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Robert Donley, Executive Director

January 8, 2014

Glen Dickinson, Director
Legislative Services Agency
State Capitol

Re: CHEEC Annual Report

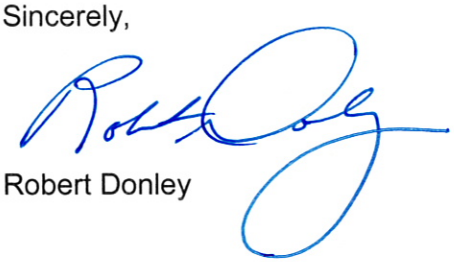
Dear Mr. Dickinson:

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 2013

Submitted by:

The Center for Health Effects of Environmental Contamination

At

The University of Iowa

December, 2013

Background The Center for Health Effects of Environmental Contamination (CHEEC) at The University of Iowa (UI) is submitting this progress report for 2013 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 5, 2013. The final FY 2013 budget was discussed and the proposed FY 2014 budget presented to the committee and approved unanimously. Mr. Chad Fields (Iowa Geological and Water Survey, Iowa Department of Natural Resources) presented preliminary results of the CHEEC-funded IDNR virus surveillance project in a talk titled *What's in your water? Overview and initial findings of the Iowa Public Well Virus Survey*.

Budget for Fiscal Year 2013 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 $469,155 in FY 2013. 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 slight deficit from FY 2011 ($824) was covered by FY 2013 funds. The unexpected increase in the allocation from the Iowa Groundwater Fund resulted in a free balance of $39,213 at the end of FY 2013. These funds were carried over to FY 2014 and will be used for research grants (either an additional seed grant award or a cooperative research grant award) during FY 2014.

FY 2013 operating budget:

Revenue

Agricultural Management Account	$469,155
Deficit from FY 2011	$ (824)
Total revenue	**$468,331**

Expenditures

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

Administration	$ 66,018
Data Management	$ 52,814
Education	$ 39,611
Research	$ 92,424
Service	$ 13,203
Total	**$ 264,070**

Administration

Travel	$ 2,500
General Supplies/misc	$ 1,215
Telecommunications/postage	$ 176
Total	**$ 3,891**

Data Management Center

Hardware, Software, lic, maintenance	$ 6,167
Staff Travel/education	$ 2,403
Total	**$ 8,570**

Education Programs

Publications	$1,000
Seminars/Conference Exp.	$2,760
Education grants	$2,500
Total	**$ 6,260**

Research Programs

Seed Grants	$118,827
Cooperative Grant	$ 27,500
Total	**$146,327**

Total Expenditures	**$429,118**
Balance general account FY 2013	**$39,213**

CHEEC Data Management Center During 2013, 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*, the *Municipal Analytical Water Quality Database*, and the *Statewide Rural Well Water Survey (SWRL)*. Federal Safe Drinking Water Act data through 2011 were added for all municipal supplies to the *Municipal Analytical Water Quality Database.* In 2013, research efforts utilizing CHEEC's environmental health and computer database and 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 (NBDPS). 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. In 2013, CHEEC and the Iowa Registry for Congenital and Inherited Disorders (UI College of Public Health) began analyses on risk for cleft lip and palate defects in the NBDPS. Other NBDPS Centers are conducting analyses on other birth defect outcomes using individual exposure levels to DBPs from the CHEEC-led exposure assessment project.

- **Obtaining Water Quality Data for Public Water Supplies and 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. The data generated in this project will also be linked to the Iowa Women's Health Study (IWHS) cohort (~28,000 Iowa women enrolled in 1986), so that estimated exposures to pesticides and other contaminants in public water supplies, and nitrate and pesticides in private drinking water well users in the IWHS can be evaluated for cancer risk, and other adverse health outcomes.

- **Exposure Assessment for Drinking Water Contaminants and Cancer Risk in the Iowa Women's Health Study**
  Collaborators: University of Minnesota, National Cancer Institute, CHEEC
  Funding Agency: National Cancer Institute
  This project will determine associations between environmental exposures and cancer incidence and mortality among older Iowa women by linking drinking water contaminant data including nitrate, DBPs, and pesticides to the women's drinking water source to evaluate risk of brain, bladder, kidney, ovarian, thyroid and gastrointestinal cancers. This is a follow-up investigation to work which began in 1996 on the IWHS cohort, specifically looking at nitrate. Preliminary work will also begin on assessing arsenic drinking water concentrations in communities where IWHS participants resided.

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 2013, CHEEC staff gave presentations at local and state meetings on CHEEC research projects. CHEEC staff served on the IDPH Advisory Committee for the Environmental Public Health Tracking Program, and on the State Hygienic Laboratory Board of External Advisors. During 2013, 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 2013, CHEEC awarded the following seed grants:

Point-of-use electrocatalytic filters for reduction of persistent contaminants from drinking water
Investigators: D. Cwiertny, D. Shuai, R. Valentine, Department of Civil and Environmental Engineering, The University of Iowa
Executive Summary: Although regulated by EPA for the risk they pose to human health, nitrate and disinfection by-products are pervasive contaminants often encountered in drinking water. Traditional approaches have proven inadequate for their removal. This project will develop a

promising, point-of-use (POU) electrocatalytic filtration unit targeting these pollutants. With the potential for high pollutant removal efficiency and self-cleaning ability, this study will demonstrate the feasibility and sustainability of this technology. Specific tasks include synthesis and characterization of nanofiber supported metal catalysts exhibiting systematically varied physicochemical properties, assessing electrocatalytic filter performance when exposed to various water chemistries, and a preliminary environmental impact assessment addressing the cost and sustainability of this innovative technology. This work represents the first step in the development of a low-cost, POU water treatment device with the potential to lower health risks associated with drinking water sources compromised by persistent pollutant classes.

Enhanced CNS exposure to glyphosate following inhalation resulting from olfactory uptake

Investigators: M. Donovan, Department of Pharmaceutical Sciences and Experimental Therapeutics; The University of Iowa; H. Lehmler, P. O'Shaughnessy, Department of Occupational and Environmental Health, The University of Iowa

Executive Summary: Glyphosate, the ingredient present in the widely used RoundUp® family of herbicides with an excellent safety profile following topical and oral exposure, presents a potential CNS exposure risk if it is able to access the olfactory transfer pathways within the nasal mucosa. These pathways afford the opportunity for molecules to access the brain without needing to cross the blood-brain barrier. This study will evaluate whether glyphosate and several commercial glyphosate herbicide formulations are able to permeate through the olfactory mucosa into the olfactory bulb and nearby brain regions following direct nasal instillation and aerosol exposure. Preliminary results will provide initial quantitative evidence regarding the risk of CNS glyphosate exposure following nasal inhalation and will support further investigations to evaluate the exposure risk along with identifying methods to limit inhalation exposure to herbicide applicators or those in close proximity to spraying operations.

Effects of PCBs on adipocytes and the development of metabolic syndrome

Investigator: A.J. Klingelhutz, Department of Microbiology, The University of Iowa

Executive Summary: Epidemiological studies indicate that exposure to polychlorinated biphenyls (PCBs) is associated with an increased risk of metabolic syndrome, a group of disorders that includes obesity, glucose intolerance, high cholesterol, and hypertension. Metabolic syndrome increases the risk for type 2 diabetes. PCBs accumulate in adipocytes, which are known to play a key role in the genesis of metabolic syndrome. Recently generated extended lifespan human pre-adipocytes will provide a unique opportunity to assess the short and long term effects of PCBs on adipocyte biology. These cells will be used to test the hypothesis that exposure of adipocytes to PCBs causes long-term effects on gene expression to alter adipocyte differentiation and function. This study will lead to further understanding of how PCBs cause metabolic syndrome, may provide useful biomarkers for assessment of disease risk, and could point to new targets for therapy.

Predicting the transport and fate of emerging contaminants using multi-tracer characterization of reactive pathways

Investigators: A. Ward, Department of Geoscience, The University of Iowa; D. Cwiertny, Department of Civil and Environmental Engineering, The University of Iowa; D. Kolpin, U.S. Geological Survey

Executive Summary: Contaminants of emerging concern (CECs, unregulated compounds

including pharmaceuticals and personal care products) are ubiquitous in environmental and drinking waters, posing potential risks to human and ecosystem health. This proof-of-concept study will characterize the transport and fate of CECs in a stream reach using a suite of tracers with well-characterized, complementary reactivities. Specific research tasks include quantifying reaction pathways within the environmental system, laboratory experiments linking tracer and CEC reaction rates, and numerical modeling to predict transport and fate of CECs. The overall goal of this research is to quantify reaction pathways in the environment and successfully predict the transport and fate of CECs. A major outcome will be a mechanistic understanding of transport and fate processes that can be applied to any CEC in the system; this will enable prediction of the spatial extent and temporal persistence of CECs in streams.

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 FY 2013, CHEEC awarded one Cooperative Research Grant:

Occurrence of Viruses and Unregulated Contaminants in Iowa Public Water Supply Groundwater

Investigators: R. Libra, Iowa Geological & Water Survey (Iowa Department of Natural Resources); M. Wichman, State Hygienic Laboratory
Cooperators: Iowa Department of Natural Resources, U.S. Geological Survey, UI Department of Geosciences, U.S. Department of Agriculture

Executive Summary: Groundwater supplies drinking water to about 2.4 million Iowans, or about 80% of the population; over 2 million obtain water from a public water supply (PWS). PWS are required by EPA to monitor finished water for chemical, physical, and biological contaminants; raw source water monitoring is infrequently required. EPA publishes a *Drinking Water Contaminant Candidate List* detailing contaminants that may require standards and monitoring in the future. A strategy to assess future drinking water regulatory needs and guide source water protection activities for public and domestic wells is targeted sampling/analysis of raw PWS groundwater for currently unregulated contaminants with environmental and public health concerns. Concurrent analysis of raw source water for more commonly monitored groundwater constituents is a key component. This provides context for the occurrence or lack of unregulated contaminants and will begin efforts to identify indicators for them. This project sampled 66 Iowa PWS wells with known construction and hydrogeologic vulnerability for a number of contaminants. The majority of the funding came from EPA and Iowa DNR Drinking Water and Source-Water Protection programs. CHEEC funds were used for sampling and analysis of PWS wells for human enteric viruses. The upcoming federal *Unregulated Contaminant Monitoring Rule* will have an emphasis on groundwater contaminants, and our efforts will complement the national plan and establish Iowa as a leader in monitoring groundwater quality for contaminants with public health implications.