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The Pipeline of Graduate Students to the National Laboratories

Abstract

It is well know that the national laboratories are in a critical situation to recruit "new blood" into its aging workforce. Competition for highly qualified U.S. students comes from both industry and the national labs. In the past several years we have actively pursued a strong collaboration with Los Alamos, Sandia, Oak Ridge, Idaho, and Brookhaven National Laboratories. We have followed an excellent format to recruit, secure funding and eventually place students in the national labs.

Introduction

Since the late 1990's the University of Texas at Austin Nuclear and Radiation Engineering Program has made a priority of placing of students with advanced degrees at the national laboratories. The initial inception of this idea came under the auspicious of the Amarillo National Resource Center for Plutonium (ANRCP) where DOE funding was secured to support research activities at the University of Texas at Austin, Texas A&M and Texas Tech, with the hope of eventual placing students at PANTEX and other national laboratories. At the University of Texas funding was also received to offer M.S. and Ph.D. graduate degrees to employees at PANTEX. Thus we initiated a two prong effort to both recruit students in the Nuclear and Radiation Engineering Program by attracting funding from national labs and to offer advanced degrees to employees at these labs as well.

Recruitment

In 1997, there were only fifteen graduate students, almost all foreign students and a very small number of undergraduate students in the undergraduate nuclear technical option within the Mechanical Engineering Department. Several strategic initiatives were followed that included:

1. Pursuing highly qualified US graduate students.
2. Advertising a new nuclear and radiation engineering technical option which included the following three mandatory courses.
    a. Introduction to Nuclear and Radiation Engineering Concepts (1 hr)
    b. Introduction to Nuclear Power Systems (3 hr)
    c. Radiation and Radiation Protection (3 hr)

    and one of the following
    d. Reactor Engineering (3 hr)
    e. Radiation and Radiation Protection Laboratory (3 hr)
    f. Radioactive Waste Management (3 hr)
3. Establishment of a Radiation Physics option with the Physics Department which included all the following courses.
    a. Introduction to Nuclear and Radiation Engineering Concepts (1 hr)
    b. Introduction to Nuclear Power Systems (3 hr)
    c. Radiation and Radiation Protection (3 hr)

d. Radiation and Radiation Protection Laboratory (3 hr)
e. Radioactive Waste Management (3 hr)

Research topic classes worth three hours of credit were also offered to interested students. Once the pipeline of students was established from the undergraduate program we were able to fill our graduate program with well qualified graduate students. We furthermore offered various undergraduate research assistants to students who showed a keen interest in graduate school. Through this mechanism we were able to identify the students who were most qualified to then attend the national laboratories either as summer interns or on funded M.S. and Ph.D. projects. To satisfy the need of the national laboratories for US students we have attained >95% domestic students in our graduate program and 100% students in our undergraduate program. A special focus has also been made to recruit underrepresented students, primarily Hispanic and women.

Distance Learning

A very comprehensive graduate distance learning program was established that allowed The University of Texas at Austin graduate students to finish their degrees while working at a national lab. While at a national lab, the student works on their research and completes their remaining coursework through distance learning. Full time employees at the national labs are also provided with the opportunity to continue their education and pursue advanced engineering degrees.

National Laboratories

A cornerstone to the pipeline of students into national labs is the maintenance of relationships with key divisions within the laboratories. This relationship entails on-site visits by The University of Texas at Austin faculty to the national labs and reciprocal visits by national lab staff . Often times, these visits are associated with seminars. Once a relationship has begun national lab staff often participate in student supervision through membership on graduate student committees. Many laboratory staff are also attracted into a relationship with The University of Texas at Austin in their desire to pursue M.S. and Ph.D. degrees.

Below is a list of Ph.D. dissertations and M.S. theses completed through national laboratory collaborations. This list includes work completed by full-time students as well as work completed by national laboratory staff who worked via distance learning for their degrees.

Ph.D. Dissertations

Feasibility Study of *In Vivo* Partial Body Potassium Determination in the Human Body Using Gamma-Ray Spectroscopy (BNL employee)

Evaluation of the Impact of Non-Uniform Neutron Radiation Fields on the Dose Received by Glove Box Radiation Workers (LANL employee)

Development of Composite Materials for Non-Leaded Gloves for Use in Radiological Hand Protection (LANL)

Radiological Dose Analysis of Target Materials for Accelerator Transmutation of Waste (ATW) Applications (PANTEX employee)

Estimate of Radiation-Induced Steel Embrittlement in the BWR Core Shroud and Vessel Wall from Reactor-Grade MOX/UOX Fuel for the Nuclear Power Plant at Laguna Verde, Veracruz, Mexico (PANTEX employee)

Active Interrogation of Highly Enriched Uranium (PANTEX employee)

Alpha Radiation Effects on Weapons Grade Plutonium Encapsulating Materials (PANTEX)

Numerical Analysis of Two Dimensional Natural Convection Heat Transfer Following a Contained Explosion (Pantex)

M.S. Theses

A Qualification Methodology that Enables Calibrated Volumes for Optical 3-Dimensional Measurements of Nuclear Weapons Components (PANTEX employee)

Creating a Robust, Reliable, Reproducible, Automated Electrodeposition System for Analyzing Trace Quantities of Actinides (LANL)

Testing and Assessment of the Nuclear Fuel Cycle Simulator (NFCSim) Computer Code (Sandia)

Analysis of Dynamic Fuel Expansion Effects in a Fast Burst Reactor (Sandia employee)

Monte Carlo Simulations of Germanium Detector Efficiency Curves (LANL)

Minimizing Glovebox Breeches in Plutonium Handling Facilities at Los Alamos National Laboratory (LANL)

Development of a Methodology for the Assessment of International Safeguards on the Commercial Nuclear Fuel Cycles of Argentina and Brazil (Oak Ridge)

Mechanical Properties of Irradiated and Unirradiated High-Chromium Ferritic/Martensitic Steels for Use in Nuclear Applications (Oak Ridge)

Development of a Probabilistic Network Model to Simulate the Smuggling of Nuclear Materials (LANL)

Developing Computer Models for the UREX Solvent Extraction Process and Performing a Sensitivity Analysis of Variables used for Optimizing Flowsheets for Actinide Transmutation (Argonne)

Demonstration of the Feasibility of a Nuclear Archeology Methodology (LANL)

Methodology for Assessing the Proliferation Resistance of Accelerator Transmutation of Waste Technology Options (LANL)

Effects of Heat Flow Plutonium Metal Combustion: Impacts on Release Fractions for Accident Analysis (Sandia employee)

Heavy Metal Determination and Lead Leaching Dynamics of Soil at the Pantex Firing Range, Amarillo, Texas (PANTEX)

Evaluation of the Decoupled BC454/NaI Detector Coincidence System in Detecting Neutrons in a High Gamma Ray Field (LANL)

A Corrosion Study of AL-R8 (Sealed Insert) Plutonium Storage Containers (PANTEX)

Process Modeling of Plutonium Conversion and MOX Fabrication for Plutonium Disposition (PANTEX)

A Computational Model for the ANL Centrifugal Contactor (Argonne)

Evaluation of the Performance of Inconel Alloy 600 in Molten Salt Oxidation Environment (LANL)

Methodology for Assessing the Proliferation Resistance of Accelerator Transmutation of Waste Technology Options (LANL)

Thermodynamics of Beryllium Corrosion (PANTEX)

MCNP Benchmark Calculations for Mixed Oxide Lattices of the Plutonium Program (PANTEX)

Process Modeling of Plutonium Conversion and MOX Fabrication for Plutonium Disposition (PANTEX)

UTXS: NJOY Generated MCNP Continuous Neutron Cross Section Libraries for Light Water Reactor Calculations (PANTEX)

MCNP Critical Benchmarks for Mixed Oxide Lattices of the Saxton Plutonium Program (PANTEX)

Conclusion

Through careful planning, recruitment and pursuing funding opportunities we have been able to attract well qualified students who have worked at interns at the national labs and/or have secured employment, while employees at the national labs have been able to pursue advanced degrees through our distance learning program.

Biographic Information

Dr. Steven Biegalski is an Assistant Professor in the Nuclear and Radiation Engineering Program. He specializes in the fields of nuclear instrumentation, neutron radiography, analysis of environmental media with nuclear methods, and modeling of environmental pathways. Prior to working for the University of Texas, Dr. Biegalski has utilized his expertise to support the development of technology in support of the Comprehensive Nuclear Test-Ban Treaty (CTBT). This includes the development and installation of environmental aerosol and xenon monitoring stations, the development of software to analyze data from the radionuclide monitoring systems, and investigation of the trends, sources, and origin of anthropogenic radionuclides in the environment. In the past, Dr. Biegalski has used this expertise for investigations of air pollution sources in the Arctic, assessing the toxic metal input into the Great Lakes, and working on global change modeling.

Dr. Sheldon Landsberger is a Professor in the Nuclear and Radiation Engineering Program and Director of the Nuclear Engineering Teaching Lab. He is primarily involved in the determination of heavy metals in environmental samples using nuclear analytical methods. He has had experience many years of experience in analyzing air samples from the Arctic, Great Lakes, and other urban and rural areas. In particular he has developed improved nuclear techniques to better determine the elements of critical importance in identifying regional sources of airborne particles, and characterizing solid waste leaching dynamics. His current research interests include low-level counting of natural radioactivity, corrosion studies, Compton suppression gamma-ray spectrometry and risk assessment in radioactivity handling.

Dr. Erich Schneider is an Assistant Professor in the Nuclear and Radiation Engineering Program. He has Schneider served as a technical staff member at Los Alamos National Laboratory. During his four years at LANL, Dr. Schneider has been involved in transmutation physics and systems analysis research activities for the US Department of Energy Advanced Nuclear Fuel Cycle Initiative (AFCI). His work in this area includes development of computational models for the simulation and optimization of nuclear fuel cycles, reactor physics calculations and cross section sensitivity analyses for advanced transmuting reactors and economic modeling including uranium resource base assessment. Dr. Schneider is also active in the areas of nuclear proliferation risk assessment, nuclear reactor and weapon safety, and reactor thermal hydraulic systems analysis.