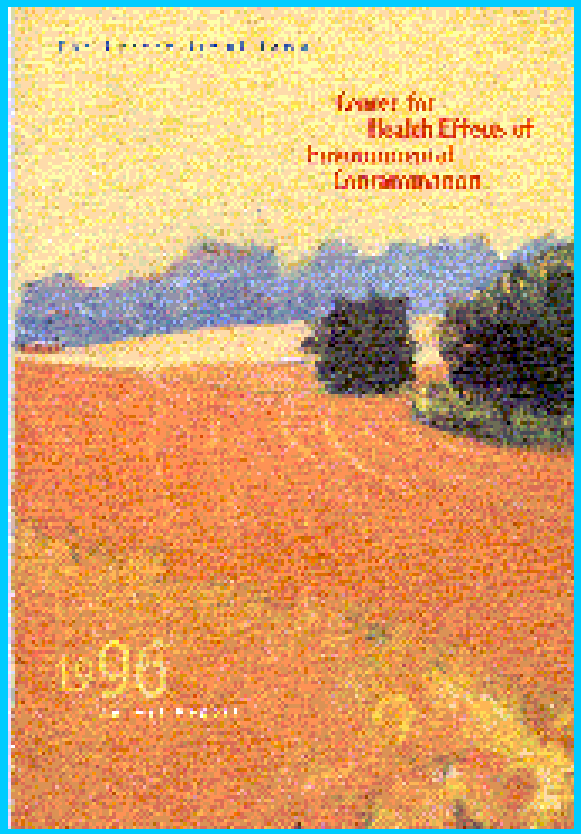
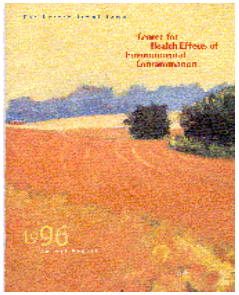
Center for Health Effects of Environmental Contamination | CHEEC

1996 Annual Report



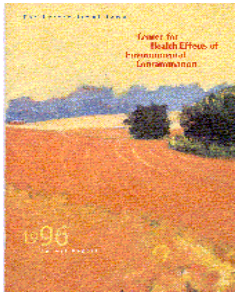


1997 has been designated by Governor Branstad as the Year of Water in Iowa to celebrate a decade of progress since the passage of the 1987 Groundwater Protection Act. The Act established a number of programs aimed at both pollution prevention and cleanup of Iowa's water supplies. The Center for Health Effects of Environmental Contamination (CHEEC) was established at the University of Iowa "to determine the levels of environmental contamination which can be specifically associated with human health effects." Sister centers were established at the other Regent's institutions: the Leopold Center for Sustainable Agriculture at Iowa State University, and the Iowa Waste Reduction Center at the University of Northern Iowa.

In 1996, the CHEEC Data Management Center (CDMC) continued to update the many water quality databases we manage. For example, in cooperation with the University Hygienic Laboratory, the CDMC is adding information on finished drinking water quality collected under the Safe Drinking Water Act. In addition, the CDMC continues to provide data management support to a wide variety of health effects research, including the *Agricultural Health Study*, the *Residential Radon and Lung Cancer Case-Control Study*, and the *Mammography Surveillance Pilot Study*. The CDMC also began a collaborative effort with the Iowa Birth Defects Registry and the Agency for Toxic Substances and Disease Registry to study the effects of synthetic and volatile organic chemicals on the development of birth defects.

We continue to allocate approximately one-third of our budget to seed grant research. Through fiscal year 1996 we have invested approximately $725,000 in seed grants. Results of these seed grants have been used to help generate almost $4 million in external funds. We funded eight new seed grants during fiscal year 1996.

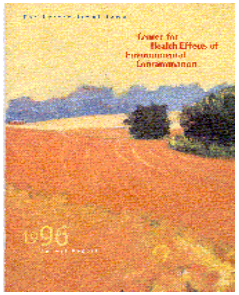
Our education and service activities in 1996 were many and varied. A number of seminars were sponsored and CHEEC participated in a variety of professional and public environmental education programs. For example, we were a co-sponsor of the 8th International



Workshop on Glucuronidation. A major activity was the organization of the first Johnson County Water Festival, a public education program aimed at the family unit with two days of activities at Northwest Junior High School in Coralville.

We in CHEEC are proud of our 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 understanding of human health as it is affected by environmental contamination. We hope you enjoy our report and find it useful!

Gene Parkin, Director



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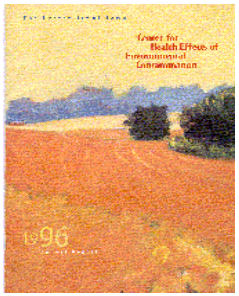


Data Management Center

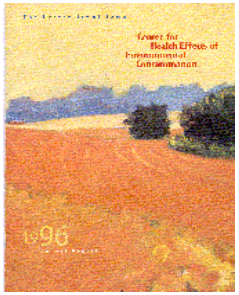
The CHEEC Data Management Center (CDMC) has a staff of three full time database analysts who provide full support for system programming, local area network administration, database design and administration and applications development. Environmental databases are designed and managed on the Oracle database management system. The CDMC provides computer services for several state and federally funded environmental health research projects.

Water Databases

CDMC staff continue to update and maintain data on Iowa drinking water supplies. During 1996, several activities focused on adding information to the CHEEC system.

Historical Municipal Water Supply and Treatment Database
Water treatment plant operators statewide (municipalities of >400 population) were contacted regarding any recent changes in treatment processes and any changes in use of water sources (new wells or closed wells). This information is current through 1996 and will be published in the 3rd edition of *Historical Community Water Supply and Treatment Data for the State of Iowa,* due out in the fall of 1997.

Municipal Analytical Water Quality Database
During 1996, historical information on nitrate and their naturally-occurring minerals in municipal supplies from the mid 1930's and early 1960's was added to the CHEEC system. In cooperation with the University Hygienic Laboratory, CDMC staff provided computer support and statistical analysis on water quality data collected under the Safe Drinking Water Act (SDWA). This effort was undertaken to assist the Iowa Department of Natural Resources-Environmental Protection Division. SDWA monitoring is an ongoing



effort to analyze the chemical content of all finished Iowa public water supplies. SDWA monitoring began in 1988 and was phased in over time; the CHEEC/UHL analysis covers 1988-95.

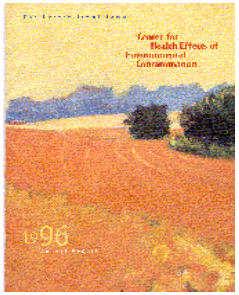
The SDWA database is important for several reasons. First, it provides an ongoing look at finished water supplies; in the past, many monitoring efforts and databases focused on raw samples. Secondly, it provides a comprehensive overview of the quality of water being consumed by Iowans using public water supplies. Finally, it identifies temporal trends in water quality to see where improvements in water quality have been made and where problem areas exist. The report documented that

- 25% of the more than 450,000 analytical results present a quantified detection;
- 2.2% of all results exceeded federal Maximum Contaminant Levels (MCLs);
- nearly 26% of Iowa public water supplies had a detection of a regulated synthetic organic chemical or a volatile organic chemical; and
- trihalomethanes followed by atrazine were the most commonly detected organic chemicals.

CHEEC has responded to requests for SDWA information from students, University researchers and federal environmental health agencies. The database design provides easy linkage to all CHEEC water databases and State Health Registry health outcome databases; the full SDWA monitoring report can be obtained from CHEEC.

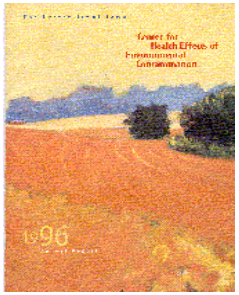
CDMC Research

Systems and applications support continues for the *Agricultural Health Study* (funding agencies: National Cancer Institute (NCI)/National Institute for Environmental Health Sciences (NIEHS)/Environmental Protection Agency (EPA)), systems support is ongoing for the *Residential Radon and Lung Cancer Case-Control Study* (NIEHS), and work on the *Mammography Surveillance Pilot Study* (NCI) continues.



In 1996, a collaborative effort was established between CHEEC, the Iowa Birth Defects Registry and the Agency for Toxic Substances and Disease Registry (ATSDR) to analyze levels of various synthetic organic and volatile organic chemicals in Iowa municipal water supplies and correlate these with incidence rates of specific categories of birth defects. Previous research in New Jersey reported and association of birth defects with several chemical contaminants in drinking water.

During 1996, grants were awarded to both the University of Iowa Environmental Health Sciences Research Center (NIEHS) and the Iowa Birth Defects Registry (Centers for Disease Control and Prevention) to conduct a variety of service activities and research projects over the next five years. The CDMC will be providing expertise and support for projects involving water quality exposure data for both programs.



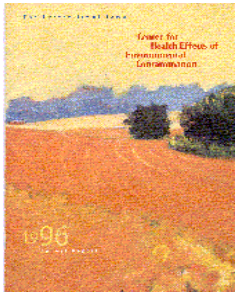
Johnson County Water Festival

A 1996 highlight was CHEEC's role in organizing, planning and co-sponsoring the Johnson County Water Festival. This was a culmination of CHEEC's increased effort to provide leadership for community-based education programs for primary and secondary grade levels. As a statewide pilot project, the Festival was a cooperative effort between local, state and federal agencies and private groups to provide an interdisciplinary program centered around water.

Planning for the Festival began in 1995 as local groups met with school officials to create an organizational structure capable of carrying out a Festival for area school districts. CHEEC took the lead in planning efforts required to make the Festival a success. Past cooperative programming with area groups provided the framework to get the Festival off the ground.

In March 1996, after months of planning, more than 1,000 seventh and eighth graders from five area school districts converged at Northwest Junior High School in Coralville for the first of two days of the Johnson County Water Festival. Sixty presenters treated students to a diverse program of water education activities, ranging from testing water for chemical constituents to watershed models demonstrating the benefits of streambank conservation practices. One of the most popular activities demonstrated the physical effects of hypothermia by having students retrieve pennies from a fish tank filled with ice water. Civic leaders participated by guiding discussions on local water concerns, and offering ways students could become involved and voice their concerns on issues important to them.

That evening, jazz bands from Northwest Junior High and Iowa City West High School entertained an audience of 150 people with a program called *Liquid Jazz*. Crowd pleasing numbers included *"Seeking the Aquifer"* and *"Don't Drink the Water, Johnny...It B. Badd."*



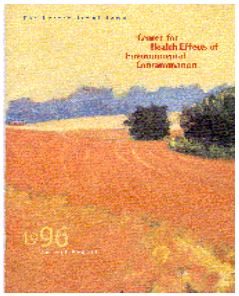
A new approach to water festival programming highlighted the second day of the Festival, which was open to the entire community. More than 500 persons of all ages experienced the Johnson County Water Festival offerings. Less formal in nature than the first day's program, the second day of the Festival included storytelling, musical entertainment, home water testing, "dripial" pursuit contests, and a host of hands-on activities.

A main goal of the second day was the promotion of the event as a family festival. Studies have shown that water quality improvements can be addressed and reinforced best when the entire family learns together. Presenters geared demonstrations to be hands-on and experiential in nature, thus promoting participation by a wide variety of ages. Whether exploring the subterranean movement of water or working on a scale model that demonstrates land use practices and subsequent sources of nonpoint source pollution, activities generated enthusiasm and greater appreciation for the water around us.

An example of the true interdisciplinary nature of the Festival can be captured by the University of Iowa Center for the Book presentation titled *"15th Century Italian Hand Papermaking and Water Quality."* This talk displayed samples of 15th century paper that were still of superior quality and did not show any of the yellowing characteristics that accompany modern papers. The speaker explored the chemical composition of these papers by gas chromatography analysis and proposed that the mineral concentration of the waters used in the papermaking process was the reason behind the longevity and continued high quality of the paper.

The cooperative effort of participating agencies is one of the many lasting legacies of the Festival. Groups who are involved in environmental and water education programs were all able to showcase their expertise under one umbrella organization and discover what others are doing in the area of water education. This gave them a chance to see how their outreach programs fit into broader water education programming. CHEEC's role as lead organizer demonstrated its broad-based commitment to community programming and its ability to lead and manage a program of this magnitude and complexity.

As a pilot project, Festival organizers hoped to demonstrate the feasibility of holding water festivals for other groups around the state. The success of this first time effort has generated interest within a Des Moines area group, which has organized a Water Festival for the spring of 1997. Planning for a second Johnson County Water Festival, to be held in the fall of 1997, is underway.



Main Financial Sponsors for the Festival:

Aquadrill, Inc.
City of Iowa City
Hawkeye State Bank
Iowa Groundwater Association
Iowa State Water Resources Research Institute
Leopold Center for Sustainable Agriculture
UI Environmental Health Sciences Research Center
University Hygienic Laboratory
CHEEC

Participants Included:

Army Corps of Engineers

National Soil Tilth Laboratory

Trees Forever

Quality Care

Ecolotree, Inc.

Grant Wood AEA

Des Moines Water Works

Leopold Center for Sustainable Agriculture

Aquadrill, Inc.

Howard R. Green, Inc.

Coralville Water Department

Kirkwood Environmental Training Center

U.S. Geological Survey

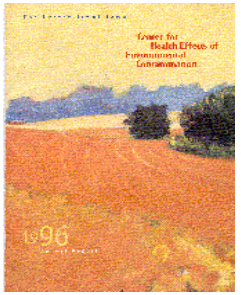
Mark Twain National Wildlife Refuge

Iowa City Division of Water and Wastewater

East Central Iowa Council of Governments

Holly Berkowitz

Northwest Junior High School



Coralville Recreation Center

Northwest Junior High School Orchestra

Iowa City High School Drama Club

Iowa City City Council

Senator Tom Harkin's Office

Senator Charles Grassley's Office

Congressman Jim Leach's Office

Johnson County Soil and Water Conservation Service

Northwest Junior High School Jazz Band

Iowa City West High School Jazz Band

Coralville City Council

Johnson County Board of Supervisors

Johnson County Conservation Board

Office of the State Archaeologist

KGAN

Iowa City/Coralville Chamber of Commerce

Alternatives

Northwest Junior High School Ecology Club

Eastern Iowa Environmental Educators

Johnson County Public Health Department

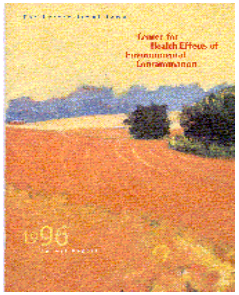
Johnson County Extension Service

KCRG

KCJJ

University of Iowa:

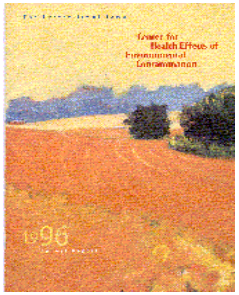
Museum of Natural History
Center for the Book
Physics and Astronomy Department
Department of Civil and Environmental Engineering
Geology Department
College of Nursing



College of Dentistry
University Hygienic Laboratory
Institute for Hydraulics Research
CHEEC
Environmental Health Sciences Research Center

Iowa Department of Natural Resources:

Geological Survey Bureau
Parks Department
Fisheries Department

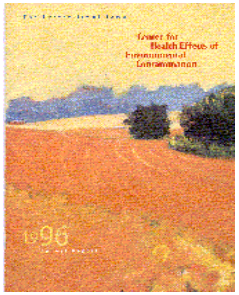


Seed Grant Program

CHEEC awards almost one-third of its annual state allocation as grants for pilot studies on exposure or risk assessment of environmental contaminants. To date, the CHEEC Seed Grant Program has funded fifty-seven research projects, many have produced methods or results which have been used to garner federal and private funding for environmental research in Iowa. Over thirty articles describing CHEEC-funded research have been published either in scientific journals or as chapters in books, and several masters and doctoral theses have resulted from projects funded by the Seed Grant Program. The following projects were awarded CHEEC seed grants during 1996:

Flow cytometric assessment of chromosomal damage induced by environmental contaminants

Investigators : S. Berberich, G. Hallberg, M. Wichman, University Hygienic Laboratory
Summary : The health consequences of chronic low concentration exposure to environmental contaminants are not well understood; most toxicological studies use concentrations well above those observed in the environment. This study will use the exceptional sensitivity and discriminatory power of low flow cytometric analysis to detect if chromosomal breakage occurs in cells grown in culture, and to find out whether damage results from exposure to common herbicides at concentrations found in the environment. The effects of ten individual herbicides and two metabolites will be assessed; additive or synergistic effects from exposure to combinations of herbicides will be identified. These data can provide understanding of the functional basis for some chronic toxicologic responses and contribute to other investigations.



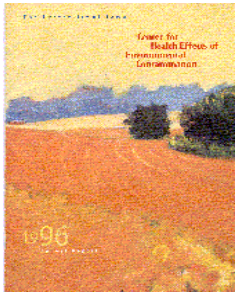
A prospective cohort study of municipal drinking water nitrate level and cancer risk: The Iowa Women's Health Study

Investigators : J. Cerhan, B. Kross, C. Lynch, P. Weyer, UI Department of Preventive Medicine and Environmental Health; A. Folsom, W. Zheng, School of Public Health, University of Minnesota
Summary : The increasing contamination of groundwater by nitrate, primarily from the widespread use of commercial fertilizers, is an evolving public health concern in agricultural states. Nitrate can undergo endogenous reduction to nitrate, and ultimately to N-nitroso compounds, which are potent carcinogens. There are few epidemiologic data, and no prospective cohort data, on whether nitrate exposure from drinking water increases the risk of cancer, in particular cancer of the digestive tract and Non-Hodgkin lymphoma. This project will link the Iowa Women's Health Study, a prospective cohort study of cancer in women aged 55-69 years (in 1986) to historical water quality databases maintained by CHEEC. Average nitrate exposure from drinking water over a twenty five year window will be related to cancer risk, after adjustment for age, dietary nitrate intake, factors which impact endogenous nitrosation, and other site-specific confounders.

Spatial variability of 226radium in a water distribution system

Investigators : L. Fuortes, E. Disher, UI Dept. of Preventive Medicine and Environmental Health
Summary : Radium is considered a "Class A carcinogen" by EPA; Iowa has some of the highest groundwater radium concentrations in the U.S. In 1976, the Safe Drinking Water Act (SDWA) set a maximum contaminant level for combined 226radium and 228radium at 5 pCi/L. EPA does not specify time or location of sample collection of radionuclides; the IDNR specifies only that the sample be representative of the water distribution system. Epidemiological studies have used 226radium analyses of samples collected for SDWA compliance as a measure of exposure. However, radium-rich pipe scale deposits found in water distribution systems are a potential source for radium contamination after it enters the distribution system. This study will determine if dissolution and/or dislodgement of radium from pipe scale significantly increases radium concentration at the tap.

Pesticides in ambient air and precipitation: Implications from exposure assessment



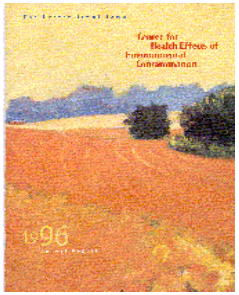
Investigators : G. Hallberg, B. Coppage, G. Breuer, D. Larrabee-Zierath, University Hygienic Laboratory
Summary: Atmospheric transport and deposition of pesticides are issues of significant concern. The presence of pesticides in rain implies their presence in air, yet few, if any studies have analyzed ambient air for multiple residues of currently used pesticides. Atmospheric transport may be another important route of exposure to the general public and to sensitive, non-target ecosystems. This study will concurrently measure pesticides initially characterize seasonal and temporal changes related to application periods. This project will develop some of the first data on year round ambient air pesticides concentrations.

Evaluation of pesticide exposure during application and incidental contact with treated areas of turf

Investigators : B. Kross, H. Nicholson, UI Dept. of Preventive Medicine and Environmental Health
Summary : Direct exposure to pesticides of persons walking or recreating on lawn and turf areas has become a concern to the public and the scientific community. Exposures acquired during the application of both agricultural and lawn chemicals have been measured extensively. However, few evaluations of exposure among bystanders and post application entrants in treated areas have been done. This study will provide estimates of these exposures by utilizing the Video Imaging Technique for assessing Exposure (VITAE) System. Using fluorescent dye as a surrogate, potential dermal exposures will be quantified through image analysis for applicators and for bystanders. Using the VITAE System allows for evaluation of potential dermal exposures to a variety of pesticide types and classes.

Municipal water softening and mortality rates of heart disease in Iowa

Investigators : G. Parkin, UI Dept. of Civil and Environmental Engineering; C. Lynch, UI Dept. of Preventive Medicine and Environmental Health
Summary : Hardness (mostly magnesium and calcium) is removed from drinking water to prevent scaling of pipes and consumption of soap. Several studies have shown that magnesium and calcium may be protective against heart disease. Removing water hardness by ion exchange results in an increase in sodium concentration; sodium is a well known risk factor for hypertension and resulting heart disease. This study of community mortality rates of heart disease in Iowa will determine if 1) mortality rates of heart disease are



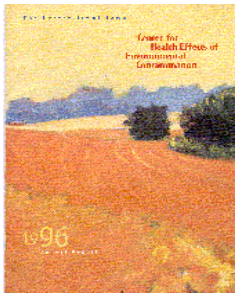
elevated in communities using ion exchange softening treatment; 2) communities using lime softening have lower mortality rates of heart disease in comparison; and 3) drinking water hardness may be protective against heart disease. Linkage of existing health outcome and municipal water quality databases maintained by the State Health Registry of Iowa and CHEEC will be a main component of the project.

An investigation of the potential use of tree-ring chemistry to record the history of site contamination

Investigators: J. Pleasants, Dept. of Zoology and Genetics, Iowa State University; M. Edelson, Ames Laboratory of U.S. DOE
Summary: In determining the health risks of a contaminated site, it is important to know when the contamination occurred, or began occurring, and when toxic materials became available to the surrounding biota. Trees growing in the vicinity of a contaminated site provide such a historic record. Chemical contamination of soil or water may be picked up in the water entering trees and be deposited in their growth rings. The chemical content of individual tree rings can be examined using a new technique. Individual rings are sampled using laser ablation; the ablated material is then analyzed by mass or optical spectrometry. This study will examine the accuracy of using the laser ablation sampling technique and the ability of tree rings to monitor contamination. Core samples of trees will be take from a site in Iowa and the material will be analyzed for various contaminants.

The toxicity of 2,4,6-trinitrotoluene (TNT) and its metabolites to Populus sp.

Investigators: J. Schnoor, P. Thompson, UI Dept. of Civil and Environmental Engineering
Summary: This project will investigate the phytoremediation of 2,4,6-trinitrotoluene (TNT) ammunition wastes using hybrid poplar trees. Studies will concentrate on phytoremediation using Imperial Carolina poplars for terrestrial/uplands treatment of TNT wastes by looking at the phytotoxicity of TNT and its two primary metabolites: 2-amino 4,6-dinitrotoluene (2A) and 4-amino 2,6-dinitrotoluene (4A). These treatability studies will lead to preliminary design calculations for TNT contaminated soil and groundwater treatment systems. In particular, the results of this research will help assess the impact of poplar hybrids at a Superfund site located at Middletown, Iowa.



Education

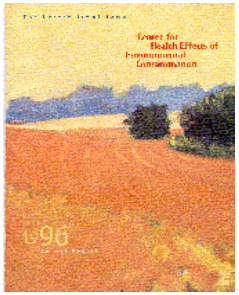
Seminars

CHEEC sponsors a continuing seminar series on environmental issues which has featured local and regional experts as well as nationally and internationally-recognized scientists from a variety of disciplines. Seminars have focused on rural and urban environmental health both in the U.S. and internationally, engineering research, global climate issues, policy development and potential socioeconomic impacts resulting from regulations on air quality and water quality. The following seminars were co-sponsored by CHEEC during 1996:

"Ozone air quality: A unique experiment in environmental decision making"
Ellis Cowling, College of Forest Resources, North Carolina State University
co-sponsors: Center for Global and Regional Environmental Research, Center for International Rural and Environmental Health, UI International Program, UI Public Policy Center
Dr. Cowling gave a second talk titled *"Pollutants in the air and acids in the rain: Lessons from history and visions of environmental futures"*.

"Amnestic disturbance and post traumatic stress disorder in the aftermath of a chemical release"
Rosemarie Bowler, Department of Psychology, San Francisco State University
co-sponsors: Environmental Health Sciences Research Center, UI Department of Psychology, UI Women in Science and Engineering Program
Dr. Bowler gave a second talk titled ,*"Epidemiological health study of a town exposed to chemicals"*.

"Air quality and the health of persons living near swine confinement operations"
P.Subramanian, Kendall Thu, UI Department of Preventive Medicine and Environmental Health

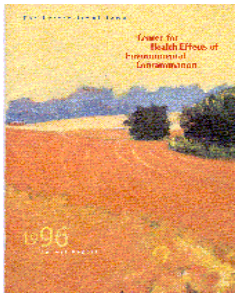


Outreach

CHEEC participated in a number of professional and public environmental education programs during 1996. For example, CHEEC staff participated in the *Pesticide Awareness Program for Farm Wives and Kids* sponsored by Land O'Lakes, Inc., Pioneer Hybrid International, and the University of Iowa Institute for Rural and Environmental Health. CHEEC also provided support for the *Rivers Project* activities developed by the Grant Wood Area Education Agency. During 1996, CHEEC responded to information requests from the Iowa Farm Bureau, Iowa state agencies, county health departments, NCI, EPA, ATSDR, area education agencies, water treatment plant operators, university researchers and students, engineering consulting firms, the media, environmental activist groups and the public.

Conferences and Workshops

CHEEC was a co-sponsor of the *8th International Workshop on Glucuronidation*, held at The University of Iowa on May 19-22, 1996. The workshop was sponsored by the UI Department of Pharmacology. Scientists from Australia, Japan, China, the U.K., Belgium, France, Germany, the Netherlands, Canada, Chile and the U.S. gathered to discuss research on the metabolism of chemical agents in lower animals and humans. Oxidation, reduction, hydrolysis and conjugation are the four chemical processes by which animal organisms can metabolize xenobiotics (chemical compounds that are foreign to a living organism). Of the many means of conjugation, glucuronide formation is recognized as one of the most important means of disposing of chemicals from the body.



Who We Are

Executive Committee

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

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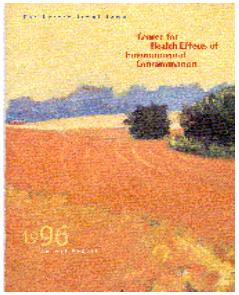
Gregory Cross, Student Programmer
Jiji Kantamneni, Senior Programmer Analyst
Douglas Kelley, Senior Programmer Analyst
David Riley, Program Assistant
Kerry Sesker, Senior Systems Analyst
Gloria Wenman, Secretary
Peter Weyer, Program Coordinator

University of Iowa Participants

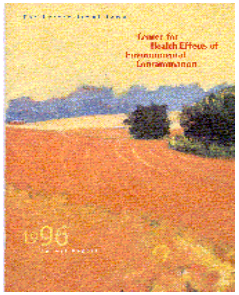
Department of Civil and Environmental Engineering
Department of Pediatrics
Department of Preventive Medicine and Environmental Health
Graduate Program in Urban and Regional Planning
Institute for Rural and Environmental Health
Iowa Birth Defects Registry
State Health Registry of Iowa
University Hygienic Laboratory

Advisory Committee

JoAnn Benda, M.D., UI Department of Pathology
Trudy Burns, Ph.D., UI Department of Preventive Medicine and Environmental Health
Kelley Donham, D.V.M., Institute for Rural and Environmental Health
Lois Dusdieker, M.D., UI Department of Pediatrics
Daryl Frey, Iowa Department of Agriculture and Land Stewardship



Richard Kelley, University Hygienic Laboratory (Committee Chair)
John Kelly, Iowa Department of Public Health
Donald Paulin, Iowa Department of Natural Resources
Wayne Paulson, Ph.D., UI Department of Civil and Environmental Engineering
Thomas Tephly, M.D., Ph.D., UI Department of Pharmacology
Frank Weirich, Ph.D., UI Department of Geography



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