History of the Center for Hazardous Substance Research (CHSR), September 2015

Origins of the CHSR

In 1985 the Kansas Legislature approved funding for research in support of the management of hazardous substances because of new federal regulations including the Resource Conservation and Recovery Act (RCRA) and Superfund. Leaders from industry in Kansas expressed their concern with respect to the need for science and technology to comply with these new regulations on hazardous substances. An Office of Hazardous Substance Research was established as a part of the Engineering Experiment Station in the College of Engineering in 1985.

The goals and objectives were to
1. Provide leadership and foster the conduct of hazardous substance research,
2. Have a point of contact for industrial and government officials with hazardous waste concerns,
3. Develop a professional staff that can conduct contract and grant research for industry and government,
4. Maintain a safe environment for the conduct of hazardous and toxic substance research,
5. Furnish well equipped laboratories for hazardous substance research,
6. Generate opportunities for research training of students in the area of hazardous substance research, and
7. Enhance the climate in Kansas for economic development for the waste processing industry.

In 1986 the first Conference on Hazardous Waste Research was held at Kansas State University to present information on new developments and to help identify research needs in Kansas (Erickson, 1986). Conferences were held annually from 1986 through 2002. Conference proceedings are available at http://www.engg.ksu.edu/HSRC/Proceedings.html. The state funding was used to support research, which was conducted in academic departments.

Great Plains/Rocky Mountain Hazardous Substance Research Center

In 1988 the U.S. EPA invited proposals to establish five Hazardous Substance Research Centers. The centers were regionally distributed. Through peer review competition, Kansas State University became the headquarters for the Great Plains/Rocky Mountain Hazardous Substance Research Center (GP/RM HSRC) in February 1989. Montana State University and the Universities of Iowa, Missouri, Montana, Nebraska, and Utah were participating institutions. The center served the needs of federal regions 7 and 8; the states are Iowa, Kansas, Missouri and Nebraska in Region 7 and Colorado, Montana, North and South Dakota, Utah and Wyoming in Region 8.

Kansas State University requested approval to establish the Center for Hazardous Substance Research; Board of Regents approval was received in March 1989 and the Office of Hazardous Waste Research became the Center for Hazardous Substance Research. The State of Kansas funding was used as matching funds for the EPA center award from 1989 - 2002. Support services and a center office were established.

In order to better serve the needs in Regions 7 and 8, additional universities were approved to be participating institutions of the GP/RM HSRC. The U.S. Department of Energy was invited to provide supplemental research funds. The Research and Re-education of Displaced Defense Personnel (R2D2) program was established with Defense funding to educate individuals with military experience to become environmental professionals as they transitioned from military service to civilian employment.

The Technical Outreach Services to Communities (TOSC) program was established to provide public education to community leaders and other citizens with respect to the remediation of contaminated properties. This allowed a more informed community participation in decisions related to cleanup of these properties. The Technical Assistance to Brownfields (TAB) program was established to help communities that had properties that were underutilized because of known or possible contamination.

When the U.S. EPA requested help from the Hazardous Substance Research Centers to involve minority academic institutions in the program, Haskell Indian Nations University and Lincoln University were invited to become partner institutions and the Native American and Other Minority Institutions (NAOMI) program was established. The Technical Outreach Services to Native American Communities (TOSNAC) program was established to provide TOSC services to Native American communities. The GP/RM HSRC provided national leadership for the TOSNAC program, and the needs of all tribes were served through the program.

The Science Advisory Committee and the Technology Transfer and Training Advisory Committee for the GP/RM HSRC provided valuable recommendations and public services. Early in the life of the GP/RM HSRC, the science advisory committee recommended an emphasis on research related to contaminants in soil and groundwater. They also responded favorably to research proposals to investigate the beneficial effects of vegetation in contaminated soil. From 1989 to 2002 there were significant advances related to the use of plants in remediation and stabilization of contaminated soil. The field of phytoremediation was established, and a professional journal, International Journal of Phytoremediation, was started. Multidisciplinary research was encouraged through workshops on the Beneficial Effects of Vegetation in Contaminated Soil and funded projects with investigators from more than one discipline. One of the investigators, Jerry Schnoor was elected to the National Academy of Engineering for his leadership and research on phytoremediation. Several students graduated and became professors with expertise related to phytoremediation. After receiving his Ph.D., Louis Licht established a company, Ecolotree, Inc., and planted vegetation at sites around the world to implement developments from the research. The American Council of Consulting Engineers selected Ecolotree, Inc. for an Honor Award in 1996 (Griswold et al., 2002).

From 1989-2002, more than $34,550,000 was expended in support of research and technology transfer through the GP/RM HSRC. The commercial value of the research has been estimated to be more than $10 for each $1 that was expended (Davis, 1999). Vegetation has been used beneficially at a large number of sites with very significant benefits. This has included millions of dollars of savings at the Riley County Landfill near Manhattan where trees have been planted to contain the contaminants that leach from the landfill. In 2014 Westar Energy received the Edison Award for the new treatment wetland at the Jeffrey Energy Center.

Midwest Hazardous Substance Research Center

In 2001, several new Hazardous Substance Research Centers were established. The Center for Hazardous Substance Research received $1,730,000 in funding for TOSC, TOSNAC, and TAB services through the Midwest HSRC, headquartered at Purdue University, from 2001 through 2008. Because of the significant progress in developing the science and technology and because of other priorities, support for the Hazardous Substance Research Centers program was terminated in 2008.

Technical Assistance to Brownfields (TAB) Program

From 2008 thru 2012 EPA has awarded $1,900,244 to Kansas State University for continuation of the TAB services that the Center for Hazardous Substance Research has been providing. Most recently the center received a $2,150,000 grant for a period of five years to provide Brownfields services for a 21-state area.

EPA's Brownfields Program empowers states, tribes, communities, and other stakeholders to work together to prevent, assess, safely clean up, and sustainably reuse brownfields. A brownfield site is real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

The EPA TAB Program funds Kansas State University (KSU) to work with a large team and network of partner organizations to provide technical assistance to communities and other stakeholders, helping them tackle the challenge of assessing, cleaning up and preparing brownfields sites for redevelopment, especially underserved, rural, small, and otherwise distressed communities.

Technical assistance being provided through KSU's TAB Program helps communities across the country increase their understanding and involvement in brownfields cleanup and revitalization and moves brownfields sites forward in the process toward cleanup and reuse. KSU, through the TAB Program, among other things, serves as an independent resource assisting communities with community involvement, better understanding the health impacts of brownfield sites, science and technology relating to brownfield site assessment, remediation, and site preparation activities, brownfield finance questions, information on integrated approaches to brownfield cleanup and redevelopment, facilitating stakeholder involvement, identifying sources of brownfields assessment and cleanup funding, understanding and complying with state brownfields and voluntary cleanup program requirements, and facilitating redevelopment activities.

Organization Description

KSU provides TAB assistance to communities in 21 states dealing with environmental issues, including tailored support based on specific needs. To provide coverage across its wide geographic service area, and in many different technical disciplines, KSU works with private and non-profit organizations, including: Community Brownfields Foundation and Mary Ahlstrom Environmental (CO), ATC/Cardno and Engaging Solutions (IN & OH), Delta Institute and faculty at Michigan State University (MI), Envirofields (SD), Great Lakes Environmental Planning (IL) and Stevenson Institute at Illinois State University (IL), Minnesota Brownfields (MN), Southwest Research Information Center (NM), and Terracon (many states, including ND, MT, WY, OK, TX, AR, and LA).

Technical Assistance Provided

KSU provides technical assistance and education to urban, rural and tribal brownfields communities and guides communities through the entire brownfields revitalization process. KSU often works with city, county, or redevelopment agency officials, providing assistance during brownfields assessment, cleanup,

and reuse. Among other things, KSU helps identify potential funding sources for revitalization projects; assists with redevelopment planning and community outreach by providing visioning workshops; reviews brownfields grant applications; provides economic feasibility studies, assists with environmental contractor selection; reviews and summarizes technical documents; serves as a liaison between communities and state or federal agencies; and offers workshops, seminars, and trainings on brownfields-related topics. Customized technical assistance is available to address many additional brownfields issues a community might have. The Center also offers two free, online tools: (TAB EZ) to help in preparing EPA Brownfields grant applications and the Brownfields Inventory Tool (BIT). More information on KSU TAB's services, events, and contact information is at www.ksutab.org).

International Activities

In 2001, the Center for Hazardous Substance Research, Haskell Indian Nations University, the University of Kansas and Gorno Altaisk State University in Russia began working cooperatively on a drinking water project. The goal of the project was to provide simple methods to test the quality of water supplies and public education on drinking water quality. This was followed by another project on environmental journalism education. Funding was provided by the U.S. government through the Association Liaison Office for University Cooperation in Development. Since 1999, there have been 24 exchange trips, involving 75 travelers. Additional funding was provided by the U.S. EPA and U.S. Dept. of Agriculture. A unifying element of this work has been establishing cultural connections between indigenous people in the U.S. and the Altai Republic, with respect to environmental issues (Griswold and Lukyanenko, 2007). Faculty investigators and center staff have participated in several other international conferences, and many international visitors have come to Kansas State University. Sabine Martin has participated in U.S. EPA cooperative efforts with the German government to advance environmental management and quality.

The Center has worked cooperatively with EPA and faculty in Kazakhstan in support of bioremediation and phytoremediation research in Kazakhstan. An international conference/workshop on the application of phytotechnologies for cleanup of industrial, agricultural, and wastewater contaminants was held in Kiev, Ukraine; a book was published, also (Kulakow and Pidlisnyuk, 2009).

Faculty who were involved in developing the science and technology on the beneficial effects of vegetation in contaminated soils have worked cooperatively with world leaders to establish the International Phytotechnology Society which meets annually. Two faculty from the GP/RM HSRC (Jerry Schnoor and Larry Erickson) have received the international award given by this society. The society with some help from K-State will hold the 12th International Phytotechnology Conference at the Manhattan, Kansas Convention Center, September 27-30, 2015.

In 2013, the Center received a grant from NATO, "New Phytotechnology for Cleaning Contaminated Military Sites." Faculty at K-State are working with professionals in Ukraine, Slovakia, Kazakhstan, and other European countries to advance phytotechnology (Pidlisnyuk et al., 2014).

NEER Nonlethal Environmental Evaluation and Remediation Center

In 2001, $1,650,000 was received from the U.S. Dept. of Defense to establish the Nonlethal Environmental Evaluation and Remediation Center with the Center for Hazardous Substance Research as the administrative unit of K-State to lead the project. With this funding, a cooperative effort with M2 Technologies was initiated. The objective was to help the military develop nonlethal technologies by conducting environmental evaluations.

Urban Operations Environmental Laboratory: the goal of the effort was to work cooperatively with M2 Technologies to advance environmental evaluations of developing technologies. More than $13,000,000 has been received for urban operations research from 2002 to 2012. The multidisciplinary approaches that were successful earlier are being used in the present work for the Dept. of Defense.

With Marine Corps funding, the **Environmental Knowledge and Assessment Tool (EKAT)** was developed for the evaluation of new technologies. It was used for environmental assessments and life cycle studies associated with the development of new technologies. Many of its features are useful for environmental management as well (Boguski et al., 2007). Whiteley et al. (2009) have developed features for emergency response and green engineering for use with EKAT. International environmental and regulatory information has been added to EKAT for applications that are needed by the National Center for Medical Intelligence.

Consortium for Environmental Stewardship and Sustainability

During the last 30 years, environmental management has moved from end of pipe technologies toward pollution prevention, which first increased in importance about 1989. Environmental management systems that include pollution prevention and sustainability have grown in importance. Global climate change, energy conservation, energy efficiency, and renewable energy have become part of sustainability programs. The Center for Hazardous Substance Research has attempted to provide services that respond to the current needs of society. The Consortium for Environmental Stewardship and Sustainability (CESAS) was organized in 2006 in order to foster communication and cooperation related to sustainability. Dialogs on Sustainability in 2006-2015 have helped to enhance communication and identify opportunities for cooperative efforts. Monthly leadership meetings are held to encourage communication and cooperation among the participating organizations and units of CESAS. More than one million dollars has been received to fund sustainability and sustainable energy research. More than 15 faculty and more than 60 students have participated in the research.

In September 2008, EPA, the Center for Hazardous Substance Research, CESAS partner organizations, and others organized the "From Brown to Green: Sustainable Redevelopment of Contaminated Properties Workshop" which was hosted by Kansas State University. In January 2009, CESAS and the Center for Hazardous Substance Research cosponsored the KSU sustainability conference "Leading Kansas in Sustainability: The Role of K-State". The leadership for this conference was provided by the Director of Sustainability, and some support was provided by the K-State administration. In August of 2013 CESAS helped to provide sponsorship for "America's Grasslands: The Future of Grasslands in a Changing Landscape." This event was held at the Manhattan Convention Center. In September 2015, CESAS was a cosponsor of the 12th International Phytotechnology Conference, also held at the Manhattan Convention Center.

Substantial Funding and results

The Center for Hazardous Substance Research has participated in more than $54 million of project funding from 1989 to the present. More than 150 theses and dissertations have been authored by graduate students and many undergraduate students have worked on research projects. The work has resulted in more than 600 professional publications. The economic value of the work has been very significant and many communities have been served. The Internet site http://www.engg.ksu.edu/chsr/ is visited frequently by individuals from all over the world who find valuable information there.

Acknowledgement

The Center for Hazardous Substance Research has worked cooperatively with many K-State faculty, staff, and students, faculty and students from other universities, professionals from M2 Technologies, CABEM, TAB partners and others. Many have contributed to the positive results that are described above. We wish to thank all who have participated and helped.

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