The DOE-FIU Cooperative Agreement - Addressing DOE-EM’s Technical Challenges

Leonel Lagos, PhD, PMP®
(Principal Investigator & Director of Research)
Waste Management Symposia 2014
Phoenix, Arizona
Florida International University

FIU, is a vibrant, 52,000 student-centered public research university located in Miami, Florida. FIU is worlds ahead in its commitment to learning, research, entrepreneurship, innovation, and creativity so that graduates are prepared to succeed in a global market.

*FIU is among the largest Hispanic-Serving Institutions in the U.S., designated a Minority-Serving Institution.*

As a top-tier research institution, FIU emphasizes research as a major component in its mission.

*FIU averages over $100 million in research annually.*
FIU’s Applied Research Center (ARC) Serves as a Portal to FIU

- Founded in 1995, ARC has executed over $100 million in research with DOE, DoD, DARPA, FAA, USAID, other Federal and State Agencies as well as private industry.
- ARC’s Portal Concept provides ease of access to FIU’s Colleges and Centers to facilitate collaborative research.
- ARC’s mission is to provide world-class R&D and technology solutions to clients.
- ARC’s multicultural, multilingual staff are client service-oriented professionals and include Project Management Professionals (PMP®) and Professional Engineers (PE).
- Successful Workforce Development Programs.
Advancing the research and academic mission of Florida International University.

DOE-FIU Cooperative Agreement

"Working together for a safer and cleaner environment."

Dr. Leonel E. Lagos, Principal Investigator
Technical Support to DOE- Office of Environmental Management (DOE-EM)

• DOE-FIU Cooperative Agreement program was established in 1995 as a partnership between Florida International University and DOE’s Office of Science & Technology (EM-50)

• Since 1995 the Center has executed over 300 applied research projects for DOE in the areas of:
  • Deactivation & Decommissioning (D&D)
  • Soil & Groundwater Research & Modeling
  • Waste Processing/High Level Waste
  • Information Technology Development for Environmental Management
  • Workforce Development & Training

• The Center counts with five research facilities, a radiological lab, a high bay facility, and a Large Scale Technology Test Site

• The Center collaborate with other FIU’s Centers & laboratories (Dept. of Chemistry, Dept. of Earth & Environmental Sciences, Southeastern Research Center ) to accomplish DOE-EM applied research

• The Center supports 18 full time researcher (scientists and engineers), FIU faculty and about 30 students per year being trained in DOE-EM research (DOE Fellows Workforce Initiative)
The DOE Research website has been deployed to provide a centralized location for the research information developed under the FIU-DOE Cooperative Agreement and includes technical reports, quarterly progress reports, end of year reports, peer-reviewed journal articles, conference papers and presentations, industry news.

doeresearch.fiu.edu
Applied Research Center Facilities

Large Scale Testing Facility: This outdoors facility is available to conduct large scale demonstration of technologies.

Radiological Laboratory: This laboratory is equipped with state-of-the-art glove boxes, a three-stage HEPA-activated charcoal filtration system, fume hood, and a shielded enclosure for conducting studies on any material emitting alpha, beta, or gamma radiation.
Applied Research Center Facilities

Soil & Groundwater Laboratory: Research on fate, and transport of contaminants in soil, sediments, water, and biota; water and wastewater treatment; and soil sorption analysis

Analytical Chemical Laboratory: Analytical Chemistry (wet chemistry) laboratory supports applied environmental research
**Robotic & Sensors Laboratory:**
Development of innovative cleanup, monitoring, security, maintenance, and surveillance technologies for contaminated facilities

**Multifunction Technology /Deployment & Testing Facility:**
This 8,000-square-foot high-bay building is the primary laboratory resource for large scale applied research activities and technology prototyping and testing
Modeling, Simulation and GIS Research Laboratory: This laboratory hosts servers and workstations to support soil & groundwater, waste processing, and GIS research work.
FIU-DOE Cooperative Agreement

Project 1: Chemical Process Alternatives for Radioactive Waste (Dr. Dwayne McDaniel)

Project 2: Rapid Deployment of Engineered Solutions to Environmental Problems (Dr. Yelena Katsenovich)

Project 3: Remediation and Treatment Technology Development and Support (Dr. Georgio Tachiev)

Project 4: Waste and D&D Engineering and Technology Development (Dr. Leonel Lagos, Mr. Himanshu Upadhyay)

Project 5: DOE-FIU Science and Technology Workforce Development Initiative (Dr. Leonel Lagos)
FIU Project 1: Dr. Dwayne McDaniel

Chemical Process Alternatives for Radioactive Waste
High-level Waste R&D for Hanford and Savannah River Sites

This project objectives is to support the retrieval, processing and disposal of high-level radioactive waste (HLW) at the DOE Hanford and Savannah River sites. Specific activities include:

• Technology Development
• Technology Assessment
• Pilot-Scale Studies for Waste Processing
• Computational Modeling and Simulation
Project Tasks and Scope

Overview

Task 2 **Pipeline Unplugging and Plug Prevention**
- develop novel technologies that can be utilized to remove plugs formed in HLW transfer pipelines at Hanford’s Tank Farm
- computational simulation and evolution of HLW pipeline plugs

Task 17 **Advanced Topics for Mixing Processes**
- develop a multiple-relaxation time, lattice Boltzmann model (LBM) for high-density ratio multiphase flows within the tanks

Task 18 **Technology Development and Instrumentation Evaluation**
- evaluation of FIU’s Solid Liquid Interface Monitor (SLIM) for rapid measurement of HLW solids on tank bottoms (new)
- development of inspection tools for double shell tanks (DST) primary tanks (new)

Task 19 **Pipeline Integrity and Analysis**
- pipeline corrosion and erosion evaluation (new)
Peristaltic Crawler Pipeline Unplugging Tool & SLIM Technologies
Conferences/Publications

Waste Management 2014

Professional Papers/Posters
- **Computational Fluid Dynamics Modeling of High Level Waste Plug Formation**
- **Experimental Testing of Innovative High-Level Waste Pipeline Unplugging Technologies**

Student Posters
- **Innovative High-Level Waste Pipeline Unplugging Technologies for Hanford Site (Asynchronous Pulsing)**, Alexandra Fleitas (DOE Fellow) – **Selected Best Student Poster WM14 !!!!!!**
- **Rapid Imaging of Settled Solids in Hanford HLW Staging Tanks**, Dayron Chigin (DOE Fellow)
- **Computational Simulation and Evolution of High-Level Waste Pipeline Plugs**, Deanna M. Moya (DOE Fellow)
- **U.S. Low Level and Mixed Low Level Waste Treatment Technology Identification**, Gabriela Vazquez (DOE Fellow)
- **Analysis of Life Expectancy for Waste Transfer Lines Located at Hanford Site**, Jennifer Arniella (DOE Fellow)
- **Computational Fluid Dynamics Simulations of Fluid Transients in a Pipeline at Hanford Site**, Michael Abbott (DOE Fellow)
- **GPU Accelerated Lattice-Boltzmann Method for Fluid Flows in Nuclear Waste Tanks at Hanford Site**, Sasha Philius (DOE Fellow)
- **Engineering Scale Pipeline Unplugging Testing Using the Improved Peristaltic Crawler System for Removal of High Level Waste Plugs at Hanford Site Pipelines**, Carmela Vallalta (DOE Fellow)
FIU Project 2 & 3:
Dr. Yelena Katsenovich
Dr. Georgio Tachiev

Soil/Groundwater Remediation Projects
Soil/Groundwater Research for PNNL, Hanford and Savannah River Sites

- FIU is assisting EM-12, PNNL, and Hanford in developing a strategy to improve the efficiency of uranium stabilization in the subsurface. Uranium is a key contaminant of concern at many DOE sites due to its high persistence in the environment and toxicity to living organisms.
- The project conducts scientific studies on carbonate promoted uranium release from autunite minerals created as a result of polyphosphate injection to sequester uranium in the subsurface.
- At Savannah River, FIU is investigating the synergy between silica and humic acid (HA) to understand the mobility behavior of radionuclides in the groundwater at F/H area.
- FIU is also conducting a microcosm study to investigate if contaminants remain sequestered after the ARCADIS demonstration of in-situ molasses addition for U(VI) remediation via the Enhanced Anarobic Reductive Precipitation (EARP) process at SRS F-Area.
Soil/Groundwater Research and Computer Modeling for Oak Ridge, Y-12 and Moab Sites

• Soil and groundwater research also provides technical assistance to EM-12 in remediation and treatment technology development for the Oak Ridge, Y-12 and Moab sites, including modeling of soil and groundwater and simulation of fate and transport of contaminants and remedial activities.

• Modeling is being used by the sites to determine the impact of remediation alternatives on the complete hydrologic cycle, the transport overland and in surface water and rivers, sediment transport & reactions, and the mercury exchange with sediments.

• Commercially available software (MIKESHE, MIKE11, ECOLAB) and engineering solutions are implemented to accomplished these objectives
Conferences/Publications

Waste Management 2014

Professional Papers/Posters:

• Rate of Uranium Release from Calcium Meta-Autunite: Effect of Bicarbonate Solutions on the Dissolution (14218), Ravi Gudavalli, Yelena Katsenovich, Leo Lagos, Dawn Wellman (PNNL). Presenter: Yelena Katsenovich

• The Effect of Ca Ions on the Removal of U(VI) via In Situ Ammonia Gas Injection at the Hanford Site 200 Area (14434), Yelena Katsenovich, Claudia Cardona (DOE Fellow), Leo Lagos. Presenter: Claudia Cardona (DOE Fellow)

Student Posters:

• A Study of Cell Viability on DOE Hanford Soil Isolates: Effect of U (VI) and Bicarbonate – Paola Sepulveda-Medina (DOE Fellow)

• Characterization of the Uranium-Bearing Products of Novel Remediation Technologies – Robert Lapierre (DOE Fellow)

• Microcosm Study on Mineralogical Changes of Post-Molasses Injection with Savannah River Site (SRS) F-area – Valentina Padilla (DOE Fellow)

• The Effects of Silica and Humic Acid on U(VI) Removal from Savannah River Site (SRS) F/H Area Groundwater – Joel McGill (DOE Fellow)

• Environmental Remediation Optimization: Cost Savings, Footprint Reduction, and Sustainability Benchmarked on DOE Sites – Natalia Duque (DOE Fellow)
Peer Reviewed Journal Publications - 2013


Peer Reviewed Journal Publications - 2012


FIU Project 4: 
Dr. Leonel E. Lagos 
Mr. Himanshu Upadhyay 
Waste and D&D Engineering 
and Technology Development
D&D Technology Development & Evaluations

Advancing the research and academic mission of Florida International University.
Overview of Project Tasks

Task 1. Waste Information Management System (WIMS)
Maintenance and enhancement of the web-based waste forecasting and transportation system. Integration of a new forecast waste streams on an annual basis.

Overview of Project Tasks


Task 4. FIU-DOE Research Website – New task to capture and make available all the resulting research documents developed under the CA.

Task 5. Cyber Security Compliance and Deployment of Environmental Contamination and Remediation Models – New task to publish and deploy an environmental contamination and remediation model over the web using ArcGIS.
Decontamination Agents/Materials for Rad Surface Contamination

FIU is working with the SRS to investigate the decontamination agents and materials available on the market.

Conducted literature search (KM-IT, ALARA Reports, web search, vendor)

Worked with SRS to identify parameters based on application needs

40 strippable/fixative coatings identified

Report sent to Savannah River Site
**Decision Model for Mobile Device Application**

A decision model for mobile application use is being created to better guide the product end users in the selection of the appropriate products depending on their specific needs and site application.

Preliminary work done on decision model:

<table>
<thead>
<tr>
<th>Type of Radiation</th>
<th>Surface Properties</th>
<th>Location</th>
<th>Surface Type</th>
<th>Isotopes Involved</th>
<th>Product</th>
<th>% Decon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>Carbon Steel</td>
<td>N/A</td>
<td>Smooth</td>
<td>Plutonium 239</td>
<td>Decon Gel 1101</td>
<td>98%</td>
</tr>
<tr>
<td>Beta</td>
<td>Plexiglass</td>
<td>N/A</td>
<td>Smooth</td>
<td>Plutonium 239</td>
<td>Decon Gel 1101</td>
<td>53%</td>
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<tr>
<td>Beta</td>
<td>Concrete</td>
<td>N/A</td>
<td>Rough</td>
<td>Plutonium 239</td>
<td>Decon Gel 1101</td>
<td>71%</td>
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</table>
Lessons Learned/Best Practices

Collaboration with Energy Facilities Contractors Group (EGCOG) in the development of Lessons Learned and Best Practices.

A total of 13 have been developed.

7 final and published on the D&D KM-IT and EFCOG websites.

6 in review process: 2 at DOE HQ, 3 at EFCOG, 1 at FIU.
D&D Knowledge Management

Knowledge Management for D&D

- D&D Hotline
- Technology Module
- Vendor Module
- Collaboration tools
- Mobile application for vendor and specialist modules

- Currently:
  - 535 registered users
  - 64 registered subject matter specialists
  - 662 vendors
  - 688 technologies
Centralized Knowledge Management for DOE-EM

A simple interface was developed to illustrate the connection between all the independent applications or systems developed for DOE-EM under different projects.
Waste Management 2014:

Professional Presentations/Posters

• Knowledge Management Information Tool – 2014
• Waste Management System with 2013-14 Waste Streams

Student Posters at Waste Management 2014:

• Investigation of Permanent and Removable Coatings for Decontamination of Savannah River Site (SRS) Plutonium Fuel Form Facility - Mariana Evora (DOE Fellow)
• Native Android Application for Deactivation & Decommissioning Technologies - Pedro Cordon (DOE Fellow)
• Design and Development of Geographical Information System (GIS) Map for DOE Waste Streams - Sandhya Appunni (FIU Graduate Student)
• Performance Evaluation of Mobile Applications with D&D Technology Services – Revathy Venkataraman (DOE Fellow)
FIU Project 5: 
Dr. Leonel E. Lagos

DOE-FIU Science and Technology Workforce Development Program
DOE Fellows Program Description

FIU’s Applied Research Center (ARC) is supporting the U.S. Department of Energy’s Office of Environmental Management in the training of STEM, minority FIU students in an effort to create a pipeline of scientists and engineers that will enter DOE’s workforce upon completing their degrees and research at FIU.
DOE Fellows at Work
DOE Fellows Hands on Research at FIU
Program’s Components

• Paid 10-week summer internships at DOE national laboratories, DOE sites, DOE-HQ or DOE contractors, working under the supervision of DOE scientists (mentors).
• Paid 20 hours/week Student Research Assistantship at ARC during school year.
• Research experience with ARC scientists at FIU during school year: one-on-one mentoring performing “hands on” DOE-related applied research.
• Tuition waiver for graduate studies (Master, PhDs).
• 2 to 4 years Developmental Training Program (depends on masters or PhD track).
• DOE Lecture Series and technical seminars.
• Participation in conferences/workshops.
Conducted a total of 6 Induction Ceremonies since program inception in 2007. A total of 93 FIU minority STEM students have been inducted as DOE Fellows.
A total of **91 DOE Fellows have presented at Waste Management Symposia** since 2008. Obtained Best Student Poster 3 years in a row and Best Professional Poster in 2009 (DOE Fellow, Leydi Velez).
DOE Fellows at WM Conference

WM Student Posters Sessions

Panel Member – Young Professionals

Advancing the research and academic mission of Florida International University.
81 DOE Fellows Internships Completed
Annual DOE Fellows Poster Exhibition
Major Accomplishments

- **81** internships completed at DOE sites, DOE national labs, DOE-HQ, and DOE contractors
- **18** DOE Fellow internships conducted at Oak Ridge National Lab
- **93** students recruited/inducted as DOE Fellows since program inception in 2007
- **115** presentations (student posters and professional papers) at Waste Management conferences (2008 to 2014), and **6** student presentations at American Nuclear Society and American Society of Mechanical Engineers conferences
- Won Best Professional Poster (Leydi Velez) and **4** Best Student Posters (Denisse Aranda, Danny Carvajal, and Stephen Wood), **Alexandra Fleitas** at Waste Management Conferences 2008-2012, 2014
- **31** Fellows have continued and obtained master and PhD degrees at FIU and conducted their research at ARC or DOE national labs
- **2** DOE Fellows participated in the International Conference for Radioactive Waste Management (ICEM13), students were being fully sponsored by ASME
Major Accomplishments

- 3 DOE Fellows (Rosa Ramirez, Lee Brady, Edgard Espinosa) hired into DOE-EM at DOE-HQ in Washington, DC
- 1 DOE Fellow (Charles Castello) hired at Oak Ridge National Laboratory
- 8 DOE Fellows hired by other federal and state agencies including, Department of Defense (1), Department of Commerce (1), Department of State (1), Internal Revenue Service (1 Fellow), Department of Health & Humans Services (1), Florida Department of Environmental Protection (1 Fellow), NASA (2 Fellows)
- 3 DOE Fellows hired by DOE contractors – AREVA (1 Fellow), Waste Control Specialists (1 Fellow), and Bechtel (1 Fellow)
- Other DOE Fellows have graduated FIU with bachelors or masters degrees and obtained employment at Boeing Company (3 Fellows), Florida Power & Light (2 Fellows), General Electrics (1 Fellow), Lockheed Martin (1 Fellow), Mount Sinai Medical Center (2 Fellow), Johnson & Johnson (1 Fellow), PriceSmart Inc. (1 Fellow), Bouygues Civil Works Florida (1 Fellow), Crane Aerospace and Electronics (1 Fellow), HP Foundation (1 Fellow), PSI (1 Fellow)
<table>
<thead>
<tr>
<th>DOE Fellow</th>
<th>Exp. Degree</th>
<th>Major</th>
<th>Topic of Research</th>
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<tbody>
<tr>
<td>Robert Lapierre</td>
<td>M.S.</td>
<td>Chemistry</td>
<td>Characterization of the uranium-bearing products of novel remediation technologies</td>
</tr>
<tr>
<td>Joel McGill</td>
<td>M.S.</td>
<td>Civil engineering</td>
<td>The synergy effect of SI and humic acid on the removal of U(VI)</td>
</tr>
<tr>
<td>Valentina Padilla</td>
<td>M.S.</td>
<td>Environmental engineering</td>
<td>A microcosm study on mineralogical changes of post molasses injection with SRS F-area sediments</td>
</tr>
<tr>
<td>Mariela Silva</td>
<td>M.S.</td>
<td>Engineering management</td>
<td>SharePoint based secured collaboration system</td>
</tr>
<tr>
<td>Revathy Venkataraman</td>
<td>M.S.</td>
<td>Information technology</td>
<td>Performance analysis of mobile applications accessing web services built using windows communication foundation</td>
</tr>
<tr>
<td>Claudia Cardona</td>
<td>Ph.D.</td>
<td>Civil engineering</td>
<td>Evaluating the effects of Si and Al concentration ratios on the removal of uranium</td>
</tr>
<tr>
<td>Eliceck Delgado-Cepero</td>
<td>M.S.</td>
<td>Electrical engineering</td>
<td>Developing wireless monitoring systems and instrumentation</td>
</tr>
<tr>
<td>Heidi Henderson</td>
<td>M.S.</td>
<td>Environmental engineering</td>
<td>Developing water balance model to similar surface water and total suspended solids transport</td>
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<tr>
<td>Janty Ghazi</td>
<td>M.S.</td>
<td>Engineering management</td>
<td>Asynchronous pulsing as a means of unplugging high level waste transfer pipelines</td>
</tr>
<tr>
<td>Jose Matos</td>
<td>B.S.</td>
<td>Mechanical engineering</td>
<td>Development of peristaltic crawlers for unplugging of Hanford waste transfer pipelines</td>
</tr>
<tr>
<td>Joshua Midence</td>
<td>B.S.</td>
<td>Civil engineering</td>
<td>Saltstone Processing of Low-Level Waste at Savannah River Site</td>
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<tr>
<td>Lillian Marrero</td>
<td>M.S.</td>
<td>Civil engineering</td>
<td>Modeling of mercury and suspended solids</td>
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<tr>
<td>Name</td>
<td>Degree</td>
<td>Field</td>
<td>Research Area</td>
</tr>
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<tr>
<td>Paola Sepulveda-Medina</td>
<td>M.S.</td>
<td>Biomedical Engineering</td>
<td>Investigating the role of a less uranium tolerant strain, isolated from the Hanford site soil, on uranium interaction in polyphosphate remediation technology</td>
</tr>
<tr>
<td>Jaime Mudrich</td>
<td>M.S.</td>
<td>Mechanical Engineering</td>
<td>Multiphase simulations with an emphasis on solid-fluid interaction in complex domains</td>
</tr>
<tr>
<td>Eric Inclan</td>
<td>M.S.</td>
<td>Mechanical Engineering</td>
<td>Asynchronous pulsing method for unplugging high-level waste pipelines</td>
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<tr>
<td>Yulyan Arias</td>
<td>M.S.</td>
<td>Environmental engineering</td>
<td>Sequestering uranium by in situ subsurface pH manipulation using NH3 gas</td>
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<tr>
<td>Melissa Sanchez</td>
<td>M.S.</td>
<td>Environmental engineering</td>
<td>Uranium remediation in the vadose zone</td>
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<tr>
<td>Elsa Cabrejo</td>
<td>M.S.</td>
<td>Environmental engineering</td>
<td>Modeling interactions of sediment with mercury</td>
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<tr>
<td>Denny Carvajal</td>
<td>B.S.</td>
<td>Biomedical Engineering</td>
<td>Uranium remediation in the vadose zone</td>
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<tr>
<td>Mario Vargas</td>
<td>B.S.</td>
<td>Mechanical engineering</td>
<td>Development of a remote platform for characterization of nuclear stacks</td>
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<tr>
<td>Amaury Betancourt</td>
<td>M.S.</td>
<td>Environmental engineering</td>
<td>Effects of mercury in anaerobic bacteria</td>
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<tr>
<td>Lee Brady</td>
<td>M.S.</td>
<td>Mechanical engineering</td>
<td>Technologies for unplugging of high-level waste pipelines</td>
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<tr>
<td>Duriem Calderin</td>
<td>M.S.</td>
<td>Biomedical Engineering</td>
<td>Pilot scale experimental design for a wiped film evaporator</td>
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<tr>
<td>Charles Castello</td>
<td>Ph.D.</td>
<td>Electrical engineering</td>
<td>Development of a methyl-mercury analyzer</td>
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<tr>
<td>Name</td>
<td>Degree</td>
<td>Field</td>
<td>Research/Project</td>
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<tr>
<td>Melina Idarraga</td>
<td>B.S.</td>
<td>Civil engineering</td>
<td>Quantifying the dissolution of autunite as a function of aqueous bicarbonate.</td>
</tr>
<tr>
<td>Rosa Ramirez</td>
<td>M.S.</td>
<td>Biomedical Engineering</td>
<td>Study of mercury speciation in a contaminated watershed</td>
</tr>
<tr>
<td>Stephen Wood</td>
<td>M.S.</td>
<td>Mechanical engineering</td>
<td>Investigation of methods for high-level waste pipeline unplugging</td>
</tr>
<tr>
<td>Edgar Espinoza</td>
<td>M.S.</td>
<td>Mechanical engineering</td>
<td>Design Optimization of Submerged Jet Nozzle to Enhance Mixing.</td>
</tr>
<tr>
<td>Serkan Akar</td>
<td>M.S.</td>
<td>Biomedical engineering</td>
<td>Developing a Biosensor for Detection of Phosphate Species in Uranium Contaminated Ground Water and Wastewater Sediments by Employing Advanced Biotechnological Methods</td>
</tr>
<tr>
<td>Merlin Ngachin</td>
<td>M.S.</td>
<td>Geosciences</td>
<td>Tests and evaluate a new technology, namely SIMWyPES®, by Babcock &amp; Wilcox and used at the Y-12 National Complex at Oak Ridge National Laboratory (ORNL)</td>
</tr>
<tr>
<td>William Mendez</td>
<td>M.S.</td>
<td>Engineering Management</td>
<td>Development of a conceptual design of a robotic mechanism. This device was developed as a survey tool for physical and chemical characterization of contaminated nuclear stacks.</td>
</tr>
<tr>
<td>Erika McKinney</td>
<td>M.S.</td>
<td>Biomedical Engineering</td>
<td>Department project</td>
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<tr>
<td>Leydi Velez</td>
<td>M.S.</td>
<td>Engineering Management</td>
<td>Lessons Learned (LL) and Best Practices (BP) acquired in most DOE sites. Also, involved in the development of the D&amp;D Knowledge Management Information Tool (KM-IT)</td>
</tr>
<tr>
<td>Nantaporn Noosai</td>
<td>Ph.D.</td>
<td></td>
<td>Developing thermodynamic database of mercury species and integrating interactions within a flow and transport model</td>
</tr>
</tbody>
</table>
Program Website and Facebook

http://fellows.fiu.edu

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FIU Science and Technology Workforce Development Initiative

Advancing the research and academic mission of Florida International University.