the drafting of laws and regulations to reduce contamination of the environment.

  CHEEC staff have served in a array of environmental work groups and ruling making committees at the local and state level. These include essential policies that deal with air, water, and soil. CHEEC's expertise provides the public health and environmental engineering perspective in addressing environmental contamination. For example, staff have participated in

initial meetings to discuss the development of the Iowa Ambient Water Monitoring Network conducted by the Iowa Department of Natural Resources, and to assist and coordinate follow-up studies on a population impacted by an agricultural

CHEEC Seed Grant Program Highlights

Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations. --- World Health Organization

The CHEEC seed grant program has had a tremendous impact on environmental health research in Iowa and has functioned as economic development capital for environmental health research. Beginning with the first grant awards in 1989, to date CHEEC has distributed over $1,200,000 dollars in research monies. The grant program accounts for over 30% of the state appropriations CHEEC receives. In return, these projects funded by CHEEC grants have generated over $7,500,000 in additional external funding from private and public sources. Using 1999 as the baseline, that translates to an eight dollar return for every dollar invested in the seed grant program.

The definition of environment health is broad and diverse; this diversity is reflected in the scope of projects funded by CHEEC. Support has been directed at phytoremediation, a technique that utilizes the natural ability of plants to intercept and breakdown contaminants in soil and groundwater. Epidemiologic studies have investigated the role water treatment softening technologies play in the relationship to heart disease; exposure to pesticides in drinking water and the risk for adverse reproductive outcomes; recent studies are investigating environmental risk factors for the development of asthma in children. Air studies have explored grain dusts impact on farm workers, measurements of pesticides in ambient air within the state, and measuring air emissions from large swine confinement facilities. The seed grant program has funded emerging basic science research as well, including studying hepatitis E virus contamination of surface waters, and a first in its kind effort investigating antibiotic resistant ba cteria in Iowa surface waterways.

What is the return to Iowans? The obvious return is supporting the research mission of the Regents universities. Yet much of this research has benefited Iowans and, on a broader scale, has worldwide application. Phytoremediation efforts have moved from the laboratory and are being used to reduce nitrate runoff from farm fields, to provide an extra barrier at municipal landfills by intercepting subsurface water movement, and to remediate contamination at the Iowa Army Ammunition Plant. It is a cost effective

technology that has saved millions of dollars in cleanup and is an important pollution prevention strategy. Drinking water treatment studies have added to a body of knowledge ensuring the continued quality of water at the tap. Small scale research funded by CHEEC has enhanced the ability of epidemiologic studies in refining exposure assessment, thus improving the overall quality of multimillion dollar epidemiological studies. Graduate students receive important training through seed grant funds as monies t o grant recipients frequently fund graduate level student research. Forty percent of the grants have generated either a Masters or Ph.D. thesis. These students go on to careers in public health, environmental engineering, and chemistry in both the private and public sectors.

FY 2001 Seed Grants

In 2001,CHEEC continued to pursue the goals of the Groundwater Protection Act through research and activities in response to the mission created fifteen years ago. CHEEC awards approximately one-third of its annual state appropriation as grants for pilot studies on exposure or risk assessment of environmental contaminants.

In FY 2001,CHEEC awarded the following research grants.

Emission estimation, measurement, and modeling of ambient ammonia concentrations
Investigators: PT O 'Shaughnessy, KJ Donham, Department of Occupational and Environmental Health, G Carmichael, Department of Chemical and Biochemical Engineering, The University of Iowa
*Summary:*The profusion of swine confinements in Iowa has led to many areas in Iowa where local populations are exposed to atmospheric ammonia,and other gases,generated by these facilities.The research for this grant will center on collecting the data necessary for the development of ammonia-emission and dispersion models to determine the levels of ammonia in the vicinity of swine confinements.For this,sensitive analytical instruments are needed to measure the low levels (<1 ppm)of ammonia expected in the atmosphere.Studies will be conducted to establish the accuracy of several ammonia sampling instruments in the laboratory prior to application in field.Field work will also include the sampling required to estimate ammonia emissions from a working swine confinement.A box model and plume dispersion model will be developed to relate emissions to expected ambient concentrations.Future work will then involve the development of a sophisticated three-dimensional combined meteorological and ammonia exposure model to estimate ambient ammonia given the various chemical reactions ammonia undergoes in the atmosphere.

Assessment of low-level hydrogen sulfide exposure among wastewater treatment workers
Investigators: SJ Reynolds, Department of Occupational and Environmental Health, The University of Iowa; J Johnson, Environmental Health Systems,Iowa City, Iowa
Summary: Hydrogen sulfide (H_2S) is a toxic gas generated in significant quantities from a variety of industrial processes and wastewater treatment. Acute exposures to high levels of H_2S (>1000 ppm) have been fatal in many instances. Conflicting and sometimes inconclusive studies regarding the health effects associated with low level (<20 ppm) chronic exposure to H_2S have led to

increased interest in H_2S both as an occupational and an ambient air pollutant.Very limited quantitative data exist on the longer-term low-level H_2S exposures likely to be encountered by workers in the wastewater treatment industry.By characterizing H_2S exposures during specific tasks in four large and four smaller wastewater treatment facilities over an extended period, the study will collect information needed to conduct future risk assessments or epidemiological studies in order to characterize the health risks, if any, that may be involved in exposure to low concentrations of hydrogen sulfide.The study will also identify factors associated with potential high-level exposures.

Service and Education

CHEEC staff participated in a variety of environmental health service and education activities in 2001.Staff participated in a series of informal roundtable discussions organized by the Des Moines Water Works on water quality and agricultural issues. The group is comprised of drinking water utility managers and agribusiness leaders. Last year the group released a series of fact sheets on nitrate which can be accessed at http://www.cheec.uiowa.edu/nitrate/faq.html.The CHEEC Associate Director gave a series of talks on nitrate and endocrine disruptors to state and national audiences this past year. He participated in syndicated radio broadcasts and webcast events discussing Center research on these topics.

CHEEC sponsors a continuing seminar series on environmental health issues. The following seminars were held on the University of Iowa campus in 2001.

"Factory farm use of antibiotics: A growing threat to public health"
Speaker: David Wallinga, MD, Institute for Agriculture and Trade Policy
co-sponsored with the UI Department of Occupational and Environmental Health

"Evidence for transfer of tylosin and tylosin-resistant bacteria in air from swine production facilities using sub-therapeutic concentrations of tylan in feed"
Speaker: Jim Zahn, Ph.D., Swine Odor and Manure Management Research Unit, US Department of Agriculture-Agricultural Research Service, National Swine Research &Information Center
co-sponsored with the University of Iowa Hygienic Laboratory

During 2001,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.

Data Management

During 2001, CHEEC Data Management Center (CDMC) staff provided full system support for programming, local area network administration, database design/administration, and applications development for in-house and state and federally funded environmental health research projects. Environmental databases are designed and managed on the Oracle database management system.

CDMC created and maintains computerized databases on Iowa water quality, including the Iowa Historical Municipal Water Treatment and Supply Database, the Municipal Analytical Water Quality Database, and the Statewide Rural Well Water Survey (SWRL). CDMC continues providing full system support for the Agricultural Health Study funded by the US EPA, National Cancer Institute, and National Institute of Environmental Health Sciences. In 2001,CHEEC research efforts included: 1)continued collaboration with the American Water Works Association Research Foundation and the University of Colorado modeling disinfection by-products in drinking water distribution systems; 2)completion of a study with the IDNR and University Hygienic Laboratory investigating ammonia in municipal drinking water wells and potential adverse health outcomes; 3)ongoing work with the National Cancer Institute on nitrate research; and 4)preliminary work on a cooperative project titled Statewide Study of Drinking Water Quality in Iowa Communities without Public Water Systems.

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Department of Occupational and Environmental Health

Department of Pediatrics

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University Hygienic Laboratory

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