2014 Curriculum Development Grant Program Awards

Institution	Amount	Title
Aiken Technical College	$195,484	Nuclear Welding Technical Education Project (NWTEP)
Duke University	$199,813	Development of New Laboratory Modules in Health Physics Curriculum at Duke University
Indian River State College	$199,547	Development of a Combined Concentration of Radiation Protection (RP) and Chemistry Technician (CT)
Jackson State University	$199,726	Jackson State, Alcorn State, and Mississippi Valley State Curriculum Development Alliance (JAMCDA)
Kansas State University	$87,426	Development of an Interactive Nuclear Power Systems Laboratory Class
The Ohio State University	$198,287	Nuclear Materials II: High-Temperature Material Corrosion and Failure Mechanisms
University of New Mexico	$111,193	Developing a Modern Nuclear Reactor Safety Course at the University of New Mexico and University of California-Berkeley
University of Pittsburgh	$200,000	University of Pittsburgh Curriculum Development in Nuclear Chemistry and Radiochemistry
University of Texas at El Paso	$188,684	Development of Educational Courses on Nuclear Engineering Materials at the University of Texas at El Paso
Worcester Polytechnic Institute	$197,682	Curriculum Development for Worcester Polytechnic Institute's Nuclear Science and Engineering Program

Nuclear Welding Technical Education Project (NWTEP)

Executive Summary:

Aiken Technical College (ATC) proposes to address current documented nuclear workforce needs by designing and implementing a nuclear welding program for undergraduate students that can be delivered in a traditional classroom and in a performance laboratory setting where students will focus on skill mastery. The Nuclear Welding Technical Education Project (NWTEP) will provide training for workers in the Central Savannah River Area of South Carolina and Georgia, an area whose economy centers on Plant Vogtle and nearby V.C. Summer Nuclear Station, two NRC-licensed nuclear commercial power plants, as well as the Department of Energy's Savannah River Site, home of the NRC-licensed Mixed Oxide Fuel Fabrication facility and the Salt Waste Processing Facility, both currently under construction. The nuclear employers are supportive of ATC's nuclear programs as evidenced by their commitment to the already developed Radiation Protection and Nuclear Quality Systems programs. Both programs are fully supported by Advisory Committees. ATC will form a Nuclear Welding Advisory Committee with members representing the Savannah River Site contractors, the Commercial Nuclear power sector, and nuclear welding vendors. To address the nuclear welding need ATC will develop a Nuclear Welding Certification to prepare employable students to weld in accordance with the nuclear industry standards. The Nuclear Welding certification will be obtained after students have completed an accredited Applied Associate of Science degree in welding or equivalent program. By the end of the grant period, the college will enroll 75 students in the nuclear welding program.

Principal Investigator: Dr. Joy Watson, watsonj3@atc.edu

Development of New Laboratory Modules in Health Physics Curriculum at Duke University

Executive Summary:

The objectives of this project are three-fold: (1) to develop and add a new neutron dosimetry laboratory module, (2) to strengthen the Monte Carlo computational laboratory, and (3) to strengthen the pediatric medical dosimetry module.

Benefits from this project include the following: (1) educating the next generation of health physicists with the cutting-edge research tools, (2) expanding student radiation laboratory experiences beyond the traditional x- and gamma-ray experiments into the neutron domain at the major accelerator facilities on Duke campus, (3) replacing older computers in the MC teaching laboratory with more powerful and faster PCs for our students, and (4) students will have access to a family of anthropomorphic phantoms including a new 10-year old phantom for their thesis research in medical health physics.

Principal Investigator(s): Dr. Terry Yoshizumi, yoshi0003@mc.duke.edu, Dr. Rathnayaka Gunasingha, rathnayaka.gunasingha@duke.edu

Development of a Combined Concentration of Radiation Protection (RP) and Chemistry Technician (CT)

Executive Summary:

Indian River State College (IRSC) is pleased to submit this proposal to the U. S. Nuclear Regulatory Commission to fund the development of a combined concentration of Radiation Protection (RP) and Chemistry Technician (CT) within our successful Associate in Science Degree (A.S.) in Electrical Power Technology. This request is grounded on the necessity to develop sustainable programs that meet not only the training needs of our industry partners, but their hiring needs, constantly constrained by the uncertainty of retirements and changes in their workforce. The proposed curriculum development leverages the commonalities between two career pathways and takes advantage of the reduced resources (personnel, faculty, and labs) necessary to maintain a program.

The program goal will be achieved through the following objectives:

1. Expand current radiation protection curriculum to include chemistry technician Nuclear Uniform Curriculum Program (NUCP) requirements.

2. Develop laboratory exercises to present students with experiential learning linked to NUCP learning objectives.

3. Develop demonstrations, accessible to all NUCP schools, through a Learning Repository.

Principal Investigator: Jose Farinos, jfarinos@irsc.edu

Jackson State, Alcorn State, and Mississippi Valley State Curriculum Development Alliance (JAM CDA)

Executive Summary:

This proposed project is a cooperative effort of Jackson State University (JSU), Alcorn State University (ASU), and Mississippi Valley State University (MVSU), all of which are predominantly minority-serving institutions. These three universities comprise the Jackson State, Alcorn State, and Mississippi Valley State Curriculum Development Alliance (JAM CDA).

We propose to develop two new courses, one lab module, and a virtual reality training program, revise four existing courses, as well as introduce new teaching strategies into several existing courses over the two years of grant support. These efforts will promote and encourage undergraduate and graduate students to pursue careers in the nuclear field as well as ensure that they will better understand the problems of dealing with nuclear safety and problems related to nuclear emergency preparedness and response.

Principal Investigator: Dr. Pao-Chiang Yuan, pao-chiang.yuan@jsums.edu

Development of an Interactive Nuclear Power Systems Laboratory Class

Executive Summary:

The objective of this course is to teach important reactor safety and power systems concepts, such as critical heat flux, the effect of corrosion on centerline fuel temperature, and reactor behavior during transients, through a series of specially-designed laboratory experiments. Recorded versions of the experiments and computer-based modules will be made available for distance students through the University Engineering Alliance (formerly the Big 12 Engineering Consortium). The benefit of this course will be to provide the only course in nuclear power systems and reactor safety at Kansas State University, and to reinforce the most important concepts through hands-on laboratory experience.

Principal Investigator(s): Dr. Amy Betz, arbetz@ksu.edu, Dr. Jeffrey Geuther, geuther@ksu.edu

Nuclear Materials II: High-Temperature Material Corrosion and Failure Mechanisms

Executive Summary:

The project objective is to develop a new course entitled "*Nuclear Materials II: High Temperature Material Corrosion and Failure Mechanisms*" for graduate students from the Departments of Mechanical and Aerospace Engineering and Materials Science Engineering, and from the Nuclear Engineering Program at The Ohio State University (OSU).

Project benefits include: (1) providing the Ph.D. and M.S. students with fundamental knowledge of processes, tools, and case studies in the field of high-temperature material corrosion in nuclear environments that will benefit their research work at OSU and their future field of employment, and (2) increasing the number of students with non-nuclear engineering background that have knowledge of materials issues for nuclear applications.

Principal Investigator(s): Dr. Jinsuo Zhang, zhang.3558@osu.edu, Dr. Wolfgang Windl, windl.1@osu.edu

Developing a Modern Nuclear Reactor Safety Course at the University of New Mexico and University of California, Berkeley

Executive Summary:

This proposal details a project designed to establish a modern nuclear reactor safety course at the University of New Mexico (UNM) and revise existing nuclear reactor safety curriculum at the University of California, Berkeley (UCB) in a manner consistent with the mission of the U.S. Nuclear Regulatory Commission (NRC). The proposed project will be performed over a two-year time period and will address both the nuclear engineering and reliability and risk analysis technical focus areas. The key outcome of this project will be a modern reactor safety course that will be piloted at both UNM and UCB. This course will be offered to senior undergraduate and graduate students and co-taught by Prof. Blandford (UMN) and Prof. Peterson (UCB). The objectives of this proposal are based on a comprehensive and integrated approach to nuclear education that:

- Revises and modernizes an existing nuclear reactor safety and risk analysis course to incorporate:
    - Approaches to Level II and Level III PRA consistent with NRC risk informed and performance-based regulation;
    - Potential quantitative societal objectives as they relate to the existing NRC quantitative health objectives;
    - Treatment of beyond design basis events with an emphasis on severe natural hazards; and
    - Synergies and conflicts of reactor safety and security
- Utilizes modern technology for distance learning approaches such that the course can be offered simultaneously at both UNM and UCB thus maximizing both universities' expertise and leveraging nearby DOE lab guest lecturers
- Achieves experiential learning through simulated real-world projects and interactions with involved reactor safety practitioners, decision-makers, and relevant stakeholders
- Increases access to course material through distance learning approaches, such that these course materials can be potentially used at other universities
- Develops stronger linkages between supporting courses offered at both universities in key areas important to nuclear reactor safety and security.

Principal Investigator(s): Dr. Edward Blandford, edb@unm.edu, Dr. Per Peterson, peterson@nuc.berkeley.edu

University of Pittsburgh Curriculum Development in Nuclear Chemistry and Radiochemistry

Executive Summary:

The National Academy of Science (NAS) recently released a report entitled "*Assuring a Future U.S.-Based Nuclear and Radiochemistry Expertise*." In this report the panel states "since the 1970's a steadily declining number of academic staff in nuclear and radiochemistry has led to decreases in the number of U.S. citizens with training in the fields of nuclear security, medicine, energy, environmental management, and basic research – and in the number of U.S. colleges and universities that offer research in these fields." A key finding of the NAS panel was that "There is little or no nuclear and radiochemistry coursework being offered at U.S. universities."

The University of Pittsburgh Swanson School of Engineering (SSoE)'s Nuclear Engineering Program and the University of Pittsburgh School of Medicine's Department of Radiology, specifically the PET Center and the Molecular Imaging Center, are collaborating to develop core academic opportunities in the area of nuclear and radiochemistry applicable to both the nuclear power and the medical industry. We are planning to build a strong educational foundation in the general area of nuclear chemistry and radiochemistry to support the needs of the nuclear power and medical communities in the Pittsburgh and southwest Pennsylvania area. Towards this end we are teaming with faculty in the Chemical Engineering Department and the Computer Science Department to develop two new courses:

1. *Radiation Measurement and Detection Laboratory*
2. *Radiation Interaction with Matter and Health Physics*, which applies a novel game-based platform for student practice and assessment.

Principal Investigator(s): Dr. Daniel Cole, dgcole@pitt.edu, Dr. Cheryl Bodnar, bodnarca@pitt.edu

Development of Educational Courses on Nuclear Engineering Materials at the University of Texas at El Paso (UTEP)

Executive Summary:

The objective of this project is to create and advance the educational opportunities in Nuclear Engineering at the University of Texas at El Paso (UTEP), a top ranked Hispanic-serving minority institution. Three new courses are proposed to be developed and offered at the undergraduate and graduate levels in the Department of Mechanical Engineering at UTEP. At the undergraduate level, a comprehensive introductory course on the concepts of nuclear engineering will be offered, and at the graduate level two courses will center on various aspects of materials in nuclear engineering, including material selection, characterization techniques, degradation and failure mechanisms, nondestructive examination technology, and computational approaches in modeling materials behavior due to irradiation. In addition, a laboratory module on “nondestructive examination and characterization techniques of nuclear engineering materials” will also be developed.

The project will significantly enhance the existing energy engineering instructional capacity and infrastructure in the Department of Mechanical Engineering at UTEP by incorporating nuclear materials engineering educational opportunities. Students graduating with a strong theoretical knowledge and hands-on laboratory experience in nuclear engineering will be better able to pursue careers with nuclear industry, the Nuclear Regulatory Commission (NRC), the Department of Energy (DOE), national laboratories, and academia. The motivation to offer these courses and enhance the nuclear engineering curriculum at UTEP is derived from a natural combination of the faculties from mechanical engineering whose interests and expertise span a broad range of energy engineering, structural and aerospace materials, fracture mechanics, nanotechnology, composite materials, nuclear engineering materials, and computational approaches to nuclear materials. The long-term benefits include: (1) coalescence of faculty teaching interests, (2) enhancement of underlying teaching competency and skills, (3) capacity enhancement to provide nuclear engineering materials educational training, and (4) stronger collaboration between academia and industry for advancing the Nation’s educational infrastructure.

Principal Investigator: Dr. Ahsan Choudhuri, ahsan@utep.edu

Curriculum Development for Worcester Polytechnic Institute's Nuclear Science and Engineering Program

Executive Summary:

The administration at Worcester Polytechnic Institute (WPI), in recognition of expected growth in the nuclear field, has recently made a strong commitment to re-launching their nuclear science education programs, including a new Graduate Certificate Program in Nuclear Science and Engineering. Herein, we request funding from the Nuclear Regulatory Commission to develop four new courses necessary to establish new B.S., M.S., and Ph.D. programs in the area of Nuclear Science and Engineering. WPI is greatly committed to this venture, both through a hiring initiative of new, well-qualified faculty and through the substantial investment of funds in instrumentation suitable for the training and research efforts of highly trained nuclear professionals. Our overall objective is to substantially improve the current WPI academic curriculum, establish laboratory capabilities in order to meet the current and future demands of the nuclear field, and to comply with the ABET accreditation criteria for Nuclear Science and Engineering programs. The duration of the program is two years, and the curriculum development efforts will be sustained through the attainment and maintaining of ABET accreditation and an annual review of the curriculum development.

Principal Investigator(s): Dr. Izabela Stroe, izabela@wpi.edu, Dr. David Medich, dmedich@wpi.edu, Dr. Germano Innacchione, gsiannac@wpi.edu, and Dr. Peter Miraglia, pgmiraglia@wpi.edu