YEAR-END TECHNICAL REPORT

September 29, 2021 to September 28, 2022

DOE-FIU Science & Technology Workforce Development Initiative

http://fellows.fiu.edu/

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Addendum:

This document represents one (1) of five (5) reports that comprise the Year End Reports for the period of September 29, 2021 to September 28, 2022 prepared by the Applied Research Center at Florida International University for the U.S. Department of Energy Office of Environmental Management (DOE-EM) under Cooperative Agreement No. DE-EM0005213.

The complete set of FIU's Year End Reports for this reporting period includes the following documents:

- Project 1: Chemical Process Alternatives for Radioactive Waste Document number: FIU-ARC-2021-800012997-04b-006
- Project 2: Environmental Remediation Science and Technology Document number: FIU-ARC-2021-800013918-04b-004
- Project 3: Waste and D&D Engineering and Technology Development Document number: FIU-ARC-2021-800013919-04b-005
- Project 4: DOE-FIU Science & Technology Workforce Development Initiative Document number: FIU-ARC-2021-800013920-04b-017

Project 5: Long-Term Stewardship of Environmental Remedies: Contaminated Soils and Water and STEM Workforce Development Document number: FIU-ARC-2021-800013922-04b-004

Each document will be submitted to OSTI separately under the respective project title and document number as shown above. In addition, the documents are available at the DOE Research website for the Cooperative Agreement between the U.S. Department of Energy Office of Environmental Management and the Applied Research Center at Florida International University: <u>https://doeresearch.fiu.edu</u>

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PROJECT 4 EXECUTIVE SUMMARY

Over the past two decades, there has been a national need for more careers in the science, technology, engineering and mathematics (STEM) workforce. This shortage is felt not only in the private industry sector but also across many federal agencies including the U.S. Department of Energy (DOE). Within DOE Environmental Management (EM), there is a critical shortage of entry-level STEM personnel. About 60% of the workforce is eligible to retire in 5 years, average work age is 55 years and only less than 4% of the workforce is less than 30 years of age. The effects are already being felt across DOE-EM and new ways to stimulate interest in STEM are being initiated by the federal government. If this shortage is not addressed, the risks include knowledge gaps (discontinuity of lessons learned) within the department and a lack of skilled personnel to carry out its cleanup mission effectively.

Florida International University (FIU), the largest Hispanic serving research-extensive institution in the continental United States, is one of the nation's leading producers of scientists and engineers from underrepresented groups. In 1995, DOE created a unique partnership with FIU to support environmental cleanup technology development, testing and deployment at DOE sites. This partnership spawned a research center at FIU dedicated to environmental research and development (R&D). The center, now known as the Applied Research Center, has tackled and helped solve problems at many DOE sites.

The DOE-FIU Science and Technology Workforce Development Program (also known as the DOE Fellows Program) was established in 2007 to create a pipeline of minority engineers specifically trained and mentored to enter the DOE workforce in technical areas of need. This innovative program was designed to help address DOE's future workforce needs by partnering with academic, government and DOE contractor organizations to mentor future minority scientists and engineers in the research, development, and deployment of new technologies addressing DOE's environmental cleanup challenges. The main objective of the program is to provide interested students with a unique opportunity to integrate course work, DOE field work, and research work at FIU into a well-structured academic program that leads to entry into DOE EM or other career opportunities. Students selected as DOE Fellows perform research at FIU and at DOE sites, national laboratories, and DOE contractors. Upon graduation and completion of this fellowship, the students are encouraged to submit an application to join the DOE federal internship programs, apply to DOE contractors, pursue post master's or postdoctoral positions at DOE national laboratories, or apply to private industry in their field of study.

The DOE Fellows Program has inducted a total of 189 minority FIU STEM students since program inception in 2007 up to the most recent induction ceremony held in November 2021. The DOE Fellows induction ceremonies have been attended by DOE EM officials each year, including EM-1's Mr. James Rispoli and Dr. Inés Triay, other DOE-EM managers including Mr. Mark Gilbertson in 2007, Mr. Kurt Gerdes in 2017 and 2018, Mr. Leonard Spearman in 2019, Ms. Nicole Nelson-Jean in 2020 and most recently, Mr. Todd Shrader in 2021.

The following DOE-EM Fellows are supporting the projects under this cooperative agreement:

Project 1: Brendon Cintas (graduate, Ph.D., Mechanical Engineering), Desmond Sinnott (undergraduate, Mechanical Engineering), Douglas Baptiste (Undergraduate, Civil Engineering),

Gabriel Cerioni (Graduate, M.S., Mechanical Engineering), Joel Adams (graduate, Ph.D., Mechanical Engineering), Josue Estrada Martinez (graduate, M.S., Mechanical Engineering), Nicholas Espinal (undergraduate, Mechanical Engineering), Philip Moore (graduate, M.S., Mechanical Engineering), Rafael Velasquez (Undergraduate, Electrical Engineering) and Sebastian Story (graduate, M.S., Mechanical Engineering).

Project 2: Aubrey Litzinger (undergraduate, Environmental Engineering), Caridad Estrada (Undergraduate, Environmental Engineering), Carolina Trummer, (Undergraduate, Environmental Engineering), Hannah Aziz (undergraduate, Environmental Engineering), Kirsten Olson (Undergraduate, Environmental Engineering), Mariah Doughman (graduate, Ph.D., Chemistry), Melanie Sztybel (undergraduate, Civil Engineering), Phuong Pham (graduate, Ph.D., Chemistry) and Stevens Charles (undergraduate, Civil Engineering).

Project 3: Alejandro De La Novela (Graduate, M.S., Computer Science), Aris Duani Rojas (Graduate, Ph.D., Computer Science) Aurelien Meray (graduate, Ph.D., Computer Science), Bryan Torres (Undergraduate, Mechanical Engineering), Roger Boza (graduate, Ph.D., computer science), and Rohan Shanbhag (undergraduate, Computer Science).

The following ARC researchers are supporting this project and helping the DOE-EM Fellows: Leonel Lagos (Ph.D., PMP®, Mechanical/Civil/Env. Engineering, PI/DOE Fellows Program Director), Ravi Gudavalli (Ph.D., Env. Engineering, Mentor/Program Manager), Angelique Lawrence (M.S., Environmental Science, Technical support), Walter Quintero (M.S., Computer Engineering, IT Support), Jose Rivera (B.S., Civil Engineering, Research Analyst) and Clint Miller (MCSA, MCSE, CompTIA Security +, C|EH, IT Support).

MAJOR ACCOMPLISHMENTS

- FIU conducted three recruitment campaigns during fall 2021, spring 2022 and summer 2022. A total of 7 FIU STEM students were selected to be part of the DOE Fellows Class of 2021 and Class of 2022.
 - Karina Hernandez, Nicholas Espinal, Oscar Roa, and Sebastian Trevino were selected to be part of the DOE Fellows Class of 2021 from the fall 2021 recruitment campaign.
 - From the summer 2022 campaign, Gabriel Cerioni, Hannah Aziz, and Rafael Velasquez were selected to be part of the DOE Fellows Class of 2022.
- Fourteen (14) summer internship reports were developed based on summer 2021 internship assignments from across the DOE complex. Upon approval from the sites, reports were published online at https://fellows.fiu.edu/internships-reports/#2021.
 - Aurelien Meray pyLEnM Update: A Machine Learning and Data Analysis Python Package for Long-Term Soil and Groundwater Monitoring
 - o Brendon Cintas Development of an Authorized Release Limit Database
 - Christian Dau Dataset Curation and Virtual Environment Creation for Machine Learning Tasks
 - Christian Gonzalez Gap-Filling Time Series using Direct Sampling in the Hanford 100-Areas
 - Gisselle Gutierrez Exploration of Toolsets for Development of an Integrated Hydrology Model of Basin-6 near the Waste Isolation Pilot Plant (WIPP)
 - Jeff Natividad Autonomous Navigation and Radiation Mapping Platform -Hardware Updates and Integration
 - Joel Adams Development of Semi-Autonomous Robotic Platform for Mapping Radioactive Hanford Farms
 - Josue Estrada Contributing to the DOE EM 3.2, Office of Technology Development: Dashboard/Wearable Technologies Database
 - Mariah Doughman Adsorption of Uranium to Hanford Formation Sediment in the Vadose Zone
 - Philip Moore Environmental Testing of Polyurethane Foams for use as 3-Dimensional Fixatives
 - o Phuong Pham Sorption of Iodine Species on SRS Wetland Soils
 - Roger Boza Implementing Machine Learning and Deep Learning Algorithms to Facilitate and Automate Nuclear Power Plant Operations
 - Stevens Charles Characterization of Surface Water Dynamics within Fourmile Branch and its Linkages with Groundwater and I-129 Geochemistry
 - Thi Tran Autonomous Navigation and Radiation Mapping Platform Radiation Sensor Package Development
- FIU conducted a DOE Fellows Introduction Ceremony to formally welcome DOE EM/LM Fellows Classes of 2020 and 2021. Officials from DOE and FIU participated in a hybrid

ceremony held on November 10, 2021, to welcome a total of 23 (12 from Class of 2020 and 11 from Class of 2021) FIU STEM students into the DOE Fellows Program.

- DOE Fellows Class of 2020
 - Joel Adams, Ph.D., Mechanical Engineering
 - Stevens Charles, B.S., Environmental Engineering
 - Brendon Cintas, Ph.D., Mechanical Engineering
 - Christian Dau, B.S., Computer Science
 - Mariah Doughman, Ph.D., Chemistry
 - Josue Estrada, B.S., Mechanical Engineering
 - Christian Gonzalez Lopez, B.S., Computer Science
 - Phuong Pham, Ph.D., Chemistry
 - Raymond Piloto, M.S., Computer Engineering
 - Sebastian Story, B.S., Mechanical Engineering
 - Thi Tran, B.S., Mechanical Engineering
 - Eduardo Rojas, B.S., Mechanical Engineering (DOE-LM Fellow)
- DOE Fellows Class of 2021
 - Angel Almaguer, B.S., Chemistry
 - Nicholas Espinal, B.S., Mechanical Engineering
 - Caridad Estrada, B.S., Environmental Engineering
 - Karina Hernandez, B.S., Environmental Engineering
 - Aubrey Litzinger, B.S., Environmental Engineering
 - Juana Perucina, M.S., Environmental Engineering
 - Oscar Roa, B.S., Mechanical Engineering
 - Rohan Shanbhag, B.S., Computer Science
 - Desmond Sinnott, B.S., Mechanical Engineering
 - Sebastian Trevino, B.S., Cyber Security
 - Shawn Cameron, M.S., Mechanical Engineering (DOE-LM Fellow)
- Four (4) DOE Fellows graduated from FIU in fall 2021 and participated in graduation ceremonies held during December 11 12, 2021. DOE Fellows Christian Dau, David Mareno and Josue Estrada completed bachelor's degrees in computer science, computer engineering and mechanical engineering respectively, and enrolled in master's degrees at FIU. DOE Fellow Philip Moore graduated with a bachelor's degree in Mechanical Engineering. He participated in internships at SRNL during both spring and summer of 2022 and started a graduate program at FIU in fall 2022.

- Three (3) DOE Fellows graduated from FIU in spring 2022 and participated in a graduation ceremony held on March 30, 2022. DOE Fellows Aubrey Litzinger, Rohan Shanbhag and Sebastian Story graduated with bachelor's degrees in environmental engineering, computer science and mechanical engineering, respectively. All three DOE Fellows started graduate school at FIU in fall 2022. Additionally, DOE Fellow Aubrey Litzinger received the "Outstanding Graduate in Environmental Engineering" award at the commencement ceremony.
- DOE Fellow Aurelien Meray, a Ph.D. student in computer science at Florida International University's Applied Research Center (FIU-ARC), has successfully published a peer-reviewed journal paper (https://pubs.acs.org/doi/10.1021/acs.est.1c07440) in the Environmental Science and Technology (ES&T) Journal. The paper titled "PyLEnM: A Machine Learning Framework for Long-Term Groundwater Contamination Monitoring Strategies", was authored by Aurelien Meray along with collaborators from Lawrence Berkeley National Laboratory, Savannah River National Laboratory, and Massachusetts Institute of Technology.
- DOE Fellow Juan Morales who is scheduled to complete his PhD in Environmental Health Sciences at FIU by the end of 2022, accepted a position at the Savannah River National Laboratory (SRNL) as a MSIPP Postdoctoral Fellow beginning mid-June 2022. Fellow Morales has supported and provided major contributions to the Project 2 Tims Branch hydrological and contaminant transport modeling work at Savannah River Site.
- DOE Fellow Gisselle Gutierrez accepted a position as a Civil Analyst in the Surface Water Dept. at Kimley-Horn and Associates, Inc. in August 2022. She will defend her thesis and graduate with a master's degree in Environmental Engineering in Fall 2022. DOE Fellow Jeff Natividad also accepted a Mechanical Engineer position in August 2022 with a start date of Sept. 2022 with Washington River Protection Solutions (WRPS), the Tank Operations Contractor for the U.S. DOE Office of River Protection (ORP) subcontractor.
- Three DOE Fellows, Mariah Doughman, Aurelien Meray and Juan Morales, participated virtually in the RemPlex 2021 Global Summit on Environmental Remediation held on November 7 12, 2021. Juan Morales received the "best presentation" award for his outstanding presentation during the Emerging Contaminants session.
- DOE Fellow Caridad Estrada was awarded first place for an oral presentation titled "Sustainable Sorbent Technology for Mercury Remediation in Freshwater Aquatic Systems" at the Annual Research Symposium hosted by the MARC U*STAR Program. During the symposia, competitively selected students from institutions such as FIU, MIT and the University of Pennsylvania were able to highlight their scientific work through student presentations.
- Fourteen (14) DOE Fellows attended and participated at the 2022 Waste Management Symposia held from March 6-10 in Phoenix, Arizona. Four (4) DOE Fellows, Aurelien Meray, Caridad Estrada, Marian Doughman and Thi Tran, Roy G. Post Foundation scholarship recipients, displayed their posters on Sunday, March 6, 2022 during the 034a WM2022 Roy G. Post Scholarship Winners Poster Display. Ten (10) DOE Fellows participated in the session 034b Student Posters: The Next Generation Industry Leaders of Tomorrow (1.2) on Monday, March 7, 2022 and presented posters based on their DOE-EM research accomplishments. DOE Fellow Aubrey Litzinger received the best undergraduate poster award for her poster titled "Standard Aging of Concrete for the Study of Protection Systems at Savannah River Site".

- DOE Fellow Aurelien Meray presented a poster virtually, titled "PyLEnM: Machine Learning and Analytics Toolkit for Long-term Water Quality Monitoring and Remote Sensing" at the HyrdoML Symposium held from May 18 20, 2022.
- Seventeen (17) DOE Fellows participated in summer 2022 internships at various national labs as well as with DOE-EM HQ. Sixteen Fellows conducted onsite internships, 2 Fellows at WRPS, 3 Fellows at PNNL, 1 Fellow at LANL, 1 Fellow at LBNL, 1 Fellow at ORNL, 1 Fellow at DOE-HQ, 1 Fellow at UCOR, and 6 Fellows at SRNL. One (1) DOE Fellow participated in a hybrid summer 2022 internship at INL.
- DOE Fellows participated in the Annual FIU Research Review held on 9/27/2022 9/28/2022 with DOE-HQ and site POCs. Six (6) DOE Fellows prepared PowerPoint presentations and presented their research accomplishments during this review. Below is the list of DOE Fellows and their presentation titles.
 - Autonomous Surveillance of Nuclear Facilities and Repositories Joel Adams
 - Study of Carboline Coating for the Protection of the HCAEX Tunnel's Concrete Walls at Savannah River Site Nicholas T. Espinal
 - Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments Mariah Doughman
 - Development of an Integrated Hydrology Model for Basin 6 of the Nash Draw near the Waste Isolation Pilot Plant (WIPP) using the Advanced Terrestrial Simulator (ATS) -Aubrey Litzinger
 - Artificial Intelligence System Interface for Sensor Data Ingestion and Descriptive Visual and Data Analytics (LBNL, SRNL) Aurelien Meray
 - D&D support to DOE-EM **Philip Moore**

PROJECT 4: DOE-FIU SCIENCE & TECHNOLOGY WORKFORCE DEVELOPMENT INITIATIVE

INTRODUCTION

Florida International University (FIU), the largest Hispanic serving research-extensive institution in the continental United States, is one of the nation's leading producers of scientists and engineers from underrepresented groups. In 1995, the U.S. Department of Energy created a unique partnership with FIU to support environmental cleanup technology development, testing and deployment at DOE sites. This partnership spawned a research center at FIU dedicated to environmental R&D. The center, now known as the Applied Research Center, has tackled and helped solve multiple problems at many DOE sites. The DOE-FIU Science and Technology Workforce Development Program is designed to build upon this relationship by creating a pipeline of minority engineers specifically trained and mentored to enter the DOE workforce in technical areas of need. This innovative program was designed to help address DOE's future workforce needs by partnering with academic, government and DOE contractor organizations to mentor future minority scientists and engineers in the research, development, and deployment of new technologies addressing DOE's environmental cleanup challenges.

OBJECTIVES

The DOE-FIU Science and Technology Workforce Development Program has been designed to build upon the existing DOE/FIU relationship by creating a "pipeline" of minority engineers specifically trained and mentored to enter the Department of Energy workforce in technical areas of need. The main objective of the program is to provide interested students with a unique opportunity to integrate course work, DOE fieldwork, and research work at FIU into a well-structured academic program that leads to entry into DOE EM's Pathways Program. Students selected as DOE Fellows perform research at FIU and at DOE sites, national laboratories, and DOE contractors. Graduation and completion of this fellowship leads to employment opportunities with DOE EM, DOE contractors, DOE national laboratories, other federal agencies, and private industry as well as the pursuit of post-master or post-doctoral positions at DOE national labor.

RESULTS AND DISCUSSION

Task 1: Recruitment Efforts

FIU conducted several recruitment sessions throughout the year. The Fall 2021 recruitment campaign was conducted by setting up tables at the Engineering Center, as well as the Physics & Chemistry and Computer Science buildings to promote the DOE Fellows program and distribute flyers. Classrooms were also visited to promote the program and encourage interested and eligible students to apply. Emails were sent to students who signed up at the tables, informing them about the application deadline and providing links to the DOE Fellows website where application instructions and forms could be accessed.



DOE - FIU WORKFORCE DEVELOPMENT PROGRAM - Recruitment

The DOE- FIU Science and Technology Workforce Development Program is an innovative program between the U. S. Department of Energy's Office of Environmental Management (DOE-EM) and Florida International University's Applied Research Center designed to create a "pipeline" of minority scientists and engineers specifically trained and mentored to enter the Department of Energy workforce.



	Program Components:
Apply at	 Paid 20 hours/week hands on research during fall and spring
Contact us: doefello@fiu.edu	 Paid 10 week summer internships at DOE facilities
Program Requirements:	 Tuition waiver for graduate students
U.S. Citizen/Permanent Resident Alien (A minimum of 4 years of	 Professional development and training
Permanent Residency)	
 Permanent Residency) Undergrads (Sophomores/early Juniors and Seniors accepted to FIU graduate school) 	 Application Package must contain: A completed application form Two letters of recommendation
 Permanent Residency) Undergrads (Sophomores/early Juniors and Seniors accepted to FIU graduate school) Masters/PhD students (first or second semester) 	 Application Package must contain: A completed application form Two letters of recommendation from FIU Faculty Unofficial FIU transcripts
 Permanent Residency) Undergrads (Sophomores/early Juniors and Seniors accepted to FIU graduate school) Masters/PhD students (first or second semester) Minimum 3.0 GPA 	 Application Package must contain: A completed application form Two letters of recommendation from FIU Faculty Unofficial FIU transcripts Current resume

Figure 1. Recruitment flyer distributed and used to promote the DOE Fellows program.

A total of 19 applications from eligible FIU students were received of which 14 students were called for interviews and based on the input from the selection committee, 4 students were selected to join the DOE Fellows Class of 2021. These 4 students were inducted into the DOE Fellows

program along with 6 DOE Fellows previously selected during an induction ceremony scheduled for November 10, 2021.

Take 1. DOE Fellows Class of 2021 from 1 an Reef difficient				
DOE Fellow	Class	Major	Mentor	Project Support
Karina Hernandez	Undergrad.	Environmental Engr.	Dr. Johnbull Dickson	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems
Nicholas Espinal	Undergrad.	Mechanical Engr.	Dr. Mayren Echeverria	Evaluation of Coatings for the H- Canyon Exhaust Tunnel
Oscar Roa	Undergrad.	Mechanical Engr.	Mr. Joseph Sinicrope	Innovative Technologies for D&D Activities
Sebastian Trevino	Undergrad.	Cyber Security	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies

Table 1. DOE Fellows Class of 2021 from Fall Recruitment

FIU conducted the spring 2022 recruitment campaign from January 18, 2022 - February 18, 2022. During the recruitment period, FIU set up tables in the Engineering building, Physics and Chemistry building and Computer Science building to promote the program and distribute flyers. FIU also visited classrooms to promote the program and encourage interested and eligible students to apply to the program. By the end of the application period, a total of twelve (12) applications were received from FIU STEM students, which were reviewed by a selection committee who recommended 5 of the applicants for interviews that were held between March 22 - 24. As suitable candidates could not be identified, there were no students selected to be part of the program during this recruitment period.



Figure 2. DOE Fellows promoting the program and recruiting new students.

FIU conducted recruitment efforts in the summer to recruit eligible FIU students to join the DOE Fellows program. Tables were setup at FIU's Engineering Center as well as the Chemistry and Physics building. Summer applications were accepted up to mid-September. FIU received five (5) applications from FIU STEM students during summer recruitment. The DOE Fellows selection

committee reviewed the applications and recommended all five applicants for interviews. Based on the interviews, three FIU students were selected to be part of the DOE Fellows Class of 2022.

DOE Fellow	Class	Major	Mentor	Project Support
Gabriel	Grad MS	Mechanical	Dr. Leonel	In-Situ 3D Printing Concrete Structures
Cerioni	Olau. WI.S.	Engineering	Lagos	for Waste Containment
		Environmentel	Dr. Pieter	Model Development for Fourmile Branch
Hannah Aziz	Undergrad.	Environmental	Hazenberg	with Specific Focus on the F-Area
	_	Engineering	_	Wetlands
Rafael	I.I.a. de nome d	Electrical	Mr. Anthony	Improvement of Mobile Platform
Velasquez	Undergrad.	Engineering	Abrahao	Efficiency

Table 2. DOE Fellows	Class of 2022 from	n Summer Recruitment
Table 2. DOL Fellows	Class 01 2022 1101	n Summer Keel unment

FIU initiated efforts for the fall recruitment session in mid-September. During the recruitment period, tables were setup at FIU's Engineering Center as well as the Chemistry and Physics building to promote the program. Current DOE Fellows and staff also visited classrooms and informed students about the program and encouraged them to apply. FIU's Applied Research Center also hosted an open house session on September 15, 2022, to showcase the research work/activities being performed under the DOE-FIU Cooperative Agreement. Several labs were featured and DOE Fellows and staff presented their on-going research work.



Figure 3. Open House flyer.



Figure 4. DOE Fellows showcasing DOE-EM research activities to FIU students during the FIU ARC Open House.

Applications from the fall recruitment will be accepted until September 30, 2022. So far, a total of 24 applications were received from eligible students. The DOE Fellows selection committee will review the applications and recommend applicants for interviews. Interviews and selection of new DOE Fellows to join Class of 2022 will be completed prior to an induction ceremony planned for November 8, 2022.

All new DOE Fellows completed the required health and safety trainings listed below prior to engaging in the laboratory work.

- Laboratory Hazard Awareness
- Hazard Communication (HAZCOM)
- Fire Safety (online or instructor-led)
- Environmental Awareness PT 1 & PT 2
- Small Spills and Leaks
- EPA: Hazardous Waste Awareness & Handling
- Personal Protective Equipment (Lab)
- Safe Use of Fume Hoods
- Safe Use of Emergency Eyewash & Shower
- Chemical Handling Safety Basic Principles
- Compress Gas Safety Awareness
- Safe Use of Biosafety Cabinets
- Radiation Safety

Task 2: DOE-EM Research Identification and Assignments

FIU's Applied Research Center provides leadership in the development and management of this program. Under the Cooperative Agreement, FIU provides support in the areas of waste management, robotics, soil/groundwater remediation research and modeling, deactivation & decommissioning, big data/data analytics and IT development for environmental restoration applications. The DOE-EM Fellows directly support FIU scientists and engineers in the development of the technical work under this agreement. The Fellows are assigned to supervisors/mentors and support the ongoing research by working on a part-time basis (approximately 20 hours/week). The DOE-EM Fellows support all tasks under the Cooperative

Agreement while pursuing their STEM degrees at FIU. The STEM students participate in research being conducted under the Cooperative Agreement in the technical areas described above. An example of the DOE-EM Fellows engagement includes the hands-on work and research on robotics and data acquisition/inspection technologies (e.g., LiDAR) for various DOE-EM applications. The students help develop, test and deploy systems for potential DOE-EM applications.

It is expected that the research being conducted will provide the basis for the development of master's thesis and/or Ph.D. dissertation topics for Fellows pursuing graduate degrees. The research will also provide senior research project and capstone project opportunities for DOE-EM Fellows pursuing technical undergraduate degrees.

During FIU Year 2, the Fellows continued their support to the DOE-FIU Cooperative Agreement by actively engaging in EM applied research and supporting ARC staff in the development and completion of the various tasks. The Fellows also participate in a weekly meeting conducted by the program director. During each of these meetings, one DOE Fellow presents the work he/she performed during his/her summer internship and/or the EM research work currently being performed at ARC.

A list of the current Fellows, their classification, areas of study, ARC mentor, and assigned project task is provided in the table below.

Name	Class	Major	ARC Mentor	Project Support
Angel Almaguer	Undergrad.	Chemistry	Dr. Yelena Katsenovich	Re-oxidation of Redox Sensitive Contaminants Immobilized by Strong Reductants
Aubrey Litzinger	M.S. Grad.	Environmental Engr.	Ms. Angelique Lawrence	Model Development (for Basin 6 of the Nash Draw near the WIPP)
Aurelien Meray	Ph.D. Grad	Computer Science	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Brendon Cintas	Ph.D. Grad	Mechanical Engr.	Dr. Leonel Lagos	Experimental analysis of flushing criteria for waste transport operations
Caridad Estrada	Undergrad.	Environmental Engr.	Dr. Johnbull Dickson	Engineered Multi-Layer Amendment Technology for Hg Remediation on Oak Ridge Reservation
Christian Dau	M.S. Grad.	Computer Science	Dr. Himanshu Upadhyay	WIMS & KM-IT
Christian Gonzalez Lopez	Undergrad.	Computer Science	Dr. Himanshu Upadhyay	AI solution for S & GW - Chromium prediction in 100 H area
Daniel Martin	Undergrad.	Electrical Engr.	Dr. Shervin Tashakori	Development of Inspection Tools for Primary Tanks
David Mareno	Undergrad.	Computer Engr.	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Desmond Sinnott	Undergrad.	Mechanical Engr.	Dr. Aparna Aravelli	Pipeline Corrosion and Erosion Evaluation
Gisselle Gutierrez	M.S. Grad	Environmental Engr.	Ms. Angelique Lawrence	Digital Elevation Model and Hydrologic Network

Table 3. Project Support by DOE Fellows

Name	Class	Major	ARC Mentor	Project Support
Jeff Natividad	M.S. Grad	Mechanical Engr.	Mr. Mackenson Telusma	Evaluation of coatings for H-Canyon Exhaust Tunnel
Joel Adams	Ph.D. Grad	Mechanical Engr.	Mr. Anthony Abrahao	Long Term Surveillance of Nuclear Facilities and Repositories
Josue Estrada Martinez	M.S. Grad.	Mechanical Engr.	Mr. Anthony Abrahao	Development of Inspection Tools for DST Tanks
Juan Morales	Ph.D. Grad	Environmental Health Sciences	Ms. Angelique Lawrence	Contaminant Fate and Transport Modeling in the Tims Branch Watershed
Juana Peruina	M.S. Grad	Environmental Engr.	Dr. Kexin Jiao	Multi-functional 3D Polymer Framework for Mercury Abatement
Karina Hernandez	Undergrad.	Environmental Engr.	Dr. Johnbull Dickson	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems
Mariah Doughman	Ph.D. Grad	Chemistry	Dr. Yelena Katsenovich	Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments
Nicholas Espinal	Undergrad.	Mechanical Engr.	Dr. Mayren Echeverria	Evaluation of Coatings for the H- Canyon Exhaust Tunnel
Oscar Roa	Undergrad.	Mechanical Engr.	Mr. Joseph Sinicrope	Innovative Technologies for D&D Activities
Philip Moore	Undergrad.	Mechanical Engr.	Ms. Melissa Komninakis	Innovative Technologies for D&D Activities
Phuong Pham	Ph.D. Grad	Chemistry	Dr. Ravi Gudavalli	Environmental Factors Controlling the Attenuation and Release of Iodine in the Wetland Sediments at Savannah River Site
Raymond Piloto	M.S. Grad	Computer Engr.	Dr. Aparna Aravelli	Pipeline corrosion and erosion evaluation
Roger Boza	Ph.D. Grad	Computer Science	Dr. Himanshu Upadhyay	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies
Rohan Shanbhag	Undergrad.	Computer Science	Dr. Himanshu Upadhyay	AI for EM Problem Set (Soil and Groundwater)
Sebastian Story	M.S. Grad.	Mechanical Engr.	Mr. Anthony Abrahao	Development of Inspection Tools for Primary Tanks
Sebastian Trevino	Undergrad.	Cyber Security	Dr. Himanshu Upadhyay	AI solution for S & GW - Chromium prediction in 100 H area
Stevens Charles	Undergrad.	Civil Engr.	Ms. Angelique Lawrence	Model Development for the Fourmile Branch and/or Lower Three Runs Watersheds
Thi Tran	Undergrad.	Mechanical Engr.	Mr. Anthony Abrahao	Long-Term Surveillance of Nuclear Facilities and Repositories using Mobile Systems

DOE Fellows who participated in summer internships and at FIU prepared and presented oral presentations at the weekly DOE Fellows meetings. The schedule of these presentations is provided below.

DOE Fellow	Date
Mariah Doughman	Sept 20, 2021
Jeff Natividad	Oct 4, 2021
Aurelien Meray	Oct 11, 2021
Thi Tran	Oct 25, 2021
Philip Moore	Nov 1, 2021
Phuong Pham	Nov 22, 2021
Brendon Cintas	Nov 29, 2021
Christian Dau	Dec 13, 2021
Gisselle Gutierrez	Jan 12, 2022
Joel Adams	Jan 19, 2022
Roger Boza	Jan 26, 2022
Stevens Charles	Feb 2, 2022
Josue Estrada	Feb 23, 2022
Angel Almaguer	March 16, 2022
Aubrey Litzinger	March 23, 2022
Sebastian Story	March 30, 2022
David Mareno	April 6, 2022
Juan Morales	April 13, 2022
Rohan Shanbhag	May 4, 2022
Desmond Sinnott	May 12, 2022
Sebastian Trevino	June 2, 2022
Rohan Shanbhag	Sept 14, 2022
Aubrey Litzinger	Sept 21, 2022

 Table 4. Research Presentation Schedule for DOE Fellow Meetings

DOE Fellow Aurelien Meray, a Ph.D. student in computer science at Florida International University's Applied Research Center (FIU-ARC), has successfully published a peer-reviewed journal paper (<u>https://pubs.acs.org/doi/10.1021/acs.est.1c07440</u>) in the Environmental Science and Technology (ES&T) Journal. The paper titled "PyLEnM: A Machine Learning Framework for Long-Term Groundwater Contamination Monitoring Strategies", was authored by Aurelien Meray

along with collaborators Lawrence Berkeley National Laboratory, Savannah River National Laboratory, and Massachusetts Institute of Technology.

The paper highlights mainly the development of a Python package called PyLEnM (Python for Long-term Environmental Monitoring) that has a complete set of machine learning (ML) functions for long-term groundwater contamination monitoring. Among the most significant ML innovations are:

- Time series clustering to identify groups of wells with similar groundwater dynamics and to guide spatial interpolation and well optimization.
- Evaluating several regression models for spatial interpolation, with automated model selection and parameter tweaking.
- A proxy-based spatial interpolation technique using spatial data layers or in situ measurable variables to predict contaminant concentrations and groundwater levels.
- A well optimization approach to identify the most effective subset of wells for long-term monitoring.

Four (4) DOE fellows graduated from FIU in fall 2021 and participated in graduation ceremonies held during December 11 - 12, 2021. DOE Fellows Christian Dau, David Mareno and Josue Estrada completed bachelor's degrees in computer science, computer engineering and mechanical engineering respectively, and enrolled in master's degrees at FIU. DOE Fellow Philip Moore graduated with a bachelor's degree in Mechanical Engineering. He participated in internships at SRNL during the spring and summer of 2022 and he started a graduate program in fall 2022.



Figure 5. DOE Fellows David Mareno (left photo) and Philip Moore (right photo) with family at the Fall 2021 commencement ceremony.

Three (3) DOE Fellows graduated from FIU in spring 2022 and participated in a graduation ceremony held on March 30, 2022. DOE Fellows Aubrey Litzinger, Rohan Shanbhag and Sebastian Story graduated with bachelor's degrees in environmental engineering, computer science and mechanical engineering, respectively. Aubrey, Rohan and Sebastian started graduate school at FIU in fall 2022. Additionally, DOE Fellow Aubrey Litzinger received the "Outstanding Graduate in Environmental Engineering" award at the commencement ceremony.



Figure 6. DOE Fellows during FIU's graduation ceremony: Rohan Shanbhag (Left) and Sebastian Story (Right).



Figure 7. DOE Fellow Aubrey Litzinger receiving the award of "Outstanding Graduate" in Environmental Engineering.

DOE Fellow Juan Morales who is scheduled to complete his PhD in Environmental Health Sciences at FIU by the end of 2022, accepted a position at the Savannah River National Laboratory (SRNL) as a MSIPP Postdoctoral Fellow beginning mid-June 2022. Fellow Morales has supported and provided major contributions to the Project 2 Tims Branch hydrological and contaminant transport modeling work at Savannah River Site. He has also been instrumental in performing field work activities to support the model calibration and validation. This marks another successful transition of a high-performing graduate minority STEM student to the federal government under the DOE-FIU Science and Technology Workforce Development Program (Project 4 of the DOE-FIU Cooperative Agreement), reinforcing the DOE-EM workforce in technical areas of need.

DOE Fellow Gisselle Gutierrez accepted a position as a Civil Analyst in the Surface Water Dept. at Kimley-Horn and Associates, Inc. in August 2022. She will defend her thesis and graduate in Fall 2022. DOE Fellow Jeff Natividad also accepted a Mechanical Engineer position in August

with a start date of Sept. 2022 with Washington River Protection Solutions (WRPS), the Tank Operations Contractor for the U.S. DOE Office of River Protection (ORP) subcontractor.

In September, DOE Fellows participated in the Annual FIU Research Review held on 9/27/2022 - 9/28/2022 with DOE-HQ and site POCs. Six (6) DOE Fellows prepared PowerPoint presentations and presented their research accomplishments during this review. Below is the list of DOE Fellows and their presentation titles.

- Autonomous Surveillance of Nuclear Facilities and Repositories Joel Adams
- Study of Carboline Coating for the Protection of the HCAEX Tunnel's Concrete Walls at Savannah River Site Nicholas T. Espinal
- Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments Mariah Doughman
- Development of an Integrated Hydrology Model for Basin 6 of the Nash Draw near the Waste Isolation Pilot Plant (WIPP) using the Advanced Terrestrial Simulator (ATS) Aubrey Litzinger
- Artificial Intelligence System Interface for Sensor Data Ingestion and Descriptive Visual and Data Analytics (LBNL, SRNL) Aurelien Meray
- D&D support to DOE-EM Philip Moore

Task 3: DOE-EM Fellows Poster Exhibition & Competition

The DOE Fellows annual Poster Exhibition & Competition was held on November 9, 2021. Twenty-six (26) DOE Fellows (including 2 LM Fellows) prepared posters based on their DOE-EM/LM work performed during the past year and/or during their summer internships. Ms. Jalena Dayvault (Site Manager, DOE-LM), Dr. Kateel Shetty (Research Assistant Professor, Dept. of Earth & Environment, College of Arts, Sciences & Education, FIU), Dr. Pieter Hazenberg (Senior Research Scientist, FIU-ARC), Dr. David Roelant (Radiation & Laser Safety Officer; Principal Scientist, FIU-ARC) and Dr. Inés Triay (Executive Director, FIU-ARC) served as judges during the poster exhibition & competition. Fourteen (14) DOE Fellows participated and presented in the undergraduate poster session, while twelve (12) DOE Fellows participated and presented in the graduate poster session. Judges evaluated posters from each session and selected first, second and third place winners. Awards were presented at the DOE Fellows induction ceremony.

Titles and authors of posters presented during the undergraduate session:

- 1. Re-oxidation of Technetium (⁹⁹Tc) Comingled with Uranium (²³⁸U), and Nitrate (NO₃⁻), Immobilized via Strong Reductants **Angel Almaguer**
- 2. Standard Aging of Concrete for the Study of Protection Systems at Savannah River Site Aubrey Litzinger
- 3. Sustainable Sorbent Technology for Mercury Remediation in a Freshwater Aquatic System Caridad Estrada
- 4. Responsive Design Implementation of the D&D KM-IT Application Tool Christian Dau
- 5. Web service API framework for Artificial Intelligence model deployment to support EM problem set Christian Gonzalez

- 6. Updated Design of Miniature Rover for Hanford Double Shell Tank Inspection Daniel Martin
- 7. Ethical Hacking Tools for KM-IT David Mareno
- 8. Design and Development of Bench Scale Pipe loop for Corrosion Testing with Caustic Simulants **Desmond Sinnott**
- 9. Remote Sensing Technologies for Long-Term Surveillance of DOE-LM Sites Eduardo Rojas
- 10. Marsupial Pipe Crawler for Secondary Line Inspection of Double Shell Tanks at Hanford Site Josue Estrada
- 11. Environmental Chamber Testing of Polyurethane Foams for use as 3-D Fixatives **Philip** Moore
- 12. Transfer Line Pneumatic Pipe Crawler Retrofitted for Lateral Inspection of Single Shell Tanks Laterals at Hanford Site **Sebastian Story**
- 13. Surface Water Dynamics within the F-area of Savannah River Site and its Linkages with Groundwater and I-129 Geochemistry **Stevens Charles**
- 14. Long-Term Surveillance of Nuclear Facilities and Repositories using Mobile Systems Digital Twin Development and Deployment **Thi Tran**

Titles and authors of posters presented during the graduate session:

- 1. pyLEnM: An Open Source Machine Learning Framework for Long-term Water Quality Monitoring Aurelien Meray
- 2. Evaluation of Pipeline Flushing Requirements for High-Level Waste at Hanford and Savannah River **Brendon Cintas**
- 3. Utilization of Amanzi-ATS to Develop an Integrated Hydrology Model of Nash Draw Basin west of the Waste Isolation Pilot Plant (WIPP) **Gisselle Gutierrez**
- 4. Updated Robotic System for Coating Application in the Savannah River Site H-Canyon Exhaust Tunnel **Jeff Natividad**
- 5. Development of Intelligent Mobile Robot Platforms for Performing Nuclear Surveillance - Joel Adams
- 6. Analysis of Uranium Transport Under Extreme Storm Events in the Tims Branch Watershed Juan Morales
- 7. Design of Innovative High-Efficient Technology for Mercury Abatement in Water Juana Perucina
- 8. Impact of Major Groundwater Components on the Adsorption of Uranium (VI) to Hanford Formation Sediment Mariah Doughman
- 9. Interaction of Hydroxyapatite and Uranium in Groundwater at the Old Rifle Site to Facilitate Site Remediation Olivia Bustillo
- 10. Removal of Iodine-129 by Organoclays PM-199 and MRM at Savannah River Site wetlands **Phuong Pham**

- 11. Corrosion Detection in Nuclear Waste Transfer Pipe Components Using Caustic Simulants - Raymond Piloto
- 12. Crack Detection and Localization Using Deep Learning with Knowledge Transfer **Roger Boza**



Figure 8. DOE Fellows with Dr. Ravi Gudavalli (Program Manager), Dr. Leonel Lagos (Program Director), Dr. Inés Triay (ARC Executive Director), Dr. David Roelant (Principal Scientist) and Dr. Kateel Shetty (Research Assistant Professor, College of Arts and Sciences).



Figure 9. DOE Fellows and judges during the poster exhibition.

FIU will conduct the next annual DOE Fellows poster exhibition on November 7, 2022, along with the DOE Fellows induction ceremony. DOE Fellows began drafting posters based on EM research conducted at FIU and/or at summer internships. A flyer was prepared for announcing the event and was displayed throughout the Engineering Campus and was posted on the DOE Fellows website as well as on social media outlets. One session will be conducted with both graduate and undergraduate DOE Fellows and three best posters will be selected by external judges. Winners of the poster exhibition will be announced during the induction ceremony and awards will distributed.



Figure 10. 16th Annual DOE Fellows Poster Exhibition Flyer.

Task 4: DOE-EM Fellows Induction Ceremony

During FIU Year 2, FIU conducted the 15th annual DOE Fellows Induction Ceremony on November 10, 2021. Prior to the ceremony DOE Officials and other distinguished guests had an opportunity to participate in morning tours of the ARC research laboratories and hear DOE Fellows presenting their research work. Dr. Inés Triay, Dr. Ravi Gudavalli and DOE Fellows Olivia Bustillo and Aurelien Meray gave an introduction/overview of the program and presentations of the research work being conducted under the cooperative agreement. Tours of the

ARC facilities included visits to the Radiological Laboratory; the Multi-Functional Indoor Testing Facility; the GIS, Modeling & Simulation Laboratory; the Soil and Groundwater Laboratory; the Environmental Technology Laboratory; the Robotics and Sensors Laboratory; and the Outside Test Facility.



Figure 11. DOE Fellows highlighting their research during the lab tours and presentations.

This year's hybrid Induction Ceremony, during which both DOE Fellows classes of 2020 and 2021 were inducted, was attended by high level officials in-person from the DOE's Office of Environmental Management (DOE-EM), including Mr. Todd Shrader, P.E., Principal Deputy Assistant Secretary, DOE-EM and Ms. Jalena Dayvault, Site Manager, DOE-LM. Participating virtually via MS Teams were Mr. Kurt Gerdes, Director, Office of Subsurface and Tank Closure; Ms. Genia McKinley, Program Manager, MSIPP/Technical Monitor for the DOE-FIU Cooperative Agreement; and Mr. Jean Pabon, Program Manager, DOE-EM. Dr. Andrés Gil, Senior Vice President for Research & Economic Development and Dean of the Univ. Graduate School, FIU; Dr. John L. Volakis, Dean, College of Engineering and Computing, FIU; Dr. Inés Triay, Executive Director, ARC; FIU faculty; ARC leadership and staff members; and current and former DOE Fellows also attended the event.

DOE Fellow	Degree	Major		
Joel Adams	Ph.D.	Mechanical Engineering		
Stevens Charles	B.S.	Environmental Engineering		
Brendon Cintas	Ph.D.	Mechanical Engineering		

 Table 5. DOE Fellows Class of 2020 Inducted during Induction Ceremony

DOE Fellow	Degree	Major
Christian Dau	B.S.	Computer Science
Mariah Doughman	Ph.D.	Chemistry
Josue Estrada	B.S.	Mechanical Engineering
Christian Gonzalez Lopez	B.S.	Computer Science
Phuong Pham	Ph.D.	Chemistry
Raymond Piloto	M.S.	Computer Engineering
Sebastian Story	B.S.	Mechanical Engineering
Thi Tran	B.S.	Mechanical Engineering
Eduardo Rojas*	B.S.	Mechanical Engineering

*DOE-LM Fellow



Figure 12. DOE Fellows Class of 2020. Back Row (left to right): Raymond Piloto, Sebastian Story, Phuong Pham, Brendon Cintas and Joel Adams. Front Row (left to right): Thi Tran, Eduardo Rojas, Josue Estrada, Christian Dau, Stevens Charles, and Mariah Doughman.

DOE Fellow	Degree	Major
Angel Almaguer	B.S.	Chemistry
Nicholas Espinal	B.S.	Mechanical Engineering
Caridad Estrada	B.S.	Environmental Engineering

Table 6. DOE Fellows Class of 2021 inducted during Induction Ceremony

DOE Fellow	Degree	Major
Karina Hernandez	B.S.	Environmental Engineering
Aubrey Litzinger	B.S.	Environmental Engineering
Juana Perucina	M.S.	Environmental Engineering
Oscar Roa	B.S.	Mechanical Engineering
Rohan Shanbhag	B.S.	Computer Science
Desmond Sinnott	B.S.	Mechanical Engineering
Sebastian Trevino	B.S.	Cyber Security
Shawn Cameron*	M.S.	Mechanical Engineering

*DOE-LM Fellow



Figure 13. DOE Fellows Class of 2021. Back Row (left to right): Sebastian Trevino, Shawn Cameron, Desmond Sinnott, Rohan Shanbhag and Aubrey Litzinger. Front Row (left to right): Juana Perucina, Caridad Estrada, Oscar Roa, Nicholas Espinal, Karina Hernandez, and Angel Almaguer.

During the induction ceremony, awards for the DOE Fellows Poster Exhibition and Competition were presented. Below is the list of winners for each session:

Undergraduate poster session:

3rd place: Christian Dau (Computer Science - DOE Fellow Class of 2020) Responsive Design Implementation of the D&D KM-IT Application Tool

2nd place: Eduardo Rojas (Mechanical Engineering - DOE Fellow Class of 2020) Remote Sensing Technologies for Long-Term Surveillance of DOE-LM Sites

1st Place: Caridad Estrada (Environmental Engineering - DOE Fellow Class of 2021) Sustainable Sorbent Technology for Mercury Remediation in a Freshwater Aquatic System

Graduate poster session:

3rd place: Olivia Bustillo (Environmental Engineering - DOE Fellow Class of 2019) Interaction of Hydroxyapatite and Uranium in Groundwater at the Old Rifle Site to Facilitate Site Remediation

3rd place: Phuong Pham (Chemistry - DOE Fellow Class of 2020) Removal of Iodine-129 by Organoclays PM-199 and MRM at Savannah River Site wetlands

2nd place: Mariah Doughman (Chemistry - DOE Fellow Class of 2020) Impact of Major Groundwater Components on the Adsorption of Uranium (VI) to Hanford Formation Sediment

1st Place: Aurelien Meray (Computer Science - DOE Fellow Class of 2019) pyLEnM: An Open Source Machine Learning Framework for Long-term Water Quality Monitoring

Awards were also presented for the DOE Fellow of the Year and the Mentor of the Year. Nominations were solicited from the current DOE Fellows for their ARC mentors and the ARC mentors were requested to nominate DOE Fellows for the award. The 2021 Mentor of the Year Award went to Dr. Mayren Echeverria (Post-Doctoral Associate) and the DOE Fellow of the Year Award was awarded to Ms. Olivia Bustillo (DOE LM Fellow Class of 2019).



Figure 14. DOE Fellows poster winners and Fellow of the year with Dr. Ines Triay and Dr. Ravi Gudavalli.

Task 5: Summer Internship Program (SIP)

The DOE Fellows Program Director and Program Manager coordinated with DOE-HQ, DOE sites, DOE national laboratories, and DOE contractors for placement of the DOE Fellows at various locations for their summer 2021 internships. Fourteen (14) DOE Fellows completed 2021 summer internships as part of the DOE-FIU Cooperative Agreement (Table 7).

Name	Site	Dates	Modality	Mentor
Jeff Natividad	WRPS	May 17 - Aug 6, 2021	On-Site	Alex Pappas
Joel Adams	WRPS	May 17 - Aug 6, 2021	On-Site	Alex Pappas
Thi Tran	WRPS	May 17 - Aug 6, 2021	On-Site	Alex Pappas
Philip Moore	SRNL	May 24 - 30 Jul, 2021	On-Site	Connor Nicholson
Phuong Pham	SRNL	May 24 - 30 Jul, 2021	On-Site	Hansell Gonzalez- Raymat
Brendon Cintas	DOE-HQ	Jun 1 - Aug 6, 2021	Remote	Larry Perkin
Josue Estrada	DOE-HQ	Jul 12 - Aug 20, 2021	Hybrid	Genia McKinley
Roger Boza	INL	Jun 1 - Aug 6, 2021	Remote	Ahmad Al. Rashdan
Christian Dau	INL	Jun 7 - Aug 13, 2021	Remote	Ahmad Al. Rashdan
Mariah Doughman	PNNL	Jun 1 - Aug 6, 2021	Remote	Nikolla Qafoku
Christian Gonzalez	PNNL	Jun 7 - Aug 13, 2021	Remote	Xuehang Song
Gisselle Gutierrez	LANL	Jun 1 - Aug 6, 2021	Remote	David Moulton
Aurelien Meray	LBNL	Jun 1 - Aug 6, 2021	Remote	Haruko Wainwright
Stevens Charles	LBNL	Jun 1 - Aug 6, 2021	Remote	Haruko Wainwright

 Table 7. DOE Fellows 2021 Summer Internships

DOE Fellows who participated in summer internships prepared and presented oral presentations at the weekly DOE Fellows meetings. The schedule of these presentations is provided below.

Table 8. Research Presentation Schedule for DOE Fellow Meetings

DOE Fellow	Date
Mariah Doughman	Sept 20, 2021
Jeff Natividad	Oct 4, 2021
Aurelien Meray	Oct 11, 2021
Thi Tran	Oct 25, 2021
Philip Moore	Nov 1, 2021
Phuong Pham	Nov 22, 2021
Brendon Cintas	Nov 29, 2021
Christian Dau	Dec 13, 2021

DOE Fellows completed drafting reports based on their summer 2021 internships which were submitted to DOE HQ on 12/10/2021 and were also published on the DOE Fellows website (fellows.fiu.edu).

Name	Title
Aurelien Meray	pyLEnM Update: A Machine Learning and data analysis python package for long-term soil and groundwater monitoring
Brendon Cintas	Development of an Authorized Release Limit Database
Christian Dau	Dataset Curation and Virtual Environment Creation for Machine Learning Tasks
Christian Gonzalez	Gap-filling time series using Direct Sampling in the Hanford 100-areas
Gisselle Gutierrez	Exploration of Toolsets for Development of an Integrated Hydrology Model of Basin-6 near the Waste Isolation Pilot Plant (WIPP)
Jeff Natividad	Autonomous Navigation and Radiation Mapping Platform - Hardware Updates and Integration
Joel Adams	Development of Semi-Autonomous Robotic Platform for Mapping Radioactive Hanford Farms
Josue Estrada	Contributing to the DOE EM 3.2, Office of Technology Development: Dashboard/Wearable Technologies Database
Mariah Doughman	Adsorption of Uranium to Hanford Formation Sediment in the Vadose Zone
Philip Moore	Environmental Testing of Polyurethane Foams for use as 3-Dimensional Fixatives
Phuong Pham	Sorption of iodine species on SRS wetland soils
Roger Boza	Implementing Machine Learning and Deep Learning Algorithms to Facilitate and Automate Nuclear Power Plant Operations
Stevens Charles	Characterization of Surface Water Dynamics within Fourmile Branch and its linkages with groundwater and I-129 geochemistry
Thi TranAutonomous Navigation and Radiation Mapping Platform - Radi Sensor Package Development	

Table 9.	DOE	Fellows	Summer	Internshin	Reports
Lable 7.	DOL	I CHOWS	Summer	meensinp	Reports

During FIU Year 2, DOE Fellows Program Director, Dr. Leonel Lagos, and Program Manager, Dr. Ravi Gudavalli, completed coordinating summer 2022 internships with DOE-HQ, national laboratories and contractors. Seventeen (17) DOE Fellows completed summer internships at various locations across the DOE complex (Table 10).

Name	Mentor	Site/Contractor	Modality
Angel Almaguer	Jim Szecsody	Hanford/PNNL	In-Person
Aubrey Litzinger	David Moulton	LANL	In-Person
Aurelien Meray	Zexuan Xu	LBNL	In-Person

 Table 10. DOE Fellows Summer Internships 2022

Name	Mentor	Site/Contractor	Modality
Brendon Cintas	Dan Lambert	SRNL	In-Person
Caridad Estrada	Alexander Johs	ORNL	In-Person
Christian Dau	Thomas Danielson	SRNL	In-Person
David Marreno	Genia McKinely/JP	DOE-HQ	In-Person
Desmond Sinnott	Joseph Kinney	SRNL	In-Person
Jeff Natividad [†]	Scott Ward	Oak Ridge/UCOR	In-Person
Joel Adams	Douglas Reed	Hanford/WRPS	In-Person
Josue Estrada	Douglas Reed	Hanford/WRPS	In-Person
Mariah Doughman	Nik Qafoku	Hanford/PNNL	In-Person
Philip Moore ⁸	Joseph Kinney	SRNL	In-Person
Phuong Pham	Hansell Gonzalez-Raymat	SRNL	In-Person
Roger Boza [*]	Ahmad Al Rashdan	INL	Hybrid
Rohan Shanbhag	Xuehang Song	Hanford/PNNL	In-Person
Stevens Charles	Hansell Gonzalez-Raymat	SRNL	In-Person

* funded by INL, † funded by UCOR, 8 funded by SRNL

The descriptions of the Fellows' summer internship assignments that were prepared for the monthly reports is provided below.



DOE Fellow, Josue Estrada, a graduate mechanical engineering student, is currently in Richland, WA as part of the 2022 summer internship at Washington River Protection Solutions (WRPS), one of the main contractors at the Department of Energy's Hanford Site. Josue is working with WRPS's Chief Technology Office (CTO) group in furthering the development of an automatic pipe crawler and reel system for tank inspection. The system's main component is a peristaltic-motion, pneumatic pipe-crawler delivery platform that will push a gamma scanner module through lateral channels under single-shell nuclear waste tanks to detect any possible radiation leaks in these. Additionally, the system includes a mechanized reel that will wind up the crawler's tether to recover the crawler and the scanner once inspection is finished.

Josue's primary task during the summer is integrating the components that have been developed at the Applied Research Centered into an autonomous machine. Josue is writing programs to connect the individual components through ROS2, an integrated robot communication framework, as well as testing and troubleshooting the hardware and mechatronic elements of the reel. The autonomy

of the combined elements into a single machine depends on a state machine program, which can be represented as a logical diagram of the flow between the possible states that can occur during the scanning process.

In his free time, Josue has been exploring the many hikes and parks in the Pacific Northwest for the first time, including Mount Rainier and the local Richland area mountains.



Figure 15. DOE Fellow, Josue Estrada, working with pipe crawler reel system.



DOE Fellow, Caridad Estrada, is participating in a summer internship at Oak Ridge National Laboratory (ORNL) under the mentorship of Dr. Alexander Johs. During this internship, Caridad has successfully set up three micro columns thus far and conducted conservative tracer tests using KBr diluted in artificial creek water. The samples were further analyzed using colorimetric assays with a UV-Vis Spectrophotometer and modeled using the advection-dispersion equation to understand contaminant transport through the system. Samples from the column inlet reservoir and at the outlet were also measured using the Brookhaven Dynamic Light Scattering instrument to understand particle size and the effect of sorbent media on the discharge of the column. Particle size experiments are also underway, using zinc diluted

in artificial creek water to support theories of a particulate mercury-dominated ecosystem.


Figure 16. DOE Fellow, Caridad Estrada, performing column experiments at ORNL.

DOE Fellow, Aubrey Litzinger, has been spending her summer interning with Los Alamos National Lab (LANL) in New Mexico. At LANL, she is working under mentorship of Drs. David Moulton and Yu Zhang. Her internship encompasses the use of digital elevation models of southern New Mexico to investigate groundwater recharge through integrated hydrology modeling and simulation, and will allow Aubrey to help create a hydrological model of Basin 6 of the Nash Draw near the Waste Isolation Pilot Plant (WIPP) site. With the help of her LANL mentors, Aubrey is learning several open-source software tools, like mesh generation software - TINerator, modeling software -Amanzi/ATS, and visualization software to view simulation results - VisIt and Paraview. The beginning steps for learning these programs is practice with watersheds that have previously been simulated so that



she can understand the workflow needed to produce correct results. The figures below are some of these example problems she has used to practice with the new programs.

The workflow for creating a hydrological model starts with an input file that Amanzi/ATS will then use to visualize the results. In this input file variables are specified, like soil type, surface/subsurface mesh, groundwater table, and more. Other important features are also specified, like the mathematical coupling equations to be used. In Figure 17, a section of an input file is displayed, and what is being specified is the outlet point in the Borden watershed stream. This was written by Aubrey in her internship as practice for what will need to be written with the Basin 6 (near WIPP site) project. The yellow arrows in Figure 17 specify some parts of the second html paragraph that are important variables.

<pre><parameterlist name="surface outlet flux" type="ParameterList"></parameterlist></pre>
<pre><parameter name="variable" type="string" value="surface-mass flux"></parameter></pre>
<parameter name="direction normalized flux" type="bool" value="true"></parameter>
<pre><parameter name="region" type="string" value="stream outlet"></parameter></pre>
<pre><parameter name="functional" type="string" value="extensive integral"></parameter></pre>
<parameter name="delimiter" type="string" value=" "></parameter>
<pre><parameter name="location name" type="string" value="face"></parameter></pre>
<parameter name="write interval" type="int" value="1"></parameter>
<pre><parameter name="observation output filename" type="string" value="surface_outlet_flux.dat"></parameter></pre>
<pre><parameter name="times start period stop" type="Array(double)" value="{0.0,3600,-1.0}"></parameter></pre>
Chosen name
<pre><parameterlist name="subsurface outlet flux" type="ParameterList"></parameterlist></pre>
<pre><parameter -="" name="variable" type="string" value="mass_flux"></parameter> variable of subsurde now</pre>
<pre><parameter name="direction normalized flux" type="bool" value="true"></parameter></pre>
<pre><parameter _="" name="region" type="string" value="subsurface outlet"></parameter> Region specified earlier</pre>
<pre><parameter name="functional" type="string" value="extensive integral"></parameter></pre>
<pre><parameter name="delimiter" type="string" value=" "></parameter></pre>
<pre><parameter name="location name" type="string" value="face"></parameter></pre>
<parameter name="write interval" type="int" value="1"></parameter>
<pre><parameter name="observation output filename" type="string" value="subsurface_outlet_flux.dat"></parameter></pre>
<pre><parameter name="times start period stop" type="Array(double)" value="{0.0,3600,-1.0}"></parameter></pre>

Figure 17. Input code for Amanzi/ATS simulation.

The input file was used in the simulation to create what is seen in Figure 18, rainfall on the Borden watershed. This is the visualization of the Borden watershed. In the Borden watershed simulation, the watershed underwent heavy rain (22 mm/hr) for 3,000 seconds. The total simulation cycle time was 6,000 seconds. There was only one type of soil on the surface in the simulation, but ATS can run with multiple types of land cover. The two variables that are displayed are the elevation and surface ponded depth. As the rain continued, the ponded depth along the surface increased, with the deepest along the water line.

Another practice problem to learn the open-source software stated above was the visualization of the DOE Handford BC Cribs and Trenches site. Figure 19 displays the visualization of transient vadose zone flow and non-reactive (tracer) transport in the context of Tc-99 migration at the DOE Hanford BC Cribs and Trenches site. On the left in Figure 19 is the transient vadose zone flow and on the right is the tracer transport. Some of the important input features for this simulation were soil permeability and cycle time. Both are manually inputted into the Amanzi input file which controls the simulation.



Figure 18. Visualization of Borden watershed after 3,000 seconds of heavy rain using Visit.



Figure 19. Paraview visualization of transport at DOE Hanford BC Cribs and Trenches site.



As a summer intern with the Advanced Engineering Group at Savannah River National Laboratory (SRNL), DOE Fellow, Desmond Sinnott, had the opportunity to work alongside engineers of all levels of experience. This has given Desmond insight into the type of work and the daily life of a DOE professional. Under the mentorship of Daniel Krementz, Desmond has also been able to assist with a very important mission in the area of Surplus Plutonium Disposition (SPD). The project supports the DOE's mission to dilute and dispose of many metric tons of impure plutonium in the state of South Carolina. Some of the project tasks that Desmond has been able to assist on are, modeling of mock-up components, component testing, technical drawing review, and production of a maintenance manual for the blend can loading system (BCLS).



Figure 20. CAD rendering of the Blend Can Loading System (BCLS), using Creo Parametric Software.

During this summer of 2022, DOE Fellow, Stevens Charles, was given the opportunity to participate in an internship at Savannah River National Laboratory (SRNL) and support the Advanced Long-Term Environmental Monitoring Systems (ALTEMIS) project which has a vision of creating a new paradigm of long-term monitoring to ensure environmental protection at DOE's legacy sites. His focus was helping his mentor, Dr. Hansell Gonzalez-Raymat, with the installation of temperature probes in the F-Area wetlands. These probes were installed in 97 locations and will help researchers understand the biogeochemical processes that occur in the wetlands.

Along with installing temperature probes to understand the spatial temperature variability in the F-Area, GIS was used to interpolate the temperatures at different periods throughout the year. In the F-Area,



multiple monitoring stations have collected temperature data quarterly. By using the observations at these stations, an interpolation of temperature for areas without monitoring stations can be made. These interpolated maps help researchers understand how the temperature changes throughout the year in different regions of the F-Area. This data is not continuous and has a low resolution, but it can be used to infer the temperatures in specific regions in the F-Area.

DOE Fellow Stevens Charles has also worked on finding different techniques to understand the groundwater-surface water interface in the F-Area wetlands. He has looked at techniques that have used temperature as a tracer, such as thermal imaging cameras, distributed temperature sensors and the technique currently being tested in the F-Area, distributed temperature profiling. Besides temperature, Stevens has investigated the use of isotopes as tracers. Examples of other tracers that have been used to study interactions between groundwater and surface water include alkalinity, electrical conductivity, isotopes of radon, chlorofluorocarbons, strontium and radium isotopes. Currently these tracers are being evaluated to see if they can provide better understanding of the groundwater-surface water interactions in the F-Area.



Figure 21. Image of DOE Fellow, Stevens Charles, aiding SRNL personnel (former DOE Fellow, Juan Morales) with the installation of temperature sensors in the F-Area wetlands.



Figure 22 Q3 (July – Sept) IDW Interpolated Temperatures (Deg C) in F-Area (left) , Q1 (Jan – Mar) IDW Interpolated Temperatures (Deg C) in F-Area (right).

The goal of understanding the Groundwater-Surface water interface is to eventually use the information to start building a conceptual model of the groundwater-surface water interactions, to developing a more robust monitoring system that can be implemented at the F-Area.



DOE Fellow, Jeff Natividad, traveled to Oak Ridge, TN to participate in an internship with United Cleanup Oak Ridge LLC (UCOR) as part of the new university alliance between UCOR and the DOE Fellows Program at Florida International University's (FIU) Applied Research Center (ARC). During his 12-week internship, Jeff is supporting the work of the Technical, Engineering and Nuclear Safety (TENS) group under the mentorship of Scott Ward. Some of his tasks include system diagram development to support Engineering Instruction (EI) production for multiple projects on the Oak Ridge National Laboratory (ORNL) campus and at the Heritage Center site.

Upon completion of this summer internship, Jeff will be moving to the Tri-Cities in Washington and return as a full-time employee at Washington River Protection Solutions (WRPS), where he had interned twice previously.



Figure 23. Jeff with the other UCOR summer interns after receiving Rad Worker - II status (left) and UCOR summer interns group photo (right).



Figure 24. Jeff Natividad touring the manipulator gallery at ORNL's Fission Products Pilot Plant (Building 3517) (left), and at the former control room for ORNL's Graphite Reactor (Building 3001) (right).



Figure 25. Jeff and other UCOR summer interns participating in Rad Worker Practical Factors.



DOE Fellow Rohan Shanbhag is participating in a 10-week summer internship with Pacific Northwest National Laboratory (PNNL), Richland WA. Under the mentorship of Dr. Xuehang Song, Rohan is analyzing and working with datasets from the 200 West Area in Hanford to use a technique called SSA (Single-Spectrum-Analysis) to decompose and then reconstruct the time series data of the different extraction wells of the area. The main contaminant of concern that is being analyzed is Carbon Tetrachloride (CCl₄). The main treatments used to cleanup or lower the contaminated groundwater include air stripping of activated carbon and ion exchange techniques. SSA allows the elementary components of the time series to be visualized and through this, elements of a time series such as the trend, periodic behaviors or oscillations, and noise can be identified. In turn, the underlying characteristics of the time series for each well can then be identified as well. Furthermore, since the data provided contains time series values for aqueous mass and Carbon Tetrachloride mass as well, SSA can be applied on those values and the decomposition and reconstruction of those time series can be identified and completed. Once the time series components that contain the trend and the periodicities are identified for each selected extraction well, those components will be used as inputs for a spatial clustering model.



Figure 26. Time series visualization of concentration data for extraction well 299-W12-2.



W-Correlation for well concentration time series for well 299-W12-2

Figure 27. W-Correlation visualization of concentration data for extraction well 299-W12-2. This shows which elementary time series components to group together for reconstruction later.



Figure 28. First 3 groups of components for the times series data for extraction well 299-W12-2. F0 is the trend, F1 is the sum of the first 2 components, and F2 is the sum of components 3 and 4.



Figure 29. Time series visualization for extraction well 299-W12-2. The plot in blue is the reconstructed time series using the first 18 components, the plot in red is the original time series, and the orange represents the remaining components that could contribute to noise or some other behavior.



Figure 30. Interns at a networking session at PNNL.



Phuong Pham, DOE Fellow, participated in a 10-week summer internship at Savannah River National Laboratory (SRNL). During her summer internship at SRNL, Phuong studied the sorption and release of iodide and iodate on wetland sediments at different depth interval under various environmental conditions via batch experiments and evaluates the use of organoclays as potential remediation technology for iodine-129 at the wetland under the mentorship of Dr. Hansell Gonzalez-Raymat of the Environmental Sciences and Dosimetry Group. Iodine-129 still poses a substantial clean-up problem due to its perceived high mobility in the environment, toxicity (tendency to concentrate in the thyroid), long half-life (~16 million years), and one of the lowest maximum contamination levels (1 pCi L-1) of all radionuclides. Wetlands at the F-Area have been an important sink for I-129 and other contaminants. The complex and diverse physical and

biogeochemical processes within the wetlands are mainly responsible for retaining these contaminants. However, these areas are sensitive to changing boundaries and geochemical conditions, resulting in the release of pollutants into surrounding areas. The goal of this research is to elucidate the attenuation and release mechanisms of iodine species occurring at the wetlands and the potential use of organoclays as the remediation technology. The outcome of these studies will improve understanding of the factors that contribute to the attenuation of iodine-129 at the F-Area wetlands and will provide SRS and the DOE with the ability to remediate I-129 from the F-Area more effectively. During the summer internship, Phuong also observed the Environmental Sciences and Dosimetry group as well as the Area Completion Projects team installing the temperature sensors in the wetland of the Fourmile Branch.



Figure 31. Phuong Pham at SRS F-Area Seepage Basin's wetland surface water monitoring stations during the field work (left) and presenting her research during the SRNL Student Poster Session (right).

DOE Fellow Philip Moore, returned to SRNL for a summer internship sponsored by SRNL. "I arrived at SRNL in Aiken, South Carolina on the 31st of May 2022. I rejoined the Advanced Engineering team that I worked with in the spring. I worked on a project that is seeking to increase productivity by automating the receipt inspection of waste storage containers. During the last internship I worked on end of arm tooling for a six-axis robot. Once my credentials were reinstated, I was able to immediately resume work where I left off. Over the course of the two internships, I developed my drawing and design skills, as well as my ability to work on tasks independently.

Being that I had worked on this project before, I was able to take full ownership of my tasks. My main accomplishment was an aligning gripper tool to pick up a component of the container. This tool was



conceptualized, designed, 3D printed, iterated, drawn, and then manufactured. At the time of my departure, a few parts were still in the machine shop and others were finished and awaiting heat treatment. While it was not 100% finished, I was able to make a poster about the design process and present it at the SRNL Intern poster session on the 21st of July. I am thankful to SRNL for the opportunity to learn from their engineers and hone my abilities."

DOE Fellow Joel Adams is participating in an internship at Washington River Protection Solutions (WRPS) located in Washington State under the mentorship of Dr. Douglas Reid. His work involves developing a robot manipulator, the UR5e, to perform proof of concept demonstrations of off-riser sampling inside of underground tanks. The work involves leveraging a C++ API that utilizes state of the art algorithms for trajectory planning and execution, as well as integrating computer vision for obstacle avoidance. The developed mock-up includes a test bed for the waste simulant, a collection jar, a mount for securing the robot upside down, and an end effector for collecting samples. The maturing of such technologies helps support the Hanford mission of increasing safety and efficiency.





Figure 32. UR5e robot extended from mount after scooping simulant.



Figure 33. Digital view of robot in RVIZ with mapped surroundings in Octomap form.



Figure 34. Sampling setup with mount, collection jar, and test bed.



DOE Fellow Mariah Doughman is participating in a 10-week summer internship at Pacific Northwest National Laboratory (PNNL). "The focus of my internship at the Pacific Northwest National Laboratory under my mentors Nik Qafoku, Jim Szecsody, and Hilary Emerson was to become familiar with conducting column experiments to study/model contaminant transport/attenuation in the vadose zone at the Hanford Site. I began by learning the theory and benefits behind the experiments and how to decide on the type of tracer, column, pump, and flow rate to use for specific contaminants of interest. We decided to focus on hexavalent chromium [Cr(VI)] adsorption and desorption in Hanford formation fine sand with a 20% by wt. addition of vermiculite with a bromide (Br⁻) tracer in our experiments this summer. I learned how to correctly pack a column with sediment, program the auto-fraction collector, and conduct the column experiment as shown in Figure 35.



Figure 35. Starting the auto-fraction collector for the column experiment.

I also learned how to analyze for Cr(VI) and Br⁻ using rapid economical methods including a colorimetric method for Cr(VI) and an ion selective probe for Br⁻, pictured in Figure 36. We will compare this data to samples that were also analyzed via ICP-MS for Cr(VI) and IC for Br⁻.



Figure 36. A: Colorimetric method to analyze for Cr(VI), B: UV-Vis spectrometer to analyze Cr(VI), C: Fisherbrand accumet pH and mV meter, D: Ion selective probe, E: Analyzing Br⁻ concentration using ion selective probe.

I also gained experience in packing a 2-D column as shown in Figure 37. My internship culminated with a 10-minute presentation of this work at a Virtual Research Symposium. Along with experimental work, I also took advantage of networking opportunities shown in Figure 39 including lunch events, a visit to the LIGO Hanford Observatory, and a visit to the B-Reactor.



Figure 37. Packing the 2-D column.



Figure 38. A: LIGO entrance sign, B: One of the 4 km arms at LIGO, C: APS historic site plaque.



Figure 39. A: B Reactor plaque, B: Standing next to the national park sign, C: B Reactor sign, D: Standing next to the DOE and national park signs, E: Outside of the B Reactor, F: Inside the B Reactor, G: Sitting in the control chair for the B-Reactor.

This internship will help me to conduct column studies at FIU that will be included in my dissertation, and it has allowed me to make connections with scientists in the field of environmental remediation that will continue to aid me post-graduation."



Brendon Cintas is a graduate student and DOE Fellow from Florida International University who is participating in a 10-week summer internship at Savannah River National Laboratory's (SRNL's) Chemical Flowsheet Development group. During his internship in Aiken, SC, Brendon assisted scientists at SRNL's Rheology and Grout Laboratory at Aiken Country Technology Lab (ACTL) better understand the sludge composition on the rheology of a simulant slurry using a HAAKE RheoStress 6000 rheometer and extrapolate the results to the real-waste data as it undergoes processing in the Defense Waste Processing Facility (DWPF). This research supports SRNL's task of qualifying DWPF's tenth Sludge Batch (SB). Brendon also conducted research into vane rheology to potentially implement methods of capturing more accurate slurry rheology.



Figure 40. DOE Fellow Brendon Cintas performing experiments at SRNL.

DOE Fellow Roger Boza is participating in his fourth consecutive summer internship (hybrid) at Idaho National Laboratory (INL) under the direct mentorship of Dr. Ahmad Al. Rashdan, a senior research and development scientist in the nuclear science and technology directorate at INL. The first part of his internship, done remotely, focused on designing and developing machine learning models to automate Nuclear Power Plant (NPP) processes. The second part, done on-site at the Center for Advance Energy Studies (CAES), was for live testing and demonstration of the developed algorithms. His research is helping the modernization efforts of NPPs through the Light Water Reactor Sustainability Program (LWRS) at INL.

Working at Idaho National Lab has been incredible; I am surrounded by a team of brilliant researchers. Overall, I had a great experience and



really enjoyed being exposed to new research problems. I'm thankful for having the opportunity to participate and contribute to such important research. – Roger Boza



Figure 41. DOE Fellow Roger Boza at INL's Center for Advanced Energy Studies (CAES).

Aurelien Meray, DOE Fellow and a Computer Science Ph.D. student participated in a ten-week summer internship at Lawrence Berkeley National Laboratory (LBNL). As part of his summer experience, he also participated in an Artificial Intelligence focused bootcamp partnered with the DOE called the Frontier Development Lab (FDL). The program is geared toward developing new tools to help solve some of the biggest challenges that humanity faces including climate change and improving disaster response. Aurelien was placed in a team called the Climate Adaptation: Digital Twin: Environmental Remediation. He worked with a team of three other Ph.D. students to create a surrogate model or emulator of the flow and transport models under different CMIP5 climate scenarios at the Savannah River Site (SRS) F-Area using Amanzi-ATS ensemble simulations. Aurelien trained a neural network called a U-Net Fourier Neural Operator (UFNO) to



create the surrogate model. Their UFNO models were trained using a variety of loss functions that incorporated both data-driven variables and actual boundary constraints. With various climate and subsurface inputs, the team demonstrated that they could accurately predict 1) contaminant concentration, 2) hydraulic head, and 3) Darcy's velocity from 1954 to 2100. At the end of the internship, Aurelien presented his work with one other team member at the FDL Live showcase.



Figure 42. DOE Fellow, Aurelien (right), with his FDL team.



Figure 43. Aurelien presenting at the FDL Live Showcase.



DOE Fellow Angel Almaguer participated in a 10-week summer internship at Pacific Northwest National Laboratory (PNNL). Angel conducted a single 1-D Flow-through column experiment with hexavalent chromate (CrO_4^{2-}), a bromide (Br⁻) tracer, and ≤ 2 mm Hanford formation sediment fraction. Effluent samples collected before and after designated stop-flow events were analyzed with UV-Vis spectroscopy to measure Cr^{VI} concentrations, and a bromide electrode to measure Br⁻ concentrations. The SGW solution matrix contained 200 µg/L of CrO_4^{2-} and 80 mg/L Br⁻ (Table 4). Samples were collected with an HPLC pump with a flow rate of 0.48 mL/min (Hitachi L6000 series 0.001 to 10 mL/min. A Br- tracer was used to evaluate the hydrodynamic dispersion and potential physical breakthrough tailing based on the breakthrough pattern of Br⁻.

Additionally, a 2-D column flow-through study was set up with site mentor, Dr. Jim Szecsody. This 2-D setup was fitted with electrical resistivity probes for the purposes of measuring ionic strength and hydrological conductivity of the saturated solution-sediment matrix.



Figure 44. Dilution of effluent samples from 1-D column flow-through study to be analyzed via UV-Vis spectroscopy (left), A 2-D column setup fitted with electrical resistivity probes (right).

DOE Fellow David Marreno participated in summer internship with the Department of Energy Headquarters Office in Germantown, Maryland. During this internship, David was involved in many administrative based projects and tasks to assist the Environmental Management team. David reviewed project execution plans for Idaho National Laboratory's (INL) task for Nuclear Spent Fuel, funding for MSI university collaboration for DOE and minority students, managing travel logs and the point of contacts for set visits, and managing improvements to EM dashboard and it's monitoring of program fund spending.



Task 6: Conference Participation and Presentations

Three DOE Fellows, Mariah Doughman, Aurelien Meray and Juan Morales, participated virtually in the RemPlex 2021 Global Summit on Environmental Remediation held on November 7 - 12, 2021. Juan Morales received the "best presentation" award for his outstanding presentation during the Emerging Contaminants session. Below are the details of the three DOE Fellows' research being conducted in collaboration with colleagues from Pacific Northwest National Laboratory (PNNL), Savannah River National Laboratory (SRNL) and Lawrence Berkeley National Laboratory (LBNL).

Mariah Doughman (DOE Fellow), a Ph.D. candidate in Chemistry, presented an oral presentation titled: Impact of Major Groundwater Components on the Adsorption of Uranium (VI) to Hanford Formation Sediment. She discussed the importance of understanding and predicting U (VI) behavior in the subsurface once active remediation is complete at the site. Her presentation described the approach of monitored natural attenuation (MNA). Effective MNA requires a thorough understanding of contaminant immobilization processes. She conducted batch adsorption experiments with uncontaminated Hanford Formation sediment and U(VI) spiked artificial groundwater reflective of site conditions, coupled with geochemical modeling. She presented preliminary results obtained from these experiments and how the conditions observed could potentially impact the fate of (UVI) in the subsurface.

Ph.D. candidate in Environmental Health Sciences and DOE Fellow, Juan Morales, delivered an oral presentation titled: Modeling Episodic Heavy Metal Transport and Toxicity for the Assessment of Remediated Surface Waters. His discussion was based on research conducted at Savannah River Site (SRS) in the Tims Branch watershed, in an attempt to comprehend the regulatory and toxicological variables associated with surface water treatment. Heavy metal-polluted soils are mobilized during heavy rainfall affecting water chemistry, and their elevated concentrations can be potentially detrimental to human and environmental health. A water quality model was developed, calibrated, and validated to assess heavy metal transport during periods of severe rainfall to gain a better understanding of this issue. Sensitive molecular surrogates were discovered that convey toxicity to varying levels of heavy metal exposures using a zebrafish model. The target gene was the transcription factor nuclear respiratory factor 1 (nrf1), which is implicated in several toxicity pathways. A GeNIe sensitivity analysis with Banjo, a machine

learning (ML) technique, was then used to model and verify the results. The findings of the study are critical for understanding the regulating parameters in heavy metal transport produced by episodic rain events, as well as novel dose-response toxicity mechanisms indicated by nrf1-gene surrogate indicators. After severe rains, such assessment models are helpful in recognizing areas of substantial heavy metal deposition in Tims Branch and are necessary for making informed decisions. These estimates can also be used to help with environmental health risk assessments, planning, and decision-making in the Tims Branch watershed.

Aurelien Meray, DOE Fellow and Ph.D. student in Computer Science, presented his work titled, pyLEnM: A Python based Machine Learning Framework for Long-term Water Quality Monitoring and Remediation. The research he described involved the development of a suite of machine learning algorithms in the form of an open-source python package to facilitate the analysis of monitoring datasets effectively. He presented algorithms developed to analyze and visualize correlations between different analytes and help identify key parameters that control contaminant concentrations and plume movement. Additional focus was on the development of an advanced spatial interpolation algorithm that uses a combination of regression and kriging techniques to accurately estimate contaminant plumes. Lastly, a sensor placement algorithm, which is built on top of the spatial interpolation method, was showcased to effectively select locations from a set of existing wells to maximize the capture of critical information for predictive modeling with new sensors.

DOE Fellow Caridad Estrada received the first place award for an oral presentation at the Annual Research Symposium hosted by the MARC U*STAR Program. During the symposia, competitively selected students from institutions such as FIU, MIT and the University of Pennsylvania were able to highlight their scientific work through student presentations. Caridad gave an oral presentation titled "Sustainable Sorbent Technology for Mercury Remediation in Freshwater Aquatic Systems" based on the research she is performing to evaluate low-cost sorbent media for mercury removal from a contaminated freshwater stream, the composition of which mimics that of the East Fork Poplar Creek (EFPC) ecosystem at Oak Ridge, Tennessee.

Fourteen (14) DOE Fellows attended and participated at the 2022 Waste Management Symposia held from March 6-10 in Phoenix, Arizona. Four (4) DOE Fellows, Aurelien Meray, Caridad Estrada, Marian Doughman and Thi Tran, Roy G. Post foundation scholarships recipients, displayed their posters on Sunday, March 06, 2022, during session 034a, WM2022 Roy G. Post Scholarship Winners Poster Display.

DOE Fellow	Abstract ID	Title
Aurelien Merav	22483	AI Approach to Predict Tritium Concentrations Using
5		Specific Conductance as a Proxy Variable at the SRS F-Area
Caridad Estrada	22403	Sustainable Sorbent Technology for Mercury Remediation in
Califuadi Estradia 22493		a Freshwater Aquatic System
Mariah	22186	Impact of Major Groundwater Components on the Adsorption
Doughman	22480	of Uranium (VI) to Hanford Formation Sediment
Thi Tran	22480	Intelligent Data Management to Produce Digital Twins from
	22489	Autonomous Robotic Platforms



Figure 45. DOE Fellows Thi Tran, Mariah Doughman, Aurelien Meray and Caridad Estrada with other winners and Roy G. Post Foundation board members.

DOE Fellows had an opportunity to meet Dr. Ike White, U.S. Department of Energy Office's Assistant Secretary for Environmental Management, after the keynote speech during the plenary session on Monday, March 7, 2022.



Figure 46. DOE Fellows with Dr. Ravi Gudavalli (Program Manager), Dr. Leonel Lagos (Program Director), Dr. Ike White (Assistant Secretary for Environmental Management, DOE-EM) and Ms. Nicole Nelson-Jean (Associate Principal Deputy Assistant Secretary for Field Operations, DOE-EM).

Ten (10) DOE Fellows participated in session 034b, Student Posters: The Next Generation - Industry Leaders of Tomorrow (1.2) on Monday, March 07, 2022 and presented posters based on their DOE-EM research accomplishments. DOE Fellow Aubrey Litzinger received the best undergraduate poster award for her poster titled "*Standard Aging of Concrete for the Study of Protection Systems at Savannah River Site*".

DOE Fellow	Abstract ID	Title		
Angel Almaguer	22503	Re-oxidation of Technetium (99Tc) Comingled with Uranium (238U), and Nitrate (NO_3^-), Immobilized via Strong Reductants		
Aubrey Litzinger	22485	Standard Aging of Concrete for the Study of Protection Systems at Savannah River Site		
Brendon Cintas	22484	Evaluation of Pipe Length on Flushing Requirements for High- Level Waste at Hanford and Savannah River		
Desmond Sinnott	22506	Design and Development of a Bench Scale Pipe Loop for Corrosion Monitoring Using Caustic Simulants		
Gisselle Guiterrez	22488	Development of an Integrated Hydrology Model of a Sub-Basin within Basin-6 near the Waste Isolation Pilot Plant (WIPP), NM		
Jeff Natividad	22482	Mechanical Updates on the Robotic System for Coating Application in Savannah River Site H-Canyon Exhaust Tunnel		
Joel Adams	22499	Development of Intelligent Mobile Robot Platforms for Performing Nuclear Surveillance		
Phuong Pham	22491	Removal of Iodine-129 by organoclays MRM and PM-199		
Roger Boza	22481	Surface Crack Detection of Nuclear Facility Structures Using Deep Learning and Knowledge Transfer		
Sebastian Story	22480	Retrofitted Pneumatic Pipe Crawler for Transfer Line Inspection of Double Shell Tanks at Hanford Site		
Stevens Charles	22490	Surface Water Dynamics within the F-area of Savannah River Sin and its Linkages with Groundwater and I-129 Geochemistry		

 Table 12. Abstracts Submitted by DOE Fellows for the WM2022 Student Poster Session



Figure 47. DOE Fellow Aubrey Litzinger won the best undergraduate poster at WMS2022.

Additionally, several DOE Fellows presented in oral and poster sessions under professional tracks.

March 07, 2022 - 1:50 pm - 5:00 pm

033c Posters - HLW, SNF/UNF and Long-Lived Alpha/TRU Waste Retrieval and Processing (2.1c) - Effect of Caustic Simulant Flow on the Corrosion Characteristics of Waste Transfer Pipe Components (22466) - **Desmond Sinnott** (Poster Presentation)

March 07, 2022 - 3:15 pm - 5:00 pm

024 Tank Farm Processing (2.4b) - Evaluation of Pipeline Flushing Requirements for High-Level Waste at Hanford and Savannah River (22128) - **Brendon Cintas** (Oral Presentation)

March 08, 2022 - 9:55 am - 11:35 am

053 Roundtable: Young Professionals in Nuclear Science and Engineering an International Perspective (R8.2) - Former DOE Fellow Silvina Di Pietro, NNSA Graduate Fellow and Postdoctoral Researcher (Panelist)

March 08, 2022 - 1:50 pm - 5:00 pm

067 Nuclear and Industrial Robotics, Remote Systems and Emerging Technology (9.2) -Radiological Surveillance of Hanford Tank Farm Using an Autonomous Mobile Platform (22317) - **Joel Adams** (Oral Presentation)

034c WM2022 Student Intern Poster Display - Featuring Savannah River National Laboratory - Sorption of Iodide and Iodate on Wetland Soils (22609) - Phuong Pham (Poster Presentation)

March 09, 2022 - 1:00 pm - 2:45 pm

105 Groundwater Remediation Projects - Worldwide Experiences (7.7) - Sustainable Sorbent Technology for Mercury Remediation in a Freshwater Aquatic System (22172) -Caridad Estrada (Oral Presentation)

March 09, 2022 - 1:00 pm - 4:35 pm

119 Non-Paper Poster Topic for Emerging Issues and Late Abstracts (10.1) - Obstacle Detection for Drones Using Machine Learning (22444) - Roger Boza (Poster Presentation)

March 10, 2022 - 8:00 am - 9:45 am

123 Tank Farm Inspections (2.4a) - Development and Deployment of the Miniature Rover for Inspection of Hanford's Double Shell Tank (DST) (22104) - **Sebastian Story** (Oral Presentation)

March 10, 2022 - 8:00 am - 11:35 am

129 Artificial Intelligence (AI) and Machine Learning (ML) Applications in Radioactive WM (9.13) - pyLEnM: An Open Source Machine Learning Framework for Long-term Water Quality Monitoring (22320) - Aurelien Meray (Oral Presentation)



Figure 48. DOE Fellows Olivia Bustillo and Silvina Di Pietro pictured with other panel members and session co-chairs.

The DOE Fellows joined staff from FIU-ARC to host a booth in the exhibitor hall during the conference, interacting with conference attendees on how FIU-ARC provides support to the DOE EM in their mission of accelerated risk reduction and environmental legacy cleanup. DOE Fellows also participated as Student Assistants during the conference, assisting conference organizers and presenters during the technical sessions. Additionally, DOE Fellows participated in a round table discussion with Mr. Todd Shrader, Principal Deputy Assistant Secretary, Ms. Nicole Nelson-Jean, Associate Principal Deputy Assistant Secretary for Field Operations, Ms. Genia McKinley, DOE-FIU Program Monitor and Mr. Jean Pabon and discussed how to attract new workforce into government agencies and how to retain current workforce.

ations to the WM2022 Roy G. Post Foundation Scholarship Winr



Figure 49. DOE Fellows and FIU staff at waste management symposia 2022 pictured with Ms. Nicole Nelson-Jean (Associate Principal Deputy Assistant Secretary for Field Operations, DOE-EM).



Figure 50. DOE Fellows exchanging ideas during round table discussion with Ms. Nicole Nelson-Jean (Associate Principal Deputy Assistant Secretary for Field Operations, DOE-EM) and Mr. Todd Shrader (Principal Deputy Assistant Secretary, DOE-EM).

DOE Fellow **Caridad Estrada** wrote an article describing her experience attending Waste Management Symposia, published on the DOE Fellows website, <u>https://fellows.fiu.edu/my-wm2022-experience-by-caridad-estrada/</u>.

This month I had the pleasure of attending the Waste Management Symposia in Phoenix, Arizona (March 6-10, 2022) for the first time, the premier international conference for the management of radioactive material and related topics. I was fortunate enough to win the Roy G. Post foundation scholarship and sponsorship to present my current research in mercury remediation in freshwater aquatic systems for the Department of Energy - Office of Environmental Management. My research at FIU's Applied Research Center under the mentorship of Dr. John Dickson, works to eradicate the harmful consequences of pollutants such as mercury that were the result of radioactive material developments at the Oak Ridge National Laboratory.

While attending conferences is nothing new to me, I was pleasantly surprised at the valuable experience and knowledge I gained during this penultimate event for radioactive waste management. My encounter with professionals from all over the United States and from visiting countries enlightened my perspective of the scientific community and elevated my confidence as these industry professionals regarded me as a colleague. I engaged in numerous conversations regarding my research, but many of the sessions at this conference went beyond the scope of laboratory work and into the policies that help shape the progress of waste management. The friendly and charismatic atmosphere allowed me to network with scientists and learn more about the topics I was interested in such as emerging contaminants and modeling applications to support environmental remediation. This amazing opportunity is made possible by the Department of Energy Fellows program, a STEM workforce development program sponsored by the Department of Energy's Office of Environmental Management. The program provides me with hands-on research experience, mentorship and the ability to grow as a researcher and young professional.

My favorite aspect of this conference was seeing the Department of Energy in action and the various projects that are ongoing in environmental management. The DOE has created a large network of distinguished professionals, which proved to be beneficial for a young student looking to pursue a radioactive waste management career. On my way home, I gained enthusiasm for new ideas inspired by the sessions at this conference and came back to the Applied Research Center ready to write my graduate school research proposal.



Figure 51. DOE Fellow Caridad Estrada's participation at WMS22.

DOE Fellow Aurelien Meray presented a poster virtually titled "PyLEnM: Machine Learning and Analytics Toolkit for Long-term Water Quality Monitoring and Remote Sensing" at the HyrdoML Symposium held from May 18 - 20, 2022. The purpose of this conference is to bring together experts in the fields of hydrology and machine learning (ML), demystify ML for those just joining the field, and to encourage collaboration among those already involved in order to build a community around ML for all attendees.



Figure 52. Poster presented by DOE Fellow Aurelien Meray at the HyrdoML Symposium.

DOE Fellows are preparing abstracts for the 2023 Waste Management Symposium student poster session. A total of 15 DOE Fellows are expected to attend WM2023.

Task 7: DOE-EM Fellows Lecture Series Forum

DOE Fellows attended a series of Tech Talks throughout the year sponsored by the U.S. Department of Energy focusing on several topics relevant to the DOE EM Complex. The talks, hosted by FIU's Applied Research Center, included one given by Lawrence (Larry) Boing focused on Decommissioning Knowledge Sharing in the 21st Century, and another that featured retired Idaho National Laboratory scientist Rick Demmer. The title of Mr. Demmer's talk was "Understanding Decontamination (and a dozen other lessons)" during which he discussed how to stop worrying and learn to love engineering. Rick Demmer is a recognized D&D scientist at the national and international level who led D&D efforts for 39 years.

In addition to the Tech Talks, the DOE Fellows participated in a lecture series hosted by FIU, the first lecture featuring Dr. Young Soo Park from Argonne National Laboratory (ANL) on June 27, 2022. Dr. Park visited FIU and gave a talk titled "Robotics and Remote Systems Program at Argonne National Laboratory" during which he discussed various robotic technologies that were developed or are under development. Another lecture was given by Dr. Paul Dixon, a senior advisor to the US Department of Energy's Network of National Laboratories for Environmental Management and Stewardship (NNLEMS), the science lead for the NNSA/IAEC Subsurface Science and Waste Management focus area and the Deputy Director of the Civilian Nuclear Program Office at Los Alamos National Laboratory. Lastly, Dr. James Conca, Trustee of the Herbert M. Parker Foundation in the Tri-Cities, Washington. gave a lecture titled "Our Aging Energy Infrastructure - A Precarious Future".



Figure 53. DOE Fellows with Dr. James Conca after lecture series.

DOE Fellows also participated in an info session held on Monday, September 19, 2022, by Savannah River Mission Completion (SRMC). During the info session, Ms. Connie Yung and Ms. Alison Brinkley talked about the mission of SRMC and provided information about full time and internship opportunities.

Task 8: DOE-EM Fellows and DOE-EM HBCU Collaboration/Integration

There is no progress to report on Task 8 for this reporting period. FIU will expand communication and engagement with DOE-EM HBCU STEM programs to promote collaborative synergistic research and STEM development efforts between FIU and HBCU universities related to EM technical issues and challenges. Out of these relationships, FIU hopes to identify qualified STEM students interested in pursuing graduate STEM degrees at FIU.

CONCLUSIONS

This innovative workforce development program was officially established in March 2007. This project is successfully meeting its objectives by providing research training and mentoring for students from underrepresented groups on environmental problems at DOE sites, in addition to providing several new formal recruitment and retention mechanisms for qualified students from underrepresented groups to pursue advanced studies, research training, and eventual career placement at DOE sites. One hundred and eighty-nine (189) FIU STEM students have been inducted into the program and have completed 194 internships since 2007. Twelve (16) DOE Fellows were hired by DOE EM, DOE national labs and contractors. Ninety-three (93) DOE Fellows have been hired by private industry and government agencies. Additional information about the entire program and the DOE Fellows can be found on the website <u>http://fellows.fiu.edu/</u>.

ACKNOWLEDGEMENTS

Funding for this research was provided by U.S. DOE Cooperative Agreement #DE-EM0005213. FIU's Applied Research Center would like to acknowledge the commitment of DOE-EM to this specific workforce development project and to all the research being conducted as part of the Cooperative Agreement. The partnership between DOE EM and FIU has resulted in the development and training of outstanding minority STEM students that will benefit this country as a whole.

APPENDIX A: FIU YEAR 2 ANNUAL RESEARCH REVIEW PRESENTATIONS

The following documents are available at the DOE Research website for the Cooperative Agreement between the U.S. Department of Energy Office of Environmental Management and the Applied Research Center at Florida International University: https://doeresearch.fiu.edu/SitePages/Welcome.aspx

FIU Year 2 Annual Research Review Presentations:

- 1. FIU Research Review Project 1
- 2. FIU Research Review Project 2
- 3. FIU Research Review Project 3 D&D
- 4. FIU Research Review Project 3 IT ML
- 5. FIU Research Review Project 4 & 5
- 6. FIU Research Review Project 4 DOE Fellow Aubrey Litzinger
- 7. FIU Research Review Project 4 DOE Fellow Aurelien Meray
- 8. FIU Research Review Project 4 DOE Fellow Joel Adams
- 9. FIU Research Review Project 4 DOE Fellow Mariah Doughman
- 10. FIU Research Review Project 4 DOE Fellow Nicholas Espinal
- 11. FIU Research Review Project 4 DOE Fellow Philip Moore
- 12. FIU Research Review Project 5 DOE Fellow Olivia Bustillo
- 13. FIU Research Review Project 5 DOE Fellow Shawn Cameron
- 14. FIU Research Review Wrap Up Project 1
- 15. FIU Research Review Wrap Up Project 2
- 16. FIU Research Review Wrap Up Project 3 D&D
- 17. FIU Research Review Wrap Up Project 3 IT ML
- 18. FIU Research Review Wrap Up Project 4
- 19. FIU Research Review Wrap Up Project 5

APPENDIX B: DOE FELLOWS GRADUATE PROGRAMS

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Charles Castello	Electrical Engineering	Ph.D.	Soil/Groundwater - Sensor Development for Field Measurement of Mercury	2011
Claudia Cardona	Environmental Engineering	Ph.D.	Remediation of the uranium-contaminated subsurface in the deep vadose zone via NH ₃ gas injection	2017
Hansell Gonzalez- Raymat	Chemistry	Ph.D.	Unrefined humic substances as a potential low- cost remediation method for groundwater contaminated with uranium in acidic conditions	2018
Sebastian Zanlongo	Computer Science	Ph.D.	Multipurpose All-Terrain Robotic Platform for D&D	2018
Roger Boza	Computer Science	Ph.D.	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies	2023 (anticiapted)
Silvina Di Pietro	Chemistry	Ph.D.	Ammonia Gas Treatment for Uranium Immobilization at DOE Hanford's Site	2021
Juan Morales	Public Health	Ph.D.	Accumulated Metalloestrogens Analysis for Health Risk Assessment and Watershed Toxicology Management in Tims Branch, SRS	2021 (anticipated)
Cristian Acevedo		Ph.D.	Note ¹	
Emma Lopez		Ph.D.	Note ¹	
Reiner Hernandez		Ph.D.	Note ¹	
Eric Inclan		Ph.D.	Note ¹	
Bryant Thompson		Ph.D.	Note ¹	
Alejandro Garcia		Ph.D.	Note ¹	
Orlando Gomez	Physics	Ph.D.	Note ¹	
Alejandro Hernandez	Chemistry	Ph.D.	Note ¹	
Joel Adams	Mechnical Engineering	Ph.D.	Long Term Surveillance of Nuclear Facilities and Repositories	2023 (anticiapted)
Mariah Doughman	Chemistry	Ph.D.	Evaluation of Competing Attenuation Processes for Mobile Contaminants in Hanford Sediments	2023 (anticiapted)
Phuong Pham	Chemistry	Ph.D.	Interaction of iodine species with OrganoClays and Granualted Actiavted Carbon	2022 (anticiapted)
Aurelien Meray	Computer Science	Ph.D.	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies	2024 (anticiapted)

DOE Fellows in STEM Graduate Programs - Ph.D.

				Graduation
Brendon Me Cintas Eng	echnical gineering	Ph.D.	Experimental analysis of flushing criteria for waste transport operations	2025 (anticiapted)

¹Student left the DOE Fellows program before completion of their doctoral degree.

DOE Fellows in STEM Graduate Programs - Masters

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Jose Vazquez	Environmental Engineering	Master	Effects of temperature and pH on volatilization of mercury after chemical reduction	2009
Amy Pahmer	Engineering Management	Master	Non-Thesis Option	2010
Duriem Calderin	Biomedical Engineering.	Master	Modeling of Loose Contamination Scenarios to Predict the Amount of Contamination Removed	2010
Leydi Velez	Industrial Engineering	Master	Decision Modeling Tools D&D Surveillance & Maintenance	2010
Serkan Akar	Biomedical Engineering	Master	Design and Development of an Enzyme-Linked Biosensor for Detection and Quantification of Phosphate Species	2010
Amaury Betancourt	Environmental Engineering	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2011
Denny Carvajal	Biomedical Engineering	Master	Soil/Groundwater – Bacteria Interaction due to Polyphosphate Injection at Hanford	2011
Edgard Espinosa	Mechanical Engineering	Master	Waste Processing - CFD Modeling of NuVison's Power Fluidic Technology/Process Remote Stack Characterization System	2011
Elsa Cabrejo	Environmental Engineering	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2011
Melina Idarraga	Environmental Engineering	Master	Dissolution rate of natural meta-autunite: effects of aqueous bicarbonate, pH and temperature	2011
Merlin Ngachin	Environmental Sciences	Master	Waste Processing - Baltman-Lattice Method to Model HLW	2011
Stephen Wood	Mechanical Engineering	Master	Modeling of Pipeline Transients: Modified Method of Characteristics	2011
William Mendez	Engineering Mngmt.	Master	Development of Remote Stack Char. System	2011
Eric Inclan	Mechanical Engineering	Master	Mesh adaptation for use in Lattice Boltzmann code	2012
Kanchana Iyer	Biomedical Engineering	Master	Non-Thesis Option	2012
Lee Brady	Mechanical Engineering	Master	Non-thesis option	2012
Lilian Marrero	Environmental Engineering	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2012
Mario Vargas	Mechanical Engineering	Master	Kinematic Control of Remote Stack Characterization System	2012
Melissa Sanchez **	Environmental Engineering	Master	Non-thesis option	2012

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Yulyan Arias**	Environmental Engineering	Master	Non-thesis option	2012
Elicek Delgado- Cepero	Electrical Engineering	Master	Structural Health Monitoring Inside Concrete and Grout Using the Wireless Identification Sensing Platform	2013
Heidi Henderson	Environmental Engineering	Master	Surface water and contaminant transport within the Oak Ridge National Laboratory	2013
Jaime Mudrich	Mechanical Engineering	Master	Development of a Coupling Model for Fluid- Structure Interaction using the Mesh-free Finite Element Method and the Lattice Boltzmann Method	2013
Janty Ghazi	Electrical Engineering	Master	Control, through Sensors and LabVIEW, of the Asynchronous Pulsing Unit	2013
Jose Matos	Mechanical Engineering	Master	Development of improved Bodies for a Peristaltic Crawler for Radioactive Pipeline Unplugging	2013
Mariela Sliva	Engineering Management	Master	Non-Thesis Option	2013
Joel McGill*	Environmental Engineering	Master	Non-Thesis Option	2014
Paola Sepulveda	Biomedical Engineering	Master	Investigating the Role of a Less Uranium Tolerant Strain, Isolated from the Hanford Site Soil, on Uranium Interaction in Polyphosphate Remediation Technology	2014
Revathy Venkataraman	Computer Science	Master	Performance Evaluation of Mobile Applications with KMIT Technology Web Services	2014
Valentina Padilla	Environmental Engineering	Master	Non-Thesis Option	2014
Andrew De La Rosa*	Computer Science	Master	Non-Thesis Option	2015
Dayron Chigin*	Electrical Engineering	Master	Non-Thesis Option	2015
Maximiliamo Edrei	Mechanical Engineering	Master	Investigation of Mixing Times of Sparged Bingham plastic type fluids as applied to the Pulse Jet Mixing Process	2017
Natalia Duque	Environmental Engineering	Master	Non-Thesis Option	2017
Robert Lapierre*	Chemistry	Master	Mineral characterization after uranium sequestration by pH manipulation using NH ₃ gas	2017
Alejandro Garcia	GeoScience	Master	The influence of biofilm formation on the SIP response of Hanford vadose zone sediment	2018
Mohammed Albassam	Water resource Engineering	Master	Effect of Frequent Atmospheric Events on Flow Characterization in Tims Branch and its Major Outfalls	2018
Joseph Coverston	Mechanical Engineering	Master	Evaluation of Pipeline Flushing Requirements for HLW at Hanford and Savannah River	2019

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Joshua Nunez	Mechanical Engineering	Master	The applications of intumescent technologies in support of D&D activities across the DOE complex	2019
Ryan Cruz	Cyber Security	Master	Non-Thesis Option	2019
Amanda Yankcoskie*	Environmental Engineering	Master	Non-Thesis Option	2020
Jason Soto	Mechanical Engineering	Master	Design of Robotic Inspection Platform for Structural Health Monitoring	2020
Ron Hariprashad	GeoScience (Hydrogeology)	Master	Modeling of Surface Water Flow and Contaminant Transport in the Tims Branch Ecosystem	2020
Tristan Simoes- Ponce	Mechanical Engineering	Master	D&D Technology Demonstration & Development and Technical Support to SRS's 235-F Facility Decommissioning	2020
Alexis Vento	Environmental Engineering	Master	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems	2021
Jeff Natividad	Mechanical Engineering	Master	Evaluation of Coatings for the H-Canyon Exhaust Tunnel	2021
Edward Nina*	Mechanical Engineering	Master	Non-Thesis Option	2020
Michael Thompson	Electrical Engineering	Master	Structural health monitoring of pipelines in radioactive environments through acoustic sensing and machine learning	2020
Gisselle Guiterrez	Environmental Engineering	Master	Digital Elevation Model and Hydrologic Network	2022
Lorryn Adnrade*	Environmental Engineering	Master	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems	2022
Ryan Ocampo*	Civil Engineering	Master	Evaluation of Coatings for the H-Canyon Exhaust Tunnel at the Savannah River	2022
Raymond Piloto*	Electrical Engineering	Master	Pipeline corrosion and erosion evaluation	2022
Olivia Bustillo	Environmental Engineering	Master	Use of Apatite for Uranium Sequestration at Old Rifle Site	Anticipated 2023
Josue Estrada	Mechanical Engineering	Master	Development of Inspection Tools for DST Tanks	Anticipated 2023
Christian Dau*	Computer Science	Master	Analysis of Image Data using Machine Learning/Deep Learning	Anticipated 2023
David Mareno*	Cyber Security	Master	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies	Anticipated 2023
Aubrey Litzinger	Environmental Engineering	Master	Model Development (for Basin 6 of the Nash Draw near the WIPP)	Anticipated 2023
Rohan Shanbhag	Computer Science	Master	AI for EM Problem Set (Soil and Groundwater)	Anticipated 2023
Sebastian Story	Mechanical Engineering	Master	Development of Inspection Tools for Primary Tanks	Anticipated 2023

*This student left the DOE Fellows program before completion of their master's degree. **This student left the DOE Fellows program but completed their master's degree at FIU.

APPENDIX C: DOE FELLOWS EMPLOYMENT

First Name	Last Name	Employer
Edgard	Espinosa	DOE EM Office of Nuclear Materials Disposition
Merlin	Ngachin	Argonne National Lab
Rubymir	Romero	Bechtel Power
Lee	Brady	DOE EM office of Deactivation and Decommissioning
Duriem	Calderin	Pacific Northwest National Lab (PNNL)
Charles	Castello	ORNL – Energy & Transportation Science Division
Rosa	Ramirez	DOE EM International Programs
Stephen	Wood	ORNL
Nicole	Anderson	National Energy Technology Laboratory (NETL)
Hansell	Gonzalez	Savannah River Nuclear Solutions
Adamandios	Manoussakis	Sandia National Laboratory
Silvina	Di Pietro	NNSA
Juan	Morales	Savannah River National Laboratory (SRNL)
Tristan	Simoes-Ponce	Savannah River Nuclear Solutions
Jeff	Natividad	WRPS
Phuong	Pham	Savannah River National Laboratory (SRNL)

DOE Fellows hired by DOE-EM, contractors and National Laborotries

DOE Fellows hired by Federal, State and Local Governament Agencies

First Name	Last Name	Employer
Serkan	Akar	Department of Commerce
Denisse	Aranda	NASA
Alex	Henao	Internal Revenue Services
Jose	Vazquez	Department of State
Amaury	Betancourt	Florida Department of Environmental Protection
Cindy	Cerna	Naval Sea Systems Command
Jennifer	Borges	Florida Department of Transportation
Elsa	Cabrejo	Dade County Environmental Department (Miami, Fla)
Alessandra	Monetti	Department of Defense – Office of the Secretary of Defense, Army Corp of Engineering
Kanchana	Iyer	Department of Health & Human Services
Alexander	Lopez	Florida Department of Transportation
Melissa	Sanchez	Florida Department of Environmental Protection
Frank	Silva	Department of State
Kiara	Pazan	U.S. Corps of Engineers
Jesse	Viera	U.S. Marine Corps
Christine	Wipfli	U.S. Dept of Defense
Sarah	Bird	U.S. Dept of Defense
Christopher	Strand	FAA
Mohammed	Albassam	City of Coconut Creek

First Name	Last Name	Employer
Danny	Brenner	General Electric
Ramon	Colon	Bouygues Civil Works Florida
Henry	Diaz	Lockheed
Raul	Dominguez	Kimley-Horn and Associates, Inc.
Erica	McKinney	Boeing Company
William	Mendez	Boeing Company
Amy	Pahmer	Mount Sinai Medical Center
Giancarlos	Pena	Caribe Utilities of Florida, Inc
Jose	Rivera	FIU's Applied Research Center
Leydi	Velez	PriceSmart Inc
Sandra	Zapata	Johnson & Johnson
Melina	Idarraga	Nova Consulting Inc.
Dasney	Joseph	General Electric
Victor	Uriarte	Intel Corporation
Denny	Carvajal	Mount Sinai Medical Center
Rinaldo	Gonzalez Galdamez	Crane Aerospace and Electronics
Nadia	Lima	HJ Foundation
Jose	Matos	Beckman Coulter
Mario	Vargas	Boeing Company
Yulyan	Arias	CH2M Hill
Maite	Barroso	Sikorsky Aircraft
Givens	Cherilus	Florida Power & Light
Elicek	Delgado	Motorola
Janty	Ghazi	Kiewit Power
Heidi	Henderson	CPH Inc.
Sheidyn	NG	Regeneron Pharmaceuticals
Shina	Rana	Florida Power & Light
Claudia	Cardona	STEM
Nel	Ciurdar	Burns & McDonnell
Lilian	Marrero	MWH Global
Joshua	Midence	Creativity, Value, Logic
Carol	Moreno-Pastor	Cummins
Jaime	Mudrich	Beckman Coulter
Ximena	Prugue	BRG Sports
Paola	Sepulveda	StryKer
Jennifer	Arniella	Permasteelisa North America
Francisco	Bolanos	Beckman Coulter
Dania	Castillo	HDR
Dayron	Chigin	Florida Power & Light
Joel	McGill	BND Engineers
Lucas	Nascimiento	Raytheon

DOE Fellows hired by private industry
First Name	Last Name	Employer
Raul	Ordonez	Texas Instruments
Valentina	Padilla	Brown & Caldwell
Mariela	Silva	Conoco Phillips
Gabriela	Vazquez	Florida Power & Light
Revathy	Venkataraman	TradeStation
Michael	Abbott	Magic Leap Inc
Michelle	Embon	Kimley-Horn and Associates, Inc.
Mariana	Evora	King Engineering Associates, Inc
Eduardo	Garcia	UTC Aerospace Systems
Steve	Noel	Goldman Sachs
Sasha	Philius	HaikuTech Europe B.V.
Brian	Castillo	StryKer
John	Conley	Florida Power & Light
Andrew	De La Rosa	Lockheed
Jorge	Deshon	Lockheed
Maria	Diaz	Nova Consulting Inc.
Maximiliano	Edrei	Huntington Ingalls Newport News Shipbuilding Company
Janesler	Gonzalez	Velossa Tech
Meilyn	Planas	Florida Power & Light
Ryan	Sheffield	Applied Physics Laboratory
Aref	Shehadeh	Nova Consulting Inc.
Alexis	Smooth	Nexant
Sebastian	Zanlongo	Johns Hopkins University, Applied Physics Laboratory
Michael	DiBono	Microsoft
Ron	Hariprashad	RS&H
Ripley	Raubenolt	SCS Engineering
Sarah	Solomon	County of Los Angeles Department of Public Works
Joseph	Coverston	Pennsylvania State University Applied Research Laboratory
Ryan	Cruz	Lockheed
Katherine	Delarosa	Advanced Environmental Laboratories
Christopher	Excellent	FPL
Ximena	Lugo	Kimley-Horn and Associates, Inc.
Joshua	Nuñez	Dayton-Granger, Inc.
Alex	Rivero	General Electric
Jason	Soto	SIA Solutions LLC
Patrick	Uriarte	iRobot
Alexis	Vento	SCS Engineering
Derek	Gabaldon	Rolls-Royace
Gisselle	Gutierrez	Kimley-Horn and Associates, Inc.
Daniel	Martin	FIU's Applied Research Center
Michael	Thompson	Raytheon
Rocio	Trimino Gort	A&P Consulting Transportation Engineers, Corp.

First Name	Last Name	Employer
Adrian	Muino	Lockheed Martin
Eduardo	Rojas	Kinetic Engineering and Accident Reconstruction