Grants Awarded

From 10/1/06 To 10/31/06

Principal Investigator: Sastry Munukutla, Energy Systems Research

Project Title: Center for Energy Systems Research - 2006-07

Activation Amount: $42,900.00

Agency: State of Tennessee

Principal Investigator: James Layzer, Co-op Fisheries Unit

Project Title: Development and Testing of a Protocol for Monitoring Mussels

Activation Amount: $24,000.00

Agency: U. S. Geological Survey

The objectives of this study include: 1) determine density and relative abundance of freshwater mussel species in selected areas of the Green River; 2) detect presence of the endangered Cyprogenia stegaria, and maximize the likelihood of detecting rare species; 3) estimate species richness, including number of species present but not found; and 4) determine if recruitment is occurring.

To determine the density and relative abundance of species, a systematic sampling design with three random starts is being used at 4 shoals located in the Green River within Mammoth Cave National Park, KY. These four shoals have the greatest amount of mussel habitat, high densities of mussels, and one or more endangered species are present. Additionally, two surveys of muskrat middens are being conducted along both the entire length of the Green River within MACA. At all middens, GPS coordinates are being taken, and all unionid shells collected are being identified and measured. Opportunistic searches by snorkeling and wading will also be made throughout the park to generate additional species presence/absence data. More intensive searches will be made on six shoals in the free-flowing section of river to increase the likelihood of detecting rare species. Species richness will be estimated using capture-recapture of species methods. These methods use independent species lists generated at different times, different locations, multiple sampling methods, or different collectors to estimate the number species present including those that have not been observed. Thus, potentially each data set (quadrate collections, midden surveys, and snorkel/wading surveys) collected in this study and some appropriate combinations could be used to estimate species richness for some locations.

Grants Awarded

From 10/1/06 To 10/31/06

Principal Investigator: Dennis George, Water Center

Project Title: Center for the Management, Utilization and Protection of Water Resources 2006-07

Activation Amount: $54,200.00

Agency: State of Tennessee

Principal Investigator: Benjamin Mohr, Civil and Environmental Engineering

Project Title: Transport Kinetics of Internal Curing Water in High Performance Concretes

Activation Amount: $90,088.00

Agency: National Science Foundation

High performance concretes are increasingly used in construction due to increased performance demands and infrastructure growth in more aggressive environments. However, the nature of these materials (i.e., low water-to-cementitious materials ratio and refined pore structure) can lead to early age shrinking cracking. Thus, the durability of high performances concretes can be significantly compromised. Internal curing of high performance concretes has the potential to eliminate early age cracking due to self-desiccation and improve long-term durability. Internal curing through the incorporation of water absorbent materials in a cementitious matrix has been shown to minimize early age shrinking due to self-desiccation (i.e., autogenous shrinkage). Proposed internal curing materials include saturated lightweight aggregates, super absorbent polymers, and wood-derived materials. However, there has not been a systematic examination of the mechanisms of internal curing and the relative effectiveness of the various internal curing materials. A comprehensive research program is necessary to fully understand the effects of internal curing on cement-based material performance. Thus, the objectives of this research program are: 1) to elucidate the mechanisms of internal curing through a systematic examination of the moisture transport through a high performance cementitious matrix; 2) to identify those materials that are most effective and economical for large scale use in high performance concretes; and 3) to assess the short- and long-term effects of internal curing materials on the workability and flowability, strength, and durability of high performance concretes. Novel in situ microstructural characterization techniques will be applied to quantitatively analyze and map the movement of moisture from water entrainment sites through a hydrating cement paste. These techniques, which are extremely sensitive to water, include Fourier Transform Infrared (FTIR) spectroscopy, Raman spectroscopy, 1H Nuclear Magnetic Resonance (NMR), and 1H NMR Imaging (MRI). This research program is expected to improve fundamental understanding of both the moisture transport kinetics through a cementitious matrix and the structural performance effects resulting from the incorporation of internal curing materials. The experimental results obtained from these results will be used to improve upon existing computational models to improve the prediction of internal curing performance.

Grants Awarded

From 10/1/06 To 10/31/06

Principal Investigator: Gay Shepherd, University Policy/Francis Otuonye, Research Office

Project Title: Comprehensive/Multi-Faceted Meth Response Project (SMART)

Activation Amount: $296,168.00

Agency: U. S. Department of Justice

Tennessee Technological University (TTU) in collaboration with the 6th Congressional District counties and the 13th Judicial District Drug Task Force Stop Methamphetamine Abuse in Rural Tennessee (SMART) Unit Project have established a positive momentum in dealing with the problem of clandestine lab-produced methamphetamine in the Upper Cumberland region of Tennessee. With the funding for this project we will refine our attack on the methamphetamine problem in middle Tennessee and expand the successes of this project across the 15 counties of the 6th Congressional District.

Our emphasis will continue in the crucial arena of prevention and public awareness. We have followed a strategy that a problem of this magnitude can only be successfully eradicated with the participation of a coalition of dedicated professionals from all related fields and the public at large. In the first year of operation we have seen this strategy prove to be successful. Our prevention methodology is to educate the larger population on the details of what methamphetamine is; how it works; and things they, as concerned citizens, can do to protect themselves and to join the fight. The 13th Judicial District Drug Task Force has also trained teachers, counselors, relapse prevention therapists, and other professionals on the latest and most useful techniques to address prevention and rehabilitation.

In the area of enforcement we have unified the approach across the initial project area by individualized on site trainings for the local agencies dealing with methamphetamine and how to make good cases. This training was accomplished by a local full time methamphetamine prosecutor. We have sponsored national methamphetamine clandestine lab certification and recertification courses, certifying 40 officers representing every law enforcement agency in the initial project area. These officers were supplied with field protective equipment, and evidence and intelligence gathering equipment including laptop computers and digital cameras. A web-based intelligence network was developed and made available with accompanying training so that methamphetamine cooks could be tracked across traditional jurisdictional boundaries.

The complexion of methamphetamine continues to evolve and change. It is necessary to monitor these changes as they come and to maintain the flexibility to address the problem in its most current state. In the coming grant year we propose to develop new tools and refine and expand the use of the proven successful tools of the initial project. We propose to take this unified approach and its successes into an expanded area of the 15 county 6th Congressional district.

Grants Awarded

From 10/1/06 To 10/31/06

Principal Investigator: Joseph Biernacki, Chemical Engineering

Project Title: Multi-Scale Kinetics-Based Model for Predicting Mechanical Property Development of Concrete Containing Supplementary Cementitious Materials

Activation Amount: $45,237.00

Agency: University of Michigan Ann Arbor via NSF

Multi-scale kinetics-based model for predicting mechanical properties development of concrete containing supplementary cementitious materials is a collaboration between the University of Michigan and Tennessee Technological University. The objective of the project is to develop (1) a new multi-scale kinetic-based mechanistic model for predicting early-age strength development for varying temperature-time histories, and (2) a similar model for predicting early-age stresses due to thermal and shrinkage gradients. The cementitious systems to be investigated are binary blends of slag-cement, which is the basis for further work. The model will be expanded to incorporate an additional third component consisting of flyash (C/F) or alkali-based activator. Binary and ternary cements consisting of ground granulated blast furnace slag (GGBFS) have been found to develop improved long-term durability and strength. These blends, typically called slag-cements, are now widely used in practice. Slag-cements however are more temperature sensitive than regular OPC's (ordinary Portland cement). This is especially a concern for construction at low temperatures and in the presence of fly ash as the third component since fly ashes are less reactive than slag. For massive sections a major benefit of using slag-cement is the lower heat of hydration at early ages (typically the first seven days) and improved thermal crack resistance as compared to OPC concretes of same current content. The major intellectual contribution of this proposed research is the development of a multi-scale kinetics-based mechanistic model for predicting the early-age strength and stresses from thermal and drying shrinkage gradients of concrete containing supplementary cementitious materials (GGBFS and fly ash). This study will link hydration kinetics of the cementitious system to the macro-scale mechanical behavior of concrete, something that has only been done on a lumped parameter basis using maturity methods in the past. The multi-scale approach is expected to provide insights into the design of binary and ternary cement-systems, whereas conventional heuristic macro-scale models can, at best, predict the behavior of a narrowly defined system. A significant broader impact on students is expected. The proposed collaboration will offer interdisciplinary opportunities that could not otherwise be possible.

Principal Investigator: Sharon Berk, Water Center/John Gunderson, Biology

Project Title: The Isolation and Characterization of Naturally-Occurring Amoeba-Resistant Bacteria from Water Samples

Activation Amount: $96,000.00

Agency: Middle Tennessee State University

Grants Awarded

From 10/1/06 To 10/31/06

Principal Investigator: Sue Bailey, Human Ecology

Supporting Professionals: Betty Vaudt, Leslie Hamlett, Helen Knott, Human Ecology/Ellen Wolfe, Research Office

Project Title: Upper Cumberland Child Care Resource and Referral-Project Students Against Meth (Project SAM)

Activation Amount: $30,000.00

Agency: The Tennessee Commission on National and Community Service

Project Students Against Meth (Project SAM), under the direction of Upper Cumberland Child Care Resource and Referral, will provide materials, training, teaching assistance, and coaching to teachers in school-age programs. The teachers and TTU students, engaged in service-learning activities, will facilitate service-learning with children in after-school programs at Busy Kids in Woodbury, Cookeville Creative Learning, and Kids World in Lebanon. Recognizing the importance of youth voice in service-training, program staff will put the elements in place for children to learn healthy practices and dangers of drug abuse, facilitate the children's creation of anti-meth communications products and other projects, encourage reflection activities, and share the celebration of their successes. Project SAM will engage parents and other community volunteers such as the Lion's and Rotary Clubs.

The goal of Project SAM is to create a community of individuals committed to making a difference in their neighborhoods by spreading the anti-drug message. Project SAM's specific objectives are as follows: The students will: 1) understand appropriate and inappropriate uses of chemical substances for healthful living; 2) understand the effects of substance use and abuse; 3) understand how the culture, media, and technology impact consumer decisions about healthful living; and 4) produce an anti-meth communication product for dissemination to local schools and/or other organizations.

Principal Investigator: Sue Bailey, Human Ecology

Supporting Professionals: Melinda Swafford and Lee Ann Jolley, Human Ecology

Project Title: FACS Vocational Education Basic Grant 2006-07

Activation Amount: $1,959.00

Agency: Tennessee Department of Education

The purpose of the Family and Consumer Sciences Vocational Education Basic Grant is to provide services to middle and high school FACS teachers. The services to be rendered include (1) consulting with the FACS Consultant for the purpose of advising and receiving information for FACS teachers; (2) assisting teachers on site; (3) developing and editing the web based FACS-Educator Resource; (4) presenting at the TN Vocational Conference; and (5) creating and monitoring a Teacher Resource Site. FACS teachers across Tennessee may participate in the activities related to this grant.

Grants Awarded

From 10/1/06 To 10/31/06

Principal Investigator: Wenzhong Gao, Energy Systems Research

Project Title: Design Optimization of Hybrid Powertrains

Activation Amount: $50,000.00

Agency: Argonne National Laboratory (via DOE)

This project is to develop efficient methodology for automated design optimization of hybrid powertrains-test all the possible ways a vehicle's powertrain can be configured and sized to get the best fuel economy and performance by computers. The main research goals are to: 1) investigate different optimization algorithms for this application; 2) reduce the time for optimization, using efficient optimization algorithm and distributed computing. The main methods will be computer modeling and simulation. Specifically, the Powertrain System Analysis Toolkit, or PSAT, developed by the Argonne National Laboratory will be used together with other computation software. The research results can accelerate the optimal design of hybrid vehicles, which have increased fuel economy, reduced harmful emissions and better vehicle performance comparing to the conventional vehicles.