Center for Health Effects of Environmental Contamination | CHEEC

1999 Annual Report

1999 proved to be a very busy year for CHEEC on a variety of fronts. A cooperative research program was developed to work up new projects that are of mutual interest to CHEEC and other agencies studying the environment. This program is intended to take advantage of interdisciplinary expertise and multiple sources of funding to develop pilot studies that may not have other possible avenues for support. The first two projects funded via the cooperative research program are described in this report: 1) a surveillance of pharmaceuticals in Iowa surface water (U.S. Geological Survey/CHEEC funded), and 2) a comparison of air quality in conventional swine confinement facilities and hoop structures, focusing on worker and neighbor exposures (Leopold Center for Sustainable Agriculture/UI Office of Research/CHEEC funded).

Another research area that blossomed in 1999 involved the utilization of CHEEC's municipal water supply databases. Several interdisciplinary projects were developed which will use historical information on municipal water supply treatment histories and analytical information on nitrate and disinfection by-products. The National Cancer Institute, the American Water Works Association Research Foundation (AWWARF), and the Iowa Department of Natural Resources are funding these projects. The long-term, labor intensive process of acquiring and maintaining CHEEC's water quality databases has resulted in new collaborations with researchers across the United States.

Service activities involving CHEEC faculty and staff during 1999 were numerous as well. Membership on IDNR's Water Monitoring Program Technical Advisory Committee and the Governor's Task Force on Air Toxics involved regular meetings in Des Moines and other locations around Iowa. As always, CHEEC staff participated in a variety of educational programs both on the professional and grassroots levels, and the on-campus CHEEC seminar series featured several prominent speakers. In addition, CHEEC was awarded an AWWARF contract to conduct an international workshop in the spring of 2000 on endocrine disruptors and pharmaceuticals in drinking water. Planning for that meeting began in the summer of 1999.

We will continue to work hard to provide the state of Iowa and the region with education programs, research activities and scientific expertise to help answer the questions surrounding human health and environmental contaminants.

Pete Weyer, Ph.D.
Associate Director

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Date Management Center

The CHEEC Data Management Center (CDMC) continues as the backbone of research conducted by CHEEC and its collaborators. Data management activities and support for the Agriculture Health Study conducted by the Department of Epidemiology, UI College of Public Health continued as this project began its seventh year. In addition, the CDMC is collaborating in the following studies:

CHEEC is working cooperatively with the University of Colorado, the National Cancer Institute (NCI), and Queen's University (Ontario) in a project funded by the American Water Works Association Research Foundation titled 'Improved Exposure Assessment on Existing Cancer Studies'. This three year study is modeling disinfection by-product (DBP) formation in municipal drinking water systems in an effort to better understand DBP development. This will help in characterizing personal exposures to these compounds, which have been linked to a number of cancers in previous studies.

A recent United States Geological Survey (USGS) study found high levels of naturally occurring ammonia in municipal drinking water wells. As a result, the Iowa Department of Natural Resources (IDNR) contracted with the University Hygienic Laboratory (UHL) and CHEEC to conduct a study titled 'Ammonia /Nitrite Ground Water Investigation'. Research is focusing on the distribution and concentration of naturally occurring ammonia and nitrite in 230 municipal drinking water wells. This study will quantify levels and assess possible health impacts (on an ecologic level) as a result of any exposure to ammonia from drinking water.

The NCI and CHEEC continue ongoing research examining nitrate in public water systems and potential adverse health outcomes. Efforts by CHEEC have concentrated on additional data acquisition to better clarify exposure assessment from municipal drinking water supplies.

In 1999, the completion of two major data acquisition activities added significantly to the historical analytical water quality database. Raw drinking water files from USGS databases were downloaded and integrated into the CDMC database. In the second project, original paper files from the UHL were located and entered into the database. The files covered nearly all of the municipal drinking

water supplies in Iowa from the 1950s through the early 1980s. While some of these data were already on the CHEEC system, much of it had to be input. Data were inorganic analysis of both raw and finished water - some linked to individual wells and aquifers or a surface water source. These new historical data are an integral component of the studies that began in 1999.

These projects exhibited challenges in assimilating these data into the existing CHEEC database structure. 'Older' data already on the CHEEC systems have come from a collection of agencies, most notably the USGS and IDNR. Extensive quality checks were undertaken to prevent duplication of data already on the system. While this task proved to be time consuming and labor intensive, efforts have been well worth it. Both data acquisition projects will provide a more comprehensive exposure picture invaluable to CHEEC researchers.

Cooperative Research Projects

During 1999, CHEEC instituted a program to develop cooperative agreements between CHEEC and other academic centers, departments, state agencies or federal agencies to conduct research in areas of mutual interest. Administratively, these cooperative agreements involve cost-sharing (matching funds or in-kind support) from all participating groups. Members of the CHEEC Executive Committee are either Principal Investigators or co-Investigators on approved projects. During 1999, two projects were approved, one of which was completed and the other was designed and developed, with start-up expected in 2000. These projects are described below.

Pharm-Chemical Contamination: A Reconnaissance for Antibiotics in Iowa Streams (1999)
Investigators: United States Geological Survey, Water Resource Division, Iowa District
Center for Health Effects of Environmental Contamination, The University of Iowa

Funding provided by: United States Geological Survey
Center for Health Effects of Environmental Contamination, The University of Iowa

Project Summary
Antibiotics are used extensively to treat infections in humans and livestock, as well as a feed additive for livestock to promote growth and suppress disease. Widespread use has raised concern that these antimicrobial agents may enter waterways through wastewater treatment plants or after land application of manure. CHEEC and the USGS responded by initiating a first of its kind cooperative study investigating the occurrence of these compounds in Iowa streams. Study objectives were to identify the occurrence of commonly used antibiotics, concentration levels, and geographic distribution in surface water, and to improve laboratory method techniques.

Thirty-one sites from across the state were sampled, representing large and small stream flows. Streams were sampled once during the first peak runoff event following snow melt in April 1999. These 15 distinct antibiotics were sampled:

carbadox	spectinomycin	sulfamethoxazole
erythromycin	sulfamethazine	trimethoprin
erythromycin - H2O	sulfachloropyrizadine	tylosin
ivermectin	sulfadimethoxine	virginiamycin
lincomycin	sulfamerazine	tetracyclines (total)

Preliminary analytical results suggest that 16 of the 31 stream samples had positive detections for antibiotics. Sulfamethazine was detected in 10 samples, tetracycline (total) in 6, and lincomycin in 1. One stream had two detections of a single compound. All of the concentrations were below .5 micrograms/L (parts per billion). Final analytical results (better precision and more antibiotics) will be completed on these samples in the near future. CHEEC and the USGS are currently developing proposals to expand on this study's findings.

Analysis of Environmental Exposures in Hoop Structures and Conventional Confinement Swine Barns (2000)
Investigators: Department of Occupational and Environmental Health, The University of Iowa
Department of Agricultural and Biosystems Engineering, Iowa State University

Funding provided by: The Leopold Center for Sustainable Agriculture, Iowa State University
Office of the Vice President for Research, The University of Iowa
Center for Health Effects of Environmental Contamination, The University of Iowa

Project Summary
A major health concern in swine farming is inhalation of toxicants, which may lead to significant morbidity among swine farmers. Exposures to hydrogen sulfide, ammonia, dust and endotoxin have been linked to a number of health problems in workers, including upper airway diseases, lower airway diseases and interstitial diseases. In addition, outdoor air quality in proximity to swine operations has become a major concern in recent years. Neighbor complaints have been increasing as swine units become larger and more

densely located in the neighboring community. While health effects related to odors from livestock units are very difficult to determine, the public perception that odors contain toxic substances has resulted in reports of headaches, nausea and other health complaints in neighbors. In recent years, hoop structures have emerged as an alternative method of housing hogs, and appear to have environmental benefits (related to air and water quality) in comparison to conventional confinement facilities. The purposes of this study are to 1) quantify airborne contaminant concentrations and exposure duration in hoop barns and conventional confinement barns controlling for location, season, micrometeorological conditions, animal density and other factors, and 2) to compare the exposure of airborne contaminants around and downwind of hoop structures and conventional confinement structures. The study will be conducted utilizing a pork producing farm with 3-5 hoop barns and 3-5 confinement buildings on a nearby site. The 15-month project will be a joint effort of researchers from The University of Iowa and Iowa State University; field sampling will be coordinated between study staffs, and laboratory analyses will be conducted utilizing labs at both institutions (ISU Odor Laboratory, ISU Animal Science Department, UI Inhalation Toxicology Facility), which specialize in specific contaminant identification and quantification.

Education

Seminars
CHEEC sponsors a continuing seminar series on environmental health issues of interest to the university community, statewide environmental health specialists, and the general public. Seminars cover a range of environmental health topics, including policy discussions, health study findings, environmental research, emerging research, and exposure assessment. The following seminars were held on The University of Iowa campus in 1999:

"Risk-Based Decision Making for Environmental Restoration/Remediation"
Speaker: Gene Parkin, Ph.D., Civil and Environmental Engineering, The University of Iowa
Co-sponsor: UI Environmental Health Sciences Research Center

"Drinking Water Nitrate and Health"
Speaker: Mary Ward, Ph.D., Occupational and Environmental Health Branch, National Cancer Institute
Co-sponsor: UI Women in Science and Engineering (WISE)

"Drinking Water Disinfection By-Products and Adverse Reproductive Outcomes"
Speaker: Michele Lynberg, Ph.D., National Center for Environmental Health, CDC
Co-sponsor: UI Department of Epidemiology

Outreach
In 1999, CHEEC staff participated in a variety of outreach and educational service activities statewide. Ambient water monitoring was a priority for the state in 1999, and CHEEC participated on two committees established to guide IDNR in this endeavor (Technical Advisory Committee and the Stakeholders Committee). Staff also participated in the Air Toxic Task Force, led by the IDNR- Air

Quality Bureau. This task force was established by the Governor's office to begin formulating state policy regarding toxic air emissions.

Other committee participation included continued service on the Advisory Board of the Iowa Center for Agriculture Safety and Health, serving on a study committee for the Johnson County Department of Public Health titled Onsite Wastewater Systems on Lots of Less than One Acre, and participating in the Poison Control Task Force for the Iowa Department of Agriculture and Land Stewardship.

CHEEC participated in several education events in 1999 comprised of a variety of local and state activities and age groups. An Iowa City High School class received instruction on the basics of epidemiology, staff volunteered for the Iowa Children's Water Festival, taught a class for the Belin-Blank International Center for Gifted Education, provided information for a legislative breakfast on water quality, and presented to an adult conservation education program in Buchanan County.

Conferences

CHEEC co-sponsored the C. Everett Koop Children's Conference held on the University of Iowa campus in 1999 in conjunction with Johnson County Citizens for Tobacco Free Youth. The Hancher Auditorium presentation was attended by several thousand students.

Seed Grant Program

CHEEC awards approximately one-third of its annual state allocation as grants for pilot studies. Grants are awarded but not limited to pilot studies on exposure and risk assessment, innovative environmental remediation techniques, original monitoring and sampling methods design and testing, laboratory methods development, statistical analysis relating environmental exposures to health outcomes, database design and development, health survey design, and studies based on innovative biochemical or molecular approaches toward understanding mechanisms of toxicity that relate to human exposure to and interaction of environmental chemicals. The pilot grant program has been successful as over 40% of CHEEC-funded projects have secured further funding from federal or private source - one of the primary goals of the program. The following research projects were awarded funding in fiscal year 1999:

Residential Radon Decay Product Exposure and Lung Cancer: The Use of a Novel Radon Progeny Device to Improve Dose Estimates
Investigators: RW Field, Department of Preventive Medicine and Environmental Health, The University of Iowa, DJ Steck, Department of Physics, St. John's University
Summary: Radon decay product (progeny) produces lung cancer in underground miners, yet epidemiologic studies examining residential radon gas exposure and lung cancer has yielded inconclusive results, raising the issue of whether residential radon progeny exposure poses a significant health risk. Radon decay products and not the radon gas itself deliver the radiological significant doses to the lungs, thus exposure risks need to measure actual radon progeny concentrations. This study proposes to update lung cancer risk estimates previously used in the Iowa Radon Lung Cancer Study using radon progeny dose measurement.

Development of Laboratory Techniques for the Study of Heterogeneous Chemistry of Environmental Contamination on Mineral Aerosol
Investigator: PD Kleiber, Department of Physics and Astronomy, The University of Iowa
Summary: The objective of this work is to develop new laboratory techniques for the study of heterogeneous processes involving environmental contaminants on mineral aerosol particle surfaces (such as wind blown soil) under conditions of temperature, pressure,

and relative humidity appropriate to the troposphere and surface boundary layer. New laboratory strategies are needed to quantify the chemistry and physical transport process of aerosol particles under atmospheric conditions, and to investigate how these processes affect the fate of key environmental contaminants.

Parental Pesticide Exposure and Pregnancy Outcomes Phase I: Evaluation of Self-Reports of Pregnancy History Information
Investigators: PA Romitti, CF Lynch, Department of Preventive Medicine and Environmental Health, The University of Iowa
Summary: This study will evaluate the quality of self-reports of pregnancy history information provided by female spouses enrolled in the Agricultural Health Study (AHS), a prospective cohort study of the occurrence of chronic disease among pesticide applicators and their spouses. Spouse self reports of pregnancy history information will be compared to those constructed from vital record data. Findings from this study will provide insights into the quality of pregnancy history information available in the AHS and preliminary data for future proposals.

Evaluation of an Assay for Environmental Estrogens in Effluents from Iowa Wastewater Treatment Facilities
Investigators: R Summerfelt, Department of Animal Ecology, E Farrar, Department of Zoology, Iowa State University
Summary: This study hypothesizes that sewage treatment lagoons of Iowa towns contain levels of estrogenic substances that are sufficient to cause endocrine disruption in fish when they discharge to streams. Effluents of municipal wastewater treatment facilities contain alkylphenol polyethoxylates (APEs), which degrade to products that act as estrogen mimics, as well as ethynylestradiol. In this study, blood samples of caged fish held in lagoons will be examined for the presence of a specific blood protein, vitellogenin (VTG), which is normally produced by females. VTG is a biomarker of endocrine disruption when it is found in elevated concentration in female fish and present in the blood of male fish. Quantitative techniques will be developed to assess the level of VTG being produced by the fish.

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