

Shoaib Usman

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CURRENT RESEARCH INTERESTS Health Physics, Radiological Pathway Analysis, Consent-Based Siting for Interim Storage Program, Community Engagement, Machine learning, Uncertainty quantification, Digital Twin, Cybersecurity, Thermal Hydraulics, Spent Nuclear Fuel Interrogation.

EDUCATION

PHD **University of Cincinnati**, NUCLEAR ENGINEERING **1998**
• On the Spectral Theory of Turbulence and Atmospheric Dispersion
• Advisor: Dr. Henry B. Spitz

MSc **University of Cincinnati**, HEALTH PHYSICS **1996**
• Response of Electret Radon Detector to Interference from Ambient Gamma Radiation
• Advisor: Dr. Henry B. Spitz

MSc **University of Cincinnati**, NUCLEAR ENGINEERING **1993**
• Development of a Phenomenological Model for Predicting CHF Under Low Quality and Subcooled Swirl Flow Conditions
• Advisor: Dr. Joel Weisman

BSc **N.E.D. University of Engineering and Technology**, MECHANICAL ENGINEERING **1988**
Karachi, Pakistan.
• Design of a System for Ethylene Production from Naphtha
• Advisor: Dr. Syed F. Ali

HONORS AND AWARDS

Senior Faculty Achievement Award, Missouri S&T's Mines & Metallurgy Academy, April 13, 2023.

Keynote Speaker at 2023 Laufer Energy Symposium, Saint Louis, MO, March 30- April 1, 2023.

Foreign Faculty Award, 42nd International Nathiagali Summer College on Physics and Contemporary Needs, July 17-29, 2017, Islamabad, Pakistan.

M. Yousaf (Dr. Usman's graduate student), was awarded Winner in the ICONE-24 Student Best Poster Competition – North America for the poster “Isothermal Rectangular Roughness Elements in a Rectangular Cavity Heated at the Bottom” during the 24th International Conference on Nuclear Engineering- ICONE-24 Charlotte, NC, June 26-30, 2016.

S. Sipaun, (Dr. Usman's graduate student), received Best Poster Award for; “A Parallel Plate Model Using Porous Media Approach,” Penn State Hosts iNuc – the American Nuclear Society National Student Conference, April 18, 2014.

M.L. Dennis (Dr. Usman's graduate student) was awarded University Research Alliance 2010 DOE Innovations in Fuel Cycle Research Award for Universities with Less Than \$500 million in 2008 R&D Expenditures for the paper “Feasibility of 106Ru peak measurement for MOX fuel burnup analysis”, Nuclear Engineering and Design 240 (10), pp. 3687-3696.

Fourth International Topical Meeting on Nuclear Plant Control and Human Machine Interface Technologies (NPIC & HMIT), International Secretary Award, September 19-22, 2004.

EDITORIAL RESPONSIBILITY

Frontiers in Energy Research, Associate Editor **2016 – present**
Journal of Nuclear Engineering and Radiation Science, Associate Editor **2018 – present**

LEADERSHIP
ROLE

Testimony – Missouri House of Representatives , Jefferson City, Missouri,	February 22, 2011
Presentation – Congresswoman JoAnn Emerson , Missouri,	February 25, 2011
NE Curriculum Review – King Abdulaziz University Jeddah, KSA,	June 25-29, 2012.
Mentorship– IAEA Sponsored Nuclear Masters Course Abuja, Nigeria,	March 22-28, 2014.
Testimony – Missouri House of Representatives , Jefferson City, Missouri,	April 17, 2014
Expert Witness – At the request of Attorney General Chris Koster,	2015
Foreign Faculty – 42 nd International Nathiagali Summer College, Pakistan	July 17-29, 2017
Presentation – Department of Energy , Consent-Base Siting Consortia,	July 24-25, 2023.
Meeting– Jack Ladyman, Arkansas House Representative , Jonesboro, AK,	August 28, 2023.

MEDIA
COVERAGE

- [1] Missouri S&T will ask St. Louis-area residents their opinions about nuclear waste, St. Louis Public Radio (NPR), July 5, 2023. [\[Link\]](#)
- [2] S&T researchers awarded \$2 million to assess public perception of nuclear waste sites, Missouri University of Science and Technology, News & Events, June 27, 2023. [\[Link\]](#)
- [3] Keynote Speaker at 2023 Laufer Energy Symposium,2023 [\[Link\]](#)
- [4] Featured as a grant awardee “Missouri S&T researchers awarded seed grants from Taylor Geospatial Institute,” 2023. [\[Link\]](#)
- [5] Supervising Ph.D. student on advanced nuclear concepts, July 2019. [\[Link\]](#)
- [6] Featured on “West Lake Landfill Tree Core Analysis Report,” 2015. [\[Link\]](#)
- [7] Supply chain of SMRs, featured as “Distinguished Speaker,” 42nd International Nathiagali Summer College, Islamabad - PAKISTAN, July 17-29, 2017. [\[Link\]](#)

ACADEMIC
EXPERIENCE

Missouri University of Science and Technology

Assistant/Associate Professor, Nuclear Engineering

Aug 2004 – 2008 – Present

Responsibilities include teaching undergraduate and graduate level courses for the nuclear engineering program, developing a research program in the areas of nuclear science and engineering, supervising student research, participating in the outreach effort to other institutions, including minority partners, and providing services to the university and scientific community.

King Abdulaziz University

Jeddah, Kingdom of Saudi Arabia, Adjunct Professor, Nuclear Engineering

June 2003 – Present

Responsibilities include providing; guidance to the program in the development and growth, undergraduate teaching support for various nuclear engineering courses, promote collaborative research between the faculty and students of KAU and Missouri S&T and other US universities. Also taught a class on reactor physics during summer 2013 and supervised King Abdullah City for Atomic and Renewable Energy (KACARE) nuclear engineering undergraduate students during their training visit to Lowell, Massachusetts, USA.

University of Cincinnati

Research Assistant Professor, Nuclear Engineering

January 2003 – August 2004

Developed funded research program on radio-turbulence and reactor operations and taught graduate-level courses for nuclear engineering program on need basis. Research activities included radio-turbulence, radiation detector development and computer-based procedures system for safe nuclear reactor operations.

University of Cincinnati

Adjunct Assistant Professor, Nuclear Engineering

June 1999 – December 2002

This engagement with the department included need-based teaching, participating in ongoing research projects and developing new research concepts and proposals for external funding. Areas of research interest included system automation and safety enhancement, radio-turbulence & radon diffusion, radiation measurement, and radiation effects.

Radiation Detector Paralysis & Deadtime Measurements: This research has developed an enhanced two-parameter detector deadtime correction scheme and a measurement technique to determine the two parameters, namely paralysis factor and the total deadtime. High intensity short lived radionuclides are produced at Missouri S&T reactor for collecting the required data. We are currently investigating deadtime dependence on operational conditions, voltage, radiation energy and temperature etc. Results from this research have wide applications. (Students: T. Ali – MS, S&T 2021, B. Almutairi - Ph.D., S&T, 2020, M. Yousaf - Ph.D., S&T, 2016, T. Akyurek - Ph.D. S&T May 2015, A. Patil– Ph.D. M.S., S&T – 2010, & D. Gallego- M.S., S&T – 2010).

NEUP - Experimental and Computational Investigations of Plenum-to-Plenum Heat Transfer Under Natural Circulation in a Prismatic Very High Temperature: The project has developed sophisticated measurement techniques for heat transfer coefficients and coolant dynamics in a scaled down prismatic blocks representative of post shut down HTTF/MHTGR cooling under natural convection conditions. The effort will enhance our understanding of the phenomenon of natural convection and provide benchmark experimental data to validate CFD code like FLUENT, Star CMM+ and RELAP5-3D. The project involves two additional universities as subcontractors, ORNL and AREVA as our industry partner. (Students: S. Alshehri (2019), I. A. Said (2017) and M. T. Moharam (2017) - Ph.D. S&T).

AMEREN/Callaway Nuclear Power Plant - Meteorological Data Mining & Synthesis for Site Data Supplementation: This project will provide high fidelity correlations which will allow use of off-site data to fill gaps in the on-site meteorological data due to potential instrument failures or malfunctions. This data is critical for any nuclear power plant to comply with NRC regulations. Nuclear Regulatory Commission (NRC) requirement for operating any nuclear power plant. Yearly Radiological/Environmental Report by each nuclear power station includes site specific meteorological data. Typically, hourly data (8,760 weather data sets) are recorded for wind direction, wind speed, atmospheric stability, and accumulated precipitation to evaluate impact to human health and safety. Callaway on-site meteorological monitoring system is used for this study as our test case and off-site data is obtained from the surrounding airports and weather stations. (Students: B. Sonpon - Enrolled Ph.D. S&T).

SMR Consortium - Condensation Heat Transfer Experiment and Scaling: The Passive Containment Cooling System (PCCS) is one of the integral passive cooling systems used in various new nuclear reactor designs, including various Small Modular Reactor (SMR) designs. Heat transfer via condensation on the inside of containment walls is anticipated as a passive way to keep Containment Vessel pressure within design limits, therefore, condensation is the key heat transfer phenomenon in the design of the PCCS. The presence of even a small quantity of non-condensable gases can greatly influence the condensation process. In this experiment a scaled-down facility is constructed to investigate the effect of non-condensable gas on the phenomenon of condensation heat transfer and natural convection. (Students: V. Kalra - M.S. S&T, P. Bhowmik, Ph.D., S&T, both under Dr. Schlegel)

AREVA/K.A.CARE - Hydraulic conductivity and retardation coefficient characterization of soil from Riyadh, Saudi Arabia: The project is related to radiological safety analysis of a proposed nuclear site in the Kingdom of Saudi Arabia. The soil sample and being analyzed for hydraulic conductivity and retardation coefficient using flow-through (column). CsNO₃ and SrNO₃ was tested using mass spectroscopy. This data is collected in support of Environmental Impact Analysis of a proposed site for a research reactor. (Students: Mohammed R. Alsubhi and Jay Joshi- Enrolled Ph.D. S&T).

Missouri Attorney General - Phytoforensics study of a superfund radioactive waste site near Saint Louis: The project is focused on investigating any possible leaching of radioactive material from a superfund site in the Saint Louis Metro area. The PIs are required to collect samples, perform measurement and appear as expert witness in the impending trial. (Students: LIST CANNOT BE DISCLOSED - Enrolled Ph.D. S&T).

Small Modular Reactor (SMR) Consortium And R&D: This project is to establish a center/consortium related to SMR research. In addition to recruiting new members for the consortium, I was also involved in research which will facilitate the design, development and deployment of SMR in the United States. This member driven consortium will identify and develop transformational technologies to support SMR deployment in the US. Two major SMR player joined the consortium (Westinghouse and AmerenUE). One of the initial projects involves model the life cycle sustainability assessment of SMR supply chains. My research efforts include life cycle assessment (LCA), social life cycle assessment (S-LCA) and life cycle costing (LCC) to evaluate the life cycle environmental, social

and economic impacts, of SMR on regional and global level. We documented the SMR supply chain product system and perform a gap/need analysis for local and regional growth. Based on these results we will select the relevant impact categories for the environment, social and economic impacts.

Research Reactors Simulation And Upgrade: Benchmarking research reactor and subcritical critical assembly. Experiments are conducted to unfold the neutron energy spectrum for the Missouri S&T Nuclear Reactor. Experimental data validation for determining the location of the hot channel and hot channel factor, flux shape, and criticality calculation. Computational methods for thermo-hydraulics coupled burnup analysis and determination of thermal and poison feedback effects. Reactor power upgrade and safety analysis. (Students: S. Sipaun - Ph.D. S&T - 2014, B. Richardson - M.S., S&T - 2011, K. O'Bryant - Enrolled M.S. S&T - 2013).

Conduction-Convection Transition For Rayleigh-Benard Experiment: Benchmark experiments and simulations were conducted observing the on-set of convection in a Bénard cell experiment. Dimensionless numbers were identified and a very useful analogy between RC-circuit and convective heat transfer is reported. Data collected is compared with the literature to examine validity of the experimental set-up. The set-up is also calibrated for alpha convection study to be performed. The results led to the development of a new phenomenological model for the on-set of natural convection. (Students: M. Yousaf - Ph.D. S&T, 2016, V. Khane- M.S., S&T - 2010, B. S. Mohammad-M.S. S&T 2007, M. J. Scarangella - M.S. UC 2004, & M. I. Hawwari-M.S. UC 2004).

Effect Of Surface Roughness On Natural Convection: Research is focused on investigating the effect of surface properties on the on-set of natural convection for vertical and horizontal surfaces. Using LBM simulation frame-work we have analyzed the shape and depth of surface roughness in the flow induced due to the thermal instabilities. (Student: M. Yousaf - Ph.D., S&T 2016).

Radio-Turbulence and Alpha Convection: Investigation of this newly discovered phenomenon of induced micro-scale turbulence in liquids. Preliminary results provide sufficient experimental evidence that diffusion is enhanced due to "radio-turbulence". Future research will develop understanding of the phenomenon and investigate its potential impact on various applications including nano-systems & radiological transport of radionuclides. P.I. on two DoE funded projects on this topic totaling \$396,421 expanding the research. (Students: M. Yousaf - Ph.D., S&T, 2016 & S. Syahrir-Ph.D. UC -2004).

MOX Fuel Online Burnup Analysis: This research involves non-destructive analysis of spent fuel using γ -spectroscopy to enable burnup analysis. MOX burnup and decay simulations were performed using ORIGEN-ARP. Results were analyzed and used to determine performance specifications of a detection system for field applications. Analysis of isotopic activity from simulated irradiated fuel were used to develop correlations to determine burn-up, and Plutonium content of MOX fuel supporting nuclear safeguard and proliferation deterrence. Missouri S&T Reactor was used to collect gamma spectra for validation of proof of concept. Subsequently, delayed neutron data was also collected for burnup analysis and determination of Plutonium in the Missouri S&T Reactor's fuel elements. (Student: T. Akyurek - Ph.D. S&T 2015, L. Tucker - Ph.D. S&T 2016 & M. L. Dennis-M.S. S&T -2008).

Thorium Use In Current Reactor: There are over one hundred commercial power reactor running in the country. This feasibility study is to examine the impact of modified fuel supply to these reactors, in particular using Thorium in the fuel mix. Thorium will act as burnable poison in the first stage of the burnup cycle and subsequently transform into ^{233}U fuel. Work is being conducted to compare various fuel loading options, and operational compliance with the safety guidelines established by NRC. This research involves extensive use of MCNP, MCNPX and ORIGEN-ARP for burnup simulations. Feasibility of using Thorium based fuel will be investigated both in BWR and PWR. (Student: L. Tucker - Ph.D., S&T 2016)

Annihilation Coincidence Photons Measurement: Initial experimental data (using therapy machine) was collected for annihilation photons produced by high energy photon interaction with mm-size lead target. Coincidence measurements (using 2 NaI(Tl) detectors) were made which offers the capability to measure absolute activity at the target without having to know the detection efficiencies. Simulations are under way. Collaboration with Medical Physics faculty is being developed. (Students: T. Goter-B.S. S&T 2007, A. Patil-Ph.D. S&T 2010, & D. Konate-M.S. UC 2004).

Photoconductive & Neutron Induced Conductivity: The concept of photoconductive gamma dosimeter is being extended for neutron measurements. Experimental detectors for neutron are being constructed and will be tested using Missouri S&T nuclear reactor. Data on the effect of thermal neutrons on various kinds of PN junctions have already been collected and results are analyzed for publication. (Student: D. Gallego - M.S., S&T - 2010).

NRC Curriculum Development Project - Educational: This University of Tennessee - Mis-

souri S&T joint project was funded by the US Nuclear Regulatory Commission (\$350,000) to develop teaching material in the areas of; technology implementation and teaching material development for distance learning of radiation measurements laboratory (including distance experimentation), development of teaching materials for radiological engineering and environmental assessment, nuclear material shipping and handling protocol, environmental sample collection and analysis techniques including neutron activation analysis.(Student: D. Gallego - M.S., S&T – 2010).

NRC Curriculum Development Project - Educational: This US Nuclear Regulatory Commission funded project is to develop new teaching material in the areas of; radio-chemistry and nuclear forensics. As a Co-PI of this project, I contributed in developing course material for environmental radioactivity and transport through atmosphere, surface and ground water, concentration mechanism in bio-sphere and mathematical modeling of the system. (Student: D. Gallego - M.S., S&T – 2010).

Neutron Generator Laboratory - Infrastructure Upgrade: This Department of Energy funded project is to establish a flexible neutron source at the university. The system that we have acquired is based on D-D reaction producing 2.5 MeV neutrons. At full capacity the system can produce 109 neutrons. Because of the small size of the target the neutron source can be approximated as a point source. We have performed safety analysis of the system. Installation of the system required due consideration of the potential experiments. (Students: Several)

NRC Curriculum Development Project - Educational: This NRC subcontract from Southern University and A&M College (SUBR) is to assist SUBR in their effort to launch a nuclear engineering program at their campus. Southern University at Baton Rouge is a well-recognized minority institute of higher learning in science and engineering. With a potential of developing a major in nuclear engineering in south eastern quarter of the country. SUBR is keen to initiate some fundamental courses in nuclear engineering. As a Co-PI of the project I developed teaching materials for the fundamental in nuclear engineering class and provided support in the class delivery. I also introduced the remote accessibility of the nuclear reactor to the SUBR faculty and the capability of collaborative teaching and research. Student: M. Yousaf - Ph.D. S&T, 2016)

CURRENT
GRANTS

Department of Energy - 2023 Consent-Based Siting for Interim Storage Program – Community Engagement Opportunities

FOA: DE-FOA-0002575

Role: **PI**

Title: Assessment after Engagement, Education & Experiential-learning (A-EEE)

Collaborators: **UIUC** (C. Brooks, T. Kozlowski & T. Grunloh), **Saint Louis University** (J.S. O. Sandoval, & V. Sagan), **University of Missouri** (R. Rotman), **U. Nevada** (N. Tsoufanidis), **MIT** (S. Islam), **Pattonville Schools** (B. Nelson)

Amount: \$1,999,789 / Status: **Selected for funding**

Taylor Geo-spatial Institute, Saint Louis

Title: Artificial intelligence & machine learning-driven framework for meteorological data mining & synthesis for Health Systems (2023-2024)

Role: **PI**

Amount: \$67,298 / Status: **Awarded**

U.S. Nuclear Regulatory Commission

Title: Graduate Fellowships in Nuclear Engineering at Missouri S&T (2023-2026)

Role: **PI**

Amount: \$400,000 / Status: **Awarded**

PENDING
DECISION

Department of Energy - 2024 Consolidated Innovative Nuclear Research

Funding Opportunity Announcement (FOA) Number: DE-FOA-0003039

Role: **PI**

Title: (**BBC-ARC**) **B**uilding the **B**ridge of **C**ommunication, **A**rkansas **C**ollaboration

Collaborators: **Arkansas State University** (Amanda Carpenter, Cameron Wimpy, Andrea Junqueira, Brad Rawlins), **University of Arkansas** (Han Hu), **University of Massachusetts, Lowell** (Subash Sharma)

Amount: \$1 million / Status: **Under Review**

Department of Energy - 2024 Consolidated Innovative Nuclear Research

Funding Opportunity Announcement (FOA) Number: DE-FOA-0003039

Role: **PI**

Title: **(ARC-ABC) AR**kansas **C**ollaboration for **A**cumen **B**efore **C**onsent
Collaborators: **University of Arkansas** (David C. Jenses), **Southern Illinois University, Edwardsville** (Ryne Fries), **University of Missouri, Columbia** (Robin Rotman)
Amount: \$1 million / Status: **Under Review**

Department of Energy - 2024 Consolidated Innovative Nuclear Research

Funding Opportunity Announcement (FOA) Number: DE-FOA-0003039

Role: **Co-PI**

Title: Enhanced Energy-Time Delayed Neutron Characterization for Advanced Reactor Transient Analysis

Collaborators: **University of Nevada Las Vegas** (PI - Meng-Jen (Vince) Wang), **University of Utah** (Glenn Sjoden), **Rhode Island Nuclear Science Center** (Cameron Goodwin), **Ultra Safe Nuclear Corporation** (Brian Ade)

Amount: \$1 million / Status: **Under Review**

BOOK
CHAPTERS

- [1] M. S. Hassan, A H. Khan, R. Verma, D. Kumar, K. Kobayashi, **S. Usman**, S. B. Alam, Handbook of Smart Energy Systems, Springer. Machine Learning and Artificial Intelligence-Driven Multi-Scale Modeling for High Burnup Accident-Tolerant Fuels for Light Water-Based SMR Applications, Springer Handbook of Smart Energy Systems, 2023.
- [2] K. Kobayashi, **S. Usman**, C. Castano, A. Alajo, D. Kumar, S.B. Alam. Surrogate Modeling-Driven Physics-Informed Multi-fidelity Kriging: Path Forward to Digital Twin Enabling Simulation for Accident Tolerant Fuels, Springer Handbook of Smart Energy Systems, 2023.
- [3] **S. Usman**, Nuclear Energy Encyclopedia: Science, Technology, and Applications, John Wiley & Sons, 2011 – Chapter 11- Uranium-Plutonium Nuclear Fuel Cycle.
- [4] J. D. Smith, K. Buchheit, H. Al-Rubaye, **S. Usman**, Y. Zhou, G. Gelles, Next Generation Nuclear Power for Non-Power Applications in the Middle-East Region, Submitted to Energies Manuscript ID: energies-1763672

INVITED
TALKS

- [1] **S. Usman**, Internal Dosimetry and Radiation Protection, Nuclear Science: From Energy to X-Rays, The Science Seminar Series by The Academy of Science-St. Louis, April 4, 2018.
- [2] **S. Usman**, Supply chain of SMRs, Distinguished Speaker, 42nd International Nathiagali Summer College, Islamabad - PAKISTAN, July 17-29, 2017.
- [3] **S. Usman**, Fundamentals of natural convection and circulation, Distinguished Speaker, 42nd International Nathiagali Summer College, Islamabad - PAKISTAN, July 17-29, 2017.
- [4] **S. Usman**, Plenum-to-Plenum Heat Transfer and Gas Dynamics under Natural Circulation - I, Distinguished Speaker, 42nd International Nathiagali Summer College, Islamabad - PAKISTAN, July 17-29, 2017.
- [5] **S. Usman**, Plenum-to-Plenum Heat Transfer and Gas Dynamics under Natural Circulation - II, Distinguished Speaker, 42nd International Nathiagali Summer College, Islamabad - PAKISTAN, July 17-29, 2017.
- [6] T. Akyurek, and **S. Usman**, (2016) Nuclear MOX Fuel Analysis and Monitoring Using Non-destructive Method, 1st International Underground Resources and Energy Conference, Middle Anatolia Development Agency, Vol.1. pp. 2. Yozgat-TURKEY, October 6-8, 2016.
- [7] **S. Usman**, and T. Akyurek, LWR Design Impact on Radiological Source Term, 1st International Underground Resources and Energy Conference, Middle Anatolia Development Agency, Vol.1. pp. 32, Yozgat-TURKEY, October 6-8, 2016.
- [8] **S. Usman**, Spectral Theory of Turbulence and Atmospheric Dispersion, Guest Speaker at a Special Seminar, National Oceanic & Atmospheric Administration, Oak Ridge, TN., April 23, 1997.

- [1] ATTORNEY GENERAL CHRIS KOSTER - STATE OF MISSOURI AND MISSOURI DEPARTMENT OF NATURAL RESOURCES, vs. REPUBLIC SERVICES, INC., ET AL, VIDEO-TAPED DEPOSITION OF AS EXPERT WITNESS - September 22, 2015. (Trial to continue -)
- [2] **S. Usman**, Thorium Energy Potential - Presentation to the Missouri House of Representatives, Jefferson City, Missouri, April 17, 2014. Provided expert's opinion to the state law makers on the potential of Thorium. The expert testimony was followed by a question & answer.
- [3] **S. Usman**, Thorium Energy Potential - Presentation to the Missouri House of Representatives, Jefferson City, Missouri, February 22, 2011. Provided expert opinion to the state law makers on the potential of Thorium. The expert testimony was followed by a question & answer.
- [4] **S. Usman**, Presentation to Congresswoman JoAnn Emerson, Pea Ridge Mine, Sullivan, Missouri, February 25, 2011. Gave a seminar on rare earth and accompanying thorium reserves in Missouri and the potential of developing a thorium based nuclear fuel cycle to augment the current energy portfolio of the country. The seminar was followed by a question and answer section.

- [1] P. K. Bhowmik, **S. Usman**, J. P. Schlegel, Film condensation with high heat fluxes and scaled experiments using pure steam for reactor containment cooling, Applied Thermal Engineering, Vol. 229, Article number 120610, July 2023. [\[Link\]](#) **Impact Factor: 6.47**
- [2] M.M.Taha, S. Ibrahim, Z. Zeitoun, **S. Usman**, & M. H. Al-Dahhan. Effect of non-uniform heating on temperature and velocity profiles of buoyancy driven flow in vertical channel of prismatic modular reactor core, Applied Thermal Engineering, Vol. 225, Article number 120209, May 2023. [\[Link\]](#) **Impact Factor: 6.47**
- [3] K. Kobayashi, **S. Usman**, C. Castano, A. Alajo, D. Kumar, S.B. Alam. Data-Driven Multiscale Modeling and Robust Optimization of Composite Structure with Uncertainty Quantification, Springer Handbook of Smart Energy Systems, 2023. [\[Link\]](#) **Impact Factor: 7.30**
- [4] K. Kobayashi, M. Bonney, D. Kumar, K. Paaren, **S. Usman**, S.B. Alam. Uncertainty Quantification and Sensitivity Analysis for Digital Twin Enabling Technology: Application for BISON Fuel Performance Code, Springer Smart Energy Systems, January 2023. [\[Link\]](#) **Impact Factor: 7.30**
2022.[\[Link\]](#) **Impact Factor: 4.91**
- [5] P. K. Bhowmik, J. P. Schlegel, V. Kalra, S. Alam, S. Hong, **S. Usman**, CFD validation of condensation heat transfer in scaled-down small modular reactor applications, Part 2: Steam and non-condensable gas, Experimental and Computational Multiphase Flow, July, 2022, 4(4): 424-434, [\[Link\]](#) **Impact Factor: 4.91**
- [6] W. Hao, K. F. Kapiamba, V. Abhayaratne, **S. Usman**, Y. Huang & Y. Wang, A filter-based system mimicking the particle deposition and penetration in human respiratory system for secondhand smoke generation and characterization, Inhalation Toxicology, May 2022.[\[Link\]](#) **Impact Factor: 3.01**
- [7] B. Almutairi, S. Jaradat, D. Kumar, C.S. Goodwin, **S. Usman**, A. Alajo, S. Alam, Weight Loss and Burst Testing Investigations of Sintered Silicon Carbide Under Oxidizing Environments for Next Generation Accident Tolerant Fuels for SMR Applications, Materials Today Communications, March 2022, 102958. [\[Link\]](#) **Impact Factor: 5.40**
- [8] D. Kumar, F. Ahmed, S. Usman, A. Alajo, S. B. Alam, Recent advances in uncertainty quantification methods for engineering problems, AI Assurance: Towards Trustworthy, Explainable, Safe, and Ethical AI, January 2022, 453-472, [\[Link\]](#) **Book Chapter 13th**

- [9] P. K. Bhowmik, J. P. Schlegel, V. Kalra, S. Alam, S. Hong, **S. Usman**, CFD validation of condensation heat transfer in scaled-down small modular reactor applications, Part 1: Pure steam, *Experimental and Computational Multiphase Flow*, August, 2021, 4(4): 409-423, [\[Link\]](#) **Impact Factor: 4.91**
- [10] T. Akyurek, S.B. Shoaib, **S. Usman**, Delayed fast neutron as an indicator of burn-up for nuclear fuel elements, *Nuclear Engineering and Technology*, Vol. 53(10), pp. 3127-3132, October, 2021. [\[Link\]](#) **Impact Factor: 2.82**
- [11] P.K. Bhowmik, J.P. Schlegel, V. Kalra, C., Mills, **S. Usman**, Design of condensation heat transfer experiment to evaluate scaling distortion in small modular reactor safety analysis, *Journal of Nuclear Engineering and Radiation Science*, 7(3),031406, July 2021. [\[Link\]](#) **Impact Factor: 0.44**
- [12] R. Alsulami, M. Albarqi, S. Jaradat, **S., Usman**, J. Graham, Optimizing the moderator geometry and thickness for a reactor-based slow positron source, *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms*, 497, pp. 39-46, June, 2021. [\[Link\]](#) **Impact Factor: 1.28**
- [13] B. Almutairi, S. Alam, C.S. Goodwin, **S. Usman**, T. Akyurek, Simultaneous experimental evaluation of pulse shape and deadtime phenomenon of GM detector, *Scientific Reports*, 11(1),3320, February 2021. [\[Link\]](#) **Impact Factor: 4.60**
- [14] S.M. Alshehri, I.A., Said, **S. Usman**, A review and safety aspects of modular high-temperature gas-cooled reactors, *International Journal of Energy Research*, 45(8), pp. 11479-11492, December 2020. [\[Link\]](#) **Impact Factor: 4.67**
- [15] B. Almutairi, S. Alam, T. Akyurek, C.S. Goodwin, **S. Usman**, Experimental evaluation of the deadtime phenomenon for GM detector: deadtime dependence on operating voltages, *Scientific Reports*, Vol. 10(1), 19955, November, 2020. [\[Link\]](#) **Impact Factor: 4.60**
- [16] S. M. Alshehri, I.A. Said and **S. Usman**, Effect of nonuniform isoflux heating on natural convection heat transfer in a prismatic modular reactor, *Applied Thermal Engineering*, 176,115369, July, 2020. [\[Link\]](#) **Impact Factor: 6.40**
- [17] T. Akyurek, W.S. Vas, A.B. Alajo, J.C. King, **S. Usman**, and C.H.C. Giraldo, Neutron reflector analysis for the beam-port of the Missouri S&T Reactor, *Journal of Radioanalytical and Nuclear Chemistry*, Vol. 322, pp. 975-981, September, 2019. [\[Link\]](#) **Impact Factor: 1.75**
- [18] T.Akyurek, and **S. Usman**, Determination of Plutonium and Uranium Content and Burnup Using Six Group Delayed Neutrons, *Nuclear Engineering and Technology*, Vol. 51(4), pp. 943-948, July, 2019. [\[Link\]](#) **Impact Factor: 2.82**
- [19] B. J. Almutairi, T. Akyurek, and **S. Usman**, Voltage dependent pulse shape analysis of Geiger-Müller counter, *Nuclear Engineering and Technology*, Vol. 51(4), pp. 1081-1090, July, 2019. [\[Link\]](#) **Impact Factor: 2.82**
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- [6] M. L. Dennis, Proliferation Deterrence by Spent Fuel Monitoring, Poster at DOE FCRD Annual Meeting Poster Competition, October 28, 2010.
- [7] **S. Usman**, and M. L. Dennis, Proliferation Deterrence by Spent Fuel Monitoring, Poster at Missouri Energy Summit, Columbia, MO., April 22-23, 2009.
- [8] **S. Usman**, and A. Patil, Detector Paralysis Factor and Dead-time Measurements, Poster at Missouri Energy Summit, Columbia, MO., April 22-23, 2009.
- [9] **S. Usman**, and K. Khane, Analogy Based Modeling for Natural Convection, Poster at Missouri Energy Summit, Columbia, MO., April 22-23, 2009.
- [10] C. H. Castano, G. E. Mueller, **S. Usman**, A. S. Kumar, and J. C. King, Heavily Shielded Hot-Cell at Missouri S&T, Poster at Missouri Energy Summit, Columbia, MO., April 22-23, 2009.
- [11] A. Patil and **S. Usman**, Measurement and Application of Paralysis Factor for Improved Detector Dead-time Characterization, Council on Ionizing Radiation Measurements and Standards 16th Annual Meeting, "Measurements and Standards for Radiation-based Imaging " Gaithersburg, MD, Oct. 22 - 24, 2007.
- [12] **S. Usman**, Experimental Observation of Radio-Turbulence, Guest Speaker - Special Seminar, National Institute of Standards and Technology, Gaithersburg, MD, Feb. 10, 2004.
- [13] **S. Usman**, Syahrir, H. Spitz, J. Weisman, Transport of Radon in Still Water, Council on Ionizing Radiation Measurements and Standards 12th Annual Meeting, Gaithersburg, MD, Oct. 27-29, 2003.

SOFTWARE
PRODUCTS

- [1] **S. Usman**. PulseGen. (for simulating detector deadtime behavior) 2015.
- [2] **S. Usman**. CHF, (for predicting Critical Heat Flux in pipe flows) . 1994.
- [3] **S. Usman**. SAAM: (for implementing Critical Path Method for project management). 1988.

GRADUATE
RESEARCHERS

<u>NAME</u>	<u>DEGREE - YEAR</u>	<u>ROLE</u>
Ben Sonpon	PhD - (est. 2024)	PhD Advisor
Abdallah Wazzan	PhD - (est. 2024)	PhD Advisor
Mehedi Hasan Tusar	MS - (est. 2024)	PhD Advisor
Eric A. Feisslel	PhD - (est. 2025)	PhD Advisor
Bader J. Almutairi	PhD - 2020	PhD Advisor
Mubarak M. Albarqi	PhD - 2019	PhD Co-Advisor
Salman M. Alshehri	PhD - 2019	PhD Advisor
Raed A. M. Alsulami	PhD - 2019	PhD Advisor
Salman M. Alzahrani	PhD - 2019	PhD Advisor
Mahmoud T. Moharam	PhD - 2017	PhD Co-Advisor
Ibrahim A. Said	PhD - 2017	PhD Co-Advisor
Muhammad Yousaf	PhD - 2016	PhD Advisor
Lucas P. Tucker	PhD - 2016	PhD Advisor
Tayfun Akyurek	PhD - 2015	PhD Advisor
Susan Sipaun	PhD - 2014	PhD Advisor
Amol Patil	PhD - 2010	PhD Advisor
Syahrir Syahrir	PhD - 2004	PhD Co-Advisor
Jay P. Joshi	MS - 2017	MS Advisor
Eric A. Feisslel	MS - 2017)	MS Advisor
Kelly O'Bryant	MS - 2012	MS Co-Advisor
Brad Richardson	MS - 2012	MS Co-Advisor
Lucas P. Tucker	MS - 2011	MS Advisor
Edwin Grant	MS - 2010	MS Co-Advisor
Zachary A. Kulage	MS - 2010	MS Co-Advisor
Amol Patil	MS - 2008	MS Advisor
Vaibhav B. Khane	MS - 2009	MS Advisor
David Gallego	MS - 2009	MS Advisor
Matt L. Dennis	MS - 2008	MS Advisor
Bassam S. Mohammad	MS - 2007	MS Advisor
Majd I. Hawwari	MS - 2004	MS Advisor
Dramane Konate	MS - 2004	MS Advisor
Michael J. Scarangella	MS - 2004	MS Advisor
Ned Xoubi	MS - 2003	MS Advisor
Turki Ali	MS - 2020	MS (Non-Thesis)
Jonathan Fransch	MS - 2008	MS (Non-Thesis)
Saima Rashid	MS - 2015	MS (Non-Thesis)

THESIS
COMMITTEE

Shreekanta B. Aradhya	PhD - 2013	PhD Dissertation Reviewer
Vaibhav Sinha	PhD - 2013	PhD Dissertation Reviewer
Moses O. O. Kagumba	PhD - 2013	PhD Dissertation Reviewer
Faraj Muftah Zaid	PhD - 2013	PhD Dissertation Reviewer
Jessika V. Rojas	PhD - 2014	PhD Dissertation Reviewer
Chrystian M. Posada	PhD - 2014	PhD Dissertation Reviewer
Manish K. Sharma	PhD - 2016	PhD Dissertation Reviewer
Abdelsalam Efhaima	PhD - 2016	PhD Dissertation Reviewer
Fitri B. AbdulRahman	PhD - 2017	PhD Dissertation Reviewer
Huseyin Sahiner	PhD - 2017	PhD Dissertation Reviewer
Laith S. Sabri	PhD - 2018	PhD Dissertation Reviewer
Abbas J. Sultan	PhD - 2018	PhD Dissertation Reviewer
Shaikat M. Galib	PhD - 2019	PhD Dissertation Reviewer
Ashraf Alsafasfeh	PhD - 2020	PhD Dissertation Reviewer
Abdulaleem A. Bugis	PhD - 2020	PhD Dissertation Reviewer
Palash K. Bhowmik	PhD - 2021	PhD Dissertation Reviewer

Kennard Callender	MS - 2007	MS Thesis Reviewer
Frank A. Strantz	MS - 2011	MS Thesis Reviewer
Muhammad I. K. Abir	MS - 2011	MS Thesis Reviewer
Jessika V. Rojas	MS - 2011	MS Thesis Reviewer
Chrystian M. Posada	MS - 2011	MS Thesis Reviewer
Jason J. Pleitt	MS - 2012	MS Thesis Reviewer
Lifeng Wang	MS - 2013	MS Thesis Reviewer
Brandon J. Lahmann	MS - 2014	MS Thesis Reviewer
William Kirby Compton	MS - 2015	MS Thesis Reviewer
Meiyu Xing	MS - 2015	MS Thesis Reviewer
Shaikat M. Galib	MS - 2015	MS Thesis Reviewer
Brendan Dsouza	MS - 2015	MS Thesis Reviewer
Varun Kalra	MS - 2017	MS Thesis Reviewer

UNDERGRADUATE
RESEARCHERS

<u>NAME</u>	<u>DEGREE - YEAR</u>	<u>SCHOLARSHIPS</u>
S. Yu	BS - 2006	Opportunities for UG Research Experience ANS Presentation
Thomas P. Goter	BS - 2007	Opportunities for UG Research Experience ANS Presentation
Fatin N. Binti Padzli	BS - 2018	Opportunities for UG Research Experience
Jack Vande Polder	BS - 2022	Special Problems

VISITING
RESEARCHERS

<u>NAME</u>	<u>DATES</u>	<u>LEVEL - INSTITUTION</u>
Syed Farasat Ali	2005	Prof., Tuskegee University, AL
Tayfun Akyurek	2017	Professor - Marmara University, Turkey
Bader Almutairi	2023	Scientist - Kuwait Institute Scientific Research

TEACHING

MISSOURI UNIVERSITY OF SCIENCE & TECHNOLOGY

Nuclear Technology Applications (Extension at Lincoln Uni.) – NE 25	Fall 06
Nuclear Technology Applications – NE 25	Spring 10
Interactions of Radiation with Matter – NE 203	Summer 07
Nuclear Radiation Detection & Measurements – NE 204	Spring 05
Fundamentals of Nuclear Engineering – NE 205/NE 3205	Fall 04-08, 10
Reactor Laboratory I (Lab & Lecture) – NE 304/NE 4428	Fall 05-08, 10-22
Reactor Laboratory II (Lab & Lecture) – NE 308/NE 4438	Spring 06 and 16
Nuclear Rad. Measure'ts & Spectro. – NE 312/NE 4312	Spring 06-08,10-12,14-15,21-22
Radiological Engineering – NE 301/NE 327/NE4357 & 5347	Spring 07-19, 23
Applied Health Physics – NE 333/NE4363 & 5363	Fall 11-12, 14-17, 23
Radiochemistry and Nuclear Forensics – NE 301 (20%)	Spring 12
Advanced Nuclear Thermal-Hydraulics – NE 407	Fall 13
Licensing of Nuclear Power Plants – NE4259	Fall 17, 18, 21, 22, 23
Reactor Physics I NE – 4203/5203	Spring 19
Nuclear Fuel Cycle NE – 4207/5207	Fall 19
Nuclear Engineering Seminar NE – 6010	Fall 16,17, 18 – Spring 17
Radiation Shielding NE – 6331	Fall 20, 21
Radiation Interaction with Matters NE – 3103	Spring 23

UNIVERSITY OF CINCINNATI

Nuclear Reactor Eng. I – NE 604	Winter 99
Nuclear Reactor Eng. II – NE 605	Spring 99

Radiation Effects on Materials – NE 644
Radiation Measurement I - NE 521/523
Radiation Measurement II - NE 522/524
Nuclear Reactor Lab - NE 599

Fall 99
Fall 01, 03, Winter 04
Winter 02, 03, 04 (Spring)
Spring 02, Fall 03

PEER
REVIEWING

Editorial Board

Frontiers in Energy Research **2016 – present**
Journal of Nuclear Engineering and Radiation Science **2018 – present**

Manuscript Referee

Annals of Nuclear Energy
Nuclear Engineering and Design
Nuclear Science and Engineering
Nuclear Technology
Journal of Fluid Mechanics
Progress in Nuclear Energy
Progress in Computational Fluid Dynamics
Desalination and Water Treatment
Energy
Nuclear Engineering and Technology
Applied Radiation and Isotopes
Chemical Engineering Science
Swiss National Science Foundation
Journal of Nuclear Engineering and Radiation Science
Journal of Nuclear Energy Science & Power Generation Technology
Nuclear Science and Techniques
Progress in Nuclear Energy

Grant Proposal Referee

Dept. of Energy Nuclear Energy University Programs
U.S. Nuclear Regulatory Commission
U.S. DOE SBIR/STTR
U.S. DOE NEER
U.S. DOE NERI
International Agencies: Georgia

INTERNATIONAL
SERVICE

Mentorship on Nuclear Reactor Design in the Master Course for Nuclear Engineering, Abuja, Nigeria

June 25 - 29, 2012

The main goal of this assignment was to teach Nuclear Reactor Design to graduate students of the Nigeria nuclear engineering and science program and interact with the Home-instructor for knowledge sharing and expertise development. Following tasks were performed to achieve the mission goals: 1. Prepare teaching material for Nuclear Reactor Design using up-to-date engineering literature at an appropriate level for the students. 2. Deliver the requisite lectures in nuclear reactor design in accordance with the program developed by administrators of the nuclear engineering and science program. 3. Mentor the students throughout the duration of the mission and share some research ideas for them to continue their graduate program. 4. Transfer the teach material to the local instructor for any future use in form of the power point presentation.

Consulting support for Curriculum Review of Nuclear Engineering Program at King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia

March 23 - 27, 2014

The main goal of this assignment was to enhance the nuclear engineering Bachelors, Masters and Doctoral programs at King Abdulaziz University in Saudi Arabia. As a part of four members international committee provided guidance on the overall structure of the degree programs as well as specific lecture and laboratory classes: 2. Suggested various degree program structure and degree paths with a list of required and elective courses. 3. Prepare courses syllabi with suggestions for the most appropriate textbooks and teaching materials including the course content, outline and the learning objectives for the classes.

STATE
SERVICE

	Presentation – Missouri House of Representatives , Jefferson City, Missouri	February 22, 2011
	Presentation – Congresswoman JoAnn Emerson , Missouri,	February 25, 2011
	Presentation – Missouri House of Representatives , Jefferson City, Missouri	April 17, 2014
	Expert Witness – At the request of Attorney General Chris Koster	2015
PROFESSIONAL SERVICE		
	Keynote Speaker Laufer Energy Symposium	2023
	Senior Member – Mines & Metallurgy Academy	2022
	Foreign Faculty – International Nathiagali Summer College on Physics	2007
	International Secretary – NPIC & HMIT	2006
DEPARTMENTAL SERVICE		
	Member ————— Several Faculty Search Committee	2005-present
	Faculty Advisor – ANS Student Chapter at S&T	August 2004 – August 2006
	Faculty Advisor – Alpha Nu Sigma Student Chapter at S&T	August 2006 – 2016
	Mentorship ——— Several junior faculty members	2010-present
COLLEGE SERVICE		
	Member – Faculty Senate representing nuclear engineering program	2010-present
	Member – Tenure and Promotion Committee (for both CEC and Campus)	2012-present
	Member – Tenure Policy Committee (Campus)	2012-present
	Member – Missouri S&T Radiation Safety Committee	2014-present
COMMUNITY OUTREACH		
	Project Participation Rolla School District , Dr. Mandy Welch, RSD Budget:\$30,000	Current
	Project Participation Just Moms STL, Non-profit group Mrs. Chapman & Nickel,	Current
	Presentation – Missouri House of Representatives , Jefferson City, Missouri	April 17, 2014
	Presentation – Missouri House of Representatives , Jefferson City, Missouri	February 22, 2011
	Presentation – Congresswoman JoAnn Emerson , Missouri,	February 25, 2011
CONSULTING		
	Capgemini Cincinnati, OH	1999-2002
	<i>Data Modeling, system architecture and cyber-security for Internet/Intranet ecommerce applications development</i>	
	Procter & Gamble, Johnson & Johnson and The Coca-Cola Company	