STATE/UNIVERSITY: FY 2018 NEUP/NEET/NSUF-1 FUNDING AMOUNTS

CALIFORNIA – $2,400,000

University of California, Berkeley - $1,600,000

- **2 NEUP R&D Projects - $1,600,000.**
  1. **($800,000).** This project combines experimental and modeling methods to gain a comprehensive approach for addressing scaling effects on small-scale mechanical testing. Multiscale experiments, together with modeling on reactor-relevant and model alloys, will provide better understanding of appropriate scaling relationships. The study aims to gain fundamental understanding of plasticity interactions with specific strength-determining features, such as precipitates and grain boundaries. The goal of this work is to provide the basis to add small-scale mechanical testing in the toolbox for nuclear materials research.
  2. **($800,000).** This project investigates the best possible coatings to prevent SiCf/SiCm corrosion in LWR environments. The research features a computational and experimental rapid screening approach for numerous coating compositions. The work includes autoclave exposure of rapid screening coupons in prototypical environments in combination with thermodynamic modeling (CALPHAD) and Finite Element Methods (FEM). Small-scale mechanical testing, together with thermal cycling and FEM modeling, will provide guidance on the ideal coating system design.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($1,019,579); 18 R&D Projects ($11,007,256); 17 Fellowships ($2,495,000); 1 Scholarship ($5,000) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017
FY 2009 – FY 2017 total: $14,526,835

Previous NEET Funding: None.

University of California, Los Angeles - $800,000

- **1 NEUP R&D Project - $800,000.** This project seeks to identify the thermodynamic propensity and corrosion kinetics for zeolite precipitation in borosilicate glasses used in nuclear waste immobilization applications, as a function of solution conditions, such as composition, pH, and temperature. The objectives are to predict stability of relevant secondary phases (zeolites, clays, C–S–H, etc.), to reveal rate-limiting steps of precipitation, and to quantify precipitation kinetics. This information will establish a science-based foundation to facilitate long-term corrosion rate expectations, while ensuring safe and successful vitrification operations.

Previous NEUP/IUP Funding: 2 R&D Projects ($1,598,846); 1 Fellowship ($150,000).
FY 2009 – FY 2017 total: $1,748,846

Previous NEET Funding: None.

COLORADO – $799,978

University of Colorado, Boulder - $799,978

- **1 NEUP R&D Project - $799,978.** The proposed project focuses on the geomechanical aspects of modeling by addressing the time-dependent evolution of rock microstructure and its coupling with the THC processes that are of first-order importance to the stability and the isolation performance of repositories. The research will delineate an integrated experimental, theoretical and numerical strategy in assessing the evolution EDZ over time and its implication on the long-term migration of hazardous species. These results will enhance the confidence of the predicted long-term performance of repositories, which helps to move forward the goal of one-million-year isolation of high-level nuclear wastes.

Previous NEUP/IUP Funding: 2 General Scientific Infrastructure ($402,664); 3 R&D Projects ($2,097,132) – Awarded in 2009, 2010, 2013 & 2016.
FY 2009 – FY 2017 total: $2,499,796.

Previous NEET Funding: None.

CONNECTICUT – $799,979

University of Connecticut - $799,979.

- **1 NEUP R&D Project - $799,979.** This project proposes to use advanced spectroscopic and scattering methods to provide information at the atomic and molecular scale. The research will use synchrotron-based x-ray absorption fine structure (XAFS) spectroscopy and Raman spectroscopy, at operationally relevant temperatures, to measure the local and intermediate structure as well as speciation of chloride fuel salts (NaCl, ZrCl, UCl3) for fast-spectrum applications and fluoride fuel salts (7 LiF, UF4) primarily for thermal spectrum applications This approach is expected to generate theories and concepts that would allow models to predict behavior, and develop the means for in situ monitoring.

Previous NEUP/IUP Funding: none.

Previous NEET Funding: none.

DISTRICT OF COLUMBIA – $800,000

George Washington University - $800,000.

- **1 NEUP R&D Project - $800,000.** This project aims to validate the Seven-Equation model in RELAP-7 by: 1) measuring velocity and pressure in each phase and the interface as well as return to equilibrium in fast transients with high-speed non-intrusive laser diagnostics in canonical experiments; 2) complementing experimental data with a multiscale computational approach, including a 3D proprietary direct numerical solver; and 3) validating RELAP-7 with a combination of experimental data and first-principle simulations. This combination would provide unique and complete datasets to validate RELAP-7 with high confidence and offer a new class of experimental and numerical tools.

Previous NEUP/IUP Funding: 2 R&D Projects ($1,662,435) – Awards made in 2012 & 2013.
FY 2009 – 2017 total: $1,662,435)

Previous NEET Funding: None.

FLORIDA – $800,000

University of Florida – $800,000

- **1 NEUP R&D Project - $800,000.** This project proposes to develop a comprehensive experimental and computational approach for determining constitutive relations and multiaxial failure envelopes of nuclear-grade continuous silicon fiber (SiCf) and SiC matrix woven tubular composites. The result of this work can be adopted in industry for design refinement, optimization of performance under the desired operating conditions, and reliable prediction of failure under unforeseen accidental scenarios.

Previous NEUP/IUP Funding: 3 General Scientific Infrastructure ($708,667); 3 Reactor Upgrades ($960,589); 9 R&D Projects ($6,033,495); 8 Fellowships ($1,235,000); 13 Scholarships ($72,500) – Awards made in 2009, 2010, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $9,010,251

Previous NEET Funding: 1 NEET R&D Project ($489,135) – Award made in 2016.
FY 2012 – FY 2017 total: $489,135

GEORGIA – $1,600,000

Georgia Institute of Technology - $1,600,000

- **2 NEUP R&D Projects - $1,600,000.**
  1. **($800,000)** The objective of the project is to develop a high-fidelity continuous energy (CE) transport tool for efficient transient calculations in fluoride salt-cooled high-temperature reactors with prismatic core/fuel assembly design. This will be accomplished by extending the high-fidelity 3-D continuous energy coarse mesh radiation transport (COMET) code with formidable computational speed to solve transient problems in FHRs with accurate thermal hydraulic feedback. The new capability would enable plant system codes to perform analyses necessary to address complex technical design, regulatory, reactor safety, and economic hurdles prior to construction.
  2. **($800,000)** The main objectives of this project are to: 1) generate fundamental corrosion data for commercially available low chromium alloys, as well as for newly developed alloys, for the fluoride salt-cooled high-temperature reactor (FHR) applications – in FLiNaK and FLiBe – under flow conditions; 2) develop robust and stable reference electrodes for the two molten fluoride salt flow loops to measure the reduction-oxidation (redox) potential in molten salts and correlate it to the corrosion behavior of selected alloys in respective environments. Correlation of redox potential of molten salts with the corrosion behavior of structural alloys will provide a better corrosion mitigation strategy for FHRs.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($978,000); 2 IRPs ($10,999,773); 11 R&D Projects ($7,488,719); 14 Fellowships ($2,155,000); 12 Scholarships ($70,000) – Awards made in 2009, 2010, 2012, 2013, 2014, 2015, 2016 & 2017.

FY 2009 – FY 2017 total: $21,691,492

Previous NEET Funding: 2 NEET R&D Projects ($800,000) – Awards made in 2013.
FY 2012 – FY 2017 total: $800,000.

IDAHO – $4,161,64

Idaho National Laboratory - $1,000,000

- **1 NEET R&D Project - $1,000,000.** This project will apply advanced sensor technologies, particularly wireless sensor technologies, and data science-based analytic capabilities, to advance online monitoring and predictive maintenance in nuclear plants, and improve plant performance. The resulting technology is expected to improve plant economics by enabling the transition from periodic maintenance to predictive maintenance. Predictive

Previous NEUP/IUP Funding: None.

Previous NEET Funding: 3 NEET General Scientific Infrastucture ($1,666,893); 5 NEET R&D Projects ($4,100,000) – Awards made in 2012, 2013, 2014, 2015 & 2016.
FY 2012 – 2017 total: $5,766,893.

University of Idaho - $3,161,640

- **4 NEUP R&D Projects - $1,600,000.**
  1. **($800,000).** The project goal is to apply friction stir based repair and mitigation technique for eliminating failure associated with pitting and stress corrosion cracking in dry storage canisters for spent fuels. The goal of these activities is to obtain a fundamental understanding of the processing-structure-properties correlations. This work will contribute to the development of a crack repair/mitigation strategy based on friction stir technology that can be efficiently implemented for spent fuel dry storage casks, which will enhance safety and reliability of these systems.
  2. **($761,640).** This project purposes to integrate new thermal energy storage (TES) models, developed in Modelica, with ongoing nuclear-renewable hybrid energy systems (NRHES) modeling efforts, in order to evaluate economic potential and advantages of new process designs over baseload electricity production. The computational phase of this project includes developing mathematical and physics-based TES models, which could later be translated to Modelica and integrated with existing NRHES components. The testing and optimization would be conducted using RAVEN. A techno-economic analysis will be performed to evaluate the compatibility of the newly formed integration, as well as to quantify its feasibility and economic benefits. The experimental aspect is focused on the development of scaled TES systems, which serve as verification for the Modelica models and allow system testing upon being integrated with DETAIL.
  3. **($800,000).** The overall goal of this project is to develop and demonstrate, through modeling and experimental investigations, temperature amplification capabilities of a chemical heat pump (CHP) system that can be coupled to a conventional light water reactor or a near-term small modular reactor. The outcomes would include nuclear hybrid energy system architecture containing a CHP, experimental data on the CHP performance, and dynamic model of the system, validated through experimentation, which could be used for scale-up and design.
  4. **($800,000).** The goal of this project is to develop a comprehensive understanding of the sorption system performance and effectiveness for capture of radioiodine species present in the off-gas streams from the used nuclear fuel (UNF) recycling operations, focusing particularly on the organic iodine species. The dynamic sorption experimentation and theoretical modeling will offer fundamental insights on the mechanism enabling the design and prediction the control system performance.

Previous NEUP/IUP Funding: 3 General Scientific Infrastructure ($730,549); 15 R&D Projects ($9,737,350); 1 Fellowship ($155,000); 9 Scholarships ($52,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2015.
FY 2009 – FY 2017 total: $10,675,399

Previous NEET Funding: None.

ILLINOIS – $3,800,000

Argonne National Laboratory - $2,000,000.

- **2 NEET R&D Projects - $2,000,000.**
  1. **($1,000,000).** This project aims to develop and demonstrate a novel pulsed thermal tomography (TT) non-destructive examination (NDE) method for in-service inspection of additively manufactured (AM) reactor components and materials. NDE capability developed in this project will accelerate deployment of components produced with AM techniques in commercial nuclear reactors..
  2. **($1,000,000).** This project will develop and demonstrate data-analytic methods to address the problem of how to assign a sensor set in a nuclear facility such that 1) a requisite level of process monitoring capability is realized, and in turn, 2) the sensor set is sufficiently rich to allow analytics to determine the status of the individual sensors with respect to their need for calibration. This approach will allow for automated calibration status, avoiding unneeded calibration activities in the facility.

Previous NEUP/IUP Funding: None.

Previous NEET Funding: 1 NEET General Scientific Infrastructure ($230,000); 4 NEET R&D Projects ($3,995,000)

FY 2012 – FY 2017 Total: $4,225,000,000

University of Illinois at Chicago - $800,000

- **1 NEUP R&D Project - $800,000.** This project will use synchrotron X-rays to characterize the interfacial molecular complexes (of extractants and radiologically derived impurities, complexants, buffers, and metal ions) formed during the Actinide-Lanthanide Separation Process (ALSEP) back-extraction. This work addresses the critical knowledge gap of slow stripping kinetics in ALSEP, as well as the influence of radiolytic degradation products. The outcome of the project will be a molecular-level understanding of the role of different components in the interfacial mechanism of back-extraction in the ALSEP process, therefore leading to development of more efficient and faster metal stripping relevant to the separation of actinides from lanthanides in the nuclear fuel cycle.

Previous NEUP/IUP Funding: 1 R&D Project ($700,000) - Award made in 2013.
FY 2009 – FY 2017 total: $700,000

Previous NEET Funding: None.

University of Illinois, Urbana-Champaign - $800,000

- **1 NEUP R&D Project - $800,000.** The project objective is to develop reduced-order models (ROMs) that will improve accuracy of LMR system-level analysis with low overhead. These new models will systematically mine high-fidelity DNS, LES, or uRANS simulations to construct low-order dynamical systems that can couple with a systems analysis code, such as the SAM code being developed under NEAMS. These simulations provide useful data and will be made available to the scientific community, and the overall effort will contribute to more efficient LMR conceptual design studies and licensing.

Previous NEUP/IUP Funding: 5 General Scientific Infrastructure ($896,028); 1 IRP ($3,499,945); 8 R&D Projects ($6,911,352); 5 Fellowships ($770,000); 28 Scholarships ($172,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $12,249,825

Previous NEET Funding: None.

INDIANA – $2,499,982

Purdue University - $2,399,982

- **2 NEUP R&D Projects - $1,599,982.**
  1. **($800,000).** The objective of this project is to standardize methods for nano/micro-scale tensile and ductility testing of irradiated Fe-Cr steels, through microstructure-based benchmarking. The study will investigate key process parameters for TEM in situ tension and ductility testing. Coupling experimental studies with multiscale mod els, the research will identify the approaches that provide consistent deformation mechanisms between the nano/micro-scale and macro-scale tests, from which standard practices will be obtained. The primary project outcome will be a set of recommended guidelines for nano/microscale mechanical testing, which will lead to unprecedented reductions in the time and cost for qualifying materials for in-reactor service and to ensure consistency of methods and validity of results.
  2. **($799,982).** The goal of this project is to demonstrate cold spray repair and mitigation of chloride-induced stress corrosion cracks (SCC) and pits in stainless steel dry storage canisters. The research will optimize the repair process and gain a scientifically informed understanding of SCC mechanisms. The outcome is to further develop cold spray as an attractive solution for the repair of existing SCC and mitigation of potential SCC necessary to ensure long-term integrity, security, and regulatory compliance of spent nuclear fuel storage.

Previous NEUP/IUP Funding: 1 General Scientific Infrastructure ($300,000); 1 Reactor Upgrade ($1,276,812); 11 R&D Projects ($7,761,100); 3 Fellowships ($455,000); 8 Scholarships ($45,000) – Awards made in 2009, 2010, 2012, 2013, 2014, 2015, 2016, & 2017.
FY 2009 – FY 2017 total: $9,837,912.

Previous NEET Funding: 2 NEET R&D Projects ($1,592,572) – Awards made in 2012 & 2014.

FY 2012 – FY 2017 total: $1,592,572

University of Notre Dame - $400,000

- **1 NEUP R&D Project - $400,000.** This project seeks to develop a matrix of dissolution rates for high-purity SiC material, using intense electron beam irradiation, and to measure the products of dissolution (silicic acid and CO2 (or CO)) in the water downstream of the irradiation zone. The objective is to determine the rate of SiC dissolution and gather sufficient insight about its mechanism in LWRs, so that the use of SiC/SiC composite materials for accident tolerant fuel cladding can proceed with confidence.
- **1 R&D Project with NSUF Access - $500,000.** This project aims to develop radiation-resistant nanostructured bulk thermoelectric materials and devices for in-pile power harvesting and sensing. The thermoelectric power harvesting technology has crosscutting significance to expand nuclear reactor sensing, instrumentation and offer major cost savings and enhanced safety for all reactor designs & fuel cycle concepts.

Previous NEUP/IUP Funding: 2 R&D Projects ($1,240,000); 2 Fellowships ($310,000 – Awards made in 2012, 2014, 2015, & 2016.
FY 2009 – FY 2017 total: $1,5550,000.

Previous NEET Funding: 1 NEET R&D Project ($800,000) – Award made in 2015.

FY 2012 – FY 2017 total: $800,000.

KANSAS – $399,972

Kansas State University - $399,972

- **1 NEUP R&D Project – $399,972.** This project will evaluate existing and near-term experimental data for inclusion in the International Reactor Physics Experiment Evaluation Project (IRPhEP) handbook. The data to be evaluated include compositions from a recent fuel replacement as part of an LEU conversion, a number of critical, fresh-fuel configurations, fuel temperature measurements at fresh-fuel configurations, and records from nearly a decade of operation. The proposed work would lead to a first-of-a-kind evaluation of transient, spatially-dependent reaction rates.

Previous NEUP/IUP Funding: 2 General Scientific Infrastructure ($435,690); 4 Reactor Upgrades ($1,839,831); 3 R&D Projects ($2,398,518); 1 Fellowship ($155,000); 4 Scholarships ($45,000) – Awards made in 2009, 2010, 2012, 2013, 2014, 2015, 2016 & 2017.

FY 2009 – FY 2017 total: $4,874,039

Previous NEET Funding: None.

MASSACHUSETTS – $1,600,000

Massachusetts Institute of Technology - $1,600,000

- **2 NEUP R&D Projects - $1,600,000.**
  1. **($800,000).** This project will seek detailed knowledge about molecular structure and dynamics of molten salts to inform the design of new molten-salt reactors. A combination of advanced neutron and x-ray scattering and ab initio molecular dynamics simulations will be used to model the ionic-cluster structure of the fluid and solubility of impurities. Machine learning will be applied to regress from simulations and experiments in order to develop the model and predict chemical potentials as a function of composition and temperature.
  2. **($800,000).** The objective of this project is to explore economic benefits from practical Accident Tolerant Fuels (ATFs) concepts and FLEX-type systems in current Light Water Reactors (LWRs). The work will focus on two near-term ATF cladding concepts – coated clad and steel-based clad – along with FLEX type equipment. The acquired information could be used for decision-making and margin management and for safety improvements to reduce the cost of LWR operation.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($828,583); 5 Reactor Upgrades ($1,875,526); 3 IRPs ($15,500,000); 10 R&D Projects ($6,540,018); 15 Fellowships ($2,300,000); 9 Scholarship ($65,000) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.

FY 2009 – FY 2017 total: $27,109,127.

Previous NEET Funding: None.

MICHIGAN – $2,800,000

University of Michigan - $2,800,000

- **4 NEUP R&D Projects - $1,600,000.**
  1. **($400,000).** The goal of this project is to produce a format for covariance data for inelastic thermal neutron scattering data for moderators in the ENDF format. To demonstrate the viability of this new format, an evaluation of the covariance data for thermal scattering in light water in this format will be produced, along with the capabilities to generate the files and test their efficacy. A capability for calculating sensitivity coefficients using multigroup methods to the fundamental physics parameters governing light-water scattering will be developed to facilitate identifying nuclear data needs related to thermal scattering.
  2. **($800,000).** The objective of this project is to develop a mechanistic understanding of the hydrothermal corrosion behavior of monolithic SiC and SiC/SiC composites in LWR environment under the influence of water radiolysis products and radiation damage. Complementary atomistic simulations will be

carried out to determine the rate controlling mechanisms for dissolution under different water chemistries and in the presence of radiation. Activation energies and kinetic rates will be calculated directly from these simulations and compared to experimentally fitted values. The dissolution rate constants determined and validated in this integrated experimental and modeling approach will allow predictions of long-term SiC corrosion behavior.

3. **($800,000).** The objective of this project is to better understand key phenomena in high-temperature gas-cooled reactors relevant to steam ingress and loss of forced circulation (LOFC) accidents. Specifically, the research will: 1) experimentally investigate, using an existing integral-effect test facility with some improvements, the steam-ingress accident caused by a postulated steam generator tube rupture initiating event; 2) carry out integral-effect tests for the extended LOFC accident to study the establishment of global natural circulation flow in the primary loop; 3) design, based on a scaling analysis, and construct a separate-effect test facility to study the complex helium flows in the core and hot plenum during the extended LOFC accident; and 4) perform detailed, high-resolution, separate-effects experiments using the results obtained as boundary/initial conditions.
4. **($800,000).** This project intends to develop a toolkit for modeling digital instrumentation and control (I&C) systems for nuclear power plants so that the consequences of cyber-attacks on I&C systems may conveniently be modeled using nuclear plant simulation software. The results of the toolkit-based models, the corresponding responses, and the performance of the diagnostic schemes will be tested on a virtual control room driven by a plant simulator.

Previous NEUP Funding: 5 General Scientific Infrastructure ($1,289,277); 1 IRP ($5,000,000); 19 R&D Projects ($14,536,832); 20 Fellowships ($3,075,000); 31 Scholarships ($157,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $24,058,609

Previous NEET Funding: 2 NEET R&D Projects ($999,611) – Awards made in 2016
FY 2012 – FY 2017 total: $999,611

MINNESOTA – $800,000

University of Minnesota, Twin Cities - $800,000

- **1 NEUP R&D Project - $800,000.** This project aims to develop a probabilistic failure criterion of SiC/SiC composites under multi-axial loading and to incorporate the criterion into a reliability analysis of the structural integrity of LWR SiC/SiC fuel cladding. This research will be anchored by a seamless integration of novel experimental and analytical tools, which will lead to a robust methodology for dependable analysis of SiC/SiC composite structures for LWR fuel cladding, as well as other nuclear applications. The resulting model will be experimentally validated and applied to analyze the reliability of LWR SiC/SiC fuel cladding.

Previous NEUP/IUP Funding: 2 R&D Projects ($2,220,705) – Awards made in 2010.

FY-2009 – FY 2017 total: $2,220,705.

Previous NEET Funding: None.

MISSOURI – $800,000

Missouri University of Science and Technology - $800,000

- **1 NEUP R&D Project - $800,000.** The objectives of this project are to determine the oxidation behavior of silicon carbide and graphitic materials in oxygen and/or moisture, to accurately measure the kinetic parameters of oxidation, to ascertain the oxidation mechanisms in relation to the microstructures, to determine the effect of irradiation on oxidation behavior, and to provide data and input to the safety analysis of high-temperature gas reactors under air and moisture ingress accident conditions.

Previous NEUP/IUP Funding: 2 General Scientific Infrastructure ($600,000); 2 Reactor Upgrades ($400,000); 4 R&D Projects ($2,771,466); 1 Fellowship ($155,000); 9 Scholarships ($47,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, & 2017.

FY 2009 – FY 2017 total: $3,973,966

Previous NEET Funding: None.

MONTANA – $724,906

University of Montana - $724,906

- **1 NEUP R&D Project - $724,906.** In this project, direct modeling of multiple environmental tracers will be used to improve predictions of radionuclide transport in a shallow alluvial aquifer discharge. The research will take advantage of recent theoretical developments considering the use of environmental tracers, and advances in high-performance reactive flow and transport models, to obtain the maximum information on the transport system. The goal is to develop a new methodology to characterize natural reactive flow and transport systems, reduce predictive uncertainty in radionuclide transport simulations, determine the maximum information content of the tracer suite, and optimize future groundwater characterization efforts.

Previous NEUP/IUP Funding: None.

Previous NEET Funding: None.

NEBRASKA – $799,270

University of Nebraska, Lincoln – $799,270

- **1 NEUP R&D Project - $799,270.** This project's aim is to develop an integrated theoretical, modeling, and experimental platform that enables predicting the ductility of

nuclear structural materials based on microscale mechanical tests. The research involves ion irradiation and deformation to introduce defects of adjustable size, density and morphologies in single crystal FeCrAl alloys. In conjunction with structural characterization and mechanical testing at different temperatures, the project will perform systematic tests to reveal correlations among mechanical property changes and microstructural changes in order to develop mechanisms-based meso-micro-macro crystal plasticity models. The project will also conduct in situ micro and macro mechanical tests to distinguish the role of microstructural defects and calibrate model parameters in developing and validating predictive models.

Previous NEUP/IUP Funding: 1 R&D Project ($800,000); 1 Scholarship ($5,000) – Awards made in 2014 & 2016.
FY 2009 – FY 2017 total: $805,000

Previous NEET Funding: 2 NEET R&D Projects ($1,974,975) – Awards made in 2012 & 2015
FY 2012 – FY 2017 total: $1,974,975

NEVADA – $800,000

University of Nevada, Las Vegas – $800,000

- **1 NEUP R&D Project - $800,000.** The overarching goal of this project is to use combined computational and experimental research and development activities to enhance understanding of the mechanisms and thermal-mechanical-chemical (TMC) parameters controlling the instant release fraction (IRF) and matrix dissolution of high-burnup (HB; burnup > 45 GWd/MTU) spent nuclear fuels (SNFs) and the subsequent formation, stability, and phase transformations of HB SNF alteration products under long-term storage and geological disposal conditions (e.g., high-temperature storage, α-radiolysis). The results of this research will be used to enhance the mechanistic detail of process models to reduce uncertainty in, and improve the technical bases of, safety cases and performance assessment analyses.

Previous NEUP/IUP Funding: 1 General Scientific Infrastructure ($294,222); 10 R&D Projects ($6,101,126); 4 Fellowships ($615,000); 1 Scholarship ($7,500) – Awards made in 2009, 2010, 2011, 2012, 2014 2015 & 2017.
FY 2009 – FY 2017 total: $7,017,848

Previous NEET Funding: None.

NEW MEXICO – $1,599,945

University of New Mexico – $1,599,945

- **2 NEUP R&D Projects - $1,599,945.**
  1. **($799,945).** The objective of the project is to develop a Nuclear Instrumentation and Control Simulation (NICSim) platform with a novel emulytics capability to

simulate control systems and components in nuclear power plants. The outcome of this work would be a first-in-class emulytics platform with an associated documentation and library of physical models of components that could be used by analysts and designers to assess the resilience and cybersecurity risks of different control system designs for a wide range of power plants.

2. **($800,000).** The purpose of this project is to experimentally investigate the integral effects of radioisotope interactions with liquid lead to support the following technical goals: 1) evaluating the mechanistic source term of the Lead-cooled Fast Reactor (LFR); 2) developing a universal integral effect test methodology for liquid metal source term evaluations; and 3) establishing a basis for the comparison of radioisotope retention between lead and sodium. This aim of the research is to advance the LFR licensing pathway by establishing the phenomenological foundation of the interaction between fission products and liquid lead.

Previous NEUP/IUP Funding: 2 General Scientific Infrastructure ($343,797); 2 Reactor Upgrades ($100,000); 7 R&D Projects ($4,841,879); 4 Fellowships ($620,000); 5 Scholarships ($32,500) – Awards made in 2009, 2010, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $5,938,176

Previous NEET Funding: None.

NEW YORK – $1,599,548

Rensselaer Polytechnic Institute – $800,000

- **1 NEUP R&D Project ($800,000).** This project will evaluate the failure modes of accident tolerant fuel ATF candidates to understand the different failure characteristics. The research aims to obtain a response surface of coping time by investigating the various uncertainties of accident mitigation in PWR and BWR reactors. These outputs will aid the decision making process on the implementation of ATF and FLEX to existing LWR plants from the perspective of risk reduction and economic feasibility.

Previous NEUP/IUP Funding: 3 General Scientific Infrastructure ($634,011); 2 Reactor Upgrades ($350,000); 7 R&D Projects ($4,956,199); 5 Fellowships ($770,000); 7 Scholarships ($37,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 216 & 2017.
FY 2009 – FY 2017 total: $6,747,710

Previous NEET Funding: None.

Syracuse University - $799,548

- ***1 NEUP R&D Project- $799,945.*** This project will study the capture of radioactive organoiodides from off-gas streams produced during nuclear fuel reprocessing by conducting adsorption experiments using a selected silver adsorbents. Multifaceted

simulation adsorption models will be developed to assist in the design of necessary capture systems for off-gas streams.

Previous NEUP/IUP Funding: 1 General Scientific Infrastructure ($107,319); 3 R&D Projects ($2,150,000); 1 Scholarship ($5,000) – Award made in 2010, 2011, 2013, 2014, & 2016. FY 2009 – FY 2017 total: $2,262,319.

Previous NEET Funding: None.

NORTH CAROLINA – $1,998,821

Duke University - $800,000

- **1 NEUP R&D Project - $800,000.** This project will focus on filling the gaps in understanding of mechanisms of a series of degradation processes (thermal, hydric, geo-chemical, and transport processes phenomena) potentially affecting geo-materials used in repositories. The objectives of the work are to better recognize the conditions leading to preferential paths of radionuclide transport and rock weakening, and to build mathematical models and implement them into existing codes to predict material degradation and develop strategies to reduce the adverse consequences.

Previous NEUP/IUP Funding: None.

Previous NEET Funding: None.

North Carolina State University – $1,198,821

- **2 NEUP R&D Projects - $*1,198,821*.**
  1. **($398,821).** The objective of this project is to narrow the nuclear data gap for advanced nuclear reactors that are driven by thermal neutrons. This includes concepts such as gas-cooled high-temperature reactors and molten salt or salt-cooled high temperature reactors. The generated data TSL libraries will be provided in EDNF File 7 format to the National Nuclear Data Center (NDDC) to immediately include in beta releases of the ENDF/B libraries and to consider for the future release of ENDF/B-VIII.1.
  2. **($800,000).** The goal of this project is to demonstrate the utilization of high-fidelity Nuclear Energy Advanced Modeling and Simulation (NEAMS) tools (PROTEUS, Nek5000, and BISON) to inform the improved use of conventional tools (DIF-3D, CTF, and CTFFuel) within the NEAMS Workbench on the NEA/OECD C5G7-TD benchmark. This would result in more accurate predictions of safety parameters and margins, which is important for both safety and performance improvements of the nuclear power plants being currently operated and built. The developed Workbench-based framework will also assist end users to apply high-fidelity simulations to inform lower-order models for the design, analysis, and licensing of advanced nuclear systems.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($1,213,467); 1 IRP ($4,000,000); 4 Reactor Upgrades ($2,182,827); 21 R&D Projects ($15,385, 377); 12

Fellowships ($1,855,000); 39 Scholarships ($237,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $24,874,171.

Previous NEET Funding: 2 NEET R&D Projects ($1,787,844) – Awards made in 2012 & 2017.
FY 2012 – FY 2017 total: $1,787,844.

OHIO – $3,900,000

The Ohio State University - $3,100,000

- **2 NEUP R&D Projects - $1,600.000.**
  1. **($800,000).** This project will develop a first-of-a-kind framework for integrating Big Data capability into the daily activities of our current fleet of nuclear power plants. This research will mainly focus on incorporating the wide range of data heterogeneities in nuclear power plants into an integrated Big Data Analytics capability. The primary end product of this work will be a Big Data framework that is capable of dealing with the large volume and heterogeneity of the data found in nuclear power plants to extract timely and valuable information on equipment performance and to enable optimization of plant operation and maintenance based on the extracted information. ($799,727) .
  2. **($800,000).** This project will evaluate and develop a set of tools to repair and mitigate chloride-induced pitting and stress corrosion cracking in stainless steel nuclear fuel canisters. Advanced processes, including low temperature friction stir welding and cold spray deposition, will be evaluated according to various criteria, such as corrosion performance. In addition, technologies that have not yet been evaluated for UNF applications, including vaporizing foil actuator welding and soldering will be assessed. The two most promising technologies will selected for further development and comprehensive study.

- **1 NEET R&D Project - $1,000,000.** This project aims to build and test an optical fiber based gamma thermometer (OFBGT) using two university research reactors, and to develop methods to process the data that is produced by OFBGTs to produce estimates of the power density in the volume of the reactor that surrounds the OFBGTs. The OFBGT sensor will be robust and resilient, and capable of producing 'big data' scale information, with the smallest possible sensor footprint in the core.
- **1 R&D Project with NSUF Access - $500,000.** The objective of this project is to perform a focused investigation of the irradiation behavior of piezoelectric aluminum nitride, a material considered as a highly attractive candidate for ultrasonic sensors in nuclear applications. In previous irradiation tests it has been identified as highly irradiation tolerant. The experiment will be designed to allow measurement of irradiation effects while isolating effects caused by transducer design.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($948,760); 5 Reactor Upgrades ($914,328); 20 R&D Projects ($14,262,264); 13 Fellowships ($1,995,000); 20

Scholarships ($112,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $18,232,852

Previous NEET Funding: 1 NEET R&D Project ($399,990) – Awarded in 2013.
FY 2012 – FY 2017 total: $399,990

University of Cincinnati - $800,000

- **1 NEUP R&D Project - $800,000.** This project will investigate and develop the promising laser-assisted cold spray and additive friction stir processing techniques – in combination with laser shock peening (LSP) and ultrasonic nanostructure surface modification – to mitigate adverse tensile residual stresses arising from welding/repair, in order to enhance the resistance to chloride-induced stress corrosion cracks (SCC), and to extend the life, of austenitic stainless steel spent nuclear fuel storage canisters. The results will provide insight into the relevant processing-structure-property-performance relationships and deliver quantitatively rigorous and scientifically validated solutions.

Previous NEUP/IUP Funding: 3 R&D Projects ($2,766,121) – Awards made in 2009 and 2010. FY 2009 – FY 2017 total: $2,766,121.

Previous NEET Funding: None.

OREGON – $800,000

Oregon State University - $800,000

- **1 NEUP R&D Project - $800,000.** The goal of this project is to further studies on fusion of process monitoring (PM) data and nuclear material accounting (NMA) data. PM data, which includes monitoring by various types of equipment (radiation detectors, cameras, voltage, current sensors), can supplement NMA data to help improve safeguards. For aqueous-based reprocessing facilities, it is reported that PM, integrated with traditional NMA, has a high-detection probability for specific diversions. For electrochemical reprocessing, preliminary studies have shown that PM data can support traditional NMA by providing a basis to estimate some of the in-processing nuclear material inventories.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($852,171); 1 Integrated Research Project ($4,000,000); 4 Reactor Upgrades ($2,376,380); 14 R&D Projects ($10,838,514); 8 Fellowships ($1,230,000); 8 Scholarships ($40,000) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, & 2017.
FY 2009 – FY 2017 total: $19,337,065

Previous NEET Funding: None.

PENNSYLVANIA – $1,800,000

Pennsylvania State University - $800,000

- **1 NEUP R&D Project - $800,000.** This project investigates a new approach for recovering rare-earth (RE) fission products (Nd, Gd, and Sm) from molten chlorine salts using liquid metal (Bi and Sn) electrodes. The research aids molten salt recycling by converting the RE products into chloride-free RE oxides, which could be incorporated into conventional glass/ceramic waste forms. Successful outcomes of the project include advanced separation of fission products from molten salts with better control of chemical selectivity and high-recovery yield.

Previous NEUP/IUP Funding: 2 General Scientific Infrastructure ($549,980); 2 Reactor Upgrades ($2,446,253); 2 IRP's ($6,000,000); 12 R&D Projects ($9,271,758); 4 Fellowships ($615,000); 15 Scholarships ($85,000) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $18,967,991.

Previous NEET Funding: None.

University of Pittsburgh - $1,00,000.

- **NEET R&D Project with NSUF Access - $1,000,000.** This project aims to develop and establish an innovative approach to drastically reduce development and post-processing costs associated with laser powder bed additive manufacturing (AM) of complex nuclear reactor components with internal cavities and overhangs. The proposed innovative approach integrates dissolvable supports, topology optimization, and microstructure design to achieve the project goal. Using optimally designed dissolvable supports, this research will make state-of-the-art nuclear components much cheaper, have minimal distortion, and could eliminate build failures altogether.

Previous NEUP Funding: 1 General Scientific Infrastructure ($300,000); 2 R&D Projects ($1,676,422); 5 Fellowships ($770,000); 11 Scholarships ($70,000) – Awards made in 2009, 2010, 2012, 2013, 2014, 2015 & 2016.
FY 2009 – FY 2016 total: $2,816,422

Previous NEET Funding: 2 NEET R&D Projects ($1,487,676) – Awards made in 2014 & 2017.
FY 2012 – FY 2017 total: $1,487,676.

SOUTH CAROLINA - $800,000

University of South Carolina - $8,000,000

- **1 NEUP R&D Projects - $800,000.** This project will conduct experiments and modeling work to help establish multi-axial failure criteria of nuclear grade SiCf/SiCm composites

– a promising material for accident tolerant fuel (ATF). The research includes a unique set of testing methods that place the SiCf/SiCm in various well-controlled uniform multi-axial stress states and measure their responses. The validated failure criteria will be incorporated in fuel modeling code of the industrial collaborators to support their accident tolerant fuel development effort.

Previous NEUP/IUP Funding: 1 General Scientific Infrastructure ($200,500); 1 IRP ($4,000,000); 10 R&D Projects ($8,032,646); 2 Fellowships ($310,000); 3 Scholarships ($15,000) – Awards made in 2009, 2010, 2011, 2012, 2013 , 2016 & 2017.

FY 2009 – FY 2017 total: $12,558,146

Previous NEET Funding: None.

TENNESSEE - $2,798, 934

University of Tennessee at Knoxville - $2,798,934

- **4 NEUP R&D Projects - $*2,798,934*.**
  1. **($400,000).** This project will investigate the chemical decladding and the digestion of whole MOX-based fuel rods, using thionyl chloride and surrogate materials. Digesting entire LWR fuel assemblies results in product streams that include pure decontaminated ZrCl4; pure UCl4; and a stream containing TRU/FPs, as well as alloying metals (as chloride salts). The objectives of this project are to provide a new, highly efficient protocol for the transformation of used nuclear fuel into useful components and to effectively contain a concentrated stream of highly radioactive materials for appropriate handling.
  2. **($800,000).** The goal of the proposed research is to understand molten salt chemistry relevant to advanced molten salt reactors through complementary synthesis, spectroscopy, and modeling. Through complementary synthetic, spectroscopic, and computational efforts, the aim is to achieve atomistic and molecular-level understanding of liquid structure, coordination geometry, chemical bonding, and reactivity of novel molten salt melts relevant to advanced molten reactor designs.
  3. **($799,727).** This project aims to develop and provide data analytics solutions to improve nuclear power plan economic efficiency by utilizing empirical models to integrate disparate data sources while providing uncertainty estimates to quantify risk and support decisions. The outcomes will enhance the technical and economic competitiveness by enabling advanced monitoring of critical assets, improving the operating capability of the existing fleet, and helping achieve enhancements in organizational effectiveness. Additionally, the research would provide an agile and modular data analytic framework that would have high commercialization value and supports the industry-wide drive towards digital innovation.
  4. **($799,207).** The purpose of this project is to develop a toolbox of swappable mass flow modules for liquid-fueled molten salt reactor (MSR) systems for the purposes of evaluating material control & accountancy measurement techniques.

When combined together, these modules enable modeling of the time-dependent mass flows for a variety of MSR variants. The test platform will consist of a toolbox of independent process modules representing discrete physical units, each with its own self-contained physics responsive to the input mass flow, along with appropriate measurement models that can be coupled to key flow points. These dynamic physical signatures would allow testing of the viability and efficacy of potential accountancy techniques under the full range of reactor operating conditions.

Previous NEUP/IUP Funding: 3 General Scientific Infrastructure ($734,917); 1 IRP ($3,510,000); 15 R&D Projects ($11,219,063); 15 Fellowships ($2,215,000); 64 Scholarships ($415,000) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017. FY 2009 – FY 2017 total: $18,093,980

Previous NEET Funding: 1 NEET R&D Project ($1,000,000) – Award made in 2015. FY 2012 – FY 2017 total: $1,000,000

TEXAS - $4,024,206

Texas A&M University - $1,856,375

- **3 NEUP R&D Projects - $*1,856,375***

1. **($748,000).** The overarching objectives of this project are to: 1) demonstrate new operational strategies with the combined use of Accident Tolerant Fuels (ATF) and the Reactor Core Isolation Cooling (RCIC) System to increase the passive safety capabilities of current Boiling Water Reactors (BWRs) in delaying or preventing core damage; and 2) pursue the delay of containment venting until after a 72-hour coping period through new BWR Suppression Pool mixing procedures. The research will use both simulation and experimental data to validate the objectives. The work has the potential to increase the ability of existing nuclear power plants to passively respond to beyond design basis events using existing equipment and without changes to the plants.
2. **($500,000).** The objective of this project is to demonstrate, for the first time, a methodology that enables the direct validation of microstructural evolution models for fuel in MARMOT, and the direct correlation of changes in physical properties with specific irradiation-induced microstructural features. Properly implementing this methodology will result in rapid development of MARMOT mesoscale models.
3. **($608,375).** The main goal of this project is to better understand the possible effect of gas migration (particularly through discontinuities) on the performance and long-term behavior of engineered barrier systems (EBS) envisaged for the isolation of high-level radioactive waste (HLW). Specific outcomes of this study will be an improved understanding of the role of gas migration and discontinuities in the performance of HLW disposals, with the underlying aim to improve design of EBS used for HLW.

Previous NEUP/IUP Funding: 4 General Scientific Infrastructure ($873,985); 2 IRPs ($7,500,000); 3 Reactor Upgrades ($1,614,136); 21 R&D Projects ($15,451,397); 18 Fellowships ($2,675,000); 12 Scholarships ($65,000) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $28,178,518.

Previous NEET Funding: 1 NEET R&D Project ($800,000) – Award made in 2015.
FY 2012 – FY 2017 total: $800,000

University of Houston - $800,000

- **1 NEUP R&D Project - $800,000.** Through experimental and computational studies, this project will expose the factors governing zeolite crystallization and their role in Stage III dissolution of radionuclide-containing glass waste forms generated in advanced nuclear fuel cycles. The overall goal of this project is to understand the formation of zeolite phases in order to develop process control methods to suppress Stage III dissolution.

Previous NEUP/IUP Funding: 1 General Scientific Infrastructure ($172,969); 1 IRP ($3,000,000); 4 R&D Projects ($3,003,154) – Awards made in 2011, 2012, 2014, 2015 & 2016.
FY 2009 – FY 2017 total: $6,176, 123.

Previous NEET Funding: 2 NEET R&D Projects (1,199,999) – Awards made in 2013 & 2014
FY 2012 – FY 2017 total: $1,199,999.

University of Texas at Arlington - $567,831

1 NEUP R&D Project - $800,000. The project seeks to better understand and quantify the pore structure (geometry and topology) and pore connectivity of porous media and its emergent effect on diffusion and retention of various radionuclides in barrier materials. The anticipated outcome of the project will be to more accurately evaluate the performance of geological repositories.

Previous NEUP/IUP Funding: 1 General Scientific Infrastructure ($272,316) – Award made in 2009.
FY-2009 – FY 2017 total: $272,316.

Previous NEET Funding: None.

University of Texas at San Antonio - $800,000

- **1 NEUP R&D Project - $800,000.** The proposed study will systematically investigate the oxidation behavior of TRISO particles and matrix material under a range of atmospheres that incorporate incremental additions of H2O, O2, H2, and CO2 at high temperatures (800°C≤T≤1700°C). The research will contribute to better understanding of the effects of these oxidants, specifically steam in appreciable amounts, on the integrity

of fuel forms used for high-temperature gas-cooled reactors and very high temperature gas-cooled reactors.

Previous NEUP/IUP Funding: None.

Previous NEET Funding: None.

UTAH - $776,669

University of Utah - $776,669

- **1 NEUP R&D Project - $776,669.** The objectives of this project are to establish best practices for obtaining tensile microscale ductility measurements and to validate methodologies for comparing them to macroscale ductility measurements. Anticipated outcomes of the project are: 1) measurement of grain and sub-grain localization processes micro and macroscales; 2) establishment of best practices for microtensile experimentation; 3) identification of statistically significant relationships between specimen geometry, microstructure variables and mechanical behavior; 4) modified phenomenological elongation-based ductility models to enable direct upscaling of ductility measurements from microscale to macroscopic.

Previous NEUP/IUP Funding: 2 General Scientific Infrastructure ($319,629); 3 Reactor Upgrades ($607,547); 5 R&D Projects ($3,882,513); 2 Fellowships ($310,000); 5 Scholarships ($32,500) – Awards made in 2010, 2011, 2012, 2013, 2014, 2016 & 2017. FY 2009 – FY 2017 total: $5,152,189.

Previous NEET Funding: None.

VIRGINIA - $2,408,549

Aeroprobe - $408,549

3. **1 R&D Project with NSUF Access - $408,549.** Researchers will perform irradiation and post-irradiation examination of materials produced by the MELD manufacturing process (FKA additive friction stir (AFS)) and analogous advanced manufacturing technologies. Compared with other additive manufacturing technique, MELD is much faster, generates a refined equiaxed structure, and does not require the post-manufacturing treatments needed for processes based on melting and solidification.

Previous NEUP/IUP Funding: None.

Previous NEET Funding: None.

Virginia Polytechnic Institute and State University - $1,856,375

- **3 NEUP R&D Projects - $*2,000,000***

1. **($800,000).** This project intends to accomplish three tasks: 1) to develop a predictive model to facilitate experimental data interpretation and provide mechanistic insights into the role of temperature on non-Darcian flows in low-permeability engineered clay barriers; 2) conduct experiments to unravel the role of temperature on the threshold gradient of non-Darcian flow in both saturated and unsaturated bentonite; and 3) use molecular dynamics (MD) simulation to improve fundamental understanding. The experimental data, associated with the MD simulation, will provide valuable information to improve fundamental understanding and scientific knowledge with respect to the temperature dependence of threshold gradient in non-Darcian flows, because very limited experimental data for saturated flow and no experimental data for unsaturated flow are available.
2. **($400,000).** This project will study a new concept for nuclear fuel encapsulation using an amorphous SiOC plus carbon system as the inner coating and nanocrystalline SiC plus minor carbon as the outer coating for nuclear fuel kernel particles. The outcomes of this work are: 1) new directions and possible replacement guidance for current nuclear fuel materials in operation; 2) new fuel materials for future nuclear reactor material design and development; 3) nuclear composite microstructure evolution and performance degradation understanding; 4) screening tools to guide future nuclear fuel material activities; and 5) mechanisms of nuclear fuel material evolution and degradation and effective strategies to mitigate/reduce undesirable fuel behaviors.
3. **($800,00).** This project is to study the oxidation behaviors of TRISO fuels during accidental air and water vapor ingress conditions. The work focuses on the oxidation and burn-off of the graphite fuel matrix and oxidation of the TRISO fuel SiC layer at high-temperature accidental states in the presence of air and/or water vapor. It will include both unirradiated and irradiated graphite fuel matrix and simulated fuel particles with the SiC layer.

Previous NEUP/IUP Funding: 3 General Scientific Infrastructure ($814,935); 6 R&D Projects ($3,996,296); 3 Fellowships ($255,000); 5 Scholarships ($27,500) – Awards made in 2009, 2010, 2012, 2016 & 2017.
FY 2009 – FY 2017 total: $5,093,731

Previous NEET Funding: 2 NEET R&D Projects ($2,000,000) – Award made in 2016 & 2017.
FY 2012 – FY 2017 total: $2,000,000

WISCONSIN - $4,794,271

University of Wisconsin-Madison - $4,794271

- **6 NEUP R&D Projects - $2,800,000**

1. **($799,669).** This project will measure the fission product up-take and retention in a column of liquid sodium under prototypic conditions. Sodium liquid, at 550°C, will be used to ensure quantitatively accurate conditions. Real time X-ray analysis will be conducted to measure the gas distribution, and a mass spectrometer will be used to measure upper plenum simulant gas accumulation as a function of time from a simulated fuel rupture. Sodium sampling will be conducted to ascertain fission product distribution. A series of experiments will be conducted to obtain high fidelity data on radionuclide retention in liquid sodium for gases, aerosols, and solid particles. Additionally, comparisons between experimental data and the results from computational tools will be performed.
2. **($796,792).** The goal of the proposed research is to develop and evaluate specific advanced metallic alloys for structural components in fluoride salt-cooled molten salt reactors (MSRs). The research will investigate four categories of metallic alloys: advanced Ni-based; radiation damage tolerant high entropy; refractory Mo-based, and compositionally-graded, designed for high-surface corrosion resistance and good bulk strength. Additionally, the propensity for radiation embrittlement, as well as weldability, of the alloys will be evaluated.
3. **($800,000).** This project will focus on evaluating and developing two technologies used for field mitigation and repair of stress corrosion cracking (SCC): 1) additive friction stir welding; and 2) cold spray deposition. The work involves developing low-force, low-heat input solid state technologies to lessen and repair SCC in stainless steel canisters for used nuclear fuel (UNF). This outcome of the study will inform feasibility of using the two technologies to conduct on-site field repairs.
4. **($797,820).** The overarching goal of this project is to significantly advance the ability to assess equipment condition and predict the remaining useful life to support optimal maintenance decision making in nuclear power plants. This research will work toward accomplishing and establishing a modern set of data-driven modeling, online monitoring, visualization, prognosis, and operation decision-making methodologies to address the significant opportunities and challenges arising from the emerging data-rich environment in nuclear plants. The potential impact of the work is significant and transformative and could deliver important advances in productivity with reduced unscheduled downtime and improved equipment performance.
5. **($800,000**). The goal of the proposed research is to develop corrosion-resistant coatings and liners for structural materials for use in fuel dissolved molten salt environment for future Molten Salt Reactors (MSRs). Innovative, but industrially scalable, surface cladding approaches are proposed to lead to promising surface and interfacial compositions. The processes themselves are commercial, and have high technology readiness levels, and consequently would facilitate the accelerated developments of MSRs.
6. **($799,990).** This project focuses on the development of coatings and surface modification approaches for hydrothermal corrosion protection of SiC-SiC composite in normal LWR operation environments. Innovative surface treatment recipes will be explored using processes including, interfacial stitching to improve

adhesion, multi-layered structures to improve ductility, and compositions and structures resulting from thermal treatments. The surface treatment concepts involve corrosion resistant metallic and ceramic materials, and are amenable to industrial scalability for the cladding application.

Previous NEUP/IUP Funding: 5 General Scientific Infrastructure ($1,261,750); 5 Reactor Upgrades ($815,779); 2 IRPs ($7,999,907); 37 R&D Projects ($27,097,754); 12 Fellowships ($1,740,000); 15 Scholarships ($77,500) – Awards made in 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.
FY 2009 – FY 2017 total: $38,992,690

Previous NEET Funding: 1 NEET R&D Project ($1,000,000) – Award made in 2017.
FY 2012 – FY 2017 total: $1,000,000.