YEAR-END TECHNICAL REPORT
September 29, 2018 to September 28, 2019

DOE-FIU Science & Technology Workforce Development Initiative

http://fellows.fiu.edu/

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DOE Fellows

Submitted to:

U.S. Department of Energy
Office of Environmental Management
Under Cooperative Agreement No. DE-EM0000598

FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

Addendum:

This document represents one (1) of four (4) reports that comprise the Year End Reports for the period of September 29, 2018 to September 28, 2019 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-EM0000598. Incremental funding under this cooperative agreement resulted in FIU having to execute carryover scope, which was completed in November 2019. The technical information for the carryover scope from FIU Performance Year 9 has therefore also been included in these reports.

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-2018-800006470-04b-264

Project 2: Environmental Remediation Science and Technology
Document number: FIU-ARC-2018-800006471-04b-263

Project 3: Waste and D&D Engineering and Technology Development
Document number: FIU-ARC-2018-800006472-04b-253

Project 4: DOE-FIU Science & Technology Workforce Development Initiative
Document number: FIU-ARC-2018-800006473-04b-297

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: http://doeresearch.fiu.edu

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PROJECT 4 OVERVIEW

There is a national need for more careers in science, technology, engineering and mathematics (STEM). This shortage is felt not only in the private industry sector but also across many federal agencies. Across the U.S. Department of Energy (DOE) and within DOE Environmental Management (EM), there is a similar critical shortage of entry-level STEM personnel. Only 1% of DOE-EM's workforce is younger than 30 years old. 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 internships programs, apply to DOE contractors, pursue post masters 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 164 minority FIU STEM students since program inception in 2007 up to the most recent induction ceremony held in November 2019. The DOE Fellows induction ceremonies have been attended by DOE EM officials each year, including Mr. Mark Gilbertson in 2007 all the way to Mr. Kurt Gerdes in 2017 and 2018.

MAJOR ACCOMPLISHMENTS

Major accomplishments of this program to date include:

- Nine (9) DOE Fellows applied to the DOE EMPDC program in 2009 and 2010.
- Six (6) DOE Fellows applied to DOE EM SCEP in spring 2011.
- DOE Fellows, Edgard Espinosa, Charles Castello, and Lee Brady were selected by DOE EM as part of Student Career Experience Program (SCEP) and completed their SCEP assignments.
- DOE Fellow (Edgard Espinosa) was hired by DOE-EM and began working for Nuclear Materials Disposition under the direction of Mr. Gary Deleon.
- DOE Fellow (Charles Castello) was hired by DOE's Oak Ridge National Laboratory under the Alvin M. Weinberg Fellowship program.
- DOE Fellow (Lee Brady) was hired by DOE-EM and began working for D&D and Facility Engineering under the direction of Mr. Andrew Szilagyi.
- DOE Fellow (Rosa Ramirez) was hired into the EM Professional Development Corps program.
- Eleven (11) DOE Fellows joined DOE EM, DOE National Labs and Contractors upon graduating from FIU with bachelors, master's or PhD degrees.
- Eighty-nine (89) other DOE Fellows graduated FIU with bachelors or master's degrees and obtained employment in private industry and government agencies.

First Name	Last Name	Employer
Serkan	Akar	Department of Commerce
Denisse	Aranda	NASA
Danny	Brenner	General Electric
Ramon	Colon	Bouygues Civil Works Florida
Henry	Diaz	Lockheed
Raul	Dominguez	Kimley-Horn and Associates, Inc.
Alex	Henao	Internal Revenue Services
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
Jose	Vazquez	Department of State
Leydi	Velez	PriceSmart Inc
Sandra	Zapata	Johnson & Johnson
Amaury	Betancourt	Florida Department of Environmental Protection
Cindy	Cerna	Naval Sea Systems Command

First Name	Last Name	Employer
Melina	Idarraga	Nova Consulting Inc.
Dasney	Joseph	General Electric
Victor	Uriarte	Intel Corporation
Jennifer	Borges	Florida Department of Transportation
Elsa	Cabrejo	Dade County Environmental Department (Miami, Fla)
Denny	Carvajal	Mount Sinai Medical Center
Rinaldo	Gonzalez Galdamez	Crane Aerospace and Electronics
Nadia	Lima	HJ Foundation
Jose	Matos	Beckman Coulter
Alessandra	Monetti	Department of Defense – Office of the Secretary of Defense, Army Corp of Engineering
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.
Kanchana	Iyer	Department of Health & Human Services
Alexander	Lopez	Florida Department of Transportation
Sheidyn	NG	Regeneron Pharmaceuticals
Shina	Rana	Florida Power & Light
Melissa	Sanchez	Florida Department of Environmental Protection
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
Frank	Silva	Department of State
Jennifer	Arniella	Permasteelisa North America
Francisco	Bolanos	Beckman Coulter
Dania	Castillo	HDR
Dayron	Chigin	Florida Power & Light
Joel	McGill	BND Engineers
Lucas	Nascimiento	Raytheon
Raul	Ordonez	Texas Instruments
Valentina	Padilla	Brown & Caldwell
Mariela	Silva	ConocoPhillips

First Name	Last Name	Employer
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
Kiara	Pazan	U.S. Corps of Engineers
Meilyn	Planas	Florida Power & Light
Ryan	Sheffield	Applied Physics Laboratory
Aref	Shehadeh	Nova Consulting Inc
Jesse	Viera	U.S. Marine Corps
Christine	Wipfli	U.S. Dept of Defense
Sarah	Bird	U.S. Dept of Defense
Alexis	Smooth	Nexant
Christopher	Strand	Civil Engineer - FAA
Sebastian	Zanlongo	The Johns Hopkins University, Applied Physics Laboratory
Mohammed	Albassam	City of Coconut Creek
Michael	DiBono	Microsoft
Ron	Hariprashad	RS&H
Ripley	Raubenolt	SCS Engineering
Sarah	Solomon	Civil Engineering Assistant at County of Los Angeles Department of Public Works
Joseph	Coverston	The Pennsylvania State University Applied Research Laboratory
Ximena	Lugo	Kimley-Horn and Associates, Inc.
Alex	Rivero	GE

- The DOE Fellows program has been featured in national and international newsletters.
- Best Poster Awards at Waste Management Symposia
    - DOE Fellow (Leydi Velez) won Best Professional Poster at WM09
    - DOE Fellow (Denisse Aranda) won Best Student Poster at WM09
    - DOE Fellow (Denny Carvajal) won Best Student Poster at WM10
    - DOE Fellow (Stephen Wood) won Best Student Poster at WM11

    - DOE Fellow (Alexandra Fleitas) won Best Student Poster at WM14
    - DOE Fellow (Christine Wipfli) won Best Student Poster at WM15
    - DOE Fellow (Hansell Gonzalez) won Best Student Poster at WM18
    - DOE Fellow (Michael DiBono) Won Best Undergraduate Student Poster at WM19
- Completed 151 internships at DOE sites, DOE national labs, DOE-HQ, and DOE contractors since 2007
- Over 250 presentations (posters and papers) at Waste Management conferences (2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018 and 2019) and other national and international conferences, including ICEM2013 in Brussels, Belgium
- DOE Fellows supported the Energy Facility Contractors Group (EFCOG) and contributed to the development of 13 Lessons Learned and Best Practices documents
- Development of DOE Fellows web site http://fellows.fiu.edu/ and Facebook page
- DOE Fellow Christine Wipfli completed a one year internship position with the International Atomic Energy Agency (IAEA), stationed at the agency headquarters in Vienna, Austria
- DOE Fellow Alejandro Fernandez obtained first place at the 2016 Life Sciences South Florida STEM Symposium, competing among 80 posters presented by STEM students representing state colleges and universities in the South Florida area
- The American Nuclear Society (ANS) approved the establishment of an ANS student section at Florida International University (FIU) with DOE Fellows being the key founding members of the chapter
- Two DOE Fellows received the Roy G. Post Foundation Scholarship at the Graduate Student Level awarded by Waste Management Symposium: Robert Lapierre (2014) and Silvina Di Pietro (2016).
- DOE Fellow Alejandro Hernandez received the Roy G. Post Foundation Scholarship at the Undergraduate Student Level awarded by Waste Management Symposium in 2017.
- DOE Fellow Christine Wipfli received the Roy G. Post Foundation Scholarship at the Undergraduate Student Level awarded by Waste Management Symposium in 2018.
- DOE Fellow Manuel Losada received the Roy G. Post Foundation Scholarship at the Undergraduate Student Level awarded by Waste Management Symposium in 2019.

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 field work, 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 labs.

RESULTS AND DISCUSSION

DOE Fellows Entering the Workforce

FIU continued working with DOE Fellows interested in federal jobs. FIU supports our Fellows with identifying federal entry-level career opportunities within DOE and other federal agencies with a particular emphasis on federal positions within DOE EM, the national labs, or DOE tier-1 contractors. FIU also continues to identify those DOE Fellows who are preparing to transition from academia to the workforce within the next year for conducting focused mentoring sessions with those Fellows on resume preparation and the USA Jobs application process.

FIU is proud to announce the transition of our DOE Fellows into the workforce, completing the pipeline of minority scientists and engineers specifically trained and mentored to enter the environmental workforce in technical areas of need. During FIU Performance Year 9, the following DOE Fellows completed the DOE-FIU Science and Technology Workforce

Development Program and accepted positions at federal and local governments as well as private industry.

- Hansell Gonzalez Raymat accepted a job offer from SRNL as a Sr. Scientist at Savannah River Nuclear Solutions in Aiken, SC.

- Upon graduation with a master's degree in mechanical engineering, Joseph Coverston accepted a position in Pennsylvania State University's Applied Research Laboratory as a R&D Engineer II.

- Sarah Solomon accepted a position as an Engineer II with the county of LA's Department of Public Works. Sarah holds a bachelor's degree in environmental engineering.

- Ximena Lugo joined Kimley-Horn associates as a Civil Analyst. Ximena graduated with a bachelor's degree in environmental engineering.

- Ron Hariprashad has accepted a position as a Drainage Engineering Associate - Engineer I with RS&H's Fort Lauderdale office. He started his new job on May 23 where he will work with a team of designers on storm water management, drainage design, hydrologics, hydraulic modeling, water/wastewater design and environmental permitting projects. Ron will continue to work on his master's thesis and expects to graduate in the fall of 2019.

- Ripley Raubenolt has accepted a position as an Associate Professional with SCS Engineering and started her new job on May 31, 2019.

- DOE Fellow Michael DiBono recently accepted a professional position with Microsoft. He graduated with a bachelor's degree in mechanical engineering.

Increasing the Retention of Minority Students in Science, Technology, Engineering, and Math (STEM) Disciplines

A total of **fifty four (54) DOE Fellows** are currently pursing or have pursued/completed master's or Ph.D. STEM degrees at FIU and other institutions. Most of these DOE Fellows started the DOE-FIU Science & Technology Workforce Development Program as undergraduates and were successfully encouraged and prepared to continue on to graduate studies at FIU. The research conducted at ARC, DOE sites, DOE national laboratories, and DOE private contractors serve as the basis for their master's thesis or Ph.D. dissertation topics. Table 1 below shows the DOE Fellows who pursued or completed graduate level work during this performance year. Appendix C includes a list of all past DOE Fellows who pursued graduate level work. In addition, several undergraduate DOE Fellows incorporated their EM applied research into their Senior Design or Capstone Projects at FIU.

Table 1. DOE Fellows in STEM Graduate Programs During Performance Year 9

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM Projects	Year of Graduation
Alexis Vento	Environmental Engineering	Masters	Fate of Actinides in the Presence of Ligands in High Ionic Strength Systems	2021
Amanda Yankcoskie	Environmental Engineering	Masters	Surface Water Modeling of Tims Branch	2020

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM Projects	Year of Graduation
Edward Nina	Mechanical Engineering	Masters	Evaluation of pipeline flushing requirements for HLW at Hanford and Savannah Rive	2020
Hansell Gonzalez-Raymat	Chemistry	Ph.D.	Unrefined humate solution as a potential low-cost remediation method for groundwater contaminated with heavy metals	2018
Jason Soto	Mechanical Engineering	Masters	LiDAR Mapping & Surveillance of Nuclear Infrastructure	2020
Jeff Natividad	Mechanical Engineering	Masters	Evaluation of Coatings for the H-Canyon Exhaust Tunnel	2021
Joseph Coverston	Mechanical Engineering	Masters	Evaluation of Pipeline Flushing Requirements for HLW at Hanford and Savannah River	2019
Joshua Núñez	Mechanical Engineering	Masters	Applications of intumescent technologies in support of D&D across the DOE complex	2019
Juan Morales	Public Health	Ph.D.	Accumulated Metalloestrogens Analysis for Health Risk Assessment and Watershed Toxicology Management in Tims Branch, SRS	2019 (anticipated)
Michael Thompson	Electrical Engineering	Masters	Pipeline Corrosion and Erosion Evaluation	2020
Roger Boza	Computer Science	Ph.D.	Analysis of Image Data using Machine Learning/Deep Learning and Big Data Technologies	2023 (anticipated)
Ron Hariprashad	GeoScience Hydrogeology	Masters	Modeling of Surface Water Flow and Contaminant Transport in the Tims Branch Ecosystem	2020 (anticipated)
Ryan Cruz	Cyber Security	Masters	Non-Thesis Option	2019
Silvina Di Pietro	Chemistry	Ph.D.	Ammonia Gas Treatment for Uranium Immobilization at DOE Hanford's Site	2021 (anticipated)
Tristan Simoes-Ponce	Mechanical Engineering	Masters	D&D Technology Demonstration & Development and Technical Support to SRS's 235-F Facility Decommissioning	2020 (anticipated)

DOE Fellows Recruitment & Selection

DOE Fellows fall 2018 recruitment efforts were initiated on August 27, 2018. Recruitment campaigns were conducted by placing recruitment tables at the College of Engineering and at the main FIU campus in the physics, chemistry and computer science buildings. A signup sheet was used to collect contact information from interested students and emails were sent out with information on requirements and components of the program along with application instructions and a checklist. The deadline for FIU students to submit applications for DOE Fellowships was September 26, 2018, and a total of 12 applications were received. The DOE Fellows selection committee, comprised of ARC researchers and staff, reviewed the applications and recommended FIU students for formal interviews. Dr. Leonel Lagos (Program Director) subsequently asked for the committee's input and recommendations to make the final selections and complete the recruitment process. Seven (7) students from the fall recruitment were selected to join the program as DOE Fellows Class of 2018.

Table 2. DOE Fellows Class of 2018

First Name	Last Name	Major	Degree
Roger	Boza	Computer Science	PhD
David	Mareno	Computer Engineering	BS
Jorge	Montesino	Civil Engineering	BS
Jose	Rendon	Mechanical Engineering	BS
Alex	Rivero	Computer Science	BS
Jason	Soto	Mechanical Engineering	MS
Alexis	Suarez	Environmental Engineering	BS
Patrick	Uriarte	Mechanical Engineering	BS
Alexis	Vento	Environmental Engineering	BS
Amanda	Yancoskie	Environmental Engineering	BS

For DOE Fellows class of 2019, FIU conducted two recruitment sessions one in spring 2019 and another in fall 2019. The spring 2019 recruitment efforts for new DOE Fellows was initiated in January 2019, and applications were accepted from January 14 through February 6. A review of the applications was conducted after the close of the application window. Fifteen (15) students were selected for interviews, conducted from February 19 through February 22. Seven (7) FIU students were selected to join the DOE Fellows program. Fall 2019 recruitment efforts were conducted to identify and select new DOE Fellows, the recruitment ran from September 2 to September 20, 2019 with 24 applications received and reviewed by ARC researchers and staff. Twelve (12) students were selected for interviews held on October 23-24. 2019. Five (5) FIU students were selected to join to the program as DOE Fellows Class of 2019 along with seven (7) students hired in spring. The DOE Fellows Class of 2019 were formally inducted into the program on November 7, 2019.

Table 3. FIU Students Hired as DOE Fellows during Spring 2019 Recruitment

First Name	Last Name	Major	Degree
Derek	Gabaldon	Mechanical Engineering	BS
Gisselle	Gutierrez	Environmental Engineering	BS
Daniel	Martin	Electrical Engineering	BS
Aurelien	Meray	Computer Science	BS
Philip	Moore	Mechanical Engineering	BS

First Name	Last Name	Major	Degree
Jeff	Natividad	Mechanical Engineering	BS
Edward	Nina	Mechanical Engineering	MS
Anilegna	Nunez Abreau	Mechanical Engineering	BS
Heliy	Revoll	Civil Engineering	BS
Michael	Thompson	Electrical Engineering	MS
Rocio	Trimino-Gort	Environmental Engineering	BS
Nathalie	Tuya	Environmental Engineering	BS

Each new DOE Fellow was assigned to an ARC staff member to act as their mentor and supervise their EM research work. Orientation for the new DOE Fellows was conducted and the new Fellows completed FIU's Environmental Health & Safety courses required by the university and ARC prior to conducting any work in ARC's lab facilities. The new DOE Fellows also created a brief bio to include on the DOE Fellows website.

DOE Fellows Internships

The DOE Fellows program director completed coordination for placement of DOE Fellows for summer internships. During summer 2019, thirteen (13) DOE Fellows participated in 10-week internships as part of the DOE-FIU Cooperative Agreement and two (2) DOE Fellows participated in summer internships sponsored by hosting institutions (i.e., INL, LLNL). The summer 2019 internships and technical report titles are provided below.

Table 4. Summer 2019 Internships

DOE Fellow	Internship Location	Internship Mentor(s)	Report Title
Alejandro Koszarycz	SRNL	Patricia Lee	Risk Model for EM Decision Support Toolsets
Alexis Suarez	DOE-HQ	Skip Chamberlin	Contributing to the DOE EM 4.1 and 4.12, Office of Groundwater and Subsurface Closure
Alexis Vento	SNL	Amelia Hayes	Well density Characterization/Profile
Amanda Yancoskie	SRNL	Grace Maze	2D Dam-Break Analysis of L Lake and PAR Pond Dams Using HEC-RAS
Anilegna Nunez Abreau	DOE-HQ	Skip Chamberlin	An Assessment of Long-Term Monitoring Strategies and Developing Technologies
Frances Zengotita*	LLNL	Enrica Balboni	Plutonium Migration from Estuary Sediments (Ravenglass, UK)
Jason Soto	WRPS	Matthew Garlick	Test Bed Initiative (TBI)
Juan Morales	ANL	Pamela Weisenhorn	Analyzing soil microbial communities from Tims Branch watershed exposed to heavy metals
Katherine De La Rosa &	SRNL	Brian Looney	Innovative Systems for Mercury Speciation

DOE Fellow	Internship Location	Internship Mentor(s)	Report Title
Silvia Garcia			
Patrick Uriarte	WRPS	Ruben Mendoza	Double Shelled Tank Visual Inspections
Roger Boza	INL	Mike Griffel	Subtle Process Anomalies Detection using Machine Learning Methods
Ryan Cruz*	INL	Tammie Borders	Nuclear Cyber Ontology: Blueprint for Success in the Digital Tapestry
Silvina Di Pietro	LLNL	Mavrik Zavarin	Neptunium (IV) Diffusion Rates through Bentonite Clay
Tristan Simoes-Ponce	SRNL	James Nicholson	Mechanical Properties of Permanent Foaming Fixatives for D&D Activities

* Sponsored by hosting institution

Figure 1. Summer 2019 Interns (DOE Fellows) with program manager Dr. Ravi Gudavalli (left) and program director Dr. Leonel Lagos (center).

As a part of the summer internship 2019, DOE Fellows Katherine De La Rosa and Silvia Garcia had an opportunity to travel to Oak Ridge National Laboratory (ORNL) between July 7th - July 15th to deploy DGTs at Horizons Creek, NOA Creek and Burners Creek in East Fork Poplar Creek (EFPC). During this trip they also collected water samples for microcolumn experiments.

During July 22nd - 24th, DOE Fellows Alexis Suarez and Anilegna Nunez visited SRNL in order to review the long term monitoring plan that is being pursued by SRS and the remediation and monitoring progress occurring in F-area. During this visit, they were provided a detailed site tour and got the chance to speak with Dr. Brian Looney and Ms. Carol Eddy-Dilek about their current projects at HQ. Dr. Looney gave insight on how to further develop an ROI index for the use of the Direct Mercury Analyzer instrument in total mercury analysis, while Ms. Eddy-Dilek was able to guide them through how to develop an effective ROI index based off the new Long Term Monitoring Paradigm.

Figure 2. Dr. Looney giving a tour of SRNL to DOE-HQ interns.

DOE Fellows who participated in summer internships at Savannah River National Laboratory presented their research accomplishments during a poster session held on July 24th 2019. Below are a few pictures from this event.

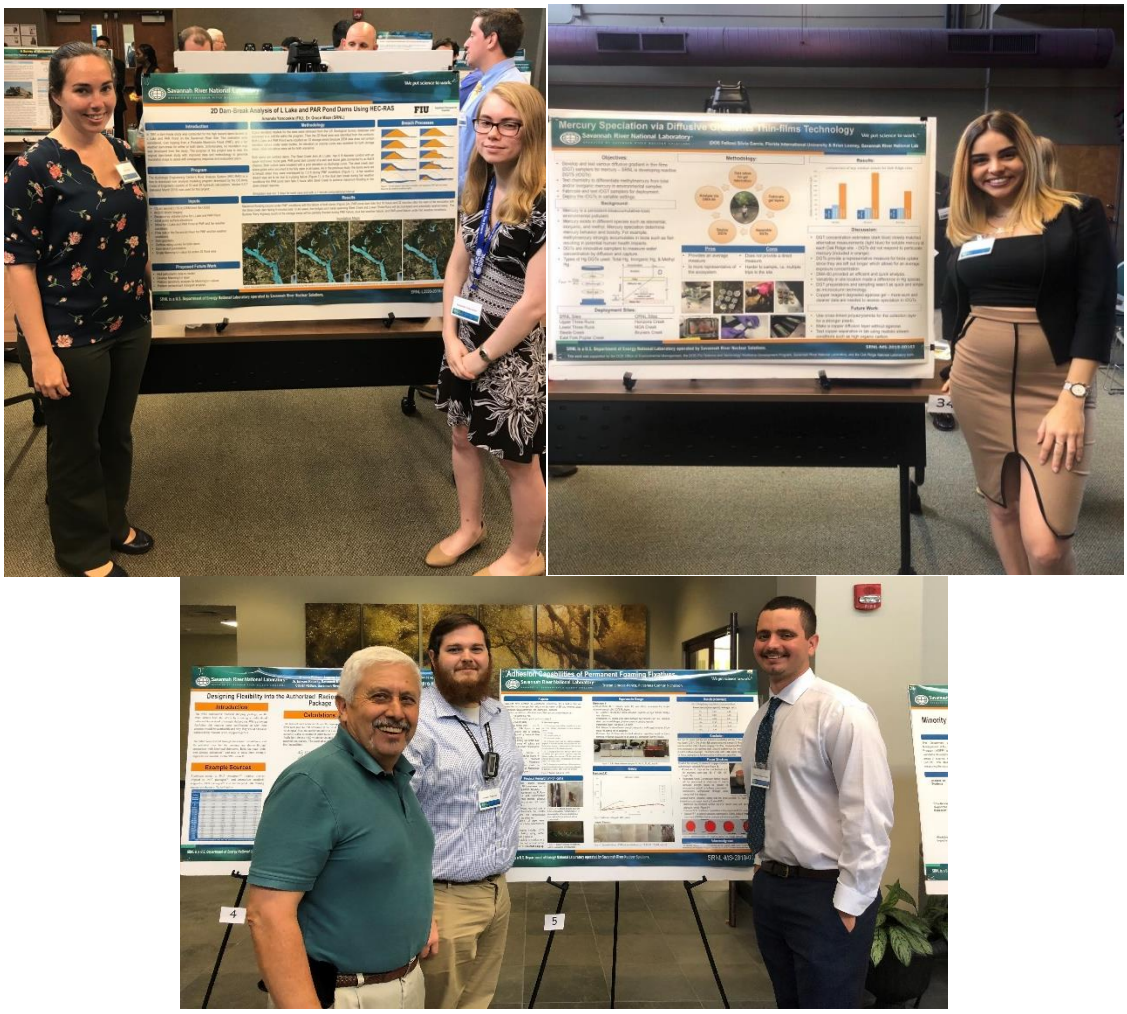

Figure 3. DOE Fellows presenting posters at SRNL intern's poster exhibition.

DOE Fellows interning at SRNL participated in a poster exhibition, presenting their summer research efforts, on July 24th, 2019. Poster titles included the following:

- Tristan Simoes-Ponce - Adhesion Capabilities of Permanent Foaming Fixatives
- Katherine Delarosa - Mercury Speciation via micro columns
- Amanda Yancoskie- 2D Dam-break Analysis of L Lake and PAR Pound Dams Using HEC-RAS
- Silvia Garcia - Mercury Speciation Via Diffusive Gradients Thin-films Technology
- Alejandro Koszarycz - Risk Model for EM Decision Support Toolsets

DOE Fellows Poster Exhibition and Competition

FIU conducted the 12th and 13th annual DOE Fellows Poster Exhibition and Competition on November 14, 2018 and November 6, 2019 respectively. The purpose of this event was to showcase the DOE Fellows' research accomplishments and their participation in various DOE EM related applied research projects. A total of seventeen (17) posters were exhibited during the 2018 poster exhibition, while twenty-one (21) posters were showcased during the 2019 poster exhibition. Some of the projects showcased by the students were a result of their summer internship assignments and additional posters reflected the DOE Fellows' DOE EM applied research that they conduct at ARC as part of the DOE-FIU Cooperative Agreement sponsored research. For some of the graduate students, these projects are also a part of their thesis towards a master's or Ph.D. degree. During 2018, Ms. Genia McKinley (DOE EM 3.2), Dr. Vicky Freedman (PNNL), Dr. Michael Shields (TRMC), and Dr. Inés Triay (ARC Executive Director) served as the panel of judges. During 2019, Mr. Jean Pabon (DOE EM 3.2), Dr. Johnbull Dickson, Dr. Marissa Morales-Rodriguez (ORNL), and Dr. Inés Triay (ARC Executive Director) served as the panel of judges.

The poster titles and DOE Fellow presenters during the 2018 poster exhibition:

1. Big Data Analytics to Solve DOE EM Challenges - Savannah River Site (SRS) Aiken, SC
   Alejandro Koszarycz
2. Performance Evaluation of Augmented Teleoperation of Contact Manipulation
   Anibal Morales
3. Pipe Crawling Activity Measurement System
   Christopher Excellent
4. Real-time Erosion-Corrosion Detection in Waste Transfer Pipelines
   Clarice Davila
5. Transport of Cesium as Bio-colloids in a High Ionic Strength System
   Frances Zengotita
6. Characterization of Thermal Properties of Intumescent Foams for D&D
   Joshua Nunez
7. Interagency Radiological and Chemical Management Involving Human Health Reference Dose and Risk
   Juan Morales
8. Mercury Speciationvia Direct Mercury Analyzer
   Katherine Delarosa

9. Portable Ultrasonic Thickness Measurement System
   Manuel Losada
10. Miniature Motorized Inspection Tool For DOE Hanford Site Tank Bottoms
    Michael DiBono
11. Investigating the Effect of Sorbed Humic Acid on the Mobility of Uranium
    Ripley Raubenolt
12. Remote Surface Water Flow Monitoring in the Tims Branch Watershed
    Ron Hariprashad
13. Authentication Protocol for ICS without Encryption
    Ryan Cruz
14. Informative Path Planning for Robotic Inspection of Rad Environments
    Sebastian Zanlongo
15. Impacts of Base Treatment to Local Mineralogy
    Silvina Di Pietro
16. Mechanical Properties of Polyurethane Foam for D&D Activities
    Tristan Simoes-Ponce
17. Iodine Co-precipitation with Calcium Carbonate
    Ximena Lugo

Figure 4. 2018 Poster Competition and Exhibition participants and judges.

Figure 5. DOE Fellows presenting posters at the 12th annual DOE Fellows poster exhibition (2018).

The poster titles and DOE Fellow presenters during the 2019 poster exhibition:

1. Big Data Analytics Framework Ecosystem
   Alejandro Koszarycz
2. Accelerated Aging of Concrete for the Evaluation of Coatings to Protect the HCAEX Tunnel at the Savannah River Site
   Anilegna Nunez Abreu
3. Development of a Crawler for the Inspection of the secondary liners of The Double shell tanks at Hanford
   Christopher Excellent
4. The design and implementation of the Mini Rover Egg
   Daniel Martin
5. Machine Learning Algorithms for Structural Health Monitoring
   David Mareno
6. Evaluation of Sinkhole Extraction Methods Using High Resolution Digital Elevation Models
   Gisselle Gutierrez
7. Mercury Speciation via Micro Column Extraction
   Katherine De La Rosa
8. Miniature Robotic Inspection Tool, Movement and Design Optimization
   Patrick Uriarte

9. Iodine Co-Precipitation with Calcium Carbonate in the Presence of Silica Ions
   Rocio Trimino Gort
10. Investigation and Analysis of Dolomite Dissolution in Variable Strength Systems Relevant to the WIPP
    Alexis Vento
11. 2D Dam-Break Analysis of L Lake and PAR Pond Dams Using HEC-RAS
    Amanda Yancoskie
12. Experimental Test Loop To Determine New Flushing Requirements for Radioactive Waste
    Edward Nina
13. Cesium Extraction From Nuclear Waste: Test Bed Initiative (TBI)
    Jason Soto
14. Robotic System For The Application Of Coatings In The Savannah River Site H-canyon Exhaust Tunnel
    Jeff Natividad
15. The Applications of Intumescent Technologies in Support of D&D Activities Across the DOE Complex
    Joshua Núñez
16. Amplicon Sequencing Assessment to Measure Microbial Community Response from Heavy Metal Contaminated Soils in Savannah River Site, Tims Branch Watershed
    Juan Morales
17. Advanced Fiber Optic and Ultrasonic Sensor Systems For Structural Health Monitoring of Pipes in Nuclear Waste Sites
    Michael Thompson
18. Deep Learning Implementation for Structural Health Monitoring of Nuclear Facility
    Roger Boza
19. Nuclear Cyber Ontology: Blueprint for Success in the Digital Tapestry
    Ryan Cruz
20. Can We Isolate Nuclear Waste? Neptunium(IV) Diffusion through Bentonite Clay
    Silvina Di Pietro
21. Adhesion Capabilities of Permanent Foaming Fixatives for Deactivation & Decommissioning Activities
    Tristan Simoes-Ponce

Figure 6. The 2019 Poster Competition and Exhibition participants and judges.

Figure 7. DOE Fellows presenting posters at the 13th Annual DOE Fellows Poster Exhibition (2019).

DOE Fellows Induction Ceremony

FIU's Science & Technology Workforce Development Program (DOE Fellows program) inducted ten (10) very talented FIU STEM students as the DOE Fellows Class of 2018 on November 15, 2018. These new DOE Fellows join the other 20 DOE Fellows already participating in the program. The 12th annual DOE Fellows Induction Ceremony was attended by representatives from the DOE EM, Mr. Kurt Gerdes and Ms. Genia McKinley, along with

representatives from DOE's Office of Economic Impact and Diversity, Mr. James Campos, FIU Dean of Engineering (Dr. John Volakis), FIU Associate VP for Research (Dr. Luis Salas), FIU faculty, ARC leadership and staff members, and current and former DOE Fellows.

Table 5. DOE Fellows Class 2018

DOE Fellow	Degree	Major Area of Study
Roger Boza	PhD	Computer Science
David Mareno	BS	Computer Engineering
Jorge Montesino	BS	Civil Engineering
Jose Rendon	BS	Mechanical Engineering
Alex Rivero	BS	Computer Science
Jason Soto	MS	Mechanical Engineering
Alexis Suarez	BS	Environmental Engineering
Patrick Uriarte	BS	Mechanical Engineering
Alexis Vento	BS	Environmental Engineering
Amanda Yancoskie	BS	Environmental Engineering

Kurt Gerdes, Director for the Office of Subsurface Closure (EM 4.12), was one of the keynote speakers for the induction ceremony. Mr. Gerdes and the other distinguished guests had the opportunity to participate in morning tours of the ARC research laboratories and hear DOE Fellows presenting their research work. Presentations were given by Dr. Lagos and DOE Fellows Michael DiBono, Ximena Lugo, and Juan Morales. Tours of the ARC facilities included visits to the ARC outdoor test and evaluation facility for a demonstration on the intumescent coatings and foams research; the radiological laboratory; multi-functional indoor testing facility; the GIS, modeling & simulation laboratory; the soil and groundwater laboratory; the environmental technology laboratory; and the robotics and sensors laboratory.

Awards for the DOE Fellows Poster Exhibition and Competition were presented at the induction ceremony. First place was awarded to Mr. Anibal Morales; second place went to Mr. Tristan Simoes-Ponce, and two third place awards went to Ms. Ripley Raubenolt and Ms. Silvina Di Pietro. 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 2018 Mentor of the Year Award went to Dr. William Tan (Research Scientist at ARC) and the DOE Fellow of the Year Award was presented to Ms. Katherine Delarosa (DOE Fellow Class of 2017).

Figure 8. DOE Fellows showcasing their research during the lab tours.

Figure 9. New DOE Fellows at the 2018 Induction Ceremony.

Figure 10. Poster competition first place award recipient

Figure 11. Dr. William Tan DOE Fellow mentor of the year for 2017.

Figure 12. Ms. Katherine Delarosa, DOE Fellow of the year for 2018.

FIU's Science & Technology Workforce Development Program (DOE Fellows program) inducted twelve (12) very talented FIU STEM students as the DOE Fellows Class of 2019 on November 7, 2019. The 13th Annual DOE Fellows Induction Ceremony was attended by representatives from DOE-EM, including Mr. Leonard H. O. Spearman Jr. and Mr. Jean Pabon, along with representatives from DOE's Office of Legacy Management, including Mr. Carmelo Melendez. Also in attendance were FIU leadership including the FIU Provost, Executive Vice President and Chief Operating Officer (Dr. Kenneth Furton), FIU's Vice President for Research & Economic Development & Dean of the University Graduate School (Dr. Andres Gil), FIU's Dean of Engineering (Dr. John Volakis), as well as FIU faculty, ARC leadership and staff members, and current and former DOE Fellows.

Table 6. New DOE Fellows Class of 2019

DOE Fellow	Degree	Major Area of Study
Derek Gabaldon	BS	Mechanical Engineering
Gisselle Gutierrez	BS	Environmental Engineering
Daniel Martin	BS	Electrical Engineering
Aurelien Meray	BS	Computer Science
Philip Moore	BS	Mechanical Engineering

DOE Fellow	Degree	Major Area of Study
Jeff Natividad	MS	Mechanical Engineering
Edward Nina	MS	Mechanical Engineering
Anilegna Nunez Abreu	BS	Mechanical Engineering
Heily Revoll Caballero	BS	Civil Engineering
Michael Thompson	MS	Electrical Engineering
Rocio Trimino Gort	BS	Environmental Engineering
Nathalie Tuya	BS	Environmental Engineering

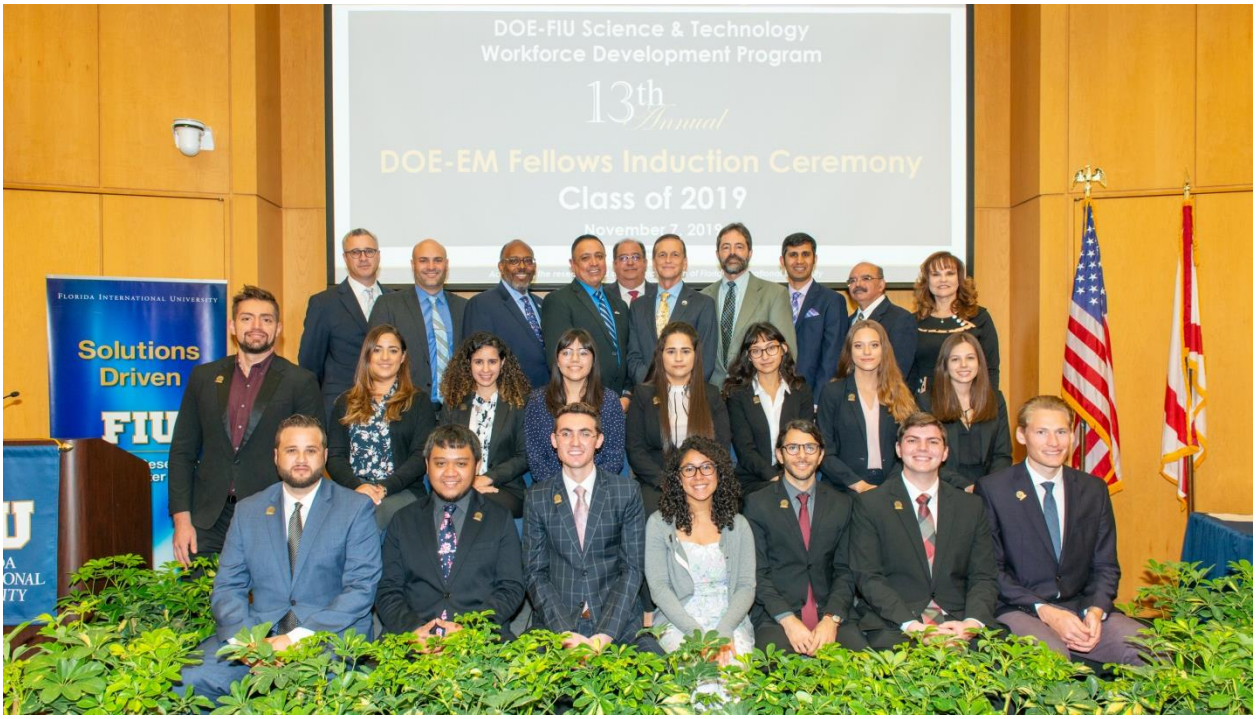

Figure 13. DOE Fellows Class of 2019 with DOE and FIU officials.

Mr. Leonard Spearman, Jr., Senior Advisor to the Assistant Secretary (EM), was one of the keynote speakers for the induction ceremony. Mr. Spearman from DOE-EM, Mr. Melendez from DOE-LM and the other distinguished guests had the opportunity to participate in morning tours of the ARC research laboratories and hear DOE Fellows presenting their research work. Presentations were given by Dr. Lagos and DOE Fellows Silvina DiPietro, Tristan Simoes-Ponce and Roger Boza. Tours of the ARC facilities included visits to the radiological laboratory; multi-functional indoor testing facility; the GIS, modeling & simulation laboratory; the soil and groundwater laboratory; the environmental technology laboratory; and the robotics and sensors laboratory.

Figure 14. DOE Fellows highlighting their research during the lab tours.

Awards for the DOE Fellows Poster Exhibition and Competition were presented at the induction ceremony. Below is the list of awards for each category:

Session I (Undergraduate posters):

2nd Place: Anilegna Nunez Abreu "Accelerated Aging of Concrete for the Evaluation of Coatings to Protect the HCAEX Tunnel at the Savannah River Site"

2nd Place: Katherine De La Rosa "Mercury Speciation via Micro Column Extraction"

1st Place: Christopher Excellent "Development of a Crawler for the Inspection of the secondary liners of The Double shell tanks at Hanford"

Session II (Graduate posters):

2nd Place: Roger Boza "Deep Learning Implementation for Structural Health Monitoring of Nuclear Facility"

2nd Place: Tristan Simoe-Ponce "Adhesion Capabilities of Permanent Foaming Fixatives for Deactivation & Decommissioning Activities"

1st Place: Michael Thompson "Advanced Fiber Optic and Ultrasonic Sensor Systems For Structural Health Monitoring of Pipes in Nuclear Waste Sites"

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 the Mentor of the Year award, and the ARC mentors were requested to nominate DOE Fellows for the Fellow of the Year award. The 2019 Mentor of the Year Award went to Dr. Yelena Katsenovich (Research Scientist at

ARC) and the DOE Fellow of the Year Award was presented to Mr. Tristan Simoes-Ponce (DOE Fellow Class of 2017).

Figure 15. DOE Fellows poster winners and Mentor and Fellow of the Year with Dr. Leonel Lagos, Dr. Inés Triay and Dr. Ravi Gudavalli.

DOE Fellows Conference Participation

Waste Management Conference 2019

DOE Fellows attended and participated in the Waste Management 2019 Symposia (WM19) in Phoenix, AZ, from March 3-7, 2019. The DOE Fellows completed technical posters, presentation materials, written biographies, and resumes for the WM conference to introduce themselves and their research. A total of sixteen (16) DOE Fellows attended WM19 and presented technical posters during Session 35 (Student Posters: The Next Generation - Industry Leaders of Tomorrow) on Monday, March 4, 2019. The posters presented the DOE-EM research that they have performed at FIU's ARC and during their summer internships at DOE sites, HQ, and national research laboratories, in the research areas of high level waste/waste processing, soil and groundwater modeling and remediation, and deactivation and decommissioning. The DOE Fellow posters and FIU student posters presented during the Student Poster Competition at WM19 are listed below.

Christopher Excellent: Development of a Peristaltic Crawler for the Inspection of the HLW Tanks at Hanford - 19638

Michael DiBono: Miniature Motorized Inspection Tool for DOE Hanford Site Tank Bottoms - 19658

Silvia Garcia, Hilary Emerson: Impact of Photodegradation of SRS Wetland Sediments on Radionuclide Mobility - 19689

Ximena Lugo, Yelena Katsenovich: Iodine Co-precipitation Process with Calcium Carbonate - 19624

Katherine Delarosa: Protocol Development for Monitoring Methylmercury and Mercury Speciation of Water Samples via DMA-80 - 19636

Alejandro Koszarycz, Himanshu Upadhyay, Leonel Lagos: Big Data Analytics to solve EM Challenges - 19666

Tristan Simoes-Ponce: Characterizing the Mechanical Properties of Polyurethane Foam - 19635

Joshua Nunez, Joseph Sinicrope, Leonel Lagos The Characterization of Thermal Properties of Intumescent Foams for D&D Activities - 19649

Ron Hariprashad: Quantifying Groundwater/Surface Water Interaction in the Tims Branch Stream, Savannah River Site, SC - 19637

Silvina Di Pietro, Hilary Emerson, Yelena Katsenovich: Potential for Mineral Transformations following Base Treatment for Remediation - 19660

Juan Morales: Contrast of Cultures in Interagency Radiological Management Involving Human Health Reference Dose - 19642

Ryan Cruz, Himanshu Upadhyay: Authentication Protocol for Industrial Control Systems without Encryption - 19626

Christopher Suarez, **Manuel Losada**, Jean Plummer, William Wells, Conor McMahon, Julian Benitez-Muniz: Savannah River Site H-Canyon Tunnel Inspection LiDAR Mapping Solution - 19477

Jason Soto, Anthony Abrahao, Himanshu Upadhyay, Leonel Lagos: LiDAR Mapping & Surveillance of Nuclear Infrastructure - 19717

Mackenson Telusma, Yew Teck Tan, Dwayne McDaniel, Leonel Lagos: Surface Contact Adhesion Force Control via Sensor Fusion and PID Controller - 19715

Abraham Gebru, Hilary Emerson, Daria Boglaienko, Yelena Katsenovich, Tatiana Levitskaia: Reduction Kinetics of Technetium (Tc) by Aged Zero Valent Iron(ZVI) - 19528

Figure 16. WM19 student poster session.

DOE Fellow Michael Di Bono won the best undergraduate student poster award for his poster titled "Miniature Motorized Inspection Tool for DOE Hanford Site Tank Bottoms", and FIU's graduate student Mackenson Telusma won the best graduate student poster award for his poster titled "Surface Contact Adhesion Force Control via Sensor Fusion and PID Controller." Both were awarded with a cash prize during the WM2019 Conference Honors and Awards Luncheon.

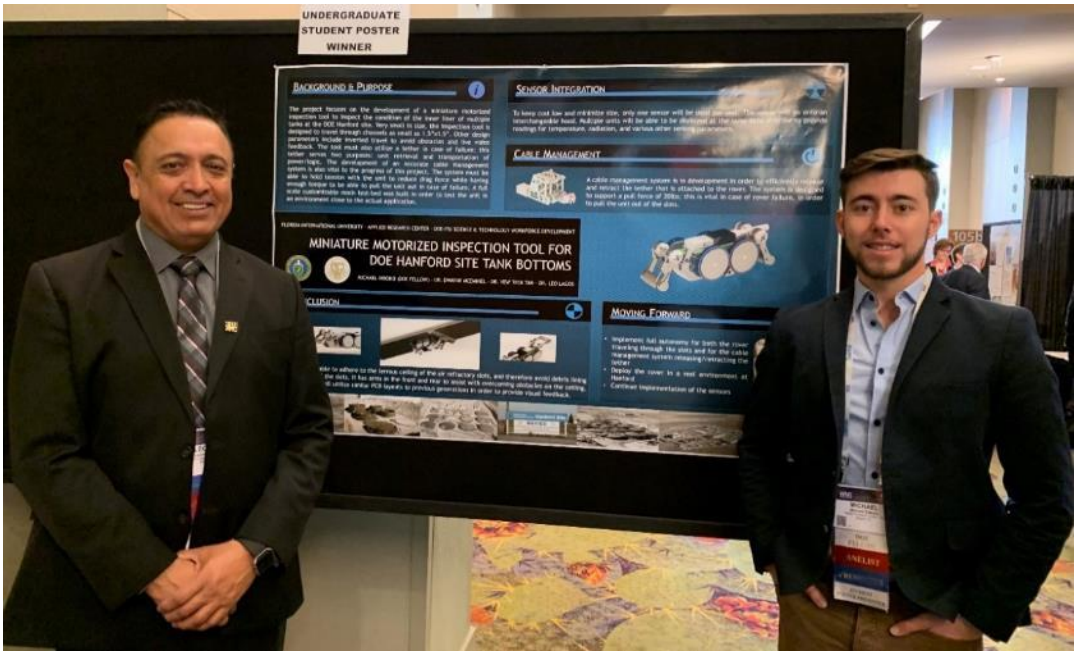

Figure 17. WM19 Undergraduate Student Poster Winner - Michael Di Bono with Dr. Leonel Lagos DOE Fellows program Director.

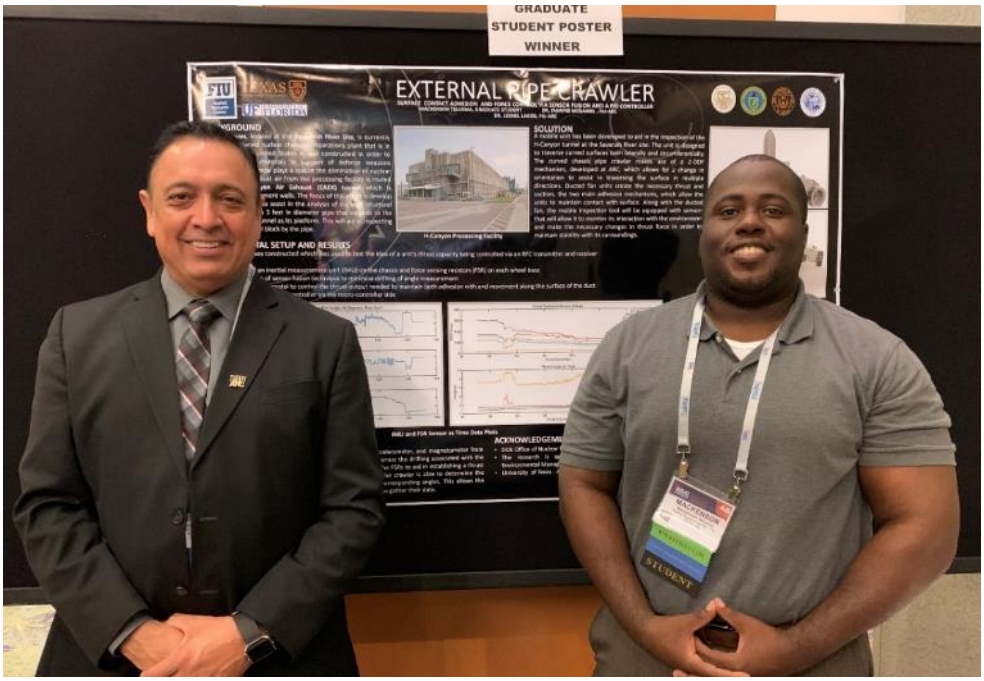

Figure 18. WM19 Graduate Student Poster Winner - Mackenson Telusma with Dr. Leonel Lagos DOE Fellows program Director

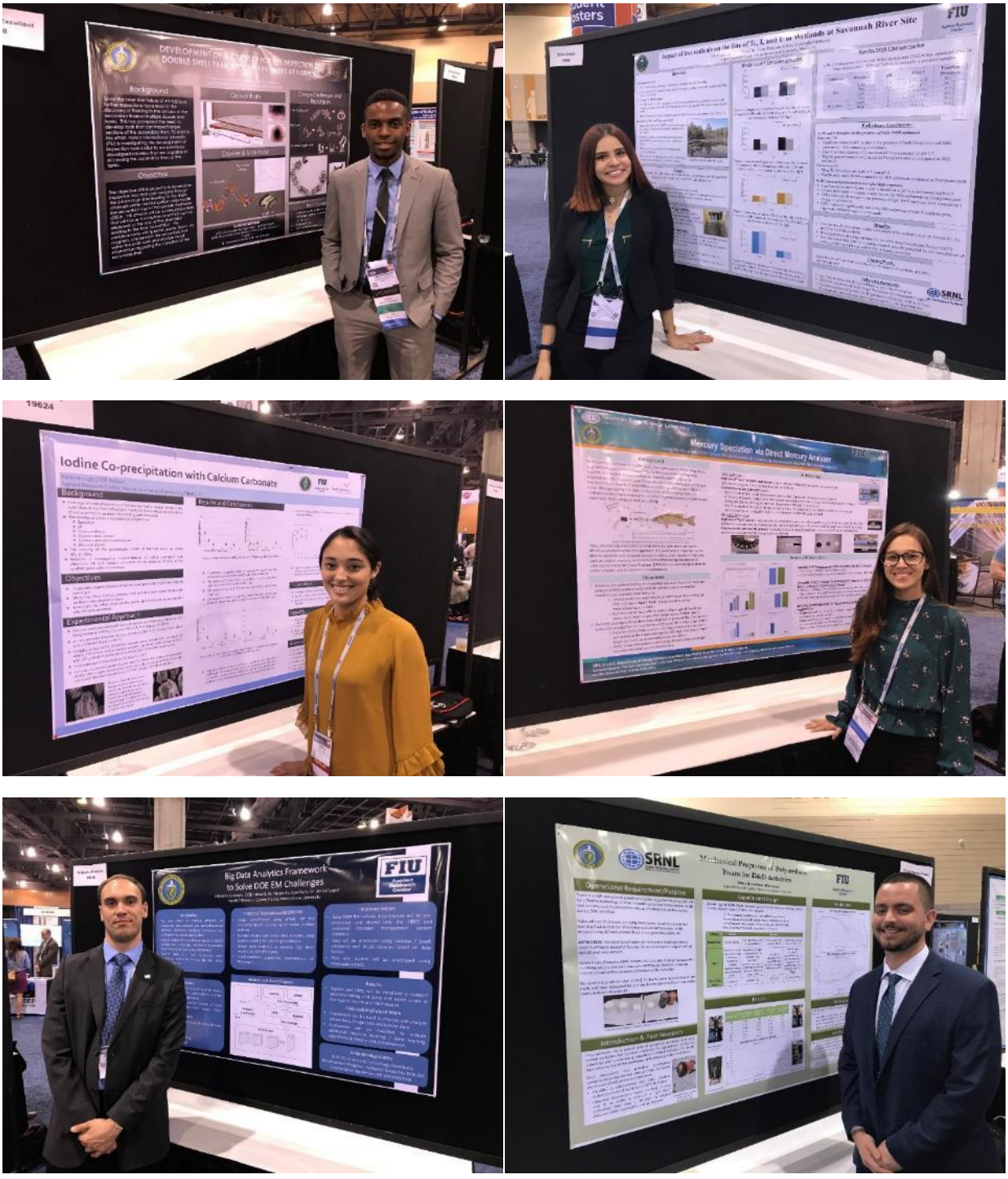

Figure 19. DOE Fellows presenting their student posters at WM19.

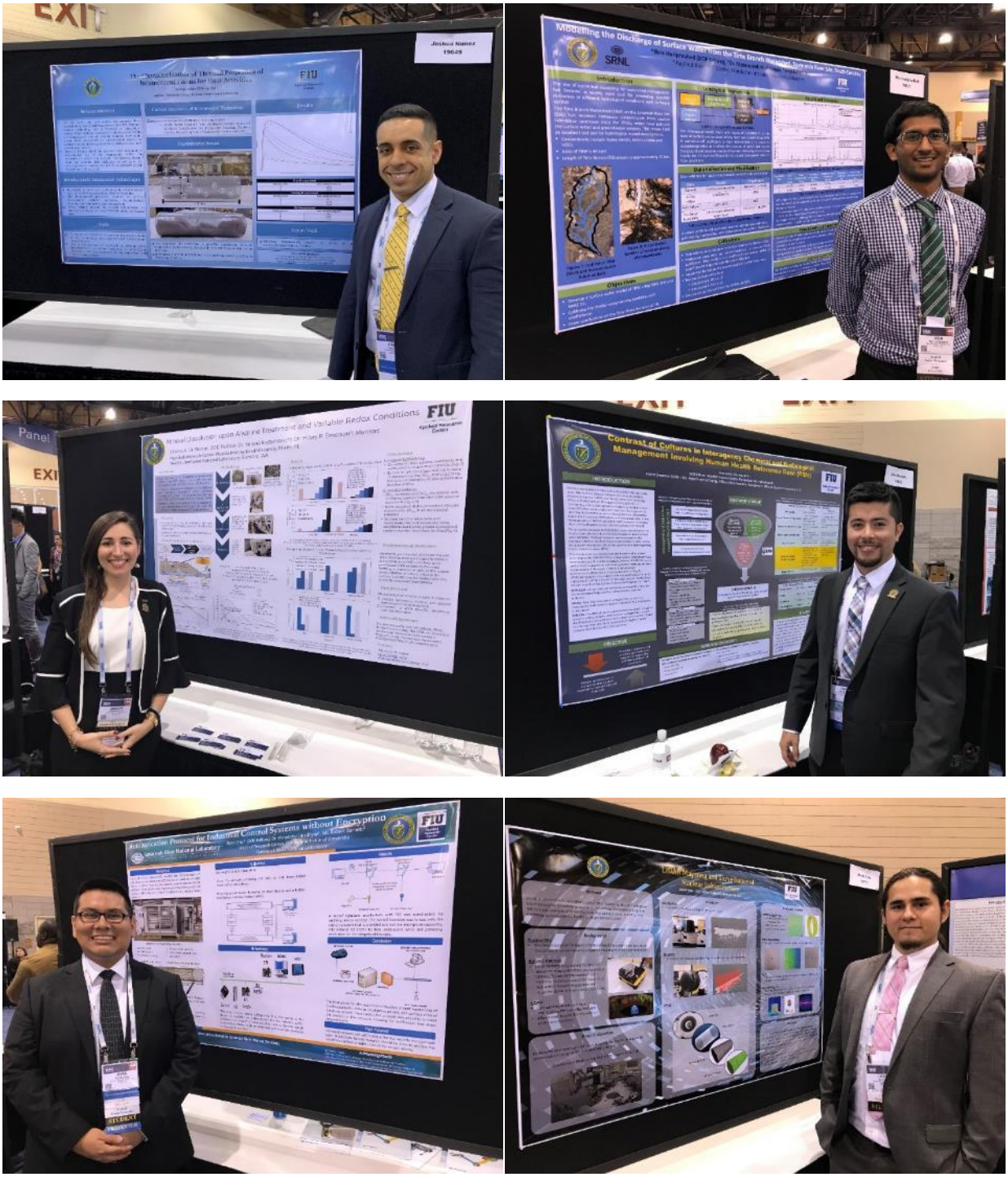

Figure 20. Additional DOE Fellows presenting their student posters at WM19.

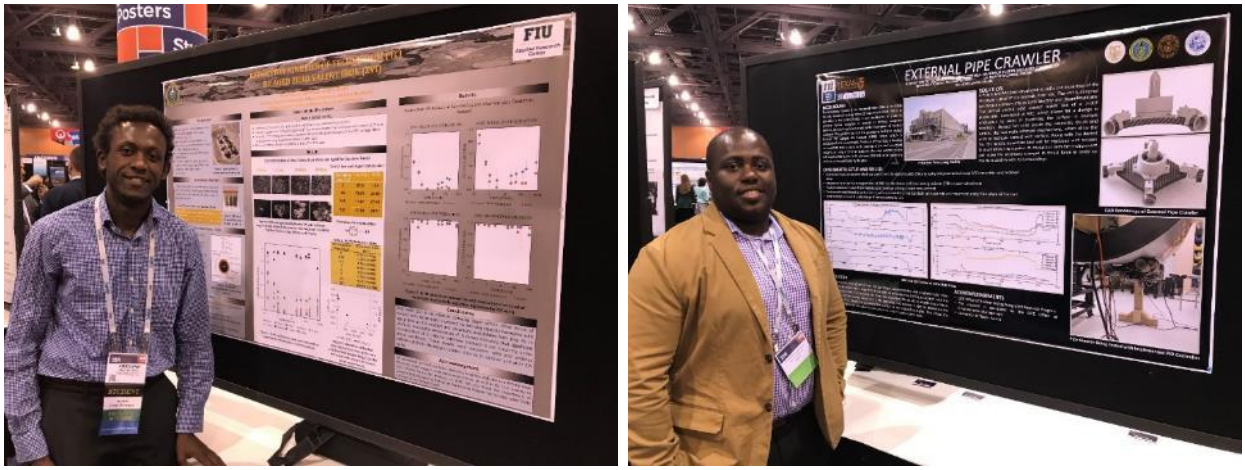

Figure 21. FIU students (non-DOE Fellows) presenting their posters at WM19.

Three DOE Fellows delivered oral and poster presentations under professional tracks for WM19 and four DOE Fellows participated in panel discussions at the conference:

Table 7. Student Panelists and Professional Presentations at WM2019

Panel: Graduating Students and New Engineers - Wants and Needs *Ximena Lugo (panelist), Silvina Di Pietro (panelist), Ron Hariprashad (panel reporter)*
Panel: Young Professionals in Nuclear Science and Engineering an International Perspective *Ron Hariprashad (panel reporter)*
Panel: Nuclear and Industrial Robotics, Remote Systems and Emerging Technologies *Michael DiBono (panelist)*
Effect of Minerals on the Removal of U(VI) in the Presence of Humic Acid and Colloidal Silica ***Katherine Delarosa**, Ravi Krishna Prasanth Gudavalli, Yelena Katsenovich*
Applications of Intumescent Technologies in Support of D&D Activities across the DOE Complex ***Joshua Nunez**, Joseph Sinicrope, FIU; James Nicholson, SRNL*
Development of a Semi-autonomous Miniature Rover for Inspection of Double-Shell Tank Floors ***Michael DiBono**, Yew Teck Tan, Leonel Lagos, Dwayne McDaniel*

Figure 22. DOE Fellows Silvina Di Pietro (left) and Ximena Lugo (right) during a WM19 panel on graduating students.

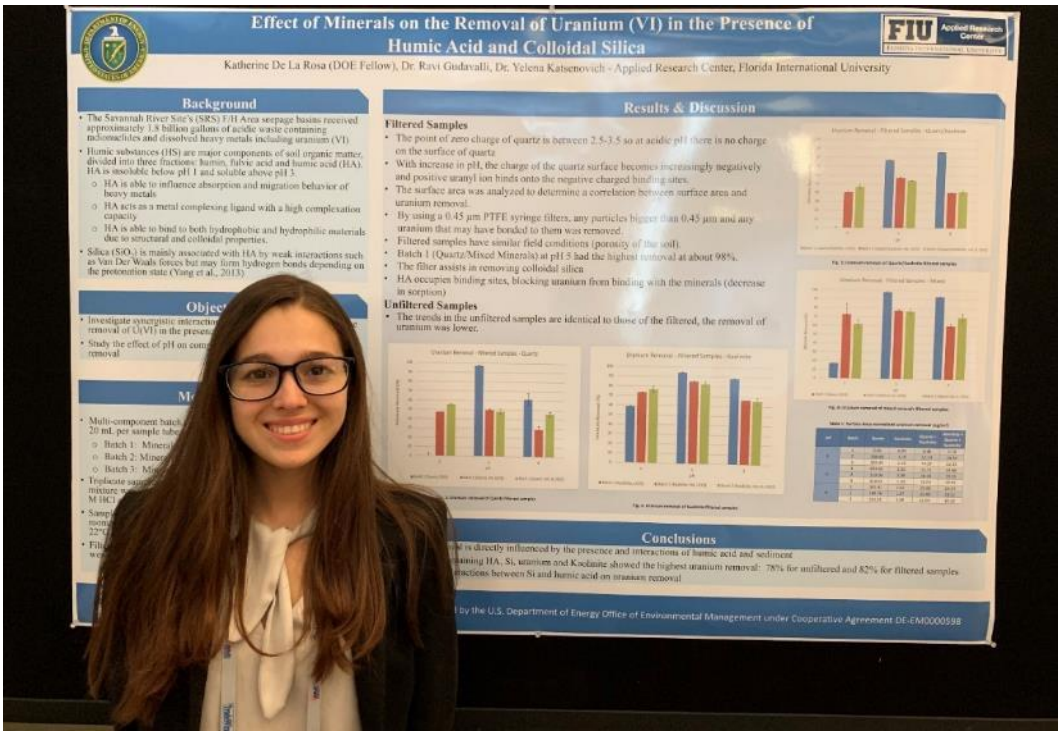

Figure 23. DOE Fellow Katherine De La Rosa presenting a professional poster at WM19.

A 2019 Roy G. Post Foundation Scholarship at the Undergraduate Student Level was awarded to DOE Fellow Manuel Losada.

Figure 24. DOE Fellow Manuel Losada with the list of undergraduate winners of the 2019 Roy G. Post Foundation Scholarship.

The DOE Fellows joined staff from the Applied Research Center at Florida International University 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.

Figure 25. FIU staff and students at the FIU ARC booth at WM19.

FIU staff and former DOE Fellows hosted an additional booth as part of the WM19 University Pavilion. The University Pavilion showcased several university programs as part of the WM19 conference theme, "Encouraging Young Men & Women Achieve their Goals in Radwaste Management."

Figure 26. Alumni from the DOE Fellows program participated in a WM19 University Pavilion.

Figure 27. Alumni from the DOE Fellows program participated in the WM19 University Pavilion.

Figure 28. FIU booth at the WM19 University Pavilion demonstrating inspection technologies.

Other Conferences & Workshops

DOE Fellows have been participating in numerous opportunities for sharing the research that they have performed in support of DOE EM at FIU-ARC and during their past summer internships at DOE sites, DOE Headquarters, and national research laboratories. A brief description of the recent publications and presentations by the DOE Fellows follows:

- **Anibal Morales** presented a poster titled "Performance Evaluation of Augmented Teleoperation of Contact Manipulation Tasks" at the American Nuclear Society (ANS) winter meeting and expo held in Orlando, FL from November 11-15, 2018.
- **Christopher Excellent** presented a poster titled "Development of a Peristaltic Crawler for the Inspection of the High Level Waste Tanks at Hanford" at the American Nuclear Society (ANS) winter meeting and expo held in Orlando, FL from November 11-15, 2018.
- **Michael DiBono** presented a poster titled "Development of A Bioinspired Multi-Link Inspection Tool for Environments with Small Size Constraints" at the American Nuclear Society (ANS) winter meeting and expo held in Orlando, FL from November 11-15, 2018.
- **Sebastian Zanlongo** presented a poster titled "Informative Path Planning for Robotic Inspection of Radioactive Environments" at the American Nuclear Society (ANS) winter meeting and expo held in Orlando, FL from November 11-15, 2018.
- **Silvina Di Pietro** also provided a guest lecture during the Panther Alumni Week (PAW) for the FIU Honors College in February 2019. She talked about her undergraduate research experience within the chemistry department and advised students on leadership. She also provided students with information about DOE Fellows program and study abroad opportunities.
- **Silvina Di Pietro** presented *Mineral Dissolution upon Alkaline Treatment and Variable Redox Conditions* to the SoFL-ACS Chapter Chemical Sciences Symposium in Miami, FL, on April 13, 2019. Silvina is studying the use of an innovative remediation technique that would inject ammonia gas into the subsurface at the Hanford Site to decrease the movement of uranium contamination below ground. The results can help to predict the long-term effectiveness of the remediation technique.
- **Silvina Di Pietro** presented *Remediation of Radioactive Waste-contaminated Sites* at the Persistent Toxic Substances Workshop hosted by the FIU Department of Chemistry and the Chinese Academy of Sciences in Miami, FL, on April 4, 2019.
- **Silvia Garcia** presented the *Impact of Photodegradation of SRS Wetland Sediments on Radionuclide Mobility*, during the Life Sciences South Florida Conference in Boca Raton, FL, on April 6, 2019.
- **Katherine De La Rosa** presented the *Effect of Mineral on the Removal of Uranium (VI) in the Presence of Humic Acid and Colloidal Silica*, during the Life Sciences South Florida Conference in Boca Raton, FL, on April 6, 2019.
- **Michael DiBono** presented *Development of a Bioinspired Multi-Link Inspection Tool* at the American Nuclear Society (ANS) student conference on April 4-6, 2019.
- **Patrick Uriarte** presented *Robotic System for fhe Application of Coatings in the Savannah River Site H-Canyon Exhaust Tunnel* at the American Nuclear Society (ANS) student conference in April 2019.

Figure 29. DOE Fellow Silvina Di Pietro (center) at the SoFL-ACS Chapter Chemical Sciences Symposium in Miami, FL.

Figure 30. Silvina Di Pietro (DOE Fellow) at Panther Alumni Week (PAW) for the FIU Honors College.

Figure 31. DOE Fellows Katherine Delarosa and Silvia Garcia at LSSF with other FIU students.

Three DOE Fellows participated and presented posters based on FIU's DOE-EM work at the 2019 Mirion Connect Conference held in Santa Anna Pueblo, NM on July 31st, 2019. The titles of the posters presented are:

- Cesium Extraction from Nuclear Waste: Test Bed Initiative (TBI) - **Jason Soto**
- Magnetic Miniature Rover for Tank Integrity Inspection at the DOE Hanford Site - **Patrick Uriarte**
- Investigation and Analysis of Dolomite Dissolution in Variable Strength Systems Relevant to WIPP - **Alexis Vento**

Figure 32. DOE Fellows Jason Soto and Patrick Uriarte presenting posters at the 2019 Mirion Connect Conference poster exhibition.

DOE Fellow and PhD candidate in the Department of Chemistry, Silvina Di Pietro, participated and attended the 258th Fall National Meeting & Exposition hosted by the American Chemical Society (ACS) in San Diego, CA from August 25 to August 29, 2019. She presented her most current data (some of it from her 2019 summer internship in Lawrence Livermore National Laboratory) in the Industrial & Engineering Chemistry (I&EC) Division. The oral presentation titled "Phyllosilicate mineral dissolution upon variable alkaline treatment and redox conditions" was delivered on Monday, August 26, 2019 during the I&EC division session upon her award as part of the 2019 Graduate Student Awardees. This award also included having the ACS graduate registration-fee waived.

Figure 33. DOE Fellow Silvina presenting her research during the I&EC division session (left) and with Dr. Frances Arnold, Frances H. Arnold, Nobel Prize laurate in Chemistry 2018 (right).

DOE Fellows Ryan Cruz, Patrick Uriarte and Manuel Losada (former Fellow) received a scholarship from Great Minds in STEM™, a gateway for Hispanics in Science, Technology, Engineering and Mathematics (STEM). Established in 1989, as HENAAC, Great Minds in STEM™ is a non-profit organization that focuses on STEM educational awareness programs for students from kindergarten to career. Great Minds in STEM™ provides resources for recognition and recruitment of Hispanics in STEM on a national level, connecting multi-areas of engineering and science arenas to the general population.

Figure 34. DOE Fellows Ryan Cruz, Manuel Losada and Patrick Uriarte at Great Minds in STEM™.

DOE Fellow Roger Boza attended the International Test And Evaluation (ITAE) 2019 conference held in Orlando FL and presented a topic titled "Deep Learning with Big Data Analytics for Nuclear Decommissioning Application". Below is the abstract of his talk:

> The nuclear industry is experiencing a steady increase in maintenance costs even though plants are maintained under high levels of safety, capability, and reliability. Nuclear power plants are always expected to run every unit at maximum capacity, efficiently utilizing assets with minimal downtime. Surveillance and maintenance of nuclear-decommissioning infrastructure provide many challenges with respect to maintenance or decommissioning of the buildings.
>
> As these facilities await decommissioning, there is a need to understand the structural health of these structures. Many of these facilities were built over 50 years ago and in some cases these facilities have gone beyond the operational life expectancy. In other cases, the facilities have been placed in a state of "cold and dark" and they are sitting unused, awaiting decommissioning. In any of these scenarios, the structural integrity of these facilities may be compromised, so it is imperative that adequate inspections and data collection/analysis be performed on a continuous and ongoing basis.
>
> A pilot-scale infrastructure was developed to implement structural health monitoring using scanning technologies, machine learning/deep learning and big data technologies. The focus for structural health monitoring was the walls of the mock-up infrastructure. A plan was developed to collect various formats of data such as structured and unstructured data from the various sensors deployed in the mock-up infrastructure. The main source considered for data was video and images from various imaging sources.
>
> During the data collection process, a total of 28,000 images (RGB) were taken with a regular camera and stored in the Big Data Platform using the Hadoop Distributed File System (HDFS). The images contain variations in light exposure, angles, and aspect ratios. The entire dataset was evenly separated into two categories, "Baseline" and "Degraded". A duplicate dataset was formed by scaling down all images using antialiasing to a manageable resolution for the neural network model. This data distribution formed the basis for the machine learning approach.

A Deep Convolutional Neural Network (CNN) was implemented in Python using the Keras library and TensorFlow architecture. The goal for the CNN was to classify the images into its two categories respectively. The CNN was constructed by a Sequential Model in Keras which is a linear stack of neuron layers. A total of 10 layers were stacked by a combination of convolutions, max pooling, and a dense layer. The model was verified with the 70/30 Cross Validation technique which achieved 97.1% accuracy during the training phase. The high accuracy of the CNN model demonstrates that with deep learning as a component of structural health monitoring can provide valuable information for the conditions of a nuclear facility.

Figure 35. DOE Fellow Roger Boza (left) with FIU DOD Fellows and Dr. Himanshu Upadhyay (middle) at ITAE.

DOE Fellows Directly Supporting DOE EM Projects

DOE Fellows provide direct support to DOE EM projects around the complex as part of the research efforts under the DOE-FIU Cooperative Agreement. Details of the applied research performed at ARC in support of DOE EM is reported in the FIU Performance Year 8 Year End Reports for Project 1, 2, and 3. The following DOE Fellows provided direct project support during FIU Performance Year 8.

Project 1: Anibal Morales (undergraduate, electrical engineering), Anilegna Nunez Abreau (undergraduate, mechanical engineering), Christopher Excellent (undergraduate, mechanical engineering), Clarice Davila (undergraduate, mechanical engineering), Daniel Martin (undergraduate, electrical engineering), Edward Nina (graduate, M.S., mechanical engineering), Jeff Natividad (undergraduate, mechanical engineering), Jorge Montesino (undergraduate, civil engineering), Joseph Coverston (graduate, M.S., mechanical engineering), Manuel Losada (undergraduate, electrical engineering), Michael DiBono (undergraduate, mechanical

engineering), Michael Thompson (graduate, M.S. electrical engineering), Patrick Uriarte (undergraduate, mechanical engineering) and Sebastian Zanlongo (graduate, Ph.D., computer science).

Project 2: Alexis Suarez (undergraduate, environmental engineering), Alexis Vento (graduate, M.S. environmental engineering), Amanda Yaconskie (graduate, M.S. environmental engineering), Frances Zengotita (undergraduate, chemistry and health), Gisselle Gutierrez (undergraduate, environmental engineering), Hansell Gonzalez (graduate, Ph.D., chemistry), Heily Revoll (undergraduate, civil engineering), Juan Morales (graduate, M.S., public health), Katherine De La Rosa (undergraduate, environmental engineering), Nathalie Tuya (undergraduate, environmental engineering), Ripley Raubenolt (undergraduate, environmental engineering), Rocio Trimino Gort (undergraduate, environmental engineering), Ron Hariprashad (graduate, M.S., geosciences), Silvia Garcia (undergraduate, biological sciences), Silvina Di Pietro (graduate, Ph.D., chemistry) and Ximena Lugo (undergraduate, environmental engineering).

Project 3: Alejandro Koszarycz (undergraduate, computer science), Alex Rivero (undergraduate, computer science), Aurelien Meray (undergraduate, computer science), David Mareno (undergraduate, computer engineering), Derek Gabaldon (undergraduate, mechanical engineering), Jason Soto (graduate, M.S., mechanical engineering), Jose Rendon (undergraduate, mechanical engineering), Joshua Núñez (graduate, M.S., mechanical engineering), Philip Moore (undergraduate, mechanical engineering), Roger Boza (graduate, Ph.D., computer science), Ryan Cruz (graduate, M.S., information technology) and Tristan Simoes-Ponce (graduate, M.S., mechanical engineering),

Additional Program Activities

Lecture Series

DOE Fellows attended a lecture series on January 30, 2019, featuring Dr. Mavrik Zavarin (Director of Glenn T. Seaborg Institute, Lawrence Livermore National Laboratory). The title of Dr. Zavarin's lecture was "Plutonium Contamination of the Environment: What's the Problem?"

Other Activities

DOE Fellows had many opportunities throughout the year to share the research that they have performed in support of DOE-EM at ARC as well as during their summer. These presentations have been in the research areas of high-level waste/waste processing, soil and groundwater modeling and remediation, deactivation and decommissioning, and technology development.

DOE Fellows prepared and presented research achievements based on their summer internships and/or FIU research during the DOE-FIU Cooperative Agreement research review held on August 6, 2019.

- 2D Dam-Break Analysis of L Lake and PAR Pond Dams Using HEC-RAS - Amanda Yancoskie
- Summer experience analyzing microbial communities from Tims Branch watershed exposed to heavy metals - Juan Morales

- Development of an Inspection Tool for Secondary Liner in Double Shell Tank - Christopher Excellent
- Mechanical Properties of Permanent Foaming Fixatives for Deactivation & Decommissioning Activities - Tristan Simoes-Ponce
- Mercury Speciation via Diffusive Gradients Thin-films Technology - Silvia Garcia
- Development of Inspection Tools for DST Primary Tanks & WRPS Internship Summer 2019 - Patrick Uriarte
- Summer 2019 Internship WRPS Test Bed Initiative (TBI) - Jason Soto

Several DOE Fellows graduated from FIU with their undergraduate or graduate degree during FIU Performance Year 9.

Graduates - December 2018

Hansell Raymat Gonzalez (Class of 2013) - PhD. Chemistry
Sebastian Zanlongo (Class of 2015) - Ph.D. Computer Science
Ripley Raubenolt (Class of 2016) - B.S. Environmental Engineering
Amanda Yancoskie (Class of 2018) - B.S. Environmental Engineering

Graduates - May 2019

Alex Rivero (class of 2018) - B.S. Computer Engineering
Michael DiBono (class of 2016) - B.S. Mechanical Engineering
Ximena Lugo (class of 2017) - B.S. Environmental Engineering
Jeff Natividad (class of 2019) - B.S. Mechanical Engineering

The DOE Fellows who participated in summer 2018 internships are preparing and presenting oral presentations at the weekly DOE Fellows meetings. The schedule for these presentations is provided below.

Table 8. Research Presentation Schedule for DOE Fellow Meetings

DOE Fellow	Internship Location	Date
Michael DiBono	CMU	9/26/2018
Juan Carlos Morales	DOE HQ (EM 4.31)	10/03/2018
Silvina Di Pietro	PNNL	10/10/2018
Ryan Cruz	SRNL	10/17/2018
Ximena Lugo	DOE HQ (EM 4.31)	10/24/2018
Tristan Simoes-Ponce	SRNL	10/31/2018
Clarice Davila	WRPS	11/07/2018
Katherine De La Rosa	SRNL	11/14/2018
Joshua Nunez	DOE HQ (EM 3.2)	01/24/2019

DOE Fellow	Internship Location	Date
Manuel Losada	SRNL/MSIPP	02/14/2019
Christopher Excellent	DOE HQ (EM 3.2) / CMU	02/21/2019
Frances Zengotita	LANL ACRSP	02/28/2019
Sebastian Zanlongo	SRNL/MSIPP	03/21/2019
Silvia Garcia	DOE HQ (EM 4.12)	03/28/2019
Alejandro Koszarycz	DOE HQ (EM 4.11)	04/04/2019

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. Additional information about the entire program and the DOE Fellows can be found on the website http://fellows.fiu.edu/.

ACKNOWLEDGEMENTS

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APPENDIX A. SUMMER INTERNSHIP REPORTS

The DOE Fellows completed development of their technical reports based on their summer 2018 internships and solicited approval from their summer mentors. The summer 2018 internships and technical report titles are provided below and a couple of highlights from the internship assignments in the DOE Fellows' own words are included in the following pages. The reports are available on the DOE Fellows website (fellows.fiu.edu).

Table A- 1 Summer 2018 Internship Reports

DOE Fellow	Internship Location	Internship Mentor(s)	Report Title
Joshua Núñez	DOE HQ (EM 3.2)	Rod Rimando	Support to the Technology Development Office
Alejandro Koszarycz	DOE HQ (EM 4.11)	Andrew Szilagyi	DOE EM Web Refresh Project and LLNL Building 280
Silvia Garcia	DOE HQ (EM 4.12)	Skip Chamberlain	Assisting DOE EM 4.12, Office of Groundwater and Subsurface Closure
Juan Carlos Morales	DOE HQ (EM 4.31)	Robert Seifert	Contrast of Cultures in Interagency Radiological Management Involving Human Health Reference Dose and Risk
Ximena Lugo	DOE HQ (EM 4.31)	Robert Seifert	Regulatory Reform: A Summer Experience
Tristan Simoes-Ponce	SRNL	Connor Nicholson	Characterizing the Mechanical Properties of Polyurethane Foams
Katherine De La Rosa	SRNL	Brian Looney	Mercury Speciation via Direct Mercury Analyzer
Ryan Cruz	SRNL	Richard Poland	Authentication Protocol for Industrial Control Systems without Encryption
Silvina Di Pietro	PNNL	Jim Szecsody	Iodate Reduction and Dissolution by Dithionite of Hanford Sediments
Clarice Davila	WRPS	Ruben Mendoza	Utilizing OSIsoft Visualizing PI Data System for Tank Level Data
Joseph Coverston	WRPS	Karthik Subramanian	Double Shell Tank Visual and Non-Destructive Evaluation Program Plan
Anibal Morales-Zambrana	ANL	Young Soo Park	Performance Evaluation of Augmented Teleoperation of Contact Manipulation Tasks
Christopher Excellent	DOE HQ (EM 3.2) / CMU	Rod Rimando, Red Whittaker	Pipe Crawling Activity Measurement System (PCAMS)
Michael DiBono	CMU	Rod Rimando, Red Whittaker	Deployment of the Pipe Crawling Activity Measurement System (PCAMS)
Frances Zengotita	LANL ACRSP	Don Reed, Julie Swanson	Potential for Transport of Cesium as Biocolloids in a High Ionic Strength System
Sebastian Zanlongo	SRNL/MSIPP	Timothy Aucott, Robin Young	Informative Path Planning for Mapping Radiation
Manuel Losada	SRNL/MSIPP	Jean Plummer	IMU Integration into Sensor Suite for Inspection of H-Canyon

The DOE Fellows continued developing their technical reports based on their summer 2019 internships. Fifteen (15) DOE Fellows completed summer internships. A total of 13 DOE

Fellows participated in summer internships as part of the DOE-FIU Cooperative Agreement. An additional two DOE Fellows conducted summer internships at LLNL and INL sponsored by the hosting institution. The summer 2019 internships and technical report titles are provided below.

Table A- 2 Summer 2019 Internships

DOE Fellow	Internship Location	Internship Mentor(s)	Report Title
Alejandro Koszarycz	SRNL	Patricia Lee	Risk Model for EM Decision Support Toolsets
Alexis Suarez	DOE-HQ	Skip Chamberlin	Contributing to the DOE EM 4.1 and 4.12, Office of Groundwater and Subsurface Closure
Alexis Vento	SNL	Amelia Hayes	Well density Characterization/Profile
Amanda Yancoskie	SRNL	Grace Maze	2D Dam-Break Analysis of L Lake and PAR Pond Dams Using HEC-RAS
Anilegna Nunez Abreau	DOE-HQ	Skip Chamberlin	An Assessment of Long-Term Monitoring Strategies and Developing Technologies
Frances Zengotita*	LLNL	Enrica Balboni	Plutonium Migration from Estuary Sediments (Ravenglass, UK)
Jason Soto	WRPS	Matthew Garlick	Test Bed Initiative (TBI)
Juan Morales	ANL	Pamela Weisenhorn	Analyzing soil microbial communities from Tims Branch watershed exposed to heavy metals
Katherine De La Rosa & Silvia Garcia	SRNL	Brian Looney	Innovative Systems for Mercury Speciation
Patrick Uriarte	WRPS	Ruben Mendoza	Double Shelled Tank Visual Inspections
Roger Boza	INL	Mike Griffel	Subtle Process Anomalies Detection using Machine Learning Methods
Ryan Cruz*	INL	Tammie Borders	Nuclear Cyber Ontology: Blueprint for Success in the Digital Tapestry (not for public release)
Silvina Di Pietro	LLNL	Mavrik Zavarin	Neptunium (IV) Diffusion Rates through Bentonite Clay
Tristan Simoes-Ponce	SRNL	James Nicholson	Mechanical Properties of Permanent Foaming Fixatives for D&D Activities

APPENDIX B. DOE FELLOWS GRADUATE PROGRAMS

DOE Fellows in STEM Graduate Programs – Ph.D.

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Claudia Cardona	Environmental Engineering	Ph.D.	Remediation of the uranium-contaminated subsurface in the deep vadose zone via NH_3 gas injection	2017
Charles Castello	Electrical Engineering	Ph.D.	Soil/Groundwater - Sensor Development for Field Measurement of Mercury	2011
Silvina Di Pietro	Chemistry	Ph.D.	Ammonia Gas Treatment for Uranium Immobilization at DOE Hanford's Site	2021 (anticipated)
Alejandro Garcia		Ph.D.	*Note*[1]	
Orlando Gomez†	Physics	Ph.D.	*Note*[1]	
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
Alejandro Hernandez	Chemistry	Ph.D.	*Note*[1]	
Juan Morales	Public Health	Ph.D.	Accumulated Metalloestrogens Analysis for Health Risk Assessment and Watershed Toxicology Management in Tims Branch, SRS	2021 (anticipated)
Sebastian Zanlongo	Computer Science	Ph.D.	Multipurpose All-Terrain Robotic Platform for D&D	2018
Roger Boza	Computer Science	Ph.D.	TBA	2023

[1]*Note: student is pursuing graduate level degree at another academic institution/department.*

DOE Fellows in STEM Graduate Programs – Masters

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Alejandro Garcia	GeoScience	Masters	The influence of biofilm formation on the SIP response of Hanford vadose zone sediment	2018
Alexis Vento	Environmental Engineering	Masters	TBA	2021
Amanda Yankcoskie	Environmental Engineering	Masters	Surface Water Modeling of Tims Branch	2020
Amaury Betancourt	Environmental Engineering	Masters	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2011

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Amy Pahmer	Engineering Management	Masters	Non-Thesis Option	2010
Andrew De La Rosa*	Computer Science	Masters	Non-Thesis Option	2015
Dayron Chigin*	Electrical Engineering	Masters	Non-Thesis Option	2015
Denny Carvajal	Biomedical Engineering	Masters	Soil/Groundwater – Bacteria Interaction due to Polyphosphate Injection at Hanford	2011
Duriem Calderin	Biomedical Engineering.	Masters	Modeling of Loose Contamination Scenarios to Predict the Amount of Contamination Removed	2010
Edgard Espinosa	Mechanical Engineering	Masters	Waste Processing - CFD Modeling of NuVison's Power Fluidic Technology/Process Remote Stack Characterization System	2011
Elicek Delgado-Cepero	Electrical Engineering	Masters	Structural Health Monitoring Inside Concrete and Grout Using the Wireless Identification Sensing Platform	2013
Elsa Cabrejo	Environmental Engineering	Masters	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2011
Eric Inclan	Mechanical Engineering	Masters	Mesh adaptation for use in Lattice Boltzmann code	2012
Heidi Henderson	Environmental Engineering	Masters	Surface water and contaminant transport within the Oak Ridge National Laboratory	2013
Jaime Mudrich	Mechanical Engineering	Masters	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	Masters	Control, through Sensors and LabVIEW, of the Asynchronous Pulsing Unit	2013
Jason Soto	Mechanical Engineering	Masters	LiDAR Mapping & Surveillance of Nuclear Infrastructure	2020
Jeff Natividad	Mechanical Engineering	Masters	TBA	2021
Joel McGill*	Environmental Engineering	Masters	Non-Thesis Option	2014

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Jose Matos	Mechanical Engineering	Masters	Development of improved Bodies for a Peristaltic Crawler for Radioactive Pipeline Unplugging	2013
Jose Vazquez	Environmental Engineering	Masters	Effects of temperature and pH on volatilization of mercury after chemical reduction	2009
Joseph Coverston	Mechanical Engineering	Masters	Evaluation of Pipeline Flushing Requirements for HLW at Hanford and Savannah River	2019
Joshua Nunez	Mechanical Engineering	Masters	The applications of intumescent technologies in support of D&D activities across the DOE complex	2019
Kanchana Iyer	Biomedical Engineering	Masters	Non-Thesis Option	2012
Lee Brady	Mechanical Engineering	Masters	Non-thesis option	2012
Leydi Velez	Industrial Engineering	Masters	Decision Modeling Tools D&D Surveillance & Maintenance	2010
Lilian Marrero	Environmental Engineering	Masters	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	2012
Mariela Sliva	Engineering Management	Masters	Non-Thesis Option	2013
Mario Vargas	Mechanical Engineering	Masters	Kinematic Control of Remote Stack Characterization System	2012
Maximiliamo Edrei	Mechanical Engineering	Masters	Investigation of Mixing Times of Sparged Bingham plastic type fluids as applied to the Pulse Jet Mixing Process	2017
Melina Idarraga	Environmental Engineering	Masters	Dissolution rate of natural meta-autunite: effects of aqueous bicarbonate, pH and temperature	2011
Melissa Sanchez **	Environmental Engineering	Masters	Non-thesis option	2012
Merlin Ngachin	Environmental Sciences	Masters	Waste Processing - Baltman-Lattice Method to Model HLW	2011
Mohammed Albassam	Water resource Engineering	Masters	Effect of Frequent Atmospheric Events on Flow Characterization in Tims Branch and its Major Outfalls	2018
Natalia Duque	Environmental Engineering	Masters	Non-Thesis Option	2017
Paola Sepulveda	Biomedical Engineering	Masters	Investigating the Role of a Less Uranium Tolerant Strain, Isolated from the Hanford Site Soil, on Uranium Interaction in Polyphosphate Remediation Technology	2014

DOE Fellow	Discipline	Degree	Research Topic Based on DOE EM projects	Year of Graduation
Revathy Venkataraman	Computer Science	Masters	Performance Evaluation of Mobile Applications with KMIT Technology Web Services	2014
Robert Lapierre*	Chemistry	Masters	Mineral characterization after uranium sequestration by pH manipulation using NH_3 gas	2017
Ron Hariprashad	GeoScience (Hydrogeology)	Masters	Modeling of Surface Water Flow and Contaminant Transport in the Tims Branch Ecosystem	2020 (anticipated)
Ryan Cruz	Cyber Security	Masters	Non-Thesis Option	2019
Serkan Akar	Biomedical Engineering	Masters	Design and Development of an Enzyme-Linked Biosensor for Detection and Quantification of Phosphate Species	2010
Stephen Wood	Mechanical Engineering	Masters	Modeling of Pipeline Transients: Modified Method of Characteristics	2011
Tristan Simoes-Ponce	Mechanical Engineering	Masters	D&D Technology Demonstration & Development and Technical Support to SRS's 235-F Facility Decommissioning	2019 (anticipated)
Valentina Padilla	Environmental Engineering	Masters	Non-Thesis Option	2014
William Mendez	Engineering Mgmt.	Masters	Development of Remote Stack Char. System	2011
Yulyan Arias**	Environmental Engineering	Masters	Non-thesis option	2012

**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.*
† This student left the DOE Fellows program before completion of their doctoral degree.

APPENDIX C. SUMMER 2019 INTERNSHIP HIGHLIGHTS

Internship Highlights from the DOE Fellows

DOE Fellow **Amanda Yancoskie** participated in a summer internship at Savannah River National Laboratory's Atmospheric Technologies group under the mentorship of Dr. Grace Maze working on dam-break analyses. Dam-break models are critical for the development of evacuation plans if there ever was a breach. Amanda's activities consisted of redoing the old dam-break analysis that was conducted on site with new and updated modeling programs and current data. Valuable information can be gained when old studies are redone using new and improved methods. When not working on her assigned project, Amanda toured the facilities and attended several networking, professional development events, and guest lectures held on site. Amanda also participated in a curated facility tour where she learned the history of the Savannah River site.

DOE Fellow **Tristan Simoes-Ponce**, a graduate student pursuing mechanical engineering, interned at Savannah River National Laboratory. This was his second internship at SRNL under the mentorship of Connor Nicholson. During this internship, Tristan conducted mechanical testing on polyurethane foams. Polyurethane foams are being considered for use as permanent foaming fixatives and can encapsulate void volumes like pipes, gloveboxes, hot cells, and waste containers. The tests will ensure the foams are mechanically sufficient to be used as fixatives so they will not fail, this causing the release of residual contamination. Tristan also oversaw an undergraduate student from Louisiana Tech, Ian Webb, who helped him conduct these experiments.

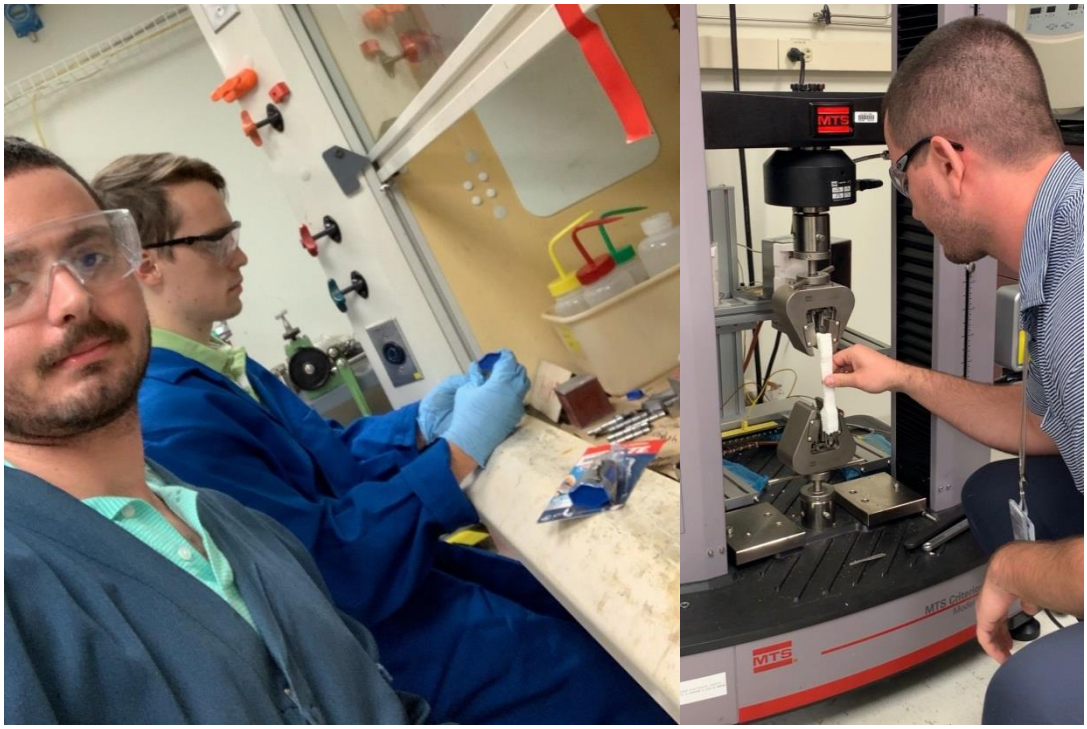

Figure A- 1 Simoes-Ponce conducting experimental tests on polyurethane foams at SRNL laboratories.

DOE Fellows **Katherine De La Rosa** and **Silvia Garcia** interned at Savannah River National Laboratory under the mentorship of Brian B. Looney. Both fellows worked on a collaborative research project between SRNL and Oak Ridge National Laboratory (ORNL) to test total mercury and mercury speciation using two separate methods. This involved fabrication of a range of reactive DGT (rDGT) samplers and micro-columns. Both of these systems provide differential sampling of various mercury species. They also travelled to ORNL in July to deploy DGTs for field testing at 3 sites. Field testing was also conducted at 7 different locations at SRS. Katherine and Silvia presented their findings at SRNL's summer intern poster session.

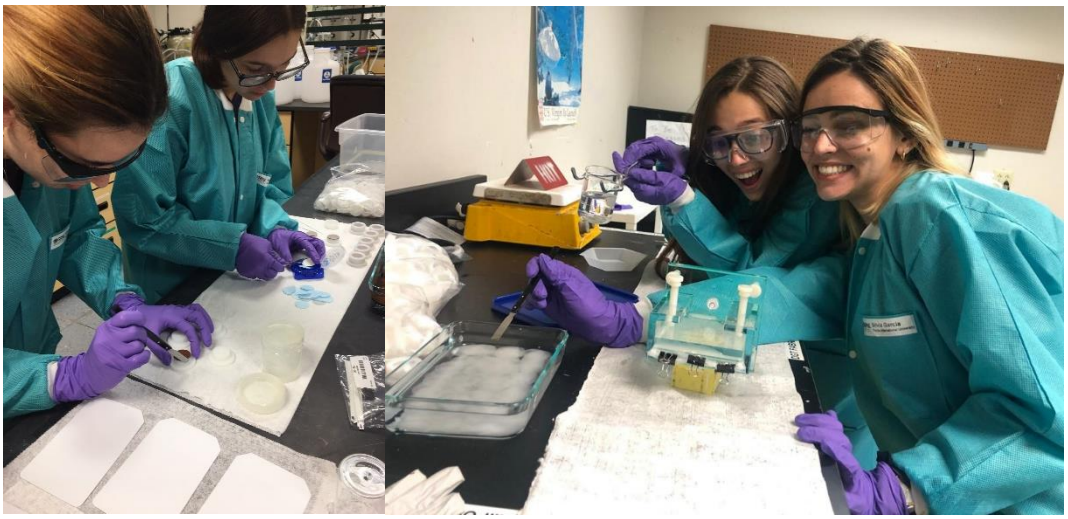

Figure A- 2 DOE Fellows Katherine De La Rosa and Silvia Garcia fabricating reactive DGT (rDGT) samplers and microcolumns at SRNL laboratories for differential sampling of various mercury species in the field.

During his summer internship at Savannah River National Laboratory under the mentorship of Patricia Lee, DOE Fellow **Alejandro Koszarycz** worked on an EM Complex Wide System Planning Risk Assessment Model and Cost Analysis Model. These two models are project toolsets that will hopefully be used at an enterprise level to help make decisions on the scope of work of contractors within contractual lifespans, deciding where the allocation of funding would be more beneficial to EM as a whole, and in negotiations for future projects. Besides working to compile and build the models, Alejandro was acquainted with some of the EM System Planning team members. Alejandro also had opportunities to tour SRNL and see the work that is being accomplished on site.

DOE Fellow **Juan Morales** participated in a summer internship at Argonne National Laboratory's Office of Biological and Environmental Research's Genomic Science Program under the mentorship of Dr. Pamela Weisenhorn. Argonne National Laboratory presently using novel approaches measuring the biogeochemical effects that contaminants induce in soil microbial biodiversity. Soil pollution has adverse effects on microbial communities and new approaches such as using metagenomics can be a powerful tool to investigate structural diversity of the microbial community in heavy metal contaminated and non-contaminated soils. Alongside his mentor, Juan used metagenomics to investigate the composition, structure and diversity of microbes in soil contaminated with different levels of heavy metals from Tims Branch system.

Figure A- 3 Pictures of Juan Morales with his mentor and conducting experiments at ANL laboratories.

During a visit to Argonne National Laboratory (ANL), Dr. Lagos had the opportunity to meet with DOE Fellow Juan Morales who was conducting an internship at ANL this summer, as well as former DOE Fellow Merlin Ngachin (Class of 2008) who is now a Sr. Health Physicist at ANL.

Figure A- 4 DOE Fellow Juan Morales and former DOE Fellow, Merlin Ngachin with Dr. Lagos at ANL.

DOE Fellow **Silvina A. Di Pietro** worked with her mentor, senior scientist and Glenn T. Seaborg Institute director Dr. Mavrik Zavarin, and Dr. Claudia Joseph from Karlsruher Institut für Technologie, Germany, to conduct a series of core abrasion surface peelings. This is a continuation of the diffusion experiment conducted by Dr. Joseph during her post-doc residency at LLNL three years ago. The second part of the experiment focuses on understanding (1) the Np movement across bentonite clay core cells as a function of depth (in millimeters) and (2) the influence of temperature (25°C, 65°C, and 85°C) for the Np transport across the clay core under anaerobic conditions. Few literature work has been found on Np(IV) as this oxidation state is rather complex. Samples vary in material (epoxy vs. clay), Np concentration, temperature exposed during the diffusion experiment, and mass or amount of clay peeled off.

The objective of the study was to identify the diffusion rate of bentonite clay within the clay core as Np is released or abraded from the core. Abrasive peeling experiments were conducted with

four different clay core samples: blank (i.e., no diffused Np) and three spiked cores (25°C, 65°C, and 85°C) with an activity of approximately 1,000 Bq. Abraded masses off the clay core will be analyzed for their tracer activity by liquid scintillation counting (LSC).

Besides working on her internship-related research, Silvina also analyzed ammonia-treated, clean mineral samples that were prepared at FIU and shipped to LLNL via nuclear magnetic resonance (NMR) analysis. The goal was to quantify the aluminum (Al) isotope-27 peaks from the treated, aerated and control samples of Hanford sediments and illite mineral.

Figure A- 5 DOE Fellow Silvina Di Pietro performing experiments and analyzing samples at LLNL.

During the summer of 2019, DOE Fellow **Jason Soto** interned with Washington River Protection Solutions (WRPS) in Hanford Washington. WRPS is a part of the cleanup efforts at the Hanford nuclear site and their role is to safely and efficiently manage the nuclear waste stored in underground tanks. Jason's role as an intern is to assist the Design Engineering team in designing a tool that would extract the radioactive isotope cesium-137 from the tank waste. This project was called the Test Bed Initiative (TBI) and is intended to both speed up and reduce the cost of the cleanup efforts by removing the problematic isotope. Cesium-137 is problematic because it highly radioactive, water soluble, inefficient to vitrify, and impossible to grout.

During his internship Jason was able to learn a great many things about the cleanup efforts currently underway at Hanford along with how radioactive waste is dealt with. This came about from his many interactions with the engineers as well as several tours he took of the Hanford

site. While designing the storage cask for the TBI extraction tool he applied his creative thinking skills in order to produce a design that was not only capable of shielding workers but also straightforward to use and to manufacture. *"This internship was an enjoyable experience as the work was rewarding and the weekends gave me plenty of time to explore Washington"* - Jason Soto.

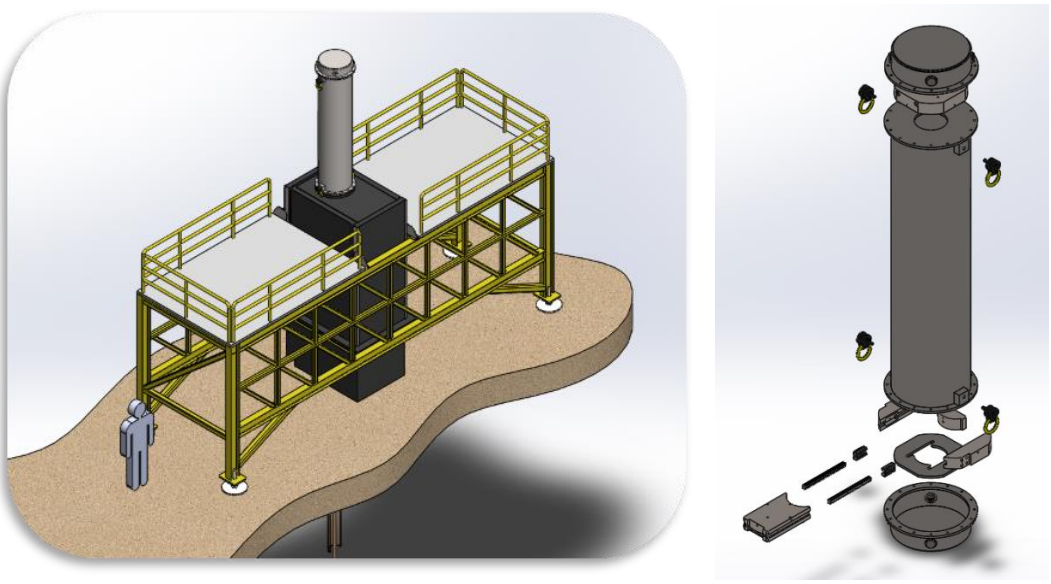

Figure A- 6 Schematic of Test Bed Initiative (TBI) extraction tool for cesium-137 extraction from tank waste.

This summer DOE Fellow **Patrick Uriarte** traveled across the country to intern at Washington River Protection Solutions (WRPS) located in Richland, Washington under the mentorship of Natalie Young to support the mission to decontaminate and remove the nuclear waste filling Single and Double Shelled Tanks (DSTs) within the Hanford Site. Patrick primarily assisted the Tank & Pipeline Integrity (TAPI) Team in preparing and compiling annual DST reports. He learned to operate new panorama constructing software to stitch video images into a large picture which would be placed into the annual report and eventually be analyzed by an engineer to inspect tank integrity. Additionally, Patrick assisted the Tanking Monitoring Team with data and legacy document compilation as backup before they transition to a new internal document database system.

Figure A- 7 Pictures from Patrick's internship.

DOE Fellows **Anilegna Nunez** and **Alexis Suarez** interned at the DOE Headquarters in Germantown, MD under the mentorship of Skip Chamberlin. During their internship, they worked on two projects as well as gained professional experience through attending meetings, intern training, and professional development events. The first project involved assessing the effectiveness of a new Long Term Monitoring Paradigm that is currently being tested at the Savannah River Site (SRS) through both qualitative and quantitative analysis. The second project consisted of creating an infographic for the Direct Mercury Analyzer instrument in the hopes of assuring stakeholders of the instrument's cost-effectiveness and reliability. In addition to the projects, the DOE Fellows had an opportunity to visit the Savannah River Site where they gained a holistic understanding of how SRS functions. They were also able to meet and get guidance from two of the key scientists who are at the forefront of the research that their projects were based on.

Figure A- 8 DOE Fellows Anilegna Nunez and Alexis Suarez at DOE-HQ and SRNL.

DOE Fellow **Frances Zengotita,** an undergraduate student pursuing a dual-degree in Chemistry and English at Florida International University participated in a summer internship at Lawrence Livermore National Laboratory (LLNL) under the mentorship of Dr. Enrica Balboni. During this internship, she examined the mobilization of plutonium (Pu) from the Ravenglass saltmarsh in the UK which was contaminated from the Sellafield reprocessing site. At the Ravenglass saltmarsh, changing redox profiles together with changing hydrological regimes have the potential to impact the speciation and mobility of Pu. Therefore, the objective of our work is to investigate the desorption behavior of risk-driving contaminants such as Pu. Frances conducted batch desorption experiments (both anoxic and oxic conditions) and used separation chemistry techniques (column purification experiments) to purify plutonium from matrix elements and other actinides. The results in these experiments will potentially suggest the desorption behavior of Pu at the Ravenglass saltmarsh.

Figure A- 9 DOE Fellow Frances Zengotita performing experiments and analyzing samples.

DOE Fellow **Ryan Cruz** participated in a 10-week internship at Idaho National Laboratory and worked on a nuclear ontology project under the mentorship of Tammie Borders. An ontology defines the concepts in a domain that shows the relationships between them. Ryan assisted in creating an ontology, adding a cyber component to it, and then importing it to a graphical database. The goal of the internship was to provide clear definitions that are critical to understanding large volumes of data. Ryan was featured on INL social media as part of their #INLInternTakeover campaign. He also got an opportunity to present his ontology research at the intern poster session.

"*The favorite thing about my time at INL is participating in their enrichment activities such as the INL Intern Bus Tour. There I got a chance to tour the in-town facilities at INL and facilities out in the desert site like the Advanced Test Reactor and Materials & Fuels Complex. I also had the opportunity to interact with other interns and learn about their education background as well as the projects they worked on. It was amazing to witness the research that has been done over the years during the tour as INL was celebrating its 70th anniversary this year.*" - Ryan Cruz

Figure A- 10 DOE Fellow Ryan Cruz at poster exhibition at INL.

DOE Fellow **Alexis Vento** had an incredible experience at Sandia National Laboratory in a regulatory driven work environment that is in compliance with the Waste Isolated Pilot Plant (WIPP) in Carlsbad, New Mexico during his 10-week internship. The WIPP is a radioactive waste repository excavated deep within a stable geologic salt formation for permanent disposal of TRU (transuranic) waste. Alexis worked intently with both the Hydrology and Geochemistry teams and had the opportunity to work in the field, lab, and office. The project objective of his internship was to get a well density profile of well H-6bR and quantify the potential stratification. These wells have been strategically placed around the WIPP site in the Chihuahua Desert and well H-6bR was picked due to the unique chemistry and geology around it compared to other wells. With the help of state-of-the-art equipment in the lab, Alexis performed density measurements and trace metal analysis and developed a specific procedure for future operators.

Figure A- 11 DOE Fellow Alexis Vento conducting field work with Sandia National Laboratory researchers.

This summer DOE Fellow **Roger Boza** was an intern at the Idaho National Lab (INL) where he was tasked with detecting anomalies from sensor data in the industrial environment as a preventative measure. It was common for him to handle very large data sets, in the order of

millions, with multiple dimensions. The problem set he was tasked to research does not have a solution which makes it very difficult to find informational resources. With the help of his mentor Mike Griffel, Roger was able to bridge the gap between his computer science skills and the industrial setting he was tackling. The team Roger worked with was composed of project investigator Ahmad Al Rashdan and department manager Tammie Border. They had weekly meetings to showcase the advancement of the project and brainstorm for innovative solutions.

"*The experience was amazing and very rewarding. Going to work daily at a national lab for 10 weeks sounds intimidating at first but the environment is rich with opportunities and learning experiences. Idaho Falls, Idaho, itself is a very friendly place with a multitude of people willing to lend a helping hand*". - Roger Boza

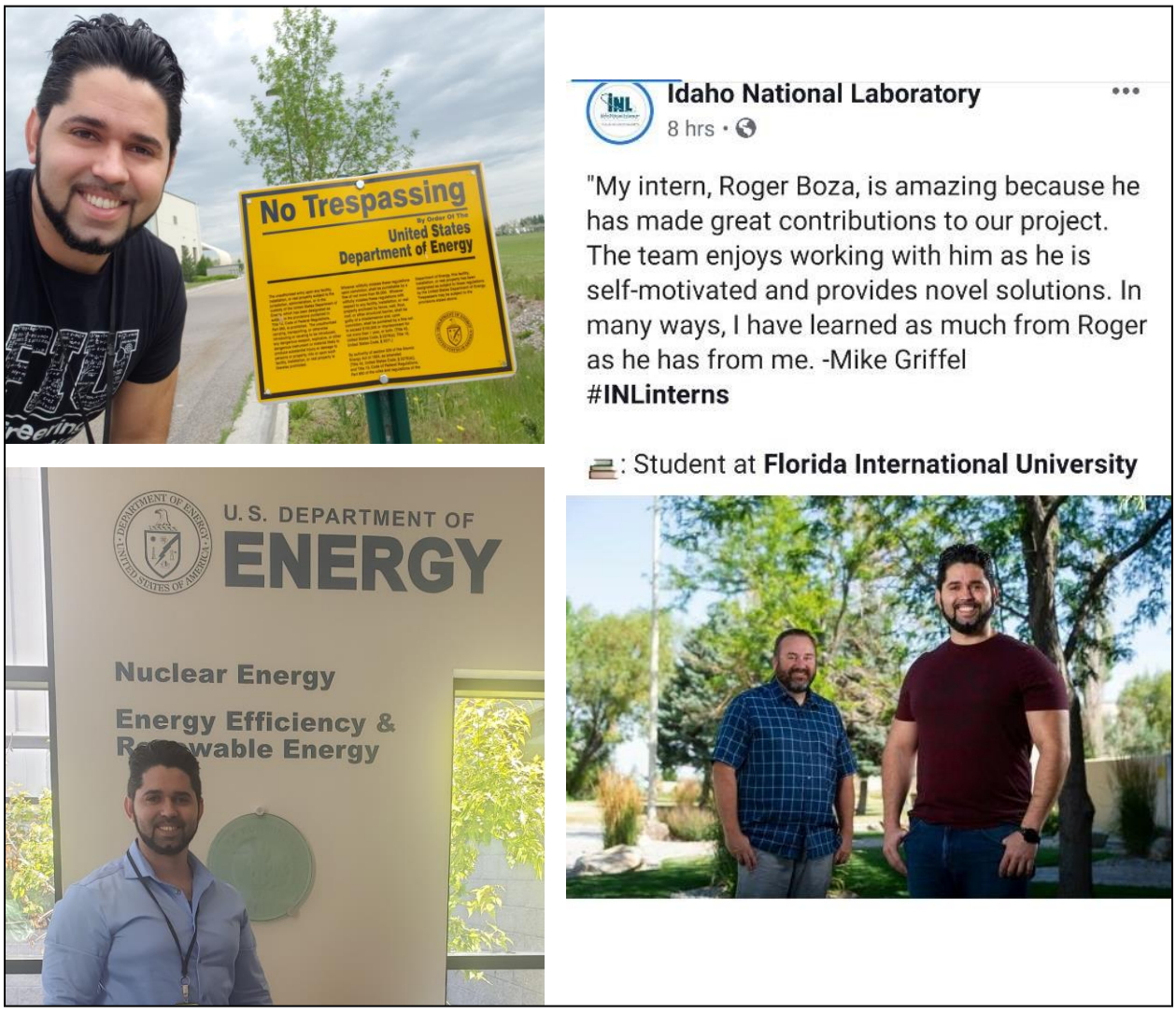

Figure A- 12 DOE Fellow Roger Boza at INL and with his mentor Mike Griffel.