Section 1.   Publications on behalf of CAES (Calendar year 2022)

Rodriguez, R., Baek, D., Case, M. Fox, R. "Studies Toward the Use of Ionic Liquids and Supercritical CO2 for the Recovery and Separation of Praseodymium from Waste Streams," Catalysts (2022) 12, 335. https://doi.org/10.3390/catal12030335

Rodriguez, R.G.; Baek, D. L.; Orme, K.; Case, M.E,; Fox, R.V. "Electrochemical, thermodynamic, and physical properties of tetradecyltrihexylphosphonium ([P6,6, 6,14]+) and methyl-propyl piperidinium containing ionic liquids and their propylene carbonate solutions". Journal of Molecular Liquids (2022) 352, 118607

M. Iqbal, **M. Mashal**, M. A. Khan, J. Grider, R. Squires, R. Richardson, J. A. Koudelka, A. Thornley, **I. van Woerden** (2022). Should We Offer Disaster Preparedness and Response Training Workshops Across Idaho? A Feasibility Study. Journal of Emergency Management. (In Press)

B. S. Aispuro and **M. Mashal** (2022). Recycled Concrete Aggregate in Eco Friendly Construction. National Diversity in STEM Conference, Society for Advancement of Chicanos/Hispanics & Native Americans in Science (SACNAS), San Juan, Puerto Rico, United States. (Poster Presentation)

J. Peck, S. Jenks, **M. Mashal**, K. Mondal, and **B Savage** (2022). Advanced Manufacturing for Bulk Storage of Hydrogen. Idaho Conference on Undergraduate Research, Boise, Idaho, United States. (Poster Presentation)

1. Mingfu He, **Amir Ali**, Minghui Chen "Steady-State Pool Boiling Heat Transfer Experimental Studies of Horizontally-Placed Tubes" International Journal of Heat and Mass Transfer, Vol.196(2022).

Scott Wahlquist, Joshua Hansel, Piyush Sabharwall, **Amir Ali**, "A Critical Review of Heat Pipe Experiments in Nuclear Energy Applications" Nuclear Science and Engineering, Online (2022). (https://doi.org/10.1080/00295639.2022.2082230)

Scott Wahlquist, **Amir Ali,** Su-Jong Yoon, Piyush Sabharwall "Laminar Flow Heat Transfer in Helical Oval-Twisted Tube Heat Exchangers," Frontier of Heat and Mass Transfer Journal, Vol. 18, (2022).

Mingfu He, **Amir Ali**, Minghui Chen "Experimental Investigations of Critical Heat Flux Re-Occurrence on Post-CHF Surfaces" Progress in Nuclear Energy, Vol. 148 (2022).

Wesley Yockey, **Amir Ali, Chad Pope** "Development of a New Control Rod Drive Mechanism Design for the ISU AGN-201M Reactor," Annals of Nuclear Energy Journal, Vol. 167 (2022)

J. Miller, S. Ercanbrack, **C. L. Pope**, The Versatile Economic Risk Tool, Nuclear Technology, accepted, (2022)

Z. Ma, S. Zhang, **C. L. Pope**, C. Smith, Research to Develop Flood Barrier Testing Strategies for Nuclear Power Plants, Nuclear Technology, accepted, (2022)

J. Bess, A. Chipman, **C. L. Pope**, C. Jensen, T. Ozawa, S. Hirooka, M. Kato, EBR-II MOX Fuel Characterization Enabling ARES Phase I Testing, Nuclear Science and Engineering, in review, (2022)

Pope, C.L. (ed), Nuclear Reactors – Spacecraft Propulsion, Research Reactors, and Reactor Analysis Topics, IntechOpen, 10.5772,intechopen.95676 (2022)

A. Wells, E. D. Ryan, **C. L. Pope**, Improving Nuclear Power Plant Flooding Hazard Analysis Through Component Performance Experiment, Fragility Model Development, and Smoothed Particle Hydrodynamic Simulation, Elsevier, in review.

C. L. Pope, R. Stewart, E. Lum, Experimental Breeder Reactor II, (2022), DOI:http//dx.doi.org/10.5772/intechopen.105800.

C. L. Pope, W. Phoenix, Idaho State University Low Power Teaching Reactor – An Overlooked Gem, (2022), DOI:http://dx.doi.org/10.5772/intechopen.105799.

Regulatory Considerations for Nuclear Energy Applications of Digital Twin Technologies, V. Yadav, A. Wells, **C. L. Pope**, J. P. Andrus, C. P. Chawasz, C. T. Trask, D. E. Eskins, J. Carlson, C. Ulmer, N. Chandran, R. Iyengar, TLR-RES/DE/REB-2022-06, Nuclear Regulatory Commission, Letter Report, (2022).

Research to Develop Flood Barrier Testing Strategies for Nuclear Power Plants, Z. Ma, S. Zhang, **C. Pope**, C. Smith, NUREG/CR-7279, INL-EXT-19-56427 (2022).

Abdalzaher, M.S., **Mostafa M. Fouda**, and Mohamed I. Ibrahem, "Data Privacy Preservation and Security in Smart Metering Systems," MDPI Energies, vol. 15, no. 19, article no. 7419, Oct. 2022. (Impact factor: 3.252), [DOI: 10.3390/en15197419]

Sherif Abdelfattah, Mohamed Baza, Mohamed Mahmoud, **Mostafa M. Fouda**, Khalid A. Abualsaud, and Mohsen Guizani, "Multidata-Owner Searchable Encryption Scheme Over Medical Cloud Data With Efficient Access Control," IEEE Systems Journal, vol. 16, no. 3, pp. 5067–5078, Sept. 2022. (Impact factor: 4.802), [DOI: 10.1109/JSYST.2021.3123956]

Amira O. Hashesh, Sherief Hashima, Rokaia M. Zaki, **Mostafa M. Fouda**, Kohei Hatano, and Adly S. Tag Eldien, "AI-Enabled UAV Communications: Challenges and Future Directions," submitted to IEEE Access, vol. 10, pp. 92048–92066, Aug. 2022. (Impact factor: 3.476) [DOI: 10.1109/ACCESS.2022.3202956]

Hanem I. Hegazy, Adly S. Tag Eldien, Mohsen M. Tantawy, **Mostafa M. Fouda**, and Heba A. TagElDien, "Real-Time Locational Detection of Stealthy False Data Injection Attack in Smart Grid: Using Multivariate-Based Multi-Label Classification Approach," MDPI Energies, vol. 15, no. 14, article no. 5312, Jul. 2022. (Impact factor: 3.252), [DOI: 10.3390/en15145312]

Abdelrahman Said, Sherief Hashima, **Mostafa M. Fouda**, and Mohamed H. Saad, "Deep Learning-Based Fault Classification and Location for Underground Power Cable of Nuclear Facilities," IEEE Access, vol. 10, pp. 70126–70142, Jul. 2022. (Impact factor: 3.476) [DOI: 10.1109/ACCESS.2022.3187026]

Mahmoud M. Badr, Mohamed Mahmoud, Waleed Alasmary, **Mostafa M. Fouda**, Khaled H. Almotairi, and Zubair Md Fadlullah, "Privacy-Preserving Federated-Learning-Based Net-Energy Forecasting," Proc. of the 2022 IEEE SoutheastCon 2022, Mobile, Alabama, Mar. 31–Apr. 3, 2022. [DOI: 10.1109/SoutheastCon48659.2022.9764093]

R. Khadka, M. Acharya, **D. LaBrier & M. Mashal**, "Visualization of Macroscopic Structure of Ultra-high Performance Concrete Based on X-ray Computed Tomography Using Immersive Environments," International Conference on Human-Computer Interaction, HCII 2022: Virtual, Augmented and Mixed Reality: Design and Development, June 2022.

Section 2.   Conferences Attended on behalf of CAES (FY22Q4)

M. Acharya and **M. Mashal** (2022). Structural Concrete Insulated Panels - A Resilient and Affordable Construction Technology. American Public Works Association – 2022 Rocky Mountain Chapter Conference, Pocatello, ID, United States. (Accepted for Oral Presentation)

K. Hogarth, **M. Mashal**, and **J. Cantrell** (2022). A Disaster Response Complex (DRC) for Research, Curriculum, and Training of First Responders. Disaster Preparedness and Response Conference, Idaho State University, Pocatello, Idaho, United States.

M. Iqbal, **M. Mashal**, M. Khan, J. Grider, R. Squires, R. Richardson, J. Koudelka, A. Thornley and I. van Woerden (2022). Should We Offer Disaster Preparedness and Response Training Workshops Across Idaho? A Feasibility Study. Disaster Preparedness and Response Conference, Idaho State University, Pocatello, Idaho, United States.

U. S. Medasetti, J. Dunker, Z. Free, S. Banda, and **M. Mashal** (2022). Disaster Response in VR. Disaster Preparedness and Response Conference, Pocatello, Idaho, United States.

U. S. Medasetti, A. Sebastian, and **M. Mashal** (2022). Scaled Source Recovery in Mobile Hot Cell Using UR5e. Disaster Preparedness and Response Conference, Pocatello, Idaho, United States.

J. Dunker, **M. Mashal**, and B. Marsh (2022). Radiation Dispersal Device Response Training. Disaster Preparedness and Response Conference, Pocatello, Idaho, United States.

Sudweeks, Canden L.; Hunter, Raiden A.; Stolworthy, Sophia; Olson, Kendal P.; Oster, Carlyn Osterhout; **Pak, Joshua J., Jenkins, Courtney,** Irradiation and degradation study of polyurethane model compounds: Abstracts of Papers, ACS Spring National Meeting & Events, San Diego, CA, United States, March 20-24, 2022

Pak, Joshua J.; Jenkins, Courtney, Stolworthy, Sophia; Olson, Kendal P.; Osterhaut, Carlyn; Sudweeks, Canden; Hunter, Raiden, 2022, Synthesis of polyurethane model compounds for degradation studies: Abstracts of Papers, ACS Spring National Meeting & Events, San Diego, CA, United States, March 20-24, 2022 (2022)

Pope, C.L., ICONE-29 Workshop 4, Bayesian Inference (August 2022)

Pope, C.L., Nuclear Criticality Safety Hands-On workshop, INL, TerraPower, and Southern Co., Idaho State University (October 2022)

LaBrier, D., "Revitalizing Safeguards Research and Education at Idaho State University," Institute of Nuclear Materials Management (INMM) Annual Meeting (virtual), July 2022.

 Sameen Mateen, **Rene Rodriguez**, Donna L. Baek, Robert V. Fox, Kavita Sharma, **Srinath Pashikanti,** Synthesis and characterization of rigid tertra-alkyl phosphonium based task specific ionic liquids: American Chemical Society, Spring 2022 – Virtual seminar, Division of Organic Chemistry, Green Methods and Synthesis Section.

Sameen Mateen, **Rene Rodriguez**, Kavita Sharma, Synthesis and Application of rigid tertra-alkyl phosphonium based task specific ionic liquids: Graduate Research Symposium 2022, Idaho State University.

Sections 3. Submitted Proposals Related to CAES Activities, FY22Q4

Lead PI	Department	Proposal Title	Sponsor
Donna Delparte	Geosciences	Model and Protect Ecological ..."	BSU
Daniel LaBrier	Nuclear Eng/Health Physics	Development of a U.S.-Based Educational ...	DOE
Minhaz Zibran	COSE Informatics / Comp Sci	BSSw - SQA for Better Scientific Softwar...	DOE
Daniel LaBrier	UBO - Science / Engineering	FY23 INL Joint Appointment Agreement- Da...	BEA
Daniel LaBrier	Nuclear Eng/Health Physics	Idaho NASA EPSCoR Summer Faculty Fellows...	UIdaho
Minhaz Zibran	COSE Informatics / Comp Sci	FY 2023 CAES Collaboration Program Devel...	BEA
Mustafa Mashal	Civil/Environmntl Engineering	NSF Engines: Type 1: Hazard Mitigation, ...	NSF
Mustafa Mashal	Civil/Environmntl Engineering	National Center for Equitable, Transform...	Rowan University
Sean McBride	ESTEC	Hierarchical Software Quality Assurance	Montana State
Rene Rodriguez	Chemistry	ISU- Support for Transient Spectrokeneti...	BEA
Courtney Jenkins	Chemistry	CAREER: Developing Sulfur-based Gels to ...	NSF

Other proposals

Amir Ali: DOE NEUP Experimental and Numerical Study of Fuel Fragmentation, Relocation, and Dispersal with Fission Gas Ejection from Failed Fuel Rod: Co-PIs: Ahmed Hamed (INL), Yidong Xia (INL), Kyle Gamble (INL)

Amir Ali: DOE-NEUP Flow-induced Vibration in MSRs: Experimental and Computational Study with Advanced Measurement Technology Development, Co-PIs: Zhangxian Deng (BSU/CAES), Joshua Fishler(INL)

Section 3.5. Funded Awards related to CAES Activities, FY22Q4

Lead PI	Department	Award Title	Sponsor
Courtney Jenkins	Chemistry	Mechanistic and Kinetic Analysis of Polymer Deco...	DOE
Keith Weber	GIS TReC	RECOVER 2.0: Cloud-Enabled Wildfire Decision Sup...	NASA
Chad Pope	Nuclear Eng/Health Physics	Resonance Absorption Densitometry for Materials ...	GE Global Research
Mostafa Fouda	Electrical and Comp Engineering	Collaborative Research: NeTS: JUNO3: SWIFT: Soft...	NSF
Kendra Murray	Geosciences	Research Assistants for Data Collection and Mana...	DOI
Rene Rodriguez	Chemistry	ISU- Support for Transient Spectrokeneti...	BEA

Section 4. Patents, Licenses, other IP - None

Section 5. Other Awards - None

Section 6. Graduated CAES-affiliated students (FY22Q4)
Mustafa Mashal (advisor): Mahesh Mahat
Josh Pak, Cori Jenkins (advisors): Canden Sudweeks (BS)
Amir Ali (advisor): Scott Wahlquist (M.Sc.)
Chad Pope (advisor): Cody Race (MS)
Dan LaBrier (advisor): Morgan Robbins, Jordan Harley, Eric Martinez (former student), John Stemkoski (former student)
David Beard (advisor): Ekow Barlow, Davis Bolt, Nicholas Garrett, Joshua Wheeler (Cybersecurity Certificates)

Section 7. Continuing CAES-affiliated students (FY22Q4)
Mustafa Mashal (advisor): Mahesh Acharya, Sindi Banda, Kabiraj Phuyal, Jack Dunker, Uma Shankar Medasetti
Josh Pak, Cori Jenkins (advisors): Kendal Olson (BS), Raiden Hunter (BS), Sophia Stolworthy (BS), Carlyn Osterhout (BS/MS)
Amir Ali (advisor): Scott Wahlquist (Ph.D.), Sutapa Biswas (Ph.D.), and Kyle Shredder (M. Sc.)
Keith Weber (advisor): Alyssa Farnes (BS)
Chad Pope (advisor): Brenna Carbno (MS), Maira Orozco (MS), Braeden Higby (MS), Andrew Fowler (MS)
Dan LaBrier (advisor): Eslam Ali, Sutapa Biswas, Michael Benson, Minh Nguyen
Bruce Savage (advisor): Sam Potter (BS)

Section 8. Incoming CAES-affiliated students (FY22Q4)
Rene Rodriguez (advisor): Shanae VanLeuven, Aaron Barlow, Forrest Hiatt
Mustafa Mashal (advisor): Ujwal Sharma
Mostafa Fouda (advisor): Ahmed Ashour (Ph.D.), Antora Dev (MS)
Bruce Savage (advisor): Icewall Ghmire (MS)
Srinath Pashikanti (advisor): Sameen Mateen, Shanae Van Leuven

Section 9. Joint Appointments (continuing) (FY22Q4)
Chad Pope (nuclear engineering)
Sean McBride (cybersecurity)
Larry Leibrock (cybersecurity)
David Rodgers (CAES AD)

Section 10. New Equipment - None

Section 11. Collaborative Research:

(1) CAES Collaboration Grants - continuing in FY22Q4

INL PI	ISU co-PI	ISU Department	BSU/UI Co-PI	Project
Kunal Mondal	Mustafa Mashal	Civil Engineering		Net Zero: Utilization of Waste Products from Agricultural and Biomass Industries to Reduce Concrete Emissions
Vaibhav Yadav	Mustafa Mashal	Civil Engineering		Mobile Robot for Security Applications in Remotely Operated Advanced Reactors
Kingyue Yang Rajiv Khadka John Koudelka	Mustafa Mashal	Civil Engineering		Investigation on Designing a Framework of Utilizing Sensor Data in Virtual Training for Disaster Response Preparedness and Response
Ryan Stewart	Leslie Kerby	Computer Science		Using Artificial Intelligence to Guide the Run-In of a Pebble Bed Reactor
Joshua Fishler	Amir Ali	Nuclear Engineering	Lan Li	Fundamentals of Computational Analysis of Thermal Systems: Curriculum Development
Asef Redwan	Anirban Chakraborty	Biological Sciences		Improving the electron shuttling efficiency of activated carbon in relation to biological nitrogen removal during water treatment
Md Riaz Kayser Ahmed Hamed	Mostafa Fouda	Electrical & Computer Engineering		Developing Machine Learning Based Force Field for Predicting Radiation Resistance of High Entropy Alloys

(2) ISU-CAES Seed Grant Program - continuing in FY22Q4

ISU PI	ISU Department	ISU co-PIs	University co-PIs	INL co-PI	Project
Ali, Amir	Nuclear engineering			Yasir Arafat	Performance optimization of MARVEL Microreactor power conversion system
Bodily, Paul	Computer Science			Rajiv Khadka	Application of Advanced Computational Theory to Facilitate Efficient Solutions to Real-World Combinatorial Problems
Forest, Tony	Physics			Chutiing Tan	A neutron Generator for Materials Testing
Fouda, Mostafa	Electrical & Computer Engineering			Ahmed Hamed	Smart Analytics of Biomass Images
Kalivas, John	Chemistry			John Koudelka	Virtual Reality for Dynamic Data Visualization of Analytical Chemical Data
Mashal, Mustafa	Civil Engineering	Dan LaBrier Jared Cantrell		Som Duhlipala Amit Jain	Machine Learning-Aided Validation of a Sustainable and Highly Durable Construction

					Technology for the Containment Facility of Advanced Reactors
Pashikanti, Srinath	Biomedical and Pharmaceutical Sciences	Rene Rodriguez		Robert Fox Donna Baek	Incorporation of Sterics in novel Phosphonium Ionic Liquid (PIL) and their Effect on Ligand Intermolecular Interactions and Chelation Properties
Savage, Bruce	Civil Engineering	Chikashi Sato Jim Mahar Mustafa Mashal	Karen Humes, UI Dakota Roberson, UI		Water Storage Infrastructure Viability using Repurposed Tires for Pumped Hydro
Weber, Keith	GIS TReC		Kathleen Araujo BSU Cassandra Koerner, BSU	Kelly Wilson Ryan Hruska Shiloh Elliot Chris Forsgren	The Power Grid/Wildfire Nexus: Using GIS and Satellite Remote Sensing to Identify Vulnerabilities
Xu, Danny	Biomedical and Pharmaceutical Sciences		Kenneth Cornell, BSU	Eric Whiting	Hearing Loss Prevention through Integrative High Performance Computing, Data Science, and Experimental Biology

(3) Other collaborations and outreach **(FY22Q4)**

Dan LaBrier
Project 1: ATR-C & ATR Gamma Tube - Student Engagement (Dave Schoonen, Ryan Little, Monica Dudenhoeffer – all INL; TBD – UI; Brian Jaques – BSU)
Project 2: Use of UHP Concrete in Nuclear Applications (Mustafa Mashal, Arya Ebrahimpour – ISU; Kunal Mondal, Drew Johnson, Elmar Eidelpes – INL)
Project 3: Investigation of Metal Hydride Distribution and Speciation (Mahmut Cinbiz, Chase Taylor – INL); INL LDRD FY21 Subaward

Mostafa Fouda
INL LDRD: "Reinforcement-Learning-Based Approach to Optimizing Quality of Service and Security on Fifth-Generation Networks" Principal Investigator: Cameron Krome, Directorate: NS&T, External Co-investigator: Dr. Mostafa Fouda Institution: Idaho State University, Fund Amount: $800K USD (ISU share is $150K USD), Dates: Oct. 2022 to Sep. 2024 (2 years)

Rene Rodriguez
Ongoing collaboration with Dr. Rebecca Fushimi on catalysis project
Ongoing collaboration with Dr. Fox in ionic liquid project

Bruce Savage
Water Storage Infrastructure Viability using Repurposed Tires for Pumped Hydro. Collaborators: C. Sato, J. Mahar, M. Mashal, K. Humes (UI), and Docota Roberson (UI)

Mustafa Mashal
2022 Disaster Preparedness and Response Conference (DPRC): The Disaster Response Complex (DRC) in partnerships with many units at Idaho State University (ISU), Idaho National Laboratory (INL), the Center for Advanced Energy (CAES), Qal-Tek Associates, Southeast Idaho Public Health and several other entities hosted the inaugural Disaster Preparedness and Response Conference (DPRC) at the indoor DRC (Armory Building), April 8-9, 2022. President Satterlee delivered the opening remarks at the DPRC. The DPRC was well attended with expert speakers, keynote (Laurie Holien from ISU's Homeland Security and Emergency Management), throughout the country. The conference included a student poster session, gala dinner, and demos by health and emergency response experts. The feedback from the conference was overwhelmingly positive and the DRC is hoping to make this conference an annual event. Thanks to all sponsors and exhibitors for their participation.
Tour of the DRC with H.E. Scott Bedke (Idaho Speaker of the House): The Disaster Response Complex (DRC) personnel were thrilled to provide a tour of the Indoor DRC (Armory Building) to H.E. Scott Bedke (Idaho Speaker of the House) and his accompanying staff, and Commissioner Jeff Hough of Bannock County.
CAES Codebreaker Session: Dr. Mashal (Director of the Disaster Response Complex) and Bryon Marsh (Idaho National Laboratory) were the presenters at the Center for Advanced Energy Studies (CAES) Codebreaker session in May 2022. The Disaster Response Complex at Idaho State University was the focus of the Codebreaker webinar on May 5 at 3:30 p.m. MT.
Biodefense Collaboration (Mustafa Mashal, Laurie Holien, Bryon Marsh)
Emergency Operations Center (EOC) Collaboration (Mustafa Mashal, Laurie Holien, Bryon Marsh)