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January 8, 2009

Holly Lyons
Legislative Services Agency
State Capitol

Re: CHEEC Annual Report

Dear Ms. Lyons:

The Center for Health Effects of Environmental Contamination was established at the University of Iowa with the passage of House File 631 by the 72nd General Assembly.

In accordance with Iowa Code §263.17 (4b), this annual report for the Center for Health Effects of Environmental Contamination is hereby submitted to the Legislative Council of the General Assembly.

If there are any questions concerning this report, please don't hesitate to contact this office.

Sincerely,

Robert Donley

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cc: Dwayne Ferguson
Legislative Liaisons
Legislative Log

CHEEC Report to the Iowa Legislature: 2008

Background The Center for Health Effects of Environmental Contamination (CHEEC) at The University of Iowa (UI) is submitting this progress report for 2008 to the Iowa General Assembly in accordance with requirements outlined in the 1987 Iowa Groundwater Protection Act. Mandated within the Act was the establishment of CHEEC, whose mission is "to determine the levels of environmental contamination which can be specifically associated with human health effects." Center activities include 1) developing and maintaining environmental databases to be used in conducting health effects research, 2) managing a seed grant program to support health effects research, 3) providing education and service programs to the citizens of the state and the region, and 4) serving on state and local committees whose needs require environmental health expertise.

CHEEC is comprised of faculty from the UI Departments of Civil and Environmental Engineering, Epidemiology, Occupational and Environmental Health, Chemistry, and the University of Iowa Hygienic Laboratory (UHL). Participating areas include the Environmental Engineering Laboratory, the Institute for Rural and Environmental Health, the State Health Registry of Iowa and Iowa Registry for Congenital and Inherited Disorders. CHEEC works cooperatively with the Iowa Departments of Natural Resources (IDNR), Public Health, and Agriculture and Land Stewardship (IDALS), plus the United States Geological Survey and Leopold Center for Sustainable Agriculture at Iowa State University.

Advisory Committee The CHEEC Advisory Committee met on October 27, 2008. Bernie Hoyer from IDNR continued to be the committee chair. The FY 2008 budget was discussed and FY 2009 budget was presented to the committee and approved unanimously. Naresh Kumar (UI Dept. of Geography) presented preliminary results of a past CHEEC seed grant award titled: *Predicting Indoor and Outdoor Air Quality by Indirect Methods*. Other discussion topics included CHEEC research activities, specifically private drinking water well sampling results from across the state.

Budget for Fiscal Year 2008 CHEEC receives 9% of the annual receipts in the Agricultural Management Account of the Iowa Groundwater Protection Fund. A total of \$407,809 was allocated to CHEEC in FY 2008. Additionally, CHEEC generates revenue through federal grants and contracts that support Center activities and mission.

The personnel budget is presented in the categories of administration, data management, education programs, research programs, and service activities, in order to reflect effort in these areas. General operating costs for administration, data management expenses, education programs, and research programs are also presented separately.

The CHEEC FY 2008 operating budget:

Expenditures

Personnel

(Salary + Fringe) (2.4 FTE + Faculty director support)

Administration	\$	78,079
Data Management	\$	36,562
Education	\$	13,622
Research	\$	84,914
Service	\$	15,374
Total	\$	228,551

Administration

Travel	\$	910
General Supplies/misc	\$	1,744
Telecommunications/postage	\$	792
Employee Job Search	\$	788
Total	\$	\$4,234

Data Management Center

Hardware, Software, lic, maintenance	\$	7,696
Staff Travel/education	\$	525
Total	\$	8,221

Education Programs

Publications	\$	564
Seminars/Conference Exp.	\$	9,137
Education grants	\$	1,040
Total	\$	10,741

Research Programs

Seed Grants	\$	164,839
Cooperative Grant	\$	-
Total	\$	\$164,839

Total Expenditures **\$416,586**

Balance general account FY2008 **\$18,907**

CHEEC Data Management Center During 2008, CHEEC Data Management Center (CDMC) staff provided full system support for programming, local area network administration, database design and administration, and applications development for in-house and state and federal 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)*. The *Iowa Historical Municipal Water Treatment and Supply Database* was updated and is current through 2008. Additionally, federal Safe Drinking Water Act data were added for all municipal supplies to the *Municipal Analytical Water Quality Database*.

In 2008, CDMC research efforts utilizing CHEEC's environmental health and computer database expertise include:

- **Exposure Assessment Method for Disinfection Byproducts in Drinking Water in the National Birth Defects Prevention Study**
Collaborators: National Birth Defects Prevention Study centers, U.S. EPA, and the University of North Carolina
Funding Agency: National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention (CDC)
- **Comprehensive Assessment of Rural Health in Iowa: the Carroll County Well Water Study**
Collaborators: Carroll County (IA) Environmental Health Department, Iowa Department of Public Health, and the University Hygienic Laboratory
Funding Agency: Iowa Department of Public Health and National Center for Environmental Health
- **Nitrates, Nitrites and Nitrosatable Drugs and the Risk for Selected Birth Defects**
Collaborators: Texas A&M University, the University of Iowa Registry for Congenital and Inherited Disorders, and National Birth Defects Prevention Study centers.
Funding Agency: National Institute for Environmental Health Sciences
- **SWRL Phase II**
Collaborators: Iowa Department of Natural Resources, University Of Iowa Hygienic Laboratory, UI College of Public Health, and County environmental health specialists.
Funding Agency: Iowa Department of Natural Resources
- **MDSTARNet:**
Collaborators: Centers for Disease Control and Prevention (CDC), Iowa Registry for Congenital and Inherited Disorders, Iowa Department of Public Health, and researchers from Arizona, Colorado, Georgia, and New York.
Funding Agency: Centers for Disease Control and Prevention

Service/Education Activities CHEEC staff participate in environmental health service and education activities through committee membership, organizing and funding educational programs, and answering environmental health questions from the public through the CHEEC website or referrals from public and environmental health entities.

In 2008, CHEEC staff gave professional presentations at state and regional conferences highlighting CHEEC research projects. Center staff serves on the advisory boards of the statewide Ambient Water Quality Monitoring and the Lake Nutrients Standards Technical Advisory Committee. Center staff provided external reviews for numerous academic journal articles submissions.

In April 2008, CHEEC hosted a conference titled *Keep it Small Keep it All: Cultivating the Bioeconomy at the Local Scale*. Speakers discussed the bioeconomy on local and regional scales, emphasizing environment and health opportunities and challenges.

In November 2008, CHEEC, the Leopold Center for Sustainable Development at ISU, and the Center for Energy and Environmental Education University at UNI hosted Dr. Preston Maring, who presented the three Regents Universities over a two day period. The theme of his talk was *Sustaining Iowa: Making the Connection between Food, Health and the Land*.

CHEEC awarded two education grants in FY 2008. The grants partially supported a Leopold Center for Sustainable Agriculture conference, plus a University of Iowa activity titled *An Endangered River Runs Through Us: Three Iowa River Journeys*.

During 2008, CHEEC responded to information requests from state and county health departments, the National Cancer Institute, engineering consulting firms, state and county public health personnel, university researchers and students, high school students, water and waste water treatment plant operators, agriculture extension personnel, the media, environmental activist groups, and the public.

Research Funding With money received from the Agricultural Management Account, CHEEC administers a seed program. It supports pilot level research across a range of environmental health research topics. "Pilot" research refers to small-scale projects designed to test new and unusual hypotheses, develop innovative methodologies in both laboratory and field settings, or perform initial statistical analyses to support efforts to acquire federal or private grants for larger studies. The funding supports the University of Iowa strategic goals by providing graduate level research opportunities and strengthening graduate level programs, creates innovative research, and fosters interdisciplinary development of research and service opportunities.

CHEEC awards more than one-third of its annual allocation in seed funding. Recently this investment has generated ten dollars in external funding for every dollar invested for University of Iowa and Iowa State University researchers. In the past 5 years, seed grants have attracted \$6.9 million in external funding for researchers at the University of Iowa. Seed funding

provides hands-on learning opportunities for undergraduate and graduate level students enhancing their education experience and preparing them for their professional life.

In fiscal year 2008, CHEEC awarded the following grants:

Predicting Indoor and Outdoor Air Quality by Indirect Methods

Investigator: N. Kumar, Ph.D., Department of Geography, University of Iowa

This research aims to develop indirect measures of indoor and outdoor air pollution, which can be used for computing personal exposure by linking an individual's time-activity diary with the indirect estimates of indoor and outdoor air pollutions. Building on current research, satellite remote sensing will be used to estimate ambient air pollution at a household location. Imputing indoor air pollution, however, can be challenging. In this research indirect measures of indoor air quality will be identified by evaluating the indoor air pollution with reference to household characteristics, such cooking and heating fuel, flooring type, number of occupants, exchange of air between indoor and outdoor environments and ambient air pollution at the household location. The study will sample indoor and outdoor air quality, measured by fine and coarse particles (PM_{2.5}, PM₁₀, PM_{10-2.5}), in 33 households in and around Iowa City during the fall 2008 and spring 2009. An incremental optimal sampling design will be adopted to draw the sample of households, which will capture more than 95% of the total variability in ambient air pollution. Particulates of different sizes will be monitored for a week in and outside of each household, and a brief questionnaire will be administered to collect the data on household characteristics. The analyses of these data using standard statistical methods will allow us to determine indirect measures of indoor air pollution.

Effect of Agricultural Pesticides on Prostate Cancer Progression

Investigators: M. Henry, Ph.D., Department of Molecular Physiology and Biophysics and C. Lynch, MD Ph.D., Department of Epidemiology, University of Iowa

The Agricultural Health Study (AHS) associated exposure to certain pesticides with increased prostate cancer risk in individuals with a first-degree family history of prostate cancer. These findings indicate that exposure to these environmental contaminants may interact with a genetic predisposition toward prostate cancer, but the biologic mechanism(s) by which this might occur remain unclear. This information is critical not only for better defining the risks posed by these pesticides for farm workers and others exposed to these chemicals, but also may advance our understanding of prostate cancer progression in the general population. Experimental exploration of the mechanistic links between pesticide exposure and prostate cancer progression will be difficult in humans. Therefore, the objective of this proposal is to test whether exposure to organophosphorothioates accelerates prostate cancer progression in a mouse model genetically predisposed to develop premalignant prostate lesions (B6:PTEN/luc) in order to establish an experimental platform for exploring these links.

Transformation and Fate of Manufactured Metal Nanoparticles in Aqueous Environments

Investigator: V.Grassian, Ph.D., Department of Chemistry, University of Iowa

This study is designed to provide the data needed to predict the environmental fate and human health effects of commercially manufactured nanoparticles in aqueous solution. With the widespread development of nanoscience and nanotechnology, nanoparticles represent a

potential emerging contaminant. The main objectives of the research are to determine under what environmental conditions do manufactured metal nanoparticles of different size and composition aggregate in solution and under what conditions do metal nanoparticles dissolve? Complementary studies to investigate the fundamental surface properties and surface chemistry of metal nanoparticles will be done as surface properties control both nanoparticle aggregation and dissolution as well as nanoparticle-biological interactions. These data can then be used to predict the environmental fate of commercial nanoparticles and are important in assessing the human health effects associated with these materials.

Evaluation of Adenovirus Real-Time and Conventional PCR Assays to Detect Fecal Contamination in Water and to Identify Its Source

Investigators: M. Chorazy¹ and G. Gray, MD MPH, Department of Epidemiology, University of Iowa

Fecal contamination of water is a significant public health concern. The primary objective of this proposal is to determine the usefulness of adenovirus as an indicator of fecal contamination and its potential for fecal source-tracking. This objective will be addressed by the following aims: (1) to improve upon and validate a PCR algorithm to detect human and animal adenoviruses in fecal waste and water, (2) to conduct surveys of adenoviruses in cattle and swine stool in order to determine the usefulness of adenovirus as a source-tracking organism, and (3) to estimate the prevalence of human and animal adenoviruses at impaired and transitional Iowa beaches and to identify parameters associated with adenovirus in surface water. Results from this study will be used to further develop rapid methods to detect adenoviruses in water and accurately identify sources of contamination which would be informative to risk assessment and risk management practices.

Evaluation of Enterococci and Bacteroides Real Time PCR Assays for Measuring Recreational Water Quality in Iowa with a Source Tracking Perspective

Investigators: L. DesJardin, Ph.D. and N. Hall, B.S., MT, University Hygienic Laboratory, University of Iowa

Enterococci are recognized by the U.S. EPA as indicator organisms to assess water quality in fresh and marine waters. Although enterococci are a robust indicator of fecal contamination in marine waters, interpretation of elevated levels in fresh waters is less clear. Because enterococci can originate from plants or sewage, it is important to understand the source of the enterococci as it relates to swimmers' health. It may be that the species of *Enterococcus* present, rather than total *Enterococcus* spp., more accurately indicates the public health risk. This project will evaluate four real-time qPCR methods for enterococci and *Bacteroides* and apply these methods to monitor ten Iowa beaches with elevated levels of enterococci and/or *E. coli*. This study will determine if the rapid total enterococci qPCR method can serve as a surrogate for the standard EPA culture method and if all four rapid tests will be able to track the source of the enterococci.

A Molecular Microbiological Search for Active Biphenyl Dioxygenases in Polychlorinated Biphenyl-contaminated Sediments

Investigators: T. Mattes Ph.D. and K. Hornbuckle Ph.D., Department of Civil and Environmental Engineering, University of Iowa

Polychlorinated biphenyls (PCBs) are toxic, carcinogenic, and bioaccumulative compounds that are often found in lake and river soils and sediments. PCBs in soils and sediments represent a human health risk, especially if natural processes promote PCB volatilization and subsequent exposure to humans. Biodegradation of PCBs would reduce the risk of adverse human health effects, but this process is poorly understood in sediments. The objective of this research is to test the hypothesis that aerobic, PCB-degrading bacteria are present and active in PCB-contaminated sediments from Indiana Harbor. Preliminary studies revealed aerobic PCB biodegradation potential, but additional experiments are needed to determine if PCB-degraders are active in these sediments. An array of experimental approaches, some of which are innovative, involving reverse-transcription (RT)-PCR, real-time RT-PCR, proteomics, and metabolite analysis are proposed.