

## Nuclear Energy University Programs 2012 Awards

### Nuclear Energy Research and Development Awards

Lead University and Location	Estimated University Funding*	Description
Northwestern University Evanston, IL	\$760,000	Researchers will evaluate the effectiveness of chalcogenide based materials and design novel metal sulfides to effectively capture and store radioisotopes released during reprocessing of used nuclear fuel. This project will focus on understanding structure-property relationships to enable refined and direct synthesis approaches for improved and cost-efficient nuclear waste forms.
Washington State University Pullman, WA	\$875,000	Researchers will use advanced characterization techniques (experimental and computational) to improve understanding of the molecular level processes/interactions during separation processes for advanced fuel cycles. The understanding of these interactions will be used to develop more robust and streamlined separation processes for advanced fuel cycles.
Alfred University Alfred, NY	\$840,000	This project aims to advance fundamental understanding of the kinetics of structural evolution of crystalline ceramic waste forms. The structure/property relationships will be identified and will reveal new formulations, improved processing routes, and strategies for improved performance or ceramic waste forms.

<p>Alfred University Alfred, NY</p>	<p>\$880,000</p>	<p>This project will investigate the links between the morphology, structure and chemistry of surface layer-bulk glass interface and the long-term corrosion-reaction kinetics using in-situ and ex-situ experiments. The understanding will result in improved models for long-term predictive behavior of high-level-waste (HLW) glasses under repository conditions.</p>
<p>University of Nevada-Las Vegas Las Vegas, NV</p>	<p>\$790,000</p>	<p>This project aims to use advanced electrochemical methods to investigate the corrosion related degradation of metal alloys used for housing fission products. The data obtained from this study will allow for the prediction of the long-term behavior of the metallic host phase materials over geological time-scales.</p>
<p>University of Nevada-Las Vegas Las Vegas, NV</p>	<p>\$795,000</p>	<p>This project team will harvest thermodynamic and microstructural data on the evolution of ceramic based waste forms. The data will be used to advance the current state-of-the-art methodology used for isolation and stabilization of fission products and improve on nuclear fuel recycling processes.</p>
<p>Ohio State University Columbus, OH</p>	<p>\$885,000</p>	<p>The researchers on this project will investigate the performance of sapphire optical fibers and sensors in reactor environments. The project, if successful, will result in improved instrumentation to understand the behavior and predict performance of nuclear fuel systems at the microstructural level.</p>

Case Western Reserve University Cleveland, OH	\$850,000	This project aims to develop new case-hardened stainless steels by saturating them with materials that improve their mechanical properties, corrosion resistance and radiation resistance. This project, if successful, will result in safer, longer-lasting and more accident tolerant fuel claddings.
University of Florida Gainesville, FL	\$800,000	Researchers will evaluate the use of diamond nanoparticles composite material in innovative accident tolerant fuel pellets. This could significantly improve both the thermal conductivity of fuel pellets and light water reactors' efficiency and safety.
University of Tennessee Knoxville, TN	\$815,000	Researchers will use novel experimental methods to investigate the links between microstructure, phase stability and damage evolution in nanostructured ceramic fuel materials. The project will study fuel materials at temperatures and irradiation conditions relevant to operation and accidental scenarios.
University of Kentucky Louisville, KY	\$880,523	Researchers will measure nuclear data for elastic/inelastic scattered neutrons on coolants and structural materials. The data generated will be useful for future R&D programs that will study innovative next generation LWR and future fast systems.
North Carolina State University Raleigh, NC	\$875,000	Researchers will develop and use state-of-the-art radiation transport codes to account accurately for the fissile material in a nuclear materials processing facility. An accurate estimation of the materials will allow for ensured radiological safety, security, waste management and efficient plant operation.

<p>Texas A&amp;M University College Station, TX</p>	<p>\$875,000</p>	<p>This project aims to create a prototype demonstration of a novel neutron/alpha detector based on a technology that is blind to gamma field used fuel. The prototype, if successful, will enhance instrumentation for monitoring real-time material balance during various stages of the nuclear cycle.</p>
<p>University of Idaho Moscow, ID</p>	<p>\$820,000</p>	<p>This project aims to use advanced characterization techniques to investigate the microstructural changes and micromechanisms related to irradiation induced damage in used nuclear fuels and waste forms. This project, if successful, will result in enhanced models to predict the structural and chemical response of used fuel and waste forms during interim storage and permanent disposal.</p>
<p>University of Nevada-Reno Reno, NV</p>	<p>\$745,000</p>	<p>Researchers will conduct experiments to investigate and develop advanced computational models of heat transfer in post-pool-storage drying operations. This project, if successful, will result in tools that can be used to design efficient drying processes to ensure suitability for dry-cask systems for long-term storage and transport.</p>
<p>University of Tennessee Knoxville, TN</p>	<p>\$770,000</p>	<p>This project aims to investigate the structural and chemical response of used nuclear fuel and waste forms during interim storage and permanent disposal. If successful, this project will generate models that will allow the prediction of structural evolution and hence the radiological safety and security of nuclear fuel and waste forms.</p>

<p>University of Houston Houston, TX</p>	<p>\$865,000</p>	<p>This project aims to investigate the performance of dry cask storage systems under multiple hazard systems (earthquake, tornados, combined with aging effects) using a probabilistic multi-hazard framework. This framework will be validated based on experimental research and will provide improved models for safety and reliability of spent nuclear fuels during storage and transportation.</p>
<p>University of Houston Houston, TX</p>	<p>\$800,000</p>	<p>Researchers aim to design a new class of multifunctional concrete materials. The project, if successful, will result in a novel multifunctional concrete material that possesses inherent degradation monitoring capability and is suitable for an extended storage system for the used nuclear fuel.</p>
<p>Northwestern University Evanston, IL</p>	<p>\$885,000</p>	<p>Researchers aim to use nondestructive damage characterization methods to detect, manage and mitigate the degradation/damage mechanisms of dry cask storage systems for nuclear fuels. This project, if successful, will provide tools that will allow the prediction of the reliability and the safety of concrete structures in dry cask storage systems.</p>
<p>Massachusetts Institute of Technology Cambridge, MA</p>	<p>\$850,000</p>	<p>Researchers aim to carry out a comprehensive evaluation of the deep borehole option for disposal of used nuclear fuel and high level waste. The models developed will predict potential movement of water through natural and engineered barriers and release of radionuclides to the biosphere which will aid in site selection.</p>

<p>Washington State University Pullman, WA</p>	<p>\$885,000</p>	<p>Researchers will conduct experiments to understand the mechanisms responsible for the corrosion of nuclear waste forms in realistic chemical environments. The data generated from these experiments will enable increased reliability of the models used to predict the waste form performance in repository environments.</p>
<p>Utah State University Logan, UT</p>	<p>\$690,000</p>	<p>Researchers in this project aim to conduct experiments that generate data on natural convection through a fuel assembly. The data will be used to validate the computational models being developed for nuclear safety and design.</p>
<p>Virginia Commonwealth University Richmond, VA</p>	<p>\$850,000</p>	<p>This project will create a comprehensive framework for the evaluation of alternative fuel cycle systems that will be used to identify and analyze key elements related to long-term management of nuclear fuels, with the ultimate goal to develop a communications strategy to reach stakeholders.</p>
<p>Massachusetts Institute of Technology Cambridge, MA</p>	<p>\$800,000</p>	<p>Researchers will work to develop a model to characterize the factors affecting social acceptance of nuclear projects with potential stakeholders. The resultant model will strengthen the ability to design and implement large projects more efficiently, leading to higher rates of success of future nuclear projects.</p>

<p>Georgia Institute of Technology Atlanta, GA</p>	<p>\$784,689</p>	<p>Researchers will examine new options for fuel and core designs in liquid salt cooled reactors where the current standard of TRISO type fuel has limitations due to loading characteristics. The research could enable new, more feasible fuel-core-reload options that will improve safety and performance parameters.</p>
<p>University of Wisconsin-Madison Madison, WI</p>	<p>\$877,000</p>	<p>Researchers will investigate the benefits of utilizing advanced Brayton cycles with supercritical carbon dioxide in new reactor systems and components. Benefits of this research include improvement of analysis and performance of components currently utilizing these cycles, as well as the potential for a large scale advanced CO<sub>2</sub> power system.</p>
<p>University of Illinois-Urbana Champaign Urbana, IL</p>	<p>\$876,332</p>	<p>Researchers will perform post-radiation analysis and develop tools for future development and application of the Fe-Cr class of alloys. The results of this research will lead to better modeling of performance and development of an alloy designated as the primary choice for reactor fuel cladding and structural applications in advanced systems.</p>
<p>University of Michigan Ann Arbor, MI</p>	<p>\$831,876</p>	<p>Researchers will determine the extent to which high dose rate irradiation can be used as an irradiation damage tool to understand microstructure evolution at high doses and temperatures relevant to advanced fast reactors. This project will provide fundamental understanding of the effectiveness of this process and thus of microstructure development in irradiated materials.</p>

<p>Georgia Institute of Technology Atlanta, GA</p>	<p>\$877,000</p>	<p>Researchers will explore new nondestructive materials evaluation and monitoring techniques utilizing nonlinear ultrasonic measurements. This technique will allow researchers to assess remaining useful life of select reactor components. Breakthroughs in this area will lead to the ability to characterize radiation damage in reactor pressure vessels and other components – leading to a clearer definition of reactor safety margins.</p>
<p>University of Wisconsin-Madison Madison, WI</p>	<p>\$875,350</p>	<p>Researchers will study mechanisms controlling both radiation swelling and radiation creep in silicon carbide. These two effects are crucial to understanding the issues associated with the brittle silicon carbide composite. Success in this project will ground progress in the adoption of silicon carbide for reactor solutions, particularly as fuel cladding.</p>
<p>Texas A&amp;M University College Station, TX</p>	<p>\$713,051</p>	<p>Researchers will model the internal coolant flow of a prismatic core very high temperature reactor (VHTR) by using large eddy simulation tools. This method will enable more accurate prediction of flow field characteristics and better evaluation of VHTR behavior under operational and accidental conditions.</p>
<p>University of Pittsburgh Pittsburgh, PA</p>	<p>\$876,422</p>	<p>Researchers will develop a comprehensive experimentally validated computational framework for the turbulent mixing in the lower plenum of a very high temperature reactor (VHTR). Through CFD modeling and experimental validation, the results from this project will lay the groundwork for future stress analysis, failure and fatigue studies, and uncertainty quantification for the VHTR system.</p>

<p>University of Idaho Moscow, ID</p>	<p>\$877,000</p>	<p>Researchers will demonstrate an intelligent control system in a hybrid energy conversion loop for a next generation nuclear power plant. Hybrid energy systems are a method of optimizing the use of natural resources for energy production. Hybrid systems present an opportunity to develop domestic energy sources to improve energy security.</p>
<p>University of Idaho Moscow, ID</p>	<p>\$869,997</p>	<p>Researchers will model the behavior of the Advanced Reactor Intermediate Heat Exchanger Chemical Process system and develop advanced control techniques that take into account abnormal scenarios. The data and information obtained will assist in the development of intelligent control systems for next generation nuclear reactor systems.</p>
<p>State University of New York, Stony Brook Stony Brook, NY</p>	<p>\$599,802</p>	<p>Researchers will examine the use of solid-state thermoelectric generators to produce electricity to sense and operate during both normal and abnormal situations. This will provide indefinite monitoring of key components during power outages or station blackouts.</p>
<p>Oregon State University Corvallis, OR</p>	<p>\$871,119</p>	<p>Researchers will conduct experiments to enhance the safety and efficiency of small modular reactors (SMRs). This project will assess the impact of high-pressure steam condensation on steel containment vessels to be used for SMR designs.</p>

<p>Purdue University West Lafayette, IN</p>	<p>\$871,100</p>	<p>Researchers will perform scaled experiments to study the thermal-hydraulic instabilities that can occur in Small Modular Reactors (SMR) which rely on natural circulation cooling during normal operation and accident conditions. Their work will not only improve our understanding of general natural circulation instability but also lead to the development of stability criteria and predictability in the operation of SMR's.</p>
<p>Boston University Boston, MA</p>	<p>\$874,997</p>	<p>Researchers will develop predictive, multi-scale simulation tools for iron-chromium alloys, which are expected to be key components of advanced steels that could be used as fuel cladding for next generation reactors.</p>
<p>George Washington University Washington, DC</p>	<p>\$862,435</p>	<p>Researchers will conduct experiments that will provide comprehensive data characterizing the dynamics of the fluid and the structure in Pressurized Water Reactors (PWR) fuel assemblies under seismic loads (earthquakes and loss of coolant accidents). Completion of their project will greatly benefit the safety of existing and future nuclear reactors.</p>
<p>Georgia Institute of Technology Atlanta, GA</p>	<p>\$743,444</p>	<p>Researchers will address the question of uncertainty propagation and error estimates associated with model prediction of material behavior under irradiation. Their work will facilitate a better understanding of the connection of various unit processes to collective responses in a multiscale model chain enabling the development of high strength and high ductility materials.</p>

<p>University of Notre Dame Notre Dame, IN</p>	<p>\$440,000</p>	<p>Researchers will develop the mechanisms, conditions and protocols to prepare uranium-carbon nanocomposite materials to make them more flexible. This could result in the generation of wholesale electricity, providing process heat, and providing power for households.</p>
<p>University of Texas-Austin Austin, TX</p>	<p>\$435,000</p>	<p>The researchers will perform a neutronic analysis, a thermal-hydraulic analysis and a simulation of fuel decay heat as a function of fuel burnup, to determine if inert matrix fuel in conventional reactors will continue to be licensable. If successful, the inert matrix fuel mixtures will reduce harmful transuranic components in the fuel discharge streams at a level comparable to a fast reactor burner.</p>
<p>University of Texas-Austin Austin, TX</p>	<p>\$395,000</p>	<p>Researchers will use new analysis techniques to better predict nuclear fuel behavior. The new model will allow improved fuel cycle for a larger number of users.</p>
<p>University of South Carolina Columbia, SC</p>	<p>\$430,000</p>	<p>This project will exploit recent breakthroughs to grow epitaxial graphene on commercial SiC wafers. This will allow researchers to develop a new detection method for fast neutrons. In addition, it will lead to a better and more compact neutron detection system.</p>
<p>University of California-Berkeley Berkeley, CA</p>	<p>\$450,000</p>	<p>The research team will use detailed neutronic analysis for a new Advanced Burner Reactor concept with a low conversion ratio. The concept will use a new core shape to improve the utilization of neutrons to breed and burn.</p>

Purdue University West Lafayette, IN	\$450,000	Researchers will investigate a new type of molten metallic fuel reactor concept that will consume hazardous transuranic waste. The liquid fuel alloy has several advantages over solid fuel fast reactors that are used for the same purpose.
University of California, Davis Davis, CA	\$450,000	Researchers will work to develop nanostructured and other new materials to support the development of higher efficiency thermoelectric devices. These devices convert thermal energy to electricity with no moving parts. The new materials will operate at higher efficiencies and over a wider temperature range than those currently available – an important quality for future nuclear-powered deep space exploration.

<b>Research Reactor Upgrades and Infrastructure Awards</b>		
<b>University</b>	<b>Amount</b>	<b>Description</b>
Purdue University West Lafayette, IN	\$1,276,812	Purdue University will replace existing research reactor instrumentation and controls systems with modern, solid-state technology to reduce unscheduled maintenance downtime. Additionally, this upgrade will increase the availability and safety of the reactor to use in student education, training and research projects.
University of Wisconsin-Madison Madison, WI	\$433,082	University of Wisconsin-Madison will refinish its existing hot cell and install the infrastructure necessary for sample preparation and testing and relocate the existing CLIM facility within the UWNR and take advantage of an integrated radiation monitoring system.

Colorado School of Mines Golden, CO	\$148,667	The Colorado School of Mines will add several modular filters, provide additional neutron detection and measurement equipment, and obtain image conversion foils needed to conduct film-based neutron radiography.
Kansas State University Manhattan, KS	\$136,470	Kansas State University will replace its control rod drive mechanisms and airborne radioactivity monitoring system. The old equipment will be used as a backup system improving the reliability of the Kansas State TRIGA reactor.
North Carolina State University Raleigh, NC	\$123,840	North Carolina State University will develop a modern digital image plate system that will establish a high resolution digital neutron imaging capability at the NCSU PULSTAR reactor.
Oregon State University Corvallis, OR	\$62,244	Oregon State University will provide over \$23,000 in cost share to upgrade and automate the pneumatic transfer system serving their 1 MW Mark II TRIGA reactor.
Rensselaer Polytechnic Institute Troy, NY	\$150,000	Rensselaer Polytechnic Institute will upgrade its Walthusen Reactor Critical Facility to extend the experimental and operational capabilities of the facility for teaching and training students, conducting research, and performing subcritical experiments in support of generating bench mark data.
Texas A&M University College Station, TX	\$200,000	Texas A&M University plans to improve operability of its reactor by a power up-rate of about 1.5 MW and by replacing a 54 year old compressor. The funds will allow the reactor to provide additional capabilities to researchers in the same timeframe and reduce the amount of maintenance downtime.
The Ohio State University Columbus, OH	\$150,000	The Ohio State University will upgrade and enhance the radiological monitoring systems necessary for safe operation of the OSU Research Reactor (OSURR) and infrastructure that supports the safe handling, monitoring, storage, and emergency response capabilities for the use of radionuclides produced using the OSURR.

University of Florida Gainesville, FL	\$167,412	The University of Florida will purchase a Canberra CAM110G Series Continuous Air Monitor for online Ar-41 effluent monitoring. The new air monitoring system will allow significant upgrades to allow relicensing of the facility by the NRC and improve the uptime availability of the reactor for training of student and research activities.
University of Missouri-Columbia Columbia, MO	\$149,951	University of Missouri, Columbia will acquire a new NI system drawer and associated amplifiers and replacement components.
University of New Mexico Albuquerque, NM	\$50,000	The University of New Mexico will complete a system update including a new computer data acquisition card, associated electronics, and a physical test stand. The new equipment will improve reliability of the newly relicensed reactor.
University of Utah Salt Lake City, UT	\$24,000	University of Utah will upgrade and improve its TRIGA (UUTR) facilities including its fuel handling tool. The tool which is used for research, services, training of students will be used for a variety of experiments including control rod worth measurement, thermal power calibration, neutron activation and critical fuel loading.
Washington State University Pullman, WA	\$143,945	Washington State University will acquire three pieces of equipment including an NLW Wide Range log-power Channel, NPP-1000 Pulse Power Channel, and a radiation-tolerant underwater camera.
Alcorn State University Alcorn State, MS	\$226,420	Alcorn State University will improve the existing basic-level nuclear instrumentation laboratory and expand the radiation research laboratory within the university's health physics department, providing students with hands-on experience opportunities to prepare them for nuclear energy sector jobs upon graduation.

Colorado School of Mines Golden, CO	\$255,402	Colorado School of Mines will acquire a RoboMet.3D and Avizo Fire Edition 7.0 for its Active Materials Characterization Laboratory. The upgrade will enhance sample throughput and will expand the digital microstructure imaging and tomographic capabilities available at Colorado School of Mines.
Colorado State University Fort Collins, CO	\$260,000	Colorado State University's Health Physics program will update instrumentation to reflect current equipment used by industry and utilize measurement equipment to perform research in forensic identification of radioactive materials, detection of sources, and environmental effect of nuclear reactor effluents. Colorado State will provide a cost share of \$10,000.
Georgia Institute of Technology Atlanta, GA	\$250,000	Georgia Tech will enhance the capabilities of its Radiological Science and Engineering Laboratory by upgrading an existing neutron generator as well as adding a mass spectrometer gas analysis unit and a thermal evaporator system for neutron detector research and development.
Illinois Institute of Technology Chicago, IL	\$300,000	The Illinois Institute of Technology will provide \$200,000 cost share to acquire an Electron detector and the supporting Vacuum equipment used to better understand damage mechanisms due to heavy ion irradiations in both fuels and structural materials.
Oregon State University Corvallis, OR	\$183,158	Oregon State University will build a calorimetric and thermogravimetric analytical (TGA) instrumentation capability. Also, they will acquire a Nano Isothermal Titration Calorimeter and Thermogravimetric Analyzer.
The Curators of the University of Missouri S&T Rolla, MO	\$300,000	Missouri University of Science and Technology will add three workstations for spectroscopy of alpha particle, beta particle and gamma ray, neutron measurement, and x-ray exposure measurement. Funds will also be used for a facility upgrade for distance education.

University of Pittsburgh Pittsburgh, PA	\$300,000	University of Pittsburgh will cost share \$50,000 to purchase detectors, instrumentation, and sources to establish and equip a new Radiation Detection and Measurement Laboratory at the University of Pittsburgh.
University of Texas at Austin Austin, TX	\$232,453	The University of Texas at Austin will implement a dedicated low-level background gamma-ray counting Compton suppression system for teaching and research of nuclear engineering students. University of Texas at Austin will cost share \$50,000 for a full dedicated low-level gamma facility that will be used for counting times between 12-24 hours to perform measurements in low level gamma-ray studies in nuclear forensics, radiochemistry, fission product experiments, and nonproliferation.
Virginia Commonwealth University Richmond, VA	\$199,256	Virginia Commonwealth University will build educational and research infrastructure for its new nuclear engineering program. The funds will be used to enhance the instrumentation available at VCU's radiation detection and measurement laboratories and to acquire nuclear materials testing instrumentation.
Virginia Polytechnic Institute and State University Blacksburg, VA	\$224,935	Virginia Tech will establish a laboratory for research and education in the area of radiation measurement, simulation and visualization. Equipment purchases include basic sets of radiation detection instruments and sources along with a computer cluster and displays to provide particle transport measurement, simulation and visualization. Virginia Tech will cost share an additional \$25,000.
Washington State University Pullman, WA	\$90,608	Washington State University will add new instrumentation to an existing suite of equipment supporting radioactive materials research. The equipment focuses on lanthanide and actinide metal ions to support research into future fuel cycles that support actinide transmutation.

## Integrated University Program 2010 Awards

### Scholarships - \$5,000/one-year scholarship

University	Total Amount	Description
Francis Marion University Florence, SC	\$5,000	1 scholarship
Georgia Institute of Technology Atlanta, GA	\$10,000	2 scholarships
Idaho State University Pocatello, ID	\$5,000	1 scholarship
Missouri University of Science & Technology Rolla, MO	\$5,000	1 scholarship
North Carolina State University Raleigh, NC	\$10,000	2 scholarships
Oregon State University Corvallis, OR	\$15,000	3 scholarships
Pennsylvania State University University Park, PA	\$15,000	3 scholarships
Purdue University West Lafayette, IN	\$5,000	1 scholarship
Rensselaer Polytechnic Institute Troy, NY	\$5,000	1 scholarship
Texas A&M University College Station, TX	\$10,000	2 scholarships
University of Florida Gainesville, FL	\$15,000	3 scholarships

University of Illinois, Urbana-Champaign Urbana, IL	\$5,000	1 scholarship
University of Michigan Ann Arbor, MI	\$20,000	4 scholarships
University of New Mexico Albuquerque, NM	\$10,000	2 scholarships
University of Tennessee Knoxville, TN	\$30,000	6 scholarships
University of Utah Salt Lake City, UT	\$5,000	1 scholarship
Utah State University Logan, UT	\$20,000	4 scholarships
Virginia Polytechnic Institute and State University Blacksburg, VA	\$5,000	1 scholarship
<b>Fellowships - \$155,000/three-year fellowship</b>		
<b>University</b>	<b>Amount</b>	<b>Description</b>
Georgia Institute of Technology Atlanta, GA	\$465,000	3 fellowships
Idaho State University Pocatello, ID	\$465,000	1 fellowship
Kansas State University Manhattan, KS	\$155,000	1 fellowship
Massachusetts Institute of Technology Cambridge, MA	\$465,000	3 fellowships
North Carolina State University Raleigh, NC	\$155,000	1 fellowship

The Ohio State University Columbus, OH	\$465,000	3 fellowships
Rensselaer Polytechnic Institute Troy, NY	\$155,000	1 fellowship
Texas A&M University College Station, TX	\$465,000	3 fellowships
University of California, Berkeley Berkeley, CA	\$310,000	2 fellowships
University of Idaho Moscow, ID	\$155,000	1 fellowship
University of Michigan Ann Arbor, MI	\$465,000	3 fellowships
University of New Mexico Albuquerque, NM	\$155,000	1 fellowship
University of Pittsburgh Pittsburgh, PA	\$155,000	1 fellowship
University of Tennessee Knoxville, TN	\$155,000	1 fellowship
University of Texas, Austin Austin, TX	\$155,000	1 fellowship
University of Wisconsin, Madison Madison, WI	\$465,000	3 fellowships
Utah State University Logan, UT	\$310,000	2 fellowships