

Superfund Basic Research Program University of California Davis

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Introduction

This is the first communication to staff in State and Federal government involved in legislation and regulation of toxic substances in the environment. The goal of these updates is to provide information about the National Institutes Environmental Health Sciences (NIEHS) funded Superfund Basic Research Program (SBRP) that has been at UC Davis for the past 22 years. This national program was initiated to address human and environmental problems such as Love Canal, NY where improper disposal of chemical wastes occurred or Times Beach where oil containing chlorinated dioxins was sprayed as a dust suppressant. The mission of the SBRP is stated below¹

"Since its inception in 1987, the SBRP has applied a multidisciplinary approach to basic research focused to provide a solid foundation which environmental managers and risk assessors can draw upon to make sound decisions related to Superfund and other hazardous waste sites. We believe that basic research plays a crucial role in addressing challenges posed by environmental contamination such as health risks, toxicity, exposure predictions, fate and transport, and the need for cost-effective treatments for hazardous waste sites found throughout the United States"

The Superfund Program at UC Davis² has provided basic research information to address these needs. We continue to develop innovative, novel technology to investigate human exposures, environmental fate and transport of toxic substances, as well as cost-effective methods for the treatment and remediation these chemicals. The success of our program is due to the breadth of the multidisciplinary approach to these complex scientific issues of chemical exposure that continue to pose hazards to human and environmental health.

This program exports its findings beyond academic journals and publications to other venues and audiences. As required by the NIEHS, we have concerted efforts to effectively partner with government, transfer technology to commercial ventures, or communicate with broad public audiences for the purpose of improving human and environmental health. Research Translation of basic science is important for society to understand the goals of the SBRP in the mitigation of toxic substances in the environment.

Results

This newsletter highlights three exciting areas of research from the program: 1) green remediation of ground water containing the fuel additive MTBE and its primary degradation product with naturally occurring bacteria, 2) education of scientists in basic business principles, and 3) detection of toxic substances in the environment using novel analytical methods.

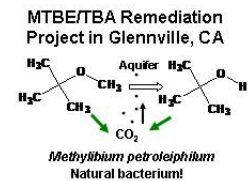
¹ www.niehs.nih.gov/research/supported/sbrp/about/index.cfm

² www-sf.ucdavis.edu/

Green remediation of MTBE-contaminated ground water:

Background

In the 1980's, the U.S. EPA instituted requirements to oxygenate auto fuels to reduce noxious vehicular emissions. Methyl *t*-butylether (MTBE), which appeared to be environmentally degradable (like sugar, it contains only carbon, oxygen and hydrogen), was chosen to fulfill this need. With levels up to 10% in the fuel, it soon began to appear in unexpected environmental compartments (lake water, groundwater, etc). The levels in fuel overwhelm the degradative capacities of organisms in the environment. Further, underground fuel storage tanks leaked and because it is not easily broken down to carbon dioxide and water, contamination of drinking water sources resulted from nearby underground gasoline storage tanks. In some places such as Santa Monica, CA, the concentration of MTBE was at levels in the drinking water that it was unpalatable because of odor.



Impact

The UC Davis SBPR's approach to clean up the MTBE-contaminated groundwater uses naturally-occurring bacteria that are already present in the wells. Successful demonstration of the efficacy of this approach has occurred around gasoline stations that have leaking underground fuel tanks. Presently, a demonstration project using this technology is ongoing in Glennville, CA; a community that has been without drinking water since 1998 because of MTBE groundwater contamination. This project was developed through partnerships with private industry, state health and water programs and the citizens of the community. The ultimate goal is to gain widespread acceptance of this technology by governmental regulatory authorities so that it can be applied more broadly.

Education of scientists in basic business principles: Laboratory to commercial venture

Background

Technology transfer of laboratory results into useful products or information for society is important. To accomplish this outcome, the UCD SBPR partnered with the UCD Graduate School of Management to develop a 5-day intensive, interactive course, The Green Technology Entrepreneurship Academy. For the last three years, the NIEHS and the Kaufman Foundation have co-sponsored this program. Attendees receive valuable information about the origins of innovation, short pitches to inform potentially interested parties in the nature of their innovation, technology, business and market validation, the importance of intellectual property to protect the innovation, funding sources and organization building.

Impact

The three year development of this course has fostered great interest. In 2008 there were 48 attendees from 23 different universities, 17 states and 4 foreign countries. At least 20 students from the national SBPR attended in the past three years. Evaluations by attendees indicated that it provides the basic business skills to move their laboratory results into a business venture. With the cost of Superfund site cleanup and remediation at about 1.2 billion dollars per annum³, it is vital that new technologies to reduce exposures and lower risks be developed. New businesses based on innovative technologies from the laboratories of the Superfund Basic Research Program are an important goal of this program.



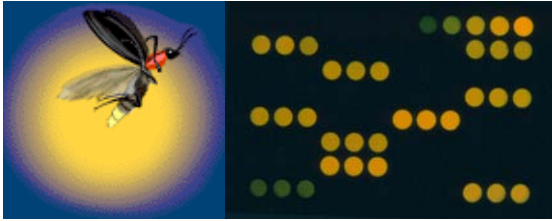
Innovation Exercise

³ GAO-08-841R Superfund Funding Costs, July 18, 2008

Cost-effective analytical assays: Detection of toxins in the environment

Background

The need exists for concentration assessment of persistent, toxic chemicals such as chlorinated dioxins and furans in humans and environmental matrices. This class of toxicants first came on the horizon as contaminants in Agent Orange used as a defoliant during the Vietnam War. Historically, methods for



characterization have used expensive analytical equipment. Researchers in the UC Davis SBRP have developed methods using cells that respond to these toxicants via firefly light visualization. Recent improvements now allow detection at levels that allow assessment of the amounts in human blood, food and other environmental compartments where the concentrations are very low.

CALUX: Firefly Luciferase

Impact

The use of this methodology has recently been accepted by the US EPA as well as many foreign country regulatory authorities for the inexpensive, rapid analysis of the concentration of these persistent toxicants in the environment. This methodology has been extended to the analysis of other classes of compounds such as natural- and xenoestrogens.

Since this the first edition of the newsletter, we would appreciate some critique so that in the future it will improve and therefore better meet the needs of the recipients. Some areas that we would like comment are the content, effectiveness of communication and will it help to build interactions and relationships with others outside the UC Davis Superfund Basic Research Program.

For more information about the UC Davis SBRP, please contact: James R. Sanborn, Research Translation Coordinator, JRSanborn@ucdavis.edu