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**ROBERT ANGELO BORRELLI**  
**ASSOCIATE PROFESSOR • UNIVERSITY OF IDAHO • IDAHO FALLS CENTER FOR HIGHER EDUCATION**  
**DEPARTMENT OF NUCLEAR ENGINEERING AND INDUSTRIAL MANAGEMENT**  
**CENTER FOR ADVANCED ENERGY STUDIES • 995 MK SIMPSON BOULEVARD • IDAHO FALLS ID 83401**  
**RBORRELLI@UIDAHO.EDU • @TheDoctorRAB • WEB**

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## EDUCATION

### UNIVERSITY OF CALIFORNIA – BERKELEY DOCTOR OF PHILOSOPHY • NUCLEAR ENGINEERING

2006

*Dissertation – Radionuclide transport modeling with bentonite extrusion*  
Examination fields – Mathematical modeling, Subsurface nuclear technology  
Committee – Joonhong Ahn (Chair), William E. Kastenberg, Tarek I. Zohdi

### WORCESTER POLYTECHNIC INSTITUTE MASTER OF SCIENCE • CIVIL & ENVIRONMENTAL ENGINEERING

1999

*Thesis – Characterization of background radiation in the environment*  
Advisor – James C. O’Shaughnessy

### WORCESTER POLYTECHNIC INSTITUTE BACHEOR OF SCIENCE • MECHANICAL & NUCLEAR ENGINEERING

1996

*Capstone – Real time PLC-based reactivity modeling by inverse point kinetics*  
Advisor – Leo M. Bobek

## RESEARCH EXPERIENCE

### UNIVERSITY OF IDAHO • IDAHO FALLS CENTER FOR HIGHER EDUCATION DEPARTMENT OF NUCLEAR ENGINEERING AND INDUSTRIAL MANAGEMENT

#### ASSOCIATE PROFESSOR 2021 –

Coordinator – Nuclear Technology Management Certificate 2023 –  
Affiliate – Boise State University Energy Policy Institute 2019 –  
Coordinator – NPP Decommissioning and Used Fuel Management Certificate 2019 –  
State of Idaho Professional Engineer – Faculty Restricted 2019 –  
Coordinator – Nuclear Criticality Safety Certificate 2015 –

#### ASSISTANT PROFESSOR 2015 – 2021

## **UNIVERSITY OF CALIFORNIA – BERKELEY**

### **DEPARTMENT OF NUCLEAR ENGINEERING**

#### **POSTDOCTORATE RESEARCHER**

*2009 – 2012*

A safeguards methodology was developed for remotely-handled nuclear materials facilities that proposes functional design components and a risk-informed framework in an effort to integrate safeguards with safety and security into facility design.

## **THE UNIVERSITY OF TOKYO**

### **DEPARTMENT OF NUCLEAR ENGINEERING/MANAGEMENT**

#### **RESEARCH ASSOCIATE**

*2007 – 2009*

Mathematical models for mass transport in the engineered barrier system of a high-level nuclear waste repository are established for bentonite extrusion and radionuclide transport under different environmental conditions to assess potential impacts on performance assessment.

## **UNIVERSITY OF CALIFORNIA – BERKELEY**

### **DEPARTMENT OF NUCLEAR ENGINEERING**

#### **POSTDOCTORATE RESEARCHER**

*2007*

Mathematical modeling of mass transport in the engineered barrier system of a high-level nuclear waste repository continued, to assess the potential of extruding bentonite to confine radionuclides.

## **UNIVERSITY OF CALIFORNIA – BERKELEY**

### **DEPARTMENT OF NUCLEAR ENGINEERING**

#### **DOCTORAL CANDIDATE**

*2005 – 2006*

The dissertation thesis focused on the mathematical modeling of mass transport in the engineered barrier system of a high-level nuclear waste repository. A mass transport model was established for radionuclides in a porous medium, bentonite extrusion model in a planar fracture to assess the potential to confine radionuclides.

## **RELATED RESEARCH EXPERIENCE**

### **LAWRENCE BERKELEY NATIONAL LABORATORY**

#### **EARTH SCIENCES DIVISION**

#### **INTERN**

*2001 – 2002*

Conducted data analysis for chaotic modeling of water flow in the unsaturated zone.

## **WORCESTER POLYTECHNIC INSTITUTE**

### **LESLIE C. WILBUR NUCLEAR REACTOR FACILITY**

#### **MAJOR QUALIFYING PROJECT**

*1995 – 1996*

The Major Qualifying Project synthesizes previous undergraduate studies to solve problems or perform tasks in the major field and communicate results effectively. For this project, a logic algorithm was developed for reactivity derived from point kinetics equations and a programmable logic controller was modified for real time collection of data during nuclear reactor operation for use with experimental coursework and

maintenance procedures.

## RELATED PROFESSIONAL EXPERIENCE

### WORCESTER POLYTECHNIC INSTITUTE

#### LESLIE C. WILBUR NUCLEAR REACTOR FACILITY

##### ASSISTANT RADIATION SAFETY OFFICER

1996 – 1999

- Responded to emergencies concerning incidents involving radioactive material
- Maintained records of radiation exposures and dosimetry to campus personnel
- Maintained the full and current inventory of radioisotopes
- Performed calibrations for radiation detectors
- Instructed all radiological and nuclear reactor laboratory safety training
- Performed secretarial duties for Radiation, Health, and Safety Committee

### WORCESTER POLYTECHNIC INSTITUTE

#### LESLIE C. WILBUR NUCLEAR REACTOR FACILITY

##### SENIOR NUCLEAR REACTOR OPERATOR #70145

1994 – 1999

- Operated the university nuclear reactor for experimental research projects
- Trained reactor operator license candidates
- Performed corrective and preventative maintenance of reactor systems
- Modified operator training program to a computer based system

## AWARDED PROJECTS

- (1) Kathleen Araújo (PI), Cassie Koerner (co-PI) - Boise State University, Stephanie Malin (co-PI) - Colorado State University, Daniel Cardenas (co-PI) - National Tribal Energy Association, R. A. Borrelli (co-PI) - University of Idaho, Weston Eaton (co-PI), Temple Stoellinger (Senior Personnel), Steven Smutko (Senior Personnel), Rachael Budowle (Senior Personnel) - University of Wyoming, Majia Nadesan (co-PI) - Arizona State University, Julia Haggerty (co-PI), Lee Spangler (Senior Personnel) - Montana State University, Denia Djokić (co-PI) University of Michigan, Sarah Robey (co-PI) - Idaho State University. Common ground: Legitimacy in consent-based siting for interim nuclear waste storage. Department of Energy Consent-Based Siting for Interim Storage Program - Community Engagement Opportunities. **\$2,000,000**. 2023.08.01 - 2025.07.31.
- (2) Andrew Kliskey (PI) - Idaho EPSCoR Director, Karla Eitel (co-PI), Alistair Smith (co-PI) - University of Idaho, Donna Lybecker (co-PI) - Idaho State University, Kathleen Araújo (co-PI) Boise State University. [RII Track-1: Idaho Community-engaged Resilience for Energy-Water Systems \(I-CREWS\)](#). National Science Foundation EPSCoR. **\$24,000,000**. 2023.09.01 - 2028.08.31.<sup>1,2</sup>
- (3) Michael Haney (PI), R. A. Borrelli (co-PI), Dakota Roberson (co-PI), Constantinos Koliass (co-PI) - University of Idaho, Ben Lampe (co-PI), Sean McBride (co-PI) - Idaho State University. Secure Cyberspace and Resilient Industrial Systems Workforce Development. Idaho Global Entrepreneurial Mis-

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<sup>1</sup>Technical Writing Team.

<sup>2</sup>University of Idaho Research Team.

- sion (IGEM) – Higher Education Research Council **\$700,000**. 2023.07.01 - 2024.06.30.
- (4) Michael Haney (PI), R. A. Borrelli (co-PI), Dakota Roberson (co-PI), Constantinos Kolias (co-PI) - University of Idaho, Ben Lampe (co-PI), Sean McBride (co-PI) - Idaho State University. Secure Cyberspace and Resilient Industrial Systems Workforce Development. Idaho Global Entrepreneurial Mission (IGEM) – Higher Education Research Council **\$693,000**. 2022.07.01 - 2023.06.30.
  - (5) R. A. Borrelli (PI), Michael Haney (co-PI) - University of Idaho. Cyber-informed design, education, and training for cyberthreat resiliency with real-time nuclear reactor simulation. University of Idaho. Operation: Resubmission Support. **\$34,122**. 2022.04.30 - 2022.09.30.
  - (6) Thomas A. Ulrich (PI) - Idaho National Laboratory, R. A. Borrelli (co-PI) - University of Idaho. User evaluation of the NuScale simulator at the Center for Advanced Energy Studies. CAES programmatic funding. **\$50,000**. 2022.03.01 - 2022.09.30.
  - (7) R. A. Borrelli (PI) - University of Idaho, Dennis D. Keiser, Jr., (co-PI) - Idaho National Laboratory. Graduate Research Assistantship: Connecting U-Mo Fuel Processing, Microstructure, and Irradiation Performance. **\$23,823**. 2021.06.01-2022.01.31.
  - (8) R. A. Borrelli (PI), Jason Barnes (Senior Adviser) - University of Idaho. Experimental determination of interactions between the radiation fields of Dragonfly’s MMRTG and Titan’s environment. Idaho NASA EPSCoR Research Initiation Grant. **\$82,962** 2021.05.01 - 2022.04.30.
  - (9) R. A. Borrelli (PI) - University of Idaho. Online educational resources for nuclear engineering courses. University of Idaho Think Open Fellowship. **\$1200**. 2021.01.01 - 05.31.
  - (10) Lee Ostrom (PI), Richard N. Christensen, R. A. Borrelli, Haiyan Zhao (co-PIs) - University of Idaho. ORED Fall 2019 EIS: Portable XFR for use in supporting material research. ORED Equipment and Infrastructure Support. **\$40,000**. 2019.12.01 - 2020.11.30
  - (11) R. A. Borrelli (PI) - University of Idaho, Mark. D. DeHart (co-PI) - Idaho National Laboratory. Application and enhancement of MAMMOTH depletion capabilities. **\$33,521**. 2020.01.13 - 2020.12.31.
  - (12) Richard N. Christensen (PI), R. A. Borrelli, Michael G. McKellar, Michael Haney, David Arcilesi (co-PIs) - University of Idaho, Richard Jacobson (co-PI) Idaho State University. NuScale Simulator at the Center for Advanced Energy Studies. Department of Energy Scientific Infrastructure Support for Consolidated Innovative Nuclear Research. **\$321,525**. 2019.10.01 - 2022.09.30. [*PI - NuScale Simulator Laboratory - 2022.01.07*]
  - (13) R. A. Borrelli (PI) - University of Idaho, Dennis D. Keiser, Jr., (co-PI) - Idaho National Laboratory. Graduate Research Assistantship: Connecting U-Mo Fuel Processing, Microstructure, and Irradiation Performance. **\$127,866**. 2018.10.01-2021.05.31.
  - (14) R. A. Borrelli (PI), Richard N. Christensen (co-PI) - University of Idaho, Brian J. Jaques (co-PI) - Boise State University, Piyush Sabharwall (co-PI) - Idaho National Laboratory, Mark Delligatti (co-PI) - Table Rock, LLC, Sakae Casting USA, LLC (co-PI). Modeling and design of borated aluminium cask for used fuel cooling. Idaho Global Entrepreneurial Mission (IGEM) - Idaho Commerce. **\$237,898**. 2018.01.01-2019.05.31.
  - (15) R. A. Borrelli (PI) - University of Idaho, Dennis D. Keiser, Jr., (co-PI) - Idaho National Laboratory. Graduate Research Assistantship: Connecting U-Mo Fuel Processing, Microstructure, and Irradiation Performance. **\$36,180**. 2017.11.01-2018.05.31.

- (16) R. A. Borrelli (PI), Lee Ostrom (Senior Advisor) - University of Idaho, Stephen G. Johnson (Senior Advisor) - Idaho National Laboratory. Performance assessment of americium as fuel in radioisotope thermoelectric generators for deep space exploration. Idaho NASA EPSCoR Research Initiation Grant. **\$55,000**. 2017.08.01-2018.04.30.
- (17) Kelley M. Verner (PI), R. A. Borrelli, Marc T. Skinner, Emma K. Redfoot, Jieun Lee, Seth Dustin, John Peterson (co-PIs) - University of Idaho. Increasing the Go-on Rate in Southeast Idaho Through the Nexus of Food, Energy, and Water. University of Idaho Vandals Big Ideas Project. **\$23,984**. 2017.07.01-2018.06.30.
- (18) R. A. Borrelli (PI) - University of Idaho, Jason Hales (co-PI) - Idaho National Laboratory. Graduate Research Assistantship: Idaho National Laboratory Code Documentation. **\$35,435**. 2016.10.01-2017.06.30.
- (19) Vivek Utgikar (PI), Fatih Aydogan, Krishnan Raja, Raghunath Kanakala, R. A. Borrelli, Haiyan Zhao, Matthew Swenson (co-PIs) - University of Idaho. University of Idaho Nuclear Engineering Faculty Development Program. United States Regulatory Commission Faculty Development Grant. **\$434,048**. 2015.09.29 - 2019.09.30.

## EQUIPMENT ACQUISITIONS

University of Idaho, Idaho State University, Idaho National Laboratory. Western Services Corporation Pressurized Water Nuclear Reactor Simulator.

## THESIS COMMITTEES

### MAJOR PROFESSOR

#### CURRENT

Nathan Manwaring, Ph.D – Criticality safety  
 Trevin Lasley, Ph.D – Criticality safety  
 Jonathon Wheelwright, MEng – Microreactor transport

#### GRADUATES

Olin Calvin, Ph.D. – Depletion chain simplification with pseudo-nuclides to model decay effects  
 Joseph Christensen, Ph.D. – Advancements in the Evaluation of Heterogeneity for Nuclear Criticality Safety in High-Assay Low-Enriched Uranium Systems  
 Teyen Widdicombe, Ph.D. – Investigation of Interactions Between Radiations from Dragonfly’s MM-RTG and Titan’s Environment  
 Kelley M. Verner, Ph.D. – Irradiation induced phase change in low enriched uranium-molybdenum fuel as it relates to microstructure  
 John Peterson, MS – Molten salt reactor neutronics design  
 Emma K. Redfoot, MS – Allocating heat and electricity in a nuclear renewable hybrid energy system coupled with a water purification system  
 Jieun Lee, MS – Risk-informed safeguards of pyroprocessing for advanced nuclear fuel concepts  
 J. Seth Dustin, MS - High level examination of Am-241 as an alternative Fuel Source in radioisotope thermoelectric generators

Trevor MacLean, MEng – Cybersecurity modeling of non-critical nuclear power plant instrumentation  
Malachi Tolman, MEng – INL BISON code documentation

## **COMMITTEE MEMBER**

### **GRADUATES**

#### *University of Idaho*

Ryan C. Hruska, Ph.D. – A Functional All-Hazard Approach to Critical Infrastructure Dependency Analysis  
James Richards, Ph.D. – Techno-Economic Analysis of Nuclear Integrated Energy Systems for Water Desalination and Hydrogen Production  
John Carter, Ph.D. – Core design of molten salt nuclear battery  
Jacob Benjamin, Ph.D. – Bounding cyber in design basis threat  
David Kamerman, Ph.D. – On the Role of Bulk Hydrides and Hydride Rims in Causing Low Temperature Ruptures of Zircaloy-4 Cladding Tubes in Transient Reactor Tests  
Kendall Bean, MS – Using static VAR Compensators to Simultaneously Regulate Power System Voltage and Frequency  
John Tacke, MS – Design of an automatic voltage regulator with limited plant information  
D. Devin Imholte, MS – Conceptual design of the Advanced Test Reactor non-destructive examination system  
Winfred Sowah, MS – Thermal behavior of cold plated storage cask for light water reactor nuclear fuels  
John Bell, MS – Hierarchical inference and spoofing alarm in HVDC control systems  
Trevin Lasley, MS – Criticality safety on the molten salt nuclear battery  
Joshua Young, MS – Analysis of a Dump Heat Exchanger For The Versatile Test Reactor's Secondary Loop  
John Biersdorf, MEng – Precipitation changes to Idaho National Laboratory over time

#### *Idaho State University*

Pedro Mena, Ph.D. – Auto Machine Learning Applications for Nuclear Reactors: Transient Identification, Model Redundancy and Security  
Pedro Mena, MS – Reactor transient classification using machine learning

### **CURRENT**

#### *University of Idaho*

John Tacke, Ph.D. – Power systems  
Sam J. Root, MS – Controls for the molten salt battery

## **REFEREED JOURNAL PUBLICATIONS**

- (1) Sam J. Root, Porter Throckmorton, Jonathan Tacke, Jacob Benjamin, Michael Haney, R. A. Borrelli (2023). Cyber Hardening of Nuclear Power Plants with Real-time Nuclear Reactor Operation – 1. Preliminary Operational Testing. Progress in Nuclear Energy 162, 104742.
- (2) Teyen Widdicombe, R. A. Borrelli (2023). Experimental Determination of Interaction Between the Radiation Fields of Dragonfly's MMRTG and Titan's Environment II: Gamma Induced Atmospheric Conductivity. Acta Astronautica 208, 91.

- (3) Olin Calvin, Barry D. Ganapol, R. A. Borrelli (2023). Introduction of the adding and doubling method for solving Bateman equations for nuclear fuel depletion. *Nuclear Science and Engineering* 197, 558.
- (4) Pedro Mena, R. A. Borrelli, Leslie Kerby (2023). Detecting Anomalies in Simulated Nuclear Data using Autoencoders. *Nuclear Technology* , 10.1080/00295450.2023.2214257.
- (5) Haruko Wainwright, Brian Powell, Megan Hoover, Dinara Ermakova, R. A. Borrelli, Christina Leggett, Milos Atz, Carol Eddy-Dilek, William Roy, Emily Stein, Kathryn Higley, Sheldon Landsberger, Rod Ewing (2023). Nuclear Waste Educator's Workshop: What and How Do We Teach About Nuclear Waste? *Journal of Environmental Radioactivity* , 10.1016/j.jnrad.2023.107288.
- (6) Sam J. Root, Haiyan Zhao, R. A. Borrelli, Michael G. McKellar (2023). Thermodynamic Analysis on Xenon Stripping to Shorten Restart Time in Molten Salt Microreactors. *Nuclear Engineering and Design* , [under review].
- (7) Emma K. Redfoot, Kelley M. Verner, R. A. Borrelli (2022). Applying analytic hierarchy process to industrial process design in a nuclear renewable hybrid energy system. *Progress in Nuclear Energy* 145, 104083.
- (8) Pedro Mena, R. A. Borrelli, Leslie Kerby (2022). Survey of markets for nuclear power in Western North America. *International Journal of Energy, Environment, and Economics* 29, 17.
- (9) Pedro Mena, R. A. Borrelli, Leslie Kerby (2022). Expanded Analysis of Machine Learning Models for Nuclear Transient Identification Using TPOT. *Nuclear Engineering and Design* 390, 111694.
- (10) Emma K. Redfoot, Michael G. McKellar, R. A. Borrelli (2022). Allocating heat and electricity in an integrated energy system coupled with a water purification system. *Nuclear Engineering and Design* 397, 111902.
- (11) Teyen Widdicombe, R. A. Borrelli (2022). Experimental Determination of Interaction Between the Radiation Fields of Dragonfly's MMRTG and Titan's Environment I: Neutron results. *Acta Astronautica* , 10.1016/j.actaastro.2022.08.048.
- (12) Joseph Christensen, R. A. Borrelli (2022). Evaluations of the effect of heterogeneity in HALEU systems using modified critical benchmarks. *Nuclear Science and Engineering* 196, 1333.
- (13) Nathan Manwaring, R. A. Borrelli (2022). At-power subcritical multiplication in the Advanced Test Reactor. *Nuclear Engineering and Design* 401, 112040.
- (14) Teyen Widdicombe, R. A. Borrelli (2021). MCNP modelling of radiation effects of the Dragonfly mission's RTG on Titan II: Atmospheric ionization effects. *Acta Astronautica* 186, 517.
- (15) Pedro Mena, R. A. Borrelli, Leslie Kerby (2021). Nuclear reactor transient diagnostics using classification and AutoML. *Nuclear Technology* 208, 232.
- (16) Jonathan Tacke, R. A. Borrelli, Dakota Roberson (2021). Advanced frequency-domain compensator design for subsystems within a nuclear generating station. *Progress in Nuclear Energy* 140, 103914.
- (17) J. Seth Dustin, R. A. Borrelli (2021). Assessment of alternative radionuclides for use in a radioisotope thermoelectric generator. *Nuclear Engineering and Design* 385, 111475.
- (18) J. Seth Dustin, R. A. Borrelli (2021). Modeling of Am-241 as an alternative fuel source in a radioisotope thermoelectric generator. *Nuclear Engineering and Design* 385, 111495.

- (19) Teyen Widdicombe, R. A. Borrelli (2021). MCNP modelling of radiation effects of the Dragonfly mission's RTG on Titan. *Acta Astronautica* 183, 363.
- (20) R. A. Borrelli, Mark S. Delligatti, Brenden J. Heidrich (2020). Borated aluminum cask design for onsite intermediate storage - neutronics design and certification analysis. *Nuclear Engineering and Design* 363, 110666.
- (21) John P. Carter, R. A. Borrelli (2020). Neutron physics study of an integral molten salt reactor using Monte Carlo N-Particle code. *Nuclear Engineering and Design* 365, 10.1016/j.nucengdes.2020.110718.
- (22) Joseph Christensen, R. A. Borrelli (2020). Nuclear criticality safety aspects for the future of HALEU: Evaluating heterogeneity in intermediate-enrichment uranium using critical benchmark experiments. *Nuclear Science and Engineering* , 10.1080/00295639.2020.1819143.
- (23) John P. Carter, R. A. Borrelli (2020). Integral molten salt reactor temperature sensitivities using Serpent target motion sampling. *Nuclear Engineering and Design* 369, 10.1016/j.nucengdes.2020.110863.
- (24) Kaelee A. Novich, Samuel V. Pedersen, R. A. Borrelli, Richard N. Christensen, Brian J. Jaques (2020). Synthesis of boron carbide reinforced aluminum castings through mechanical stir casting. *Journal of Composite Materials* 55, 10.1177/0021998320987597.
- (25) Joseph Christensen, R. A. Borrelli (2020). Parametric study of minimum critical volume for high-assay low-enriched uranium (20%) in spherical geometry against particle size. *Nuclear Science and Engineering* 196, 98.
- (26) John Peterson, Michael Haney, R. A. Borrelli (2019). An overview of methodologies for cyber security vulnerability assessments conducted in nuclear power plants. *Nuclear Engineering and Design* 346, 75.
- (27) Jieun Lee, R. A. Borrelli (2019). Sensitivity analysis and application of advanced nuclear accounting methodologies on the high reliability safeguards model: Use of discrete event simulation for material throughput in fuel fabrication. *Nuclear Engineering and Design* 345, 183.
- (28) Jieun Lee, Amey Shigrekar, R. A. Borrelli (2019). Hazard and operability analysis of a pyroprocessing facility. *Nuclear Engineering and Design* 348, 131.
- (29) Emma K. Redfoot, R. A. Borrelli (2018). Analysis of nuclear renewable hybrid energy systems modeling and nuclear fuel cycle simulators. *Nuclear Technology* 204, 249.
- (30) Jieun Lee, Malachi Tolman, R. A. Borrelli (2017). High reliability safeguards approach to remotely handled nuclear processing facilities: Use of discrete event simulation for material throughput for fuel fabrication. *Nuclear Engineering and Design* 324, 54.
- (31) R. A. Borrelli, Joonhong Ahn, Yongsoo Hwang (2017). Approaches to a practical systems assessment for safeguardability of the advanced nuclear fuel cycle. *Nuclear Technology* 197, 248.
- (32) R. A. Borrelli (2016). Functional components for a design strategy: Hot cell shielding in the high reliability safeguards methodology. *Nuclear Engineering and Design* 305, 18.
- (33) R. A. Borrelli (2014). A high reliability safeguards approach for safeguardability of remotely-handled nuclear facilities: 1. Functional components to system design. *Journal of Nuclear Materials Management* XLII, 4.
- (34) R. A. Borrelli (2014). A high reliability safeguards approach for safeguardability of remotely-handled



nuclear facilities: 2. A risk-informed approach for safeguards. *Journal of Nuclear Materials Management* XLII, 27.

- (35) R. A. Borrelli (2014). Use of curium neutron flux from head-end pyroprocessing subsystems for the high reliability safeguards methodology. *Nuclear Engineering Design* 277, 166.
- (36) R. A. Borrelli (2013). Use of curium spontaneous fission neutrons for safeguardability of remotely-handled nuclear facilities: Fuel fabrication in pyroprocessing. *Nuclear Engineering and Design* 260, 64.
- (37) R. A. Borrelli, Olivier Thivent, Joonhong Ahn (2013). Parametric studies on confinement of radionuclides in the excavated damaged zone due to bentonite type and temperature change. *Physics and Chemistry of the Earth* 65, 32.
- (38) R. A. Borrelli, Olivier Thivent, Joonhong Ahn (2011). Impacts of elevated temperatures on bentonite extrusion and radionuclide transport in the excavated damaged zone. *Nuclear Technology* 174, 94.
- (39) R. A. Borrelli, Joonhong Ahn (2008). Radionuclide transport in a water-saturated planar fracture with bentonite extrusion. *Nuclear Technology* 164, 442.
- (40) R. A. Borrelli, Joonhong Ahn (2008). Numerical modeling of bentonite extrusion and radionuclide migration in a saturated planar fracture. *Physics and Chemistry of the Earth* 33, S131.

## **BOOKS & BOOK CONTRIBUTIONS**

- (1) Trevor MacLean, R. A. Borrelli, Michael A. Haney (2019). ‘Cybersecurity modeling of non-critical nuclear power plant digital instrumentation.’ *Critical Infrastructure Protection XIII*. Jason Staggs, Sujeet Sheno, eds. in: Chapter 5, 277.
- (2) R. A. Borrelli (2015). ‘Reflections on developing an identity for the third generation nuclear engineer in the post-Fukushima society,’ *Reflections on the Fukushima Daiichi nuclear accident: Toward social-scientific literacy and engineering resilience*. ISBN 978-3-319-12090-4.

## **REFEREED CONFERENCE PROCEEDINGS**

- (1) Jonathon Wheelwright, R. A. Borrelli (2023). A Regulatory Approach to Nuclear Reactor Transportation. Washington, D. C.: Proc., American Nuclear Society Annual Meeting.
- (2) Haruko Wainwright, Brian Powell, Megan Hoover, R. A. Borrelli, Carol Eddy-Dilek, Sheldon Landsberger, Rod Ewing (2023). Nuclear Waste Educator’s Workshop: What and How Do We Teach About Nuclear Waste? Indianapolis, Indiana: Proc., American Nuclear Society Annual Meeting.
- (3) Sam J. Root, Porter Throckmorton, Michael Haney, R. A. Borrelli (2022). Simulated boron shimming cyber-attack on pressurized water reactor. Phoenix, Arizona: Proc., American Nuclear Society Winter Meeting.
- (4) Michael Haney, Jacob Benjamin, R. A. Borrelli (2021). Cyberweapon nonproliferation controls for the virtual battlefield - Applying the nuclear nonproliferation regime to an unseen enemy. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
- (5) James Richards, R. A. Borrelli (2020). Development of a tool for evaluating nuclear integrated energy systems profitability for existing reactors. [*virtual*]: Proc., American Nuclear Society Virtual Winter Meeting.

Meeting.

- (6) John Peterson, Michael Haney, R. A. Borrelli (2019). An overview of methodologies for cybersecurity vulnerability assessments conducted at nuclear power plants. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
- (7) Constantinos Kolas, R. A. Borrelli, Daniel Barbara, Angelos Stavrou (2019). Malware detection in critical infrastructures by using the electromagnetic emissions of plcs. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
- (8) Joseph Christensen, R. A. Borrelli, Charles S. Henkel, Brian Matthews (2019). Minimum accident of concern for uranyl sulfate solutions. Minneapolis, Minnesota: Proc., American Nuclear Society Annual Meeting.
- (9) R. A. Borrelli (2019). Updates on borated aluminum cask design for onsite used fuel storage. Minneapolis, Minnesota: Proc., American Nuclear Society Annual Meeting.
- (10) Trevor MacLean, Michael Haney, R. A. Borrelli (2019). Cybersecurity modeling of non-critical nuclear power plant instrumentation. Arlington, Virginia: Proc., Thirteenth Annual IFIP WG 11.10 International Conference on Critical Infrastructure Protection.
- (11) Jieun Lee, R. A. Borrelli (2018). Upgrades on high reliability safeguards model for material throughput in fuel fabrication. Philadelphia, Pennsylvania: Proc., American Nuclear Society Annual Meeting.
- (12) R. A. Borrelli, J. Seth Dustin, Samuel V. Pedersen, Brian J. Jaques (2018). Design of a borated aluminum cask design for onsite used fuel storage. Philadelphia, Pennsylvania: Proc., American Nuclear Society Annual Meeting.
- (13) R. A. Borrelli, Mark S. Delligatti (2018). Regulatory licensing pathway for a borated aluminum cask design for onsite used fuel storage. Philadelphia, Pennsylvania: Proc., American Nuclear Society Annual Meeting.
- (14) J. Seth Dustin, R. A. Borrelli (2018). Preliminary performance assessment of americium-241 as fuel in radioisotope thermoelectric generators for deep space exploration. Las Vegas, Nevada: Proc., ANS NETS 2018 - Nuclear and Emerging Technologies for Space.
- (15) Jieun Lee, R. A. Borrelli (2017). Hazard and operability analysis of a pyroprocessing facility. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
- (16) Emma K. Redfoot, Kelley M. Verner, R. A. Borrelli (2017). Applying preliminary hazard analysis and analytic hierarchy process to a nuclear renewable hybrid energy system. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
- (17) R. A. Borrelli, Malachi Tolman, Jieun Lee (2017). Preliminary analysis of facility design for pyroprocessing safeguardability. San Francisco, California: Proc., American Nuclear Society Annual Meeting.
- (18) Emma K. Redfoot, R. A. Borrelli (2017). Nuclear fuel cycle simulator as a means to model a nuclear hybrid energy system. San Francisco, California: Proc., American Nuclear Society Annual Meeting.
- (19) John Peterson, Michael A. Haney, R. A. Borrelli (2017). Cybersecurity vulnerability assessment methodologies for nuclear power plants. San Francisco, California: Proc., American Nuclear Society Annual Meeting.
- (20) R. A. Borrelli, Malachi Tolman (2016). Development of a discrete event simulation model for pyropro-

- cessing safeguardability. Las Vegas, Nevada: Proc., American Nuclear Society Winter Meeting.
- (21) R. A. Borrelli (2013). Summary of modeling studies in the high reliability safeguards approach. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
  - (22) R. A. Borrelli (2013). Applying curium spontaneous fission neutrons in the high reliability safeguards approach for remotely-handled nuclear facilities. Salt Lake City, Utah: Proc., Global 2013 - International Nuclear Fuel Cycle Conference.
  - (23) R. A. Borrelli (2012). Applying curium spontaneous fission neutrons in the high reliability safeguards approach for remotely-handled nuclear facilities. Savannah, Georgia: Proc., 9th International Conference on Facility Operations-Safeguards Interface.
  - (24) R. A. Borrelli (2011). Role of neutron detection in the high reliability safeguards approach. Albuquerque, New Mexico: Proc., International Conf., High-Level Radioactive Waste Management.
  - (25) R. A. Borrelli, Lance Kim, Edward D. Blandford, Yongsoo Hwang, Eung Ho Kim, Per F. Peterson (2010). High reliability safeguards for remote-handled nuclear materials. San Diego, California: Proc., 2010 International Congress on Advances in Nuclear Power Plants (ICAPP '2010).
  - (26) R. A. Borrelli, Joonhong Ahn (2010). Parametric studies on confinement of radionuclides in the excavated damaged zone due to bentonite type and temperature change. Nantes, France: Proc., Clays in Natural & Engineered Barriers for Radioactive Waste Confinement, 4th International Meeting.
  - (27) R. A. Borrelli, Olivier Thivent, Joonhong Ahn (2009). Effect of temperature change on bentonite extrusion and radionuclide migration in the excavated damaged zone. Luxembourg: Proc., Impact of Thermo-Hydro-Mechanical-Chemical Processes on the Safety of Underground Repositories Conference.
  - (28) R. A. Borrelli, Olivier Thivent, Joonhong Ahn (2009). Parametric studies for temperature changes of bentonite extrusion and impacts on radionuclide migration in the excavated damaged zone. Kennewick, Washington: Proc., 12th International Conference on the Chemistry and Migration Behaviour of Actinides and Fission Products in the Geosphere.
  - (29) R. A. Borrelli, Joonhong Ahn (2008). Impact of bentonite extrusion on radionuclide migration in a saturated planar fracture. Osaka, Japan: Proc., 2008 Annual Meeting of the Atomic Energy Society of Japan.
  - (30) R. A. Borrelli, Joonhong Ahn (2007). Impact of bentonite extrusion on radionuclide in a saturated planar fracture. Lille, France: Proc., Clays in Natural & Engineered Barriers for Radioactive Waste Confinement, 3rd International Meeting.
  - (31) R. A. Borrelli, Joonhong Ahn (2007). Radionuclide transport in a water-saturated planar fracture with bentonite extrusion. J. Grunlan, D. Bhattacharyya, E. Marand, O. Regev, A. Balazs (eds.), 1006E. San Francisco, California: Proc., Transport Behavior in Heterogeneous Polymeric Materials and Composites, Mater. Res. Soc. Symp.
  - (32) R. A. Borrelli, Joonhong Ahn (2006). Bentonite extrusion in planar fracture based on net water flow. Las Vegas, Nevada: Proc., International Conf., High-Level Radioactive Waste Management.
  - (33) Leo M. Bobek, R. A. Borrelli (1996). Plc-based reactivity measurements using inverse point kinetics. Reno, Nevada: Proc., American Nuclear Society Annual Meeting.

## NON-REFEREED TECHNICAL REPORTS

- (1) Kathleen Araújo, Brittany Brand, R. A. Borrelli, Vince Bowen, Lan Li, Libby Lunstrum, Bruce Savage (2021). Advancing resilience science for complex decision-making and governance of energy and water within natural-human-built systems. National Science Foundation Established Program to Stimulate Competitive Research (EPSCoR) Research Infrastructure Improvement (RII) Track-1 - Phase 2 Developmental Concept Report.
- (2) J. Seth Dustin, R. A. Borrelli (2020). High level examination of Am-241 as an alternative fuel source in radioisotope thermoelectric generators. LA-UR-20-20574.
- (3) R. A. Borrelli, Richard N. Christensen, Brian J. Jaques, Samuel V. Pedersen, Winfred Sowah (2019). Modeling and design of borated aluminum cask for used fuel cooling. Final report. APP-002714.
- (4) R. A. Borrelli, Richard N. Christensen, Brian J. Jaques, Samuel V. Pedersen, Winfred Sowah (2019). Modeling and design of borated aluminum cask for used fuel cooling. Progress report. APP-002714.
- (5) Joonhong Ahn, R. A. Borrelli, Esra Orucoglu, Bret P. van den Akker, Seung Min Woo, Jihae Yoon (2015). Systems assessment for advanced nuclear fuel cycle: Final report for UCBNE-KAERI collaboration. UCBNE-5150.
- (6) Joonhong Ahn, R. A. Borrelli, Jihae Yoon (2012). Systems assessment for advanced nuclear fuel cycle: Fourth year report for UCBNE-KAERI collaboration. UCBNE-5137.
- (7) Siegfried S. Hecker, Edward D. Blandford, Alan S. Hanson, Thomas Isaacs, Niko Milonopoulos, Joonhong Ahn, R. A. Borrelli, Jorshan Choi, Lance K. Kim, Per F. Peterson, Jihae Yoon (2012). Scientific and institutional aspects of advanced systems for spent nuclear fuels in emerging nuclear countries: Final report. UCBNE-5135.
- (8) Joonhong Ahn, R. A. Borrelli, Lance K. Kim, Per F. Peterson, Jihae Yoon, Jorshan Choi (2011). Systems assessment for advanced nuclear fuel cycle: Third year report for UCBNE-KAERI collaboration. UCBNE-5134.
- (9) Joonhong Ahn, R. A. Borrelli, Lance K. Kim, Per F. Peterson, Jasmina L. Vujic, Jihae Yoon, Jorshan Choi, Yongsoo Hwang (2010). Systems assessment for advanced nuclear fuel cycle: Second year report for UCBNE-KAERI collaboration. UCBNE-5133.
- (10) Joonhong Ahn, Per F. Peterson, R. A. Borrelli, Lance K. Kim, Jihae Yoon (2010). Scientific and institutional aspects of advanced systems for spent nuclear fuels in emerging nuclear countries: Interim report. UCBNE-5130.
- (11) Joonhong Ahn, Edward D. Blandford, R. A. Borrelli, Eung Ho Kim, Lance K. Kim, Per F. Peterson, Jasmina L. Vujic, Jihae Yoon, Jorshan Choi, Yongsoo Hwang (2009). Systems assessment for advanced nuclear fuel cycle: First year report for UCBNE-KAERI collaboration. UCBNE-5126.
- (12) R. A. Borrelli, Joonhong Ahn (2007). Radionuclide transport coupled with bentonite extrusion in a saturated planar fracture: TRIBEX manual. UCBNE-5111.
- (13) R. A. Borrelli, Joonhong Ahn (2007). Modeling and simulation of bentonite extrusion in a saturated planar fracture. UCBNE-5110.
- (14) R. A. Borrelli, Joonhong Ahn (2007). Modeling and simulation of radionuclide transport in a saturated planar fracture with bentonite extrusion. UCBNE-5109.

- (15) Joonhong Ahn, Paul L. Chambre, Daisuke Kawasaki, R. A. Borrelli (2006). Development of integrated repository performance assessment models. UCBNE-5103.

## CONFERENCE PRESENTATIONS

- (1) \*Jonathon Wheelwright, R. A. Borrelli (2023). A Regulatory Approach to Nuclear Reactor Transportation. Washington, D. C.: Proc., American Nuclear Society Annual Meeting.
- (2) \*Haruko Wainwright, Brian Powell, Megan Hoover, R. A. Borrelli, Carol Eddy-Dilek, Sheldon Landsberger, Rod Ewing (2023). Nuclear Waste Educator's Workshop: What and How Do We Teach About Nuclear Waste? Indianapolis, Indiana: Proc., American Nuclear Society Annual Meeting.
- (3) \*Sam J. Root, Porter Throckmorton, Michael Haney, R. A. Borrelli (2022). Simulated boron shimming cyber-attack on pressurized water reactor. Phoenix, Arizona: Proc., American Nuclear Society Winter Meeting.
- (4) \*Michael Haney, Jacob Benjamin, R. A. Borrelli (2021). Cyberweapon Nonproliferation Controls for the Virtual Battlefield - Applying the Nuclear Nonproliferation Regime to an Unseen Enemy. Washington, D. C.: Proc., American Nuclear Society Winter Meeting.
- (5) \*James Richards, R. A. Borrelli (2020). Development of a tool for evaluating nuclear integrated energy systems profitability for existing reactors. [virtual]: American Nuclear Society Virtual Winter Meeting.
- (6) \*Samuel Cutler, Allysa Bateman, Brenden Heidrich, R. A. Borrelli, James Simpson, Brian J. Jaques (2020). Modeling shielding designs for the safe operation of neutron generators. Boise, Idaho: Idaho Conference on Undergraduate Research [poster].
- (7) \*John Peterson, Michael Haney, R. A. Borrelli (2019). An overview of methodologies for cybersecurity vulnerability assessments conducted at nuclear power plants. Washington, D. C.: American Nuclear Society Winter Meeting.
- (8) \*Constantinos Kolias, R. A. Borrelli, Daniel Barbara, Angelos Stavrou (2019). Malware detection in critical infrastructures by using the electromagnetic emissions of plcs. Washington, D. C.: American Nuclear Society Winter Meeting.
- (9) \*John Peterson, R. A. Borrelli, Dakota Roberson (2019). Informing electrical grid policy with a nuclear power plant simulator. Boise, Idaho: Energy Policy Research Conference [poster].
- (10) \*Joseph Christensen, R. A. Borrelli, Charles S. Henkel, Brian Matthews (2019). Minimum accident of concern for uranyl sulfate solutions. Minneapolis, Minnesota: American Nuclear Society Annual Meeting.
- (11) \*R. A. Borrelli (2019). Updates on borated aluminum cask design for onsite used fuel storage. Minneapolis, Minnesota: American Nuclear Society Annual Meeting.
- (12) Trevor MacLean, \*Michael Haney, R. A. Borrelli (2019). Cybersecurity modeling of non-critical nuclear power plant instrumentation. Arlington, Virginia: Thirteenth Annual IFIP WG 11.10 International Conference on Critical Infrastructure Protection.
- (13) \*Kathryn D. Huff, Neal Davis, Paul Wilson, R. A. Borrelli, Skutnik Steven E., Anthony Scopatz, Jenny Amos (2018). Open-source curriculum development. Urbana, Illinois: Academy for Excellence in Engineering Education Strategic Instructional Innovation Program at the University of Illinois [poster].

- (14) \*Jieun Lee, R. A. Borrelli (2018). Upgrades on high reliability safeguards model for material throughput in fuel fabrication. Philadelphia, Pennsylvania: American Nuclear Society Annual Meeting.
- (15) \*R. A. Borrelli, J. Seth Dustin, Samuel V. Pedersen, Brian J. Jaques (2018). Design of a borated aluminum cask design for onsite used fuel storage. Philadelphia, Pennsylvania: American Nuclear Society Annual Meeting.
- (16) \*R. A. Borrelli, Mark S. Delligatti (2018). Regulatory licensing pathway for a borated aluminum cask design for onsite used fuel storage. Philadelphia, Pennsylvania: American Nuclear Society Annual Meeting.
- (17) \*J. Seth Dustin, R. A. Borrelli (2018). Preliminary performance assessment of americium-241 as fuel in radioisotope thermoelectric generators for deep space exploration. Las Vegas, Nevada: ANS NETS 2018 - Nuclear and Emerging Technologies for Space.
- (18) \*Jieun Lee, R. A. Borrelli (2017). Hazard and operability analysis of a pyroprocessing facility. Washington, D. C.: American Nuclear Society Winter Meeting.
- (19) \*Emma K. Redfoot, Kelley M. Verner, R. A. Borrelli (2017). Applying preliminary hazard analysis and analytic hierarchy process to a nuclear renewable hybrid energy system. Washington, D. C.: American Nuclear Society Winter Meeting.
- (20) R. A. Borrelli, Malachi Tolman, \*Jieun Lee (2017). Preliminary analysis of facility design for pyroprocessing safeguardability. San Francisco, California: American Nuclear Society Annual Meeting.
- (21) \*Emma K. Redfoot, R. A. Borrelli (2017). Nuclear fuel cycle simulator as a means to model a nuclear hybrid energy system. San Francisco, California: American Nuclear Society Annual Meeting.
- (22) \*John Peterson, Michael A. Haney, R. A. Borrelli (2017). Cybersecurity vulnerability assessment methodologies for nuclear power plants. San Francisco, California: American Nuclear Society Annual Meeting.
- (23) R. A. Borrelli, \*Malachi Tolman (2016). Development of a discrete event simulation model for pyroprocessing safeguardability. Las Vegas, Nevada: American Nuclear Society Winter Meeting.
- (24) \*R. A. Borrelli (2013). Summary of modeling studies in the high reliability safeguards approach. Washington, D. C.: American Nuclear Society Winter Meeting.
- (25) \*R. A. Borrelli (2013). Applying curium spontaneous fission neutrons in the high reliability safeguards approach for remotely-handled nuclear facilities. Salt Lake City, Utah: Global 2013 - International Nuclear Fuel Cycle Conference.
- (26) \*R. A. Borrelli (2012). Applying curium spontaneous fission neutrons in the high reliability safeguards approach for remotely-handled nuclear facilities. Savannah, Georgia: 9th International Conference on Facility Operations-Safeguards Interface.
- (27) \*R. A. Borrelli (2011). Role of neutron detection in the high reliability safeguards approach. Albuquerque, New Mexico: International Conf., High-Level Radioactive Waste Management.
- (28) \*R. A. Borrelli, Lance Kim, Edward D. Blandford, Yongsoo Hwang, Eung Ho Kim, Per F. Peterson (2010). High reliability safeguards for remote-handled nuclear materials. San Diego, California: 2010 International Congress on Advances in Nuclear Power Plants (ICAPP '2010).
- (29) \*R. A. Borrelli, Joonhong Ahn (2010). Parametric studies on confinement of radionuclides in the exca-

vated damaged zone due to bentonite type and temperature change. Nantes, France: Clays in Natural & Engineered Barriers for Radioactive Waste Confinement, 4th International Meeting [*poster*].

- (30) R. A. Borrelli, \*Olivier Thivent, Joonhong Ahn (2009). Effect of temperature change on bentonite extrusion and radionuclide migration in the excavated damaged zone. Luxembourg: Impact of Thermo-Hydro-Mechanical-Chemical Processes on the Safety of Underground Repositories Conference.
- (31) \*R. A. Borrelli, Olivier Thivent, Joonhong Ahn (2009). Parametric studies for temperature changes of bentonite extrusion and impacts on radionuclide migration in the excavated damaged zone. Kennewick, Washington: 12th International Conference on the Chemistry and Migration Behaviour of Actinides and Fission Products in the Geosphere [*poster*].
- (32) \*R. A. Borrelli, Joonhong Ahn (2008). Impact of bentonite extrusion on radionuclide migration in a saturated planar fracture. Osaka, Japan: 2008 Annual Meeting of the Atomic Energy Society of Japan.
- (33) \*R. A. Borrelli, Joonhong Ahn (2007). Impact of bentonite extrusion on radionuclide in a saturated planar fracture. Lille, France: Clays in Natural & Engineered Barriers for Radioactive Waste Confinement, 3rd International Meeting.
- (34) \*R. A. Borrelli, Joonhong Ahn (2007). Radionuclide transport in a water-saturated planar fracture with bentonite extrusion. San Francisco, California: Transport Behavior in Heterogeneous Polymeric Materials and Composites, Mater. Res. Soc. Symp. [*poster*].
- (35) \*R. A. Borrelli, Joonhong Ahn (2006). Bentonite extrusion in planar fracture based on net water flow. Las Vegas, Nevada: International Conf., High-Level Radioactive Waste Management.

## TEACHING EXPERIENCE

### UNIVERSITY OF IDAHO • IDAHO FALLS CENTER FOR HIGHER EDUCATION DEPARTMENT OF NUCLEAR ENGINEERING AND INDUSTRIAL MANAGEMENT

*NE502: Nuclear Power Plant Decommissioning Education*

*Fall 2023  
directed study*

As variable energy sources increasingly penetrate the United States energy market, the economics of nuclear energy has weakened. This has led to planned plant closures. Under NRC regulations, these plants must be decommissioned; i.e., safe removal from service and reduction of radioactivity to permissible levels in order to release the property. These activities will require specialized training. The market for decommissioning in North America was valued at \$1.92B in 2019, and it is projected to increase to \$3.35B in 2027. A significant, skilled, and technically proficient workforce will be needed to complete these activities safely and within regulations. Currently, there are no programs in the US specifically focused on decommissioning workforce training. This course will develop a nuclear power plant decommissioning asynchronous, online graduate course as part of the University of Idaho Nuclear Power Plant Decommissioning Graduate Certificate.

*NE544: Reactor Analysis – Statics and Kinetics*

*Spring 2023*

*NE504: Neutronics analysis*

*Spring 2022  
supervising instructor*

The purpose of this course is to study nuclear theory in the context of nuclear reactor engineering; concepts relating to the design and operation of nuclear reactors will be discussed. Content includes development of mathematical expressions describing the relevant nuclear processes as well as their physical implica-

tions. This course will involve the application of several common analytical tools used for the design and evaluation of nuclear systems.

*NE502: Computation and modeling of nuclear systems*

*Fall 2020  
directed study*

Using published nuclear computational modeling references, this course will examine prior efforts to simplify the neutron transport and depletion calculations for advanced reactor designs, such as high-temperature pebble-bed reactors. These include efforts to model heterogeneous stochastic media, such as TRISO fuel particles dispersed in a graphite matrix. Deterministic neutron transport in stochastic media has resulted in several new methods developed in order to address the challenges associated with modeling them, however, comparison of the proposed and implemented methods has been largely absent. Other challenges facing the modeling of pebble-bed reactors include the depletion calculations for individual pebbles. Because of the flow of pebbles through the core, and the recirculation of said pebbles in most modern designs, the depletion of individual pebbles can affect the criticality of the system as well as the temperature profile of individual pebbles, which was demonstrated to have significant safety implications based on the operation of the German AVR pebble-bed system. To these ends, this course will identify relevant literature regarding these topics and the feasibility of implementing these methods in modern nuclear modeling tools, such as the Griffin tool in development at Idaho National Laboratory.

*NE502: Heterogeneity comparisons of intermediate enrichment uranium in critical systems*

*Fall 2020  
directed study*

The ICSBEP handbook contains descriptions and evaluations of critical experiments conducted in facilities throughout the world. The reach of the handbook stretches to the beginning of the history of nuclear engineering. As part of that history, a number of critical experiments have been conducted using arrays of fissile material in the intermediate enrichment range, which is defined for the purposes of this course as ten to forty percent (10%-40%). In those evaluations, a variety of methods have been discussed and described which convert a system of known or unknown degree of heterogeneity into a simplified homogeneous model, which is a traditional method for examining the critical characteristics of multiplying systems. The specific methodology for this conversion varies between evaluations and is explained in some cases, where other cases are less descriptive. It is of interest to the field of nuclear criticality safety to improve the understanding of the effect of heterogeneity on the critical characteristics of multiplying fissile systems, particularly in the range of intermediate enrichment. It is of further interest to the field that a methodology be established which can be used to evaluate these types of systems for practical nuclear criticality safety applications, especially the development of nuclear criticality safety limits.

*NE502: Computation of spherical critical volume for nuclear criticality safety applications*

*Fall 2020  
directed study*

The nuclear safety guide, Critical Dimensions of Systems Containing U-235, Pu-239, and U-233 contains a graph of minimum critical volumes as a function of U-235 enrichment in homogeneous and heterogeneous hydrogen-moderated systems. This graph includes a wide extrapolation between the data for ten percent enrichment and ninety-three percent enrichment. A similar graph appears in Anomalies of Nuclear Criticality without the extrapolation. This graph shows a clear transition at approximately thirty-five percent enrichment between two different types of systems. It is clear that there is a difference between the extrapolated minimum spherical critical volumes and the calculated critical volumes. As part of the development of nuclear criticality safety methodology for intermediate-enrichment uranium systems, it is necessary to more fully evaluate and explain the nature of the transition point. This work will attempt to re-create and expand on the data used to produce this graph and more fully evaluate the nature of the minimum critical volume



for intermediate-enrichment systems. The secondary objective will be the proposal of nuclear criticality safety rules which could be applied to these data to ensure that fissionable material operations in this range of enrichment can be conducted safely.

*NE502: Subcritical multiplication*

*Fall 2020  
directed study*

Using published fundamental nuclear data for thermal neutrons, this course will examine the relationship between processes of fission and capture and develop models for reactivity worth as a function of thermal fission and capture cross-sections and local thermal flux. This course will include evaluation of tests in zero-power reactors. The Advanced Test Reactor (ATR) physics analyses rely heavily on measurement results from the Advanced Test Reactor Critical Facility (ATRC). These results are easily delivered in terms of reactivity worth, but the results are almost never directly applicable to ATR due to differences in thermal neutron flux. Reactivity worth is not a fundamental property of a material and indeed is not a characteristic property of a given piece of reactor hardware if the hardware is to be irradiated in a new neutron environment. However, translating reactivity worth of a piece of hardware in ATRC to a pair of macroscopic cross-sections essentially characterizes the hardware with constants that will be applicable in any subsequent location in ATR or ATRC. Therefore, reactivity worth in a new irradiation position can be predicted by calculation.

*NE502: Historical examinations of heterogeneity in nuclear criticality safety*

*Spring 2020  
directed study*

Using published nuclear criticality safety references, this course will conduct an examination of the effect of heterogeneity with respect to nuclear criticality safety. As part of the history of nuclear criticality safety, a number of critical experiments have been conducted using arrays of fissile material in an attempt to quantify the effect of heterogeneity in the determination of safe handling limits. In these attempts, a number of low-enriched experiments were examined and converted in their critical dimensions to establish a useful baseline from which other limits could be extrapolated. It is of interest to the field of nuclear criticality safety to improve the understanding of the effect of heterogeneity on the critical characteristics of multiplying fissile systems, particularly in the range of intermediate enrichment. It is of further interest to the field that a methodology be established which can be used to evaluate these types of systems for practical nuclear criticality safety applications, especially the development of nuclear criticality safety limits. To that end, this course will identify relevant data in the literature used to generate historical experiments and apply MCNP to model these experiments in order to understand and evaluate assumptions and restrictions raised in the experiments.

*NE502: Heterogeneity comparisons of intermediate enrichment uranium in critical systems*

*Spring 2020  
directed study*

Using the International Criticality Safety Benchmark Evaluation Project (ICSBEP) handbook of evaluated critical experiments, conduct an examination of the effect of heterogeneity in intermediate-enrichment uranium systems. The ICSBEP handbook contains descriptions and evaluations of critical experiments conducted in facilities throughout the world. The reach of the handbook stretches to the beginning of the history of nuclear engineering. In those evaluations, a variety of methods have been discussed and described which convert a system of known or unknown degree of heterogeneity into a simplified homogeneous model, which is a traditional method for examining the critical characteristics of multiplying systems. The specific methodology for this conversion varies between evaluations and is explained in some cases, where other cases are less descriptive. It is of interest to the field of nuclear criticality safety to improve the understanding of the effect of heterogeneity on the critical characteristics of multiplying fissile systems, particularly in the range of intermediate enrichment. It is of further interest to the field that a methodology be established

which can be used to evaluate these types of systems for practical nuclear criticality safety applications, especially the development of nuclear criticality safety limits. This course will identify and evaluate relevant benchmark experiments for heterogeneity effects using MCNP to establish new baseline models from the benchmark handbook.

*NE502: Nuclear integrated energy systems*

*Spring 2020  
directed study*

Nuclear renewable hybrid energy systems enable a nuclear reactor to load follow with a renewable energy source. These must be designed to distribute energy dynamically by supplying electricity to the grid while using either thermal or electrical energy for industrial applications. This takes advantage of the flexible distribution of electricity or heat to maximize profit. The industrial process serves as a load sink for the excess heat or electricity produced by the nuclear reactor. Economic challenges to the current United States nuclear light water reactor (LWR) fleet have led to early plant closures. While LWRs primarily deliver baseload electricity, there is no reason why nuclear energy produced by these reactors cannot be used to provide energy to a range of industrial applications. This directed study course will identify feasible systems, products, and commodities that could be produced by existing nuclear plants. As part of this, cost and potential profitability will be analyzed within the context of market structures and grid reliability.

*NE527: Nuclear material storage, transport, disposal*

*Spring 2020*

There is a wide range of nuclear materials that are stored, transported and disposed of each day. The materials include medical radioisotopes, new fuel pellets, used fuel, and industrial radioisotopes. This course will cover the regulations that govern nuclear material storage, transportation and disposal, as well as the engineering requirements and practical aspects of handling these materials.

*NE535: Nuclear Criticality Safety I*

*Spring 2022; 2020*

This course applies uses the foundation of applied nuclear physics to develop and explain the international and domestic rules and practices that are used to prevent inadvertent criticality in fuel cycle applications such as used fuel storage and processing.

*NE585: Nuclear Fuel Cycle Analysis*

*Fall 2023; 2017*

This course presents the nuclear fuel cycle can as an holistic system with components related in many complex ways. This course focuses on systems analysis of components that comprise the nuclear fuel cycle to understand the contemporary challenges facing nuclear energy. Topics include reactor design, critical size, reactor statics and dynamics, advanced reactor design, and back-end management; siting, fuel management, interim storage, repository design. Students will also gain facility with MCNP.

*TM529: Risk Assessment*

*Spring 2021–23; 2016–19*

This course is designed to provide students with an understanding of how to perform a comprehensive risk assessment applicable to a wide variety of engineering problems in many different disciplines. The course will focus on failure mode and effect analysis, fault tree analysis, probabilistic risk analysis, and human reliability analysis. The course will also cover fundamental probability and statistics content.

*NE450: Principles of Nuclear Engineering*

*Fall 2015–21*

In this course, an overview of fundamental nuclear engineering principles and how these are practically applied to contemporary, nuclear engineering problems will be presented. The topics covered in this course include: nuclear physics and reactions, materials science, radiation protection, energy production, fuel cycle analysis, advanced reactor design, fusion, nonproliferation, back-end management, and risk assessment and safety. Throughout the course, the ethical considerations with regards to engineering problems within these fields will also be discussed.

## **DIABLO VALLEY COLLEGE**

### **DEPARTMENT OF ARCHITECTURE AND ENGINEERING**

*ENGIN110: Introduction to Engineering*

*Spring 2013–15; Fall 2014*

This course introduces students to fundamental engineering principles. Students learn how these are applied to contemporary engineering problems through laboratory exercises, homework assignments, design projects, interviews with professional engineers, and field trips to engineering companies. Topics include: materials science, risk assessment and safety, critical problem-solving, engineering analysis, engineering design processes, project development, engineering software, and presentation tools. The role of the engineer in society, professionalism, and engineering ethics are major themes. The emphasis is on creative problem-solving, teamwork, and effective communication, both in presentation and writing.

## **UNIVERSITY OF CALIFORNIA – BERKELEY**

### **DEPARTMENT OF NUCLEAR ENGINEERING**

*NE92: Issues in Nuclear Science and Engineering*

*Fall 2011*

This course provides undergraduate students with an overview of the nuclear engineering profession, including fundamental nuclear engineering principles and how these are practically applied to nuclear engineering problems. The topics covered include nuclear physics and reactions, materials science, radiation protection, energy production, fuel cycle analysis, advanced reactor design, fusion, nonproliferation, back-end management, risk assessment, and safety. Throughout the course, the ethical considerations concerning engineering problems within these fields are also addressed through a comprehensive, student-driven course project.

*NE375: Teaching Techniques in Nuclear Engineering*

*Fall 2011; 2010*

This course acquaints graduate student instructors (GSIs) with teaching techniques for courses in the Department of Nuclear Engineering. The GSI will have several duties far beyond grading assignments and/or examinations: conducting discussion sessions, review lectures, or laboratory experiments. The GSI, therefore, needs to develop the appropriate tools to use when facing these pedagogical challenges. Three students from the 2010 course received the Outstanding Graduate Student Instructor Award given by the UC-Berkeley Graduate Student Instructor Teaching & Resource Center.

## **THE UNIVERSITY OF TOKYO**

### **DEPARTMENT OF NUCLEAR ENGINEERING/MANAGEMENT**

*Technical English for Scientists*

*Winter, Summer 2008; Winter 2007*

This course provided the opportunity for non-native English speaking students to develop technical communication skills; i.e., presenting scientific and technical material to an informed audience at an international conference. In this course, the ‘assertion evidence design’ concept for technical presentation of scientific topics was applied to student research interests. Transmutable skills focused on the professional communication of scientific research in various public speaking formats and a comfortable familiarity with the English language to establish a stronger foundation for technical writing.

## **RELATED TEACHING EXPERIENCE**

### **UNIVERSITY OF CALIFORNIA – BERKELEY**

#### **DEPARTMENT OF NUCLEAR ENGINEERING**

#### **GRADUATE STUDENT INSTRUCTOR**

*NE375: Teaching Techniques in Nuclear Engineering*

*Fall 2006*

Coordinated guest lecturers from departments within the College of Engineering  
Prepared lectures for effective teaching strategies for the undergraduate classroom  
Assessed individual student technical presentations and overall course grading

*E124: Ethics and the Impact of Technology on Society*

*Spring 2004–06*

Conducted multiple discussion sections on a weekly basis and review lectures  
Supervised research projects based on current, ethical and scientific issues  
Assessed individual student presentations, projects, and overall course grading

*IDS110: Introduction to Computing*

*Fall 2004*

Conducted multiple laboratory sessions on a weekly basis  
Supervised undergraduate research projects focused on web based education  
Assessed laboratory assignments and project grading

*NE92: Issues in Nuclear Science and Engineering*

*Spring 2002;2000*

Conducted multiple laboratory sessions on a weekly basis  
Supervised undergraduate research projects focused on web based education  
Assessed laboratory assignments and project grading

*NE275: Principles and Methods of Risk Analysis*

*Fall 2001*

This graduate course requires a deeper understanding of the subject matter, due to the student body. The course was one of three in the curriculum with the highest credit load. The main responsibility in this was to advise and grade semester projects and presentations based on risk assessments of engineering systems.

**READER**

*NE150: Introduction to Nuclear Reactor Theory*

*Spring 2003*

*NE104: Radiation Detection and Nuclear Instrumentation Laboratory*

*Fall 2002*

*NE107: Introduction to Imaging*

*Spring 2001*

*NE120: Nuclear Materials*

*Spring 2000*

Supervised laboratory sessions  
Assessed examinations, homework assignments, laboratory reports, final grades  
Conducted review lectures

**PROFESSIONAL SERVICE**

**UNIVERSITY OF IDAHO**

**FACULTY ADVISOR**

*American Nuclear Society University of Idaho Student Section*

**CHAIR**

*Promotion & Tenure, Department of Nuclear Engineering and Industrial Management*

*2022*

*Third Year Promotion & Tenure, Department of Nuclear Engineering and Industrial Management*

*2021*

**MEMBER**

<i>Promotion &amp; Tenure, College of Engineering</i>	2021–23
<i>NRC Student Fellowship Oversight Committee</i>	
<i>Department of Nuclear Engineering and Industrial Management Bylaws Committee</i>	
<i>Graduate Faculty</i>	
<i>Department of Nuclear Engineering and Industrial Management Admissions Committee</i>	
<i>Commencement Speaker Committee · Idaho Falls Center for Higher Education</i>	

## **ORGANIZER**

<i>American Nuclear Society Graduate School Fair</i>	2020 –
<i>NSA Fellowship Information Symposia (Idaho Universities)</i>	2017 –

## **ACADEMIC SEARCH COMMITTEES**

### **UNIVERSITY OF IDAHO**

<i>Joint University of Idaho &amp; Idaho State University Nuclear Engineering Professor</i>	2023
<i>Nuclear Engineering Associate Professor</i>	2023
<i>Nuclear Engineering Visiting Professor</i>	2022
<i>Mechanical/Nuclear Engineering Faculty</i>	2017

### **IDAHO STATE UNIVERSITY**

<i>Nuclear Engineering Faculty</i>	2018
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## **PEER REVIEWER**

### *American Nuclear Society*

Advances in Nuclear Nonproliferation Technology and Policy	
Annual and Winter Meetings	
Fuel Cycle and Waste Management Division John Randall Scholarship	Chair, 2022 –
Instrumentation, Control & Human-Machine Interface Technologies	
International High-Level Radioactive Waste Management Conference	
Student Conferences	

### *Journals*

- Advances in Engineering Software
- Annals of Nuclear Energy
- Energy Science & Engineering
- IEEE Transactions on Nuclear Science
- International Journal of Nuclear Energy
- Nuclear Science User Facilities
- Nuclear Engineering and Design
- Nuclear Engineering and Technology
- Progress in Nuclear Energy

### *Government*

USDOE Advanced Research Projects Agency-Energy Concept Papers, Open 2015 FOA

USDOE Advanced Research Projects Agency-Energy Review Panel – Arlington, Virginia  
USDOE Office of Nuclear Energy, Consolidated Innovative Nuclear Research  
USDOE SBIR/STTR Phase I Release 2  
USDOE SBIR/STTR Phase II Release 1  
USDOE SBIR/STTR Phase II Release 2

*Other*

Clays in Natural & Engineered Barriers for Radioactive Waste Confinement – Nantes, France  
Clays in Natural & Engineered Barriers for Radioactive Waste Confinement – Lille, France  
FY17 TI Portfolio, Bonneville Power Administration, Office of Technology Innovation  
FY16 TI Portfolio, Bonneville Power Administration, Office of Technology Innovation  
John Wiley & Sons, Inc.  
Khalifa University of Science and Technology

## **CONFERENCE COMMITTEES**

Co-Chair, Technical Program Committee, 2018 Advances in Nuclear Nonproliferation Technology and Policy Conference, American Nuclear Society, 11-15 November, 2018, Orlando, Florida  
Technical program committee, Advances in Nuclear Nonproliferation Technology and Policy Conference: Bridging the Gaps in Nuclear Nonproliferation, 25-30 September, 2016, Santa Fe, New Mexico  
Technical program paper review committee, Advances in Nuclear Nonproliferation Technology and Policy Conference: Bridging the Gaps in Nuclear Nonproliferation, 25-30 September, 2016, Santa Fe, New Mexico

## **TECHNICAL SESSION ORGANIZER**

Cybersecurity for nuclear installations, American Nuclear Society Winter Meeting, 30 November - 03 December 2021, Washington, D. C. (*co-Organizer with Prof. Jamie B. Coble, University of Tennessee-Knoxville*)  
Cybersecurity for nuclear installations, American Nuclear Society Winter Meeting, 17-21 November, 2019, Washington, D. C. (*co-Organizer with Prof. Jamie B. Coble, University of Tennessee-Knoxville*)

## **TECHNICAL SESSION CHAIR**

Cybersecurity for nuclear installations, American Nuclear Society Annual Meeting, 12-16 June 2022, Anaheim, California.  
Technology and policy advancements in nuclear nonproliferation, American Nuclear Society Annual Meeting, 12-16 June 2022, Anaheim, California.  
Cybersecurity for nuclear installations, American Nuclear Society Winter Meeting, 30 November - 03 December 2021, Washington, D. C.  
Diverse Approaches to Addressing Decarbonization, Boise State University Energy Policy Conference, 14 - 15 October 2021 [*virtual*].  
Spent fuel storage and transportation, American Nuclear Society Winter Meeting, 17-21 November, 2019, Washington, D. C.  
Cybersecurity for nuclear installations, American Nuclear Society Winter Meeting, 17-21 November,

2019, Washington, D. C.

Data synthesis for pyroprocessing safeguards, 2018 Advances in Nuclear Nonproliferation Technology and Policy Conference (ANTPC), American Nuclear Society, 11-15 November, 2018, Orlando Florida

Special session - Prof. Joonhong Ahn Memorial, International High-Level Radioactive Waste Management Conference, 09-13 April, 2017, Charlotte, North Carolina

Nonproliferation policy, concepts, and approaches: Treaty verification regimes, state-level concepts and fuel cycle analysis, Advances in Nuclear Nonproliferation Technology and Policy Conference: Bridging the Gaps in Nuclear Nonproliferation, 25-30 September, 2016, Santa Fe, New Mexico

Security, safeguards, and non-proliferation, International Conf., High-Level Radioactive Waste Management, 10-14 April 2011, Albuquerque, New Mexico

Used Fuel recycling technologies-I, International Congress on Advances in Nuclear Power Plants (ICAPP '10) 13-17 June, 2010, San Diego, California

Engineered systems and transport processes, International Conf., High-Level Radioactive Waste Management, 07-11 September, 2008, Las Vegas, Nevada

Challenges in nuclear waste disposal: Sociological aspects and technical approaches, Global Center of Excellence, 06 December, 2007, The University of Tokyo, Tokyo Japan

## **PANELS**

### **MODERATOR**

*American Nuclear Society Winter Meeting*

Open Discussion on the Future of Cybersecurity in Nuclear Installations 2021

### **PANELIST**

*Boise State University Energy Policy Institute Power Talks*

Economic Opportunities and Challenges for Idaho with Low Carbon Energy 2022

*American Nuclear Society Winter Meeting*

Open Discussion on the Future of Cybersecurity in Nuclear Installations 2021

*Idaho Open Education Week*

Think Open Fellowship 2021

Think Open Fellows at the University of Idaho is an open incubator program that awards 6 fellowships each year to support faculty and graduate students in transitioning a course from a standard text to open or extremely low cost course materials. To date, this program has saved students over \$300,000 while also encouraging innovation. This panel session with current and past fellows will discuss the Think Open Fellows program including design and implementation details, previous and current Think Open Projects, and tips for implementing a program at your institution.

## **WORKSHOPS**

### **AMERICAN NUCLEAR SOCIETY STUDENT CONFERENCE**

*Taking Care of You: Student-Mentor Relationships* 2021

A great mentoring situation can pave the way for success out of undergraduate or graduate school. Likewise, a poor or unhealthy mentoring relationship can cause lasting negative consequences on the students. Many

times these interactions go undiscussed, and one goal of this workshop is to empower students to talk about and take charge of unhealthy mentoring relationships. This student and faculty-led workshop will explore multiple facets of this relationship, including how to identify the right mentor for you, what it means to maintain a good student-mentor relationship, how to identify unhealthy situations, and what resources are available to students who may find themselves in such situations. This workshop will include panel discussion, small-group discussion, panelist-led role-playing, and an open Q&A.

## **INVITED TALKS**

### **INTERNATIONAL ATOMIC ENERGY AGENCY**

*Best practices at the University of Idaho*

*Knowledge Management Assist Visits for Nuclear, Radiological Education, and Training Providers* 2021

### **UNIVERSITY OF IDAHO • IDAHO FALLS CENTER FOR HIGHER EDUCATION**

*Strategies and success for ethical research*

*Vandal Advantage Graduate Student Orientation* 2018–

*P3/TRIO Upward Bound STEM Day* 2015

### **STANFORD UNIVERSITY**

*Pre-Collegiate Summer Institutes* 2014

## **SEMINARS**

### **UNIVERSITY OF IDAHO**

*CHE501* Spring 2023

### **UNIVERSITY OF TENNESSEE – KNOXVILLE**

*Department of Nuclear Engineering* Fall 2019

## **LIGHTNING TALKS**

*Future of Nuclear Waste Education Workshop* 2023; 2022

*Idaho National Laboratory Nuclear Science & Technology Research Planning Meeting* 2018

*Idaho National Laboratory Energy & Environment Research Planning Meeting* 2017

## **SYMPOSIA ORGANIZER**

### **CENTER FOR ADVANCED ENERGY STUDIES**

*Nuclear cybersecurity research initiatives* 2017

*Nuclear cybersecurity research focus areas* 2016

### **STANFORD UNIVERSITY**

*Center for International Security and Cooperation*

*Technical implications of nuclear energy system options* 2011

## **COMMUNITY SERVICE**

### **IDAHO AMERICAN NUCLEAR SOCIETY**



### *Smoke Detector Donation Program*

2016–

Over the past fourteen years, we have worked with more than 75 fire departments to donate more than 6100 smoke detectors to Idaho residents. From 2016-23, we donated over 2200 smoke detectors to Arimo, Ashton, Bancroft, Bear Lake, Clear Creek, Declo, Downey, Driggs, Grace, Hamer, Lava Hot Springs, Roberts, Shelley, and Soda Springs, across southeastern Idaho; Centerville, Clear Creek, Gem County, Horseshoe Bend, Idaho City, Lowman, Placerville and Valley of the Pines in Boise County; and north to the panhandle in Coeur D’Alene, Mullan, Shoshone, North Side, and West Pend. In 2022, we are pleased to be able to expand into Western Wyoming to Teton County.

### *Biannual Highway Cleanup*

2016–

Garbage cleanup of Miles 122–124 on Interstate 15 twice

## **OUTREACH & RELATED PROFESSIONAL ACTIVITIES**

University of Idaho, Utah State, Boise State American Nuclear Society Student Social 2022

Utah State University Graduate School Fair 2019

Montana Tech Career Fair 2018–

American Nuclear Society Diversity and Inclusion Committee Sponsorship November 2022; 2021; 2017; June 2023; 2018; 2017

University of Idaho Moscow Campus Recruiting 2017–

Department of Energy consent based siting meeting 2016

PHYSOR University of Idaho Sponsorship 2016

Boise State University Nuclear Research Summit 2016

UI & BYU American Nuclear Society Student Social 2018; 2016

BYU-Idaho Career Fair 2015

## **PROFESSIONAL TRAINING**

### **NUCLEAR WASTE TECHNICAL REVIEW BOARD**

#### **PARTICIPANT**

*International Workshop on Siting of Radioactive Waste Facilities* 2023

The mission of the U.S. Nuclear Waste Technical Review Board is to perform unbiased and ongoing technical and scientific peer review of the U.S. Department of Energy’s (DOE) nuclear waste management activities. The Board makes an essential contribution to increasing confidence in the scientific process and to informing, from a technical and scientific perspective, decisions on nuclear waste management. The Board provides objective technical information to Congress, the Administration, DOE, government and non-government organizations, and the public on a wide-range of issues related to spent nuclear fuel and high-level waste management and disposition.

### **UNIVERSITY OF IDAHO**

#### **PARTICIPANT**

*Best Practices for Working with the DoD* 2023; 2021

## **CLEMSON UNIVERSITY**

## **MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

### **INVITED PARTICIPANT**

#### *Future of Nuclear Waste Education Workshop*

2022–

Understanding and managing nuclear waste requires a broad knowledge from nuclear engineering to civil and environmental engineering. In parallel, broader system-level analyses as well as societal/regulatory contexts are necessary to inform energy policies from the nuclear waste and environmental perspectives. Energy system or nuclear fuel cycle analysis quantifies waste generation per unit energy output, and their economical and environmental impacts throughout the life cycles of nuclear energy. Historical and regulatory contexts are also important to understanding nuclear waste in the contexts of general hazardous waste management. A challenge is posed by the extreme interdisciplinary nature of the subject of nuclear waste management— which makes it difficult to cover all the important topics in one, single institution. Such a knowledge gap is a major bottleneck when transformational changes are needed to prepare for new types of wastes from advanced reactors as well as to develop new waste processing technologies such as pyro-processing. Although each individual institution can have its strengths and characteristics, it is critical to create community efforts such that the next generation workforce – interacting with the public and policy makers – has current and comprehensive knowledge about nuclear waste and its environmental impacts. This workshop will develop the blueprint of educating next generation engineers/scientists in nuclear waste as well as broader nuclear and environmental engineers. Although one student may not need to have all the knowledge, there is a minimum set of knowledge that one should have as a future scientist or engineer involved in nuclear waste and nuclear energy.

## **WEBINARS**

### **PARTICIPANT**

#### *Western Services Corporation Generation III Generic Pressurized Water Reactor Simulator*

2022

Western Services Corporation hosted a workshop to provide an overview of the simulator capabilities and how the simulator can augment education, training, and research.

## **VIRTUAL**

### **INVITED PARTICIPANT**

#### *Defense Established Program to Stimulate Competitive Research (DEPSCoR)*

2021

The Capacity Building opportunity is a new component of DEPSCoR and aims to support the strategic objectives of Institutes of Higher Education in DEPSCoR States/Territories to achieve basic research excellence in areas of high relevance to the DoD. The Virtual DEPSCoR Day will include overviews of the FOAs, various panel sessions and breakout sessions with Program Officers representing the topics in the Research Collaboration FOA.

#### *GAIN-EPRI-NEI Advanced Reactors Safeguards & Security Workshop*

2021

The focus of this workshop was to understand how advanced reactors would be able to be licensed under United States domestic safeguards requirements. Participants included academia, industry, and government.

### **PARTICIPANT**

#### *NSF Broader Impacts 101 Workshop*

2021

Proposals submitted to the National Science Foundation (NSF) are evaluated on both their intellectual merit and their broader impacts (BI) - the impacts on and benefits to society of the proposed research. This free

workshop is designed for anyone considering applying for funding to the NSF who wishes to increase the competitiveness of their proposals. Participants will develop strategies for designing, implementing, and evaluating BI activities, and will be guided through the process of aligning their BI activities with their research and professional/personal interests to develop a ‘lifelong’ BI identity.

## **NATIONAL SCIENCE FOUNDATION**

### **PARTICIPANT**

*NSF Grant Development Conference*

Los Angeles

2019

Portland

2016

Key officials representing each NSF program directorate, administrative office, Office of General Counsel, and Office of the Inspector General will participate in this two-day conference. The conference is considered a must, particularly for new faculty, researchers, educators and administrators who want to gain insight into a wide range of important and timely issues at NSF, including: the state of current funding; the proposal and award process; and current and recently updated policies and

## **UNIVERSITY OF ILLINOIS URBANA – CHAMPAIGN**

### **INVITED PARTICIPANT**

*Collaborative Open Source Curriculum Development Workshop*

2018; 2017

This workshop concluded a year of faculty interaction at six universities to develop curricula for courses common across the same disciplines at multiple universities in order to reduce the amount of time that any individual professor spends on creating what is essentially duplicate materials. The method proposed in this workshop is based on open source software development, where code is shared in online repositories, reviewed by peers, and contributed to the main project.

*PyNE Summit*

2017

PyNE is a suite of tools to aid in computational nuclear science and engineering. PyNE seeks to provide native implementations of common nuclear algorithms, as well as Python bindings and I/O support for other industry standard nuclear codes.

## **GENERATION ATOMIC + GAIN**

### **FACILITATOR**

*Nuclear Advocacy and Communications Training*

2018

Opposition groups claim nuclear power plants are unsafe. Recently, the U.S. nuclear power industry has been characterized as too expensive and dangerous when compared to other energy sources. As members of the nuclear community, we know that the success of nuclear energy has never been more important to ensuring a positive future for the world – but what can we do to make a difference? This workshop will leave participants energized to tell today’s nuclear power story and be well-equipped with the tools to do so. Convincing others about the benefits of nuclear involves more than just laying out the facts. Thoughtful and personal storytelling bridges gaps when speaking those who are unfamiliar with the technology by explaining the personal and moral reasons that we work in this field. Telling our personal stories and motivations for working in nuclear creates common ground from which we can better explain nuclear’s benefits: whether it’s as a mother talking to a father, a surfer talking to a skier, or a cook talking to a conservationist, the human stories that nuclear makes possible are our strongest tools when speaking to the public. The most effective nuclear advocacy takes place at the interpersonal level when we strike up

conversations with peers and even better, strangers. Because you can never know who it might be sitting across from you at that dinner party or next to you on the airplane, it's important to practice having open, considerate conversations with people of all backgrounds.

## **PACIFIC NORTHWEST NATIONAL LABORATORY**

### **INVITED PARTICIPANT**

#### *Cyber Security Course for Safeguards Practitioners*

2018

The course is designed for early to mid-career safeguards practitioners (technical instrument developers, instrument users, policy advisors, etc.) who will benefit from a greater understanding of cyber security threats and how to reduce risks to safeguards systems and processes. This 3.5 day course is designed to teach safeguards and cybersecurity experts how to recognize and mitigate potential cybersecurity vulnerabilities in emerging safeguards instrumentation, information systems, and conduct of operations. This training features classroom style learning opportunities through hands-on exercises and provides plenty of time for questions and discussion. Participants will learn new cyber security skills, use cyber security tools, and collaborate with one another and cyber experts to resolve challenges. They will gain an understanding of cyber security principles and a better awareness of cyber risks associated with safeguards systems. Exercises will include puzzles, exploits of attended and unattended monitoring systems, blended physical and cyber attacks on fictional nuclear facilities, and network defense.

#### *Safeguards Laboratory Day*

2017–19

Students and faculty from the University of Idaho were invited to Pacific Northwest National Laboratory to learn about the research activities at the laboratory. The day also included hands-on safeguards and security experiments conducted at laboratory facilities, such as materials accounting and vehicle searches.

#### *Next Generation Safeguards Initiative Summer Course*

2016

This course, offered through the DOE/NNSA Next Generation Safeguards Initiative (NGSI), covers major international safeguards procedures currently in use in IAEA member nations. Daily lectures were supplemented with hands-on safeguards activities conducted by IAEA safeguards inspectors and researchers at PNNL. Participants included faculty, postdoctorate researchers, and graduate students.

## **IDAHO NATIONAL LABORATORY**

### **INVITED PARTICIPANT**

#### *Collaborative Research Planning Meeting*

2018; 2017

The Center for Advanced Energy Studies (CAES) is a catalyst for collaborative projects focused on energy research, achieved via connections between the CAES entities – Idaho National Laboratory (INL), Boise State University, Idaho State University, University of Idaho, and University of Wyoming – and beyond. Through a series of strategic planning meetings, CAES leadership aims to develop a set of focused research directions. The meeting is intended to establish new collaboration, along with a list of prioritized goals and actions items that will steer internal research investments with the intent of growing sustainable, externally-funded programs. The planning meeting will focus on a strategic area tied to one or more INL directorates and will bring together the appropriate INL and university leadership and researchers.

### **PROJECT MENTOR**

#### *Modeling, Experimentation, Validation (MeV) Summer School*

2017

The MeV Summer School provides enhanced training for engineers and applied scientists involved in design, licensing, and operation of current and advanced nuclear reactor systems through a multi-faceted learning

approach of lectures, tours, and hands-on activities. The school is being organized through the cooperation of national laboratories, industry, government agencies, and universities that share the goal of building a strong workforce to support global nuclear expansion. The faculty will be drawn from the top experts in academia, industry, and government. The general organization and conduct of the school will be overseen by an international board of senior experts. A local secretariat will provide technical, logistical and administrative support to students and faculty. It is the aim of the school to foster the development of a next-generation network of scientists and engineers capable of advancing nuclear energy in the 21st century through integrated modeling and experimentation.

## **IDAHO FALLS POST REGISTER**

### **PARTICIPANT**

*Intermountain Energy Summit*

2015–17

This summit is held annually and covers energy issues unique to the intermountain region. Participants include faculty from local universities, researchers from national laboratories, energy companies, and politicians. This year, the theme is energy security with a focus on nuclear, renewable, and alternative energy sources and continued advancements in grid and cybersecurity.

## **DEPARTMENT OF ENERGY**

### **PARTICIPANT**

*Consent-Based Siting Public Meeting*

2016

The Department of Energy is in the initial phase of developing a consent-based process for siting the facilities needed to store and dispose of the nation's spent nuclear fuel and high-level radioactive waste. A consent-based approach to siting relies on understanding the views of the public, stakeholders, and governments at the local, state, and tribal levels. In this first phase, the Department is engaging with interested groups and individuals to learn about what elements are important to consider in designing an enduring approach to siting. This session is an opportunity for the public to share thoughts and perspectives through a facilitated discussion.

## **GLOBAL AMERICAN BUSINESS INSTITUTE**

### **INVITED PARTICIPANT**

*Trilateral Nuclear Energy Dialogue: Korea, Japan, United States*

2016

A high-level private workshop among preeminent Korean, Japanese, and American experts in nuclear energy and nuclear policy issues, with the intention of fostering relationships, confidence building, and seeking potential areas for trilateral cooperation. In keeping with the overarching theme of previous discussions—the back-end fuel cycle—this meeting seeks to underscore the role of advanced nuclear energy and fuel cycle technologies. Although the obstacles impeding permanent solutions to spent fuel and radioactive waste are largely political, this dialogue aims to highlight the potential of cutting-edge technologies in addressing the policy, environmental, and public acceptance challenges facing management of the nuclear fuel cycle, in addition to opportunities for international collaboration in the research, development, demonstration, and deployment of such technologies.

## **BOISE STATE UNIVERSITY**

### **INVITED PARTICIPANT**

### *Idaho's Role in Nuclear: Clean Energy Powered by the Next Generation*

2016

Boise State University is proud to bring globally recognized leaders in nuclear energy to address the benefits and challenges associated with nuclear energy production and its role in supplying clean energy for a growing world. The summit will also include a panel discussion with John Kotek, Assistant Director of Nuclear Energy, U.S. Department of Energy; Dr. Mark Peters, Laboratory Director for the Idaho National Laboratory; Mark Rudin, Vice President for Research at Boise State University; Mike McGough, Chief Commercial Officer at NuScale Power, and Dr. Harold Blackman, Associate Vice President for Research and Economic Development at Boise State University. The panel will address questions about the benefits of and concerns around nuclear power.

## **UNIVERSITY OF CALIFORNIA – BERKELEY**

### **INVITED PARTICIPANT**

#### *Proliferation Resistance and Physical Protection Working Group Workshop*

2015

The PR&PP methodology was developed within the Generation IV International Forum (GIF) to provide a structured framework to assess the proliferation resistance and physical protection robustness of Gen IV nuclear energy systems, and to guide designers to further improve their systems. This workshop is intended to familiarize non-experts in this field with the broad aspects of the methodology and its applications. The PR&PP Working Group will present an overview of the methodology to an audience of students, academics, and members of the GIF community who wish to become more familiar with the PR&PP methodology. To illustrate the methodology, its application to a hypothetical nuclear energy system will be examined. Workshop participants will be divided into subgroups that will consider different proliferation and security threats, and will identify important design features and approaches that contribute to the system's resilience to these threats. Following these subgroup sessions, workshop participants will reconvene to review insights from the subgroups. Finally, an open discussion will be held to obtain feedback from the participants on the GIF approach to PR&PP with the objective of refining the methodology and its presentation to the wider community of academics and prospective GIF users.

#### *Advanced Summer School of Radioactive Waste Disposal with Social-Scientific Literacy*

2009–11

This advanced summer school was established in conjunction with the Department of Nuclear Engineering/-Management, the University of Tokyo and the Department of Nuclear Engineering, University of California, Berkeley to provide Ph.D. students and early-career nuclear engineers with education in social sciences and engineering. The goal was to foster a next generation of engineers capable of understanding the public and societal needs, contributing to the societal decision making, and taking a responsible role as engineering experts in society. The discussant leads student group activities by stimulating questions from students and corroborating with the chair to develop a summary of lectures. Held at Hawai'i Tokai International College in 2010.

#### *Minner Fellows Program*

2011

The objective of this program was to develop a framework for making ethical judgments in engineering. Because engineering faculty and graduate students play a leadership role in the development of these technologies, it is essential that they become aware the ethical, legal and social ramifications of them. The course focused on context, or the embodiment of moral maturity and ethical expertise, in the same way that faculty and graduate students embody engineering and technical expertise.

#### *Summer Institute for Preparing Future Faculty*

2005

This unique program is for Doctoral Candidates with an interest in an academic career. Many aspects of teaching are covered: course design, syllabus development, teaching and learning assessment, teaching and

learning strategies, and the creation of a teaching portfolio. The program exposes candidates to faculty in several disciplines both within and outside the university; thus allowing for the dissemination of the full scope of teaching methods and skills, as well as broadening of perspectives with regards to the entire teaching profession.

## **STATE OF IDAHO BOARD OF EDUCATION**

### **INVITED PARTICIPANT**

*Open Education Resources Development*

Boise

2015

This workshop focused on the use of open source educational materials in order to produce an online textbook as a supplement to existing commercial textbooks. An online textbook allows flexibility for faculty to augment content without requiring multiple textbooks for a course. An online textbook allows the educational content of a course to be more closely aligned with the desired learning outcomes. Two online texts have been developed: Principles of Nuclear Engineering and Risk Assessment.

## **AWARDS & FELLOWSHIPS**

### **UNIVERSITY OF IDAHO**

#### **AMERICAN NUCLEAR SOCIETY UNIVERSITY OF IDAHO STUDENT SECTION**

*Samuel Glasstone Award for Public Service • Second Place*

2019

*Certificate of Distinction*

2019

### **UNIVERSITY OF CALIFORNIA – BERKELEY**

#### **GRADUATE STUDENT**

*Nuclear Engineering Department Block Grant Fellowship*

2005

*Outstanding Graduate Student Instructor Award*

2003

*Katherina S. DeSharton Fellowship*

1999

*Hamilton Family Memorial Fellowship*

1999

### **DEPARTMENT OF ENERGY**

#### **GRADUATE STUDENT**

*Civilian Radioactive Waste Management Fellowship*

2000–04

### **NUCLEAR ENERGY INSTITUTE**

#### **GRADUATE STUDENT**

*National Academy for Nuclear Training Fellowship*

1999

## **PROFESSIONAL SOCIETIES & POSITIONS**

### **AMERICAN NUCLEAR SOCIETY**

#### **MEMBER**

<i>National Program Committee</i>	2022–25
<i>National Program Screening Subcommittee</i>	2022–25
<i>Local Sections Committee</i>	2022–
<i>Local Sections Awards Committee</i>	2022
<i>Human Factors Instrumentation &amp; Controls</i>	2020–
<i>Nuclear Nonproliferation Policy</i>	2015–
<i>Fuel Cycle and Waste Management</i>	2015–
<i>Student Sections</i>	2015–

#### **EXECUTIVE COMMITTEE**

<i>Nuclear Nonproliferation Policy</i>	2019–22
<i>Student Sections</i>	2018–21
<i>Nonproliferation Policy Division</i>	2018–22

#### **IDAHO SECTION OF THE AMERICAN NUCLEAR SOCIETY MEMBER**

<i>Community Service</i>	2016–
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#### **EXECUTIVE COMMITTEE**

<i>Treasurer</i>	2022–
<i>Board of Directors</i>	2020; 2018

#### **TAU BETA PI ENGINEERING SOCIETY**