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BOARD OF REGENTS
STATE OF IOWA

January 3, 2013

Glen Dickinson, Director
Legislative Services Agency
State Capitol

Re: CHEEC Annual Report

Dear Mr. Dickinson:

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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Attachment
cc: Legislative Liaisons
Legislative Log

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Annual Report to the Iowa Legislature

For 2012

Submitted by:

The Center for Health Effects of Environmental Contamination

At

The University of Iowa

January, 2013

Background The Center for Health Effects of Environmental Contamination (CHEEC) at The University of Iowa (UI) is submitting this progress report for 2012 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) cooperating and collaborating on environmental health research programs and projects, 3) managing a seed grant program to support environmental health research, 4) providing education and service programs to the citizens of the state and the region, and 5) serving on state and local committees to provide 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 State Hygienic Laboratory. Participating areas include the Environmental Engineering Laboratory, the Institute for Rural and Environmental Health, the Iowa Cancer Registry and the Iowa Registry for Congenital and Inherited Disorders. CHEEC works cooperatively with the Iowa Departments of Natural Resources (IDNR), Public Health (IDPH), and Agriculture and Land Stewardship (IDALS).

Advisory Committee The CHEEC Advisory Committee met on November 27, 2012. Dr. Bill Field (UI Occupational and Environmental Health) left the Committee in 2012 and was replaced by Dr. Laurence Fuortes (UI Occupational and Environmental Health). The final FY 2012 budget was discussed and the proposed FY 2013 budget presented to the committee and approved unanimously. Dr. William Simpkins (Dept. of Atmospheric and Geological Sciences, Iowa State University) presented results of his CHEEC-funded project in a talk titled *Tracking human enteric viruses in municipal drinking water from an alluvial aquifer.*

Budget for Fiscal Year 2012 CHEEC receives 9% of the annual receipts in the Agricultural Management Account of the Iowa Groundwater Protection Fund. CHEEC's allocation from this Account totaled $421,659 in FY 2012. Additionally, CHEEC generates revenue through federal grants and contracts, and private contracts that support CHEEC research activities. The personnel budget is presented in the categories of administration, data management, education programs, research programs, and service activities, to reflect effort in these areas. General operating costs within each area are presented separately for expenses charged to the General Account (Agricultural Management Account funds). Remaining expenses (0.3 FTE and other data management costs) are covered by federal grants and contracts.

The balance from FY 2011 ($33,803) was carried forward into FY 2012 and earmarked for cooperative research grants; one was approved by the CHEEC Executive Committee late in FY 2011 (funds were encumbered to FY 2012), another was approved in late FY2012 (funds were encumbered to FY 2013). The $10,189 in educational expenses includes funds for a CHEEC-sponsored conference on ***Arsenic in Iowa's Water Sources*** and funds for a continuing medical education program co-sponsored by CHEEC on ***Pediatric Environmental Health.***

FY 2012 operating budget:

Revenue

Agricultural Management Account	$421,659
Carryover from FY 2011	$ 33,803
Total revenue	**$455,462**

Expenditures

Personnel
(Salary + Fringe)
(2.70 FTE + Faculty director support + student hourly support)

Administration	$ 79,934
Data Management	$ 63,948
Education	$ 47,961
Research	$ 111,908
Service	$ 15,987
Total	**$ 319,738**

Administration

Travel	$ 3,038
General Supplies/misc	$ 503
Telecommunications/postage	$ 129
Total	**$ 3,670**

Data Management Center

Hardware, Software, lic, maintenance	$ 4,399
Staff Travel/education	$ 1,000
Total	**$ 5,399**

Education Programs

Publications	$ 0
Seminars/Conference Exp.	$7,689
Education grants	$2,500
Total	**$ 10,189**

Research Programs

Seed Grants	$ 89,790
Cooperative Grant	27,500
Total	**$117,290**

Total Expenditures	**$456,286**
Balance general account FY 2011	**($824)**

CHEEC Data Management Center During 2012, CHEEC staff provided full system support for programming, local area network administration, database design and administration, and applications development for in-house, state, and federally-funded environmental health research projects. Environmental databases are designed and managed on the Oracle database management system.

CHEEC created and maintains computerized databases on Iowa water quality, including the *Iowa Historical Municipal Water Treatment and Supply Database* (updated in 2012), the *Municipal Analytical Water Quality Database*, and the *Statewide Rural Well Water Survey (SWRL)*. Federal Safe Drinking Water Act data through 2010 were added for all municipal supplies to the *Municipal Analytical Water Quality Database.*

In 2012, research efforts utilizing CHEEC's environmental health and computer database expertise, or other research staff expertise, included:

- **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, CHEEC
  Funding Agency: National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention (CDC)
  This project calculated disinfection byproducts (DBP) exposures in public drinking water systems for participants in the National Birth Defects Prevention Study. The exposure assessment includes linking geocoded maternal addresses to appropriate drinking water utilities, linking relevant DBP water quality data to those residences, and modeling the DBP data to account for possible spatial and temporal variability.

- **Nitrates, Nitrites and Nitrosatable Drugs and the Risk for Selected Birth Defects**
  Collaborators: Texas A&M University, the UI Registry for Congenital and Inherited Disorders, National Birth Defects Prevention Study centers, CHEEC
  Funding Agency: National Institute for Environmental Health Sciences
  This study is examining the separate and joint effects of prenatal exposures to nitrates, nitrites and nitrosatable drugs on the risk for selected congenital malformations in children, using data collected by the National Birth Defects Prevention Study. Texas and Iowa are conducting an exposure assessment for nitrate in public drinking water and in bottled water; Texas is also modeling nitrate exposures in private well water.

- **Muscular Dystrophy Surveillance, Tracking & Research Network (MDSTARnet)**
  Collaborators: Centers for Disease Control and Prevention (CDC), Iowa Registry for Congenital and Inherited Disorders, Iowa Department of Public Health, researchers from Arizona, Colorado, Georgia, and New York.
  Funding Agency: Centers for Disease Control and Prevention
  CDC is working with researchers to set up surveillance/tracking systems for Duchenne/ Becker muscular dystrophy (DBMD), the most common muscular dystrophy in children. The goal is to find all DBMD patients in these states by using information from clinic medical records and hospital records. Information about each child's treatments and medical status will be reviewed to try and answer questions re: DBMD.

- **National Children's Study**
  Collaborators: UI (Pediatrics, Epidemiology, Iowa Registry for Congenital and Inherited Disorders, CHEEC), Polk County hospitals and Public Health agencies, Des Moines University
  Funding Agency: National Institute of Child Health and Human Development
  The National Children's Study is examining the effects of the environment, which includes factors such as air, water, diet, sound, family dynamics, community and cultural influences, and genetics on the growth, development, and health of children across the United States, following them from before birth until age 21 years. In Iowa, 1,000 children in Polk County will be enrolled in the Study.

- **Water Quality Data for Private Wells for the Agricultural Health Study**
  Collaborators: CHEEC, State Hygienic Laboratory
  Funding Agency: National Cancer Institute
  This project is providing nitrate, pesticide and other water quality data for private wells and public water utilities across Iowa to use in modeling drinking water exposures for participants in the Agricultural Health Study (~ 89,000 persons enrolled in Iowa and North Carolina); the goal is to investigate the effects of environmental, occupational, dietary, and genetic factors on the health of the agricultural population.

CHEEC co-sponsored Conference

CHEEC participated in a continuing medical education program on *Pediatric Environmental Health* on September 14, 2012, at the UI Hospitals and Clinics in Iowa City. The conference was co-sponsored by the UI Department of Pediatrics, the Iowa Chapter of the American Academy of Pediatrics, and CHEEC. Approximately one hundred people attended the one day program which focused on recent developments in environmental exposures and issues relevant for the general pediatrician, family practitioner and other health professionals who work with children and adolescents.

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 agencies. In 2012, CHEEC staff gave professional presentations at national, local and state meetings on CHEEC research projects. CHEEC staff served on the IDPH Advisory Committee for the Environmental Public Health Tracking Program, on the State Hygienic Laboratory Board of External Advisors, and on the Iowa Children's Environmental Health Working Group. During 2012, CHEEC responded to information requests from state and county health departments, the National Cancer Institute, state and county public health personnel, university researchers and students, water and waste water treatment plant operators, agriculture extension personnel, the media, environmental activist groups, and the public.

Research Funding With Agricultural Management Account funds, CHEEC administers a seed grant program that supports pilot level research across a range of environmental research topics. Seed grant projects are small-scale studies designed to test new and unusual hypotheses, develop innovative methodologies in laboratory and field settings, or perform initial statistical analyses to support efforts to acquire federal or private grants for larger studies. The funding provides graduate level research opportunities, which strengthens graduate level programs, creates innovative research, and fosters interdisciplinary development of research opportunities.

CHEEC awards about one-third of its annual Agricultural Management Account allocation in seed funding. Since 1989, this investment has generated over ten dollars in external funding for every dollar invested by the program; seed grants projects have attracted over twenty million dollars in external funding for additional research. Seed grant funding provides hands-on learning opportunities for undergraduate and graduate students, enhancing their educational experience and preparing them for their professional lives. In fiscal year 2012, CHEEC awarded the following seed grants:

Sequence analysis of transferable genes encoding bacterial attachment and multi-drug resistance

Investigators: L. Jarboe, Department of Chemical and Biological Engineering, Iowa State University (ISU); M. Soupir, Department of Agricultural and Biosystems Engineering, ISU; C. Logue, L. Nolan, Department of Veterinary Microbiology and Preventive Medicine, ISU

Executive summary: The attachment of agricultural *Escherichia coli* isolates to environmental particles is significantly associated with multi-drug resistance. This association motivates our hypothesis that the genes responsible for bacterial attachment are encoded on a mobile genetic element that also encodes resistance and virulence. These mobile genetic elements are a group of transferable genes that can pass from one bacterium to another; plasmids are the most common form. Here, gene transfer confers not only resistance but possibly virulence. Thus, these genes are a possible environmental contaminant that could threaten human health. In this pilot-scale work we will first confirm that the genes encoding resistance and attachment can be co-transferred between bacteria. This would validate these genes as environmental contaminants. We will then sequence any plasmids transferred between bacteria during the transference of resistance and attachment. This would identify any virulence-associated genes, providing information about the threat that these plasmids present to human health.

Functionalized magnetic mesoporous silica for adsorption of arsenic from water

Investigator: S. Larsen, Department of Chemistry, The University of Iowa

Executive summary: Access to safe drinking water is a global health issue. Human exposure to drinking water contaminants, such as arsenic, has been linked to cancer, neurological, cardiovascular and pulmonary health problems. The arsenic levels in 8% of private wells in Iowa were determined to be greater than the EPA's drinking water standards of 10 ppb (0.01 mg/L). Therefore, it is critical, both globally and locally, to develop improved methods for removing and analyzing arsenic in water. Mesoporous silica has well-defined pores of 1.5-10 nm and very high surface areas. Mesoporous silica can be readily modified through surface functionalization. In this study, functionalized mesoporous silica will be tailored to optimize arsenic adsorption. Specifically, mesoporous silica will be functionalized with thiol and/or amine functional groups which are expected to selectively adsorb As(III) or As(V) species,

respectively. Magnetic iron oxide nanoparticles will be incorporated into the mesoporous silica to facilitate magnetic recovery from solution.

An investigation of carbon nanotube exposure assessment methods
Investigators: P. O'Shaughnessy, R. Altmaier, A. Horne, Department of Occupational and Environmental Health, The University of Iowa
Executive summary: Carbon nanotubes (CNTs) are engineered nanoparticles (<100 nm) that have been shown to cause adverse pulmonary outcomes in test animals. As such, the National Institute for Occupational Safety and Health (NIOSH) is considering a recommended exposure level (REL) for CNTs of 7 μg/m3, which is the limit of quantification (LOQ) of a method used to measure elemental carbon (EC) in diesel particles. Such a limit presents either an under- or over-exposure scenario with no information to determine actual conditions when below the LOQ. This pilot project will seek to establish a relationship between CNT particle count concentrations given known size distributions and EC mass concentrations to guide the interpretation of environments that may become contaminated with CNTs below the LOQ. A secondary objective will be to compare EC concentrations measured using the NIOSH method with those obtained from a hand-held device suitable for personal exposure assessments.

Cooperative Research Grant

CHEEC initiated a cooperative research program in 1999, which seeks to leverage research monies from university, state, and federal entities to conduct research in areas of mutual interest with collaborators. The collaboration requires matching funds from participating entities. A member of CHEEC's executive committee must serve as a co-investigator. Like the Seed Grant Program, it seeks to establish innovative lines of environmental health research leading to preliminary results that may be used in seeking further larger grant funding from federal and private sources.

In fiscal year 2012, CHEEC awarded the following Cooperative Research Grant:

Evaluation of a Web-based Approach to Data Collection in Molecular Environmental Epidemiological Investigations of Adverse Pregnancy Outcomes (2012)
Investigators: Paul Romitti, Kristen Caspers, Department of Epidemiology, UI College of Public Health; G. Ludewig, Department of Occupational and Environmental Health; M. Wichman, State Hygienic Laboratory; P. Weyer, CHEEC, The University of Iowa
Cooperators: Iowa Registry for Congenital and Inherited Disorders; Reproductive Molecular Epidemiology Research and Education Program, The University of Iowa
Executive summary: The increase in household wireless telephone use, along with caller ID and call blocking, has posed challenges to telephone-based data collection for epidemiological studies. In addition, the portability of smartphones, tablets, etc., and increased access points to the internet have removed both the time and place demands of home-based communications. Experience with telephone-based data collection in Iowa for the National Birth Defects Prevention Study has indicated a steady decline in participation rates by parents of infants. This project is a population-based, case-control feasibility study to evaluate the use of a web-based approach for molecular environmental epidemiological investigations of adverse pregnancy outcomes. 240 infants with selected birth defects (cases) and 240 infants without defects

(controls) will be selected (from Iowa Registry and Iowa birth certificate databases, respectively) and will equally be assigned to either a web-based or a telephone-based group. They will be administered a questionnaire for maternal environmental exposures; mothers in the web-based group will be asked to electronically sign a consent form to use residual newborn bloodspots for biomonitoring; for the telephone-based group, the US postal service will be used to request a hand-signed informed consent for bloodspots. Participation rates, sample representativeness, exposure reporting, and costs between the web-based and telephone-based groups will be compared. We hypothesize improved participation rates in the web-based group, which will permit increased generalization of study results and increased statistical power for studies.