

#### 2020 Fall Newsletter



## Civil | Construction | Nuclear

#### **CVEEN FACULTY EMBRACE COVID-19 RESEARCH**





The presence of COVID-19 has changed the world in many ways, but one benefit of the pandemic is how it has accelerated university research. The University of Utah's Department of Civil and Environmental faculty jumped at the opportunity to assist with researching solutions related to COVID-19.

RAMESH GOEL, a professor in civil and environmental engineering, is working on a National Science Foundationfunded project investigating the presence and diversity of SARs-CoV 2 in municipal wastewater treatment plants in Utah and around the nation. Apart from just sampling the raw influent from each sampled wastewater treatment plant, Goel's research also includes many other aspects of COVID-19, for example developing rapid testing devices to study makeup of the deadly virus in wastewater treatment plants. He is also researching the effect of various environmental factors on the survival of this virus.

Goel's lab also participated in a Utah Division of Water Quality led pilot study where the objective was to establish sampling protocols and, sample a selected set wastewater treatment plants. Dr. Goel's lab

contributed to sampling, analysis and data sharing for three big treatment plants in this pilot study.

Most recently, Goel's was awarded a student led EPA-P3 grant aimed at investigating the biodegradation of perflourinated compounds. A doctoral student funded by a Department of Defense fellowship will lead this project. "The team will develop novel biotechnologies for biodegradation of PFAS compounds." Goel said. "The final demonstration of the project will include the in-situ remediation of soil and water contaminated by PFASs using the techniques developed during the experimental lab tests."

ANDY HONG, a professor in civil and environmental engineering, aims his research at providing a new technology that adds protection for frontline healthcare workers and patients in the hospital ER/ICU environments. "The technology creates an air defense shield by arming the ER/ICU rooms with invisible nanodroplets of mist that carry in them virucides at the bubble interface to disinfect." Hong said. "With such, expelled viral cough droplets from COVID patients will not be able to travel unimpeded through airspace and persist but be tackled by the disinfectant." The project is ongoing; however, the team has finalized the experimental protocol, is currently culturing the hepatitis mouse virus (HMV) as a coronavirus surrogate, culturing the mouse liver cell line to be exposed, and setting up an exposure chamber in which a disinfecting nanodroplet mist will be released to aid the infected cell.

The testing process utilizing mouse liver cells can prove challenging. "Mouse liver cells grow under a certain temperature, atmospheric CO<sup>2</sup> concentration, and chemical conditions, while viruses can be active for up to a number of hours or days even when deposited on surfaces." Hong noted. These factors mean certain requirements need to be met in order to test for viral disinfection through an aerosol application."

"It was surprising to discover how relatively recent virology studies are around the world and yet how much we as societies have learned and implemented in that short amount of time. For example, the viral plaque assay is one of the key



tests in our procedure and was first performed in 1952, just 68 years ago. This particular assay is now widely used in determining viral presence and disinfection efficacy," said Rochelle Plaizier, a graduate student with the Department of Civil and Environmental Engineering working on the project.

JENNIFER WEIDHAAS, an associate professor in civil and environmental engineering, started collaborating with Utah Division of Water Quality and the Utah Department of Health in March to analyze over 43 utilities for SARS-CoV-2, the virus that causes COVID-19. Weidhaas's lab at the University of Utah is tracking trends in wastewater that correlates with the COVID-19 cases that are reported by the Utah Department of Health.

"Our work at the University of Utah is used daily by the UDOH along with other parameters to develop and implement public health interventions." Weidhaas explained. "We can clearly see the effect of the public mask mandates in the Salt Lake County that decreased the virus signal in wastewater along with the COVID-19 case counts." Weidhaas's lab at the U also reported several dramatic increases in the wastewater signal that preceded an increase in Utah's case count.

Currently, Weidhaas's lab is studying wastewater from dorms on the University of Utah's campus and around various primary and secondary schools in the nearby school districts. The data provided is helping to inform the campus and local school districts to plan for their COVID-19 response.



## **TRIGA REACTOR UPGRADES**

The University of Utah is one of 12 universities across the United States that has a TRIGA Reactor. A TRIGA (Training, Research, Isotopes, General Atomics) reactor allows the Nuclear Engineering program to work on many different research projects to aid the local community.

The Nuclear Engineering team has partnered with different groups such as medical companies to the United States Air Force for various research projects.

The TRIGA reactor at the University of Utah is getting an upgraded console and cooling system that will assist with future research efforts.

"This is a major modification; the system was paid for by a reactor development grant from the Department of Energy awarded in 2017-2018, and required a major design implementation to preserve analog control of all safety related control channels, augmented by digital data and displays." Civil and environmental engineering professor Glenn Sjoden explains. "This implementation allows us to update the reactor console under 10 CFR 50.59 to modify systems and control hardware without a reactor re-license application but requires generation of significant documentation."

Additionally, the cooling system will be upgraded. The proposal was awarded in September 2020, and will enhance reactor cooling capacity to provide as much as a Megawatt of heat removal, which will greatly enhance our ability to operate the reactor as much as is needed to support our research. "Currently, full power reactor operations are limited by heat removal constraints to 14 hours per week." Said Sjoden: "As a result, this opens up possibilities to enable a reactor power uprate, which could be considered after this new cooling system is installed."

To support this effort, the nuclear faculty team has been working with University of Utah Physical Plant



to establish the heat exchanger designs to be installed so it can accommodate the new reactor cooling system. Plans are in progress to install the new cooling system over the next calendar year, and it is expected to be operational no later than early 2022.

Finally, as a result of faculty efforts, research use of the reactor has received new interest. The nuclear engineering team now has 3D neutron and gamma flux maps of the reactor. This has added benefits to augment research for enhancing isotope yields, prediction of dosimetry estimates for samples and electronics, as well as new efforts to enable a neutron imaging capability using the southwest neutron beam port to support additive manufacturing research. "These research efforts are ongoing, and with the new reactor control and cooling systems, will enhance use of the reactor to support nuclear research as well as a variety of disciplines in engineering." Said Sjoden. "We are grateful to the Department of Energy for the research and equipment upgrades to enhance our reactor and nuclear facilities."

## **CVEEN FACULTY AWARDS**



**GABY OU** 

Civil and environmental engineering assistant professor Gaby Ou was awarded a grant to study a lack of information in dealing with high wind disaster events for preventative and restorative resiliency of electric power networks. According to the National Science Foundation "By integrating multiple data sources into a robust simulation tool, researchers can design new methods to mitigate the impact of hurricanes and other extreme wind events on power system operations. The outcomes of the research would positively impact reliability,resiliency, and delivery of electric power to US population centers." The project will have inter-disciplinary research between atmospheric sciences, civil engineering, and electric power engineering.

Civil and environmental engineering assistant professor Tara Mastren was awarded a grant to work in collaboration with Hunter College and the University of Wisconsin, Madison to produce therapeutic radionuclides 161Tb and 165Er in high purity for nuclear medicine applications. These low energy β- particle and Auger electron emitting radionuclides are important for targeted radiotherapy (TR). This would allow damage to the diseased cells without damage to surrounding tissues. "Currently, limited research has been performed looking into the therapeutic effect of Auger electrons." said Dr. Mastren. "Examining the effects of cell death/tumor response using these radionuclides would help elucidate the benefit from Auger electrons. We will be working on methods to produce high purity 161Tb utilizing the University of Utah's TRIGA reactor while 165Er will be produced on a small medical cyclotron at the University of Wisconsin, Madison."



TARA MASTREN



**ED CAZALAS** 

Civil and environmental engineering assistant professor Ed Cazalas was awarded a grant to provide upgrades the TRIGA reactor's cooling system. According to the Nuclear Engineering University Program's website "The cooling system of the University of Utah TRIGA reactor (UUTR) will be replaced to enhance performance and utility by allowing for the reactor to run for much longer periods at full power, increasing safety and operational reliability. Converting the cooling mechanism from a passive system to an active system will increase the cooling capacity by up to 1 MW thermal energy. This will allow for the UUTR to have much longer runtimes and higher daily neutron/gamma fluence, which will enhance the capability for a wide range of nuclear researchand development efforts."

Civil and environmental engineering assistant professor Carlos Oroza was awarded a grant to study if combining data from remote sensing LIDAR terrain data and citizenscience observations of snow depth can estimate how much snow is in the mountains. "We use machine-learning techniques to optimize the citizen-scientist observations. This is useful for us to know how much water we'll get during the rest of the season since Salt Lake City gets most of its water from snow."The research is being conducted in collaboration with Utah State University and is funded by the United States Geological Survey.



CARLOS OROZA

## **CVEEN NEW FACULTY**

#### **JIANLI CHEN**

Jianli Chen joined the the Civil & Environmental Engineering Department as an Assistant Professor for the Fall 2020 semester. He is devoted to improving the building and urban sustainability and resilience for the future smart city. Specifically, his research focus on the building energy and airflow modeling, application of Artificial Intelligence and information technology for improved building and infrastructure smartness, building energy efficiency, and occupant behavior, comfort, and health. He works as an interdisciplinary researcher actively collaborating with experts from various fields. He teaches building construction courses within the department.



### **CVEEN THRIVING AT UTAH ASIA CAMPUS**

In January 2019, The University of Utah Asia Campus in Incheon, Korea, launched the Civil and Environmental Engineering degree. Since then, the program has taken off with American and Korean students enrolling in the degree. Enrollment in CvEEN's program at the UAC increased by 164% between Spring 2019 and Spring 2020 semesters.

CvEEN students at the University of Utah Salt Lake City and Asia campuses are given a unique opportunity to study abroad. "All of our courses are taught here just like they are taught at the Salt Lake City campus." Civil and environmental engineering associate professor Steve Bartlett said. "Another benefit is the tuition is the same as a Utah resident's tuition." Students studying at the UAC get to experience infrastructure from northeast Asia. The urban infrastructure in Inchon is something students do not get in the United States, so this provides an additional urban civil engineering perspective.



# **CVEEN UAC NEW FACULTY**



#### **ROSHINA BABU**

Roshina Babu joined the University of Utah Asia Campus in January 2020 as an Assistant Professor (Lecturer) in the Department of Civil and Environmental Engineering. She has more than eight years of experience teaching undergraduate courses in Engineering Mechanics, Strength of Materials, and Structural Analysis. Her research interests are biomimetic structures, groundwater management in small islands, saltwater intrusion in coastal aquifers, and managed aquifer recharge. Her recent research focused on the groundwater resources of Tonga, a Pacific Island country, and the development of its smart groundwater management system. In addition to research interests, Dr. Babu is passionate about teaching undergraduate students and developing classroom pedagogy.



#### NICKOLAS JOVANOVIC

Nikolas Jovanovc joined the Civil & Environmental Engineering Department Utah Asia Campus as a Professor (Lecturer) for the Fall 2020 Semester. Dr. Jovanovc has conducted research on various computational and mathematical techniques for solvingmechanical and civil engineering problems on parallel supercomputers at Mathematics and Computer Science Division of Argonne National Laboratory and the Carderock Division of Naval Surface Warfare Center. He has also served as a Program Evaluator for ABET since 2010, and he has served in various roles within the American Society of Civil Engineers (ASCE).



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### **CHRISTINE POMEROY**

Civil and environmental engineering associate professor, lecturer Christine Pomeroy was selected as the ASCE Utah Section Engineering Educator of the Year. She serves as the faculty advisor for the University of Utah chapter of ASCE.

