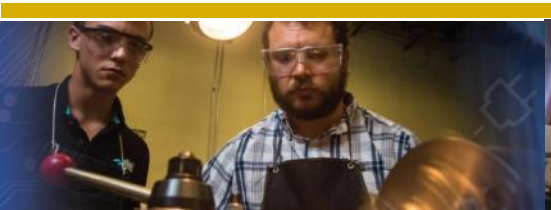
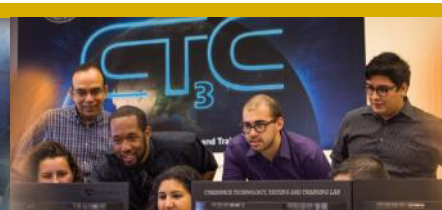



FIU Research Review
DOE-EM Cooperative Agreement

Dr. Leonel Lagos, PhD, PMP® (Principal Investigator)
Applied Research Center
Florida International University

FLORIDA INTERNATIONAL UNIVERSITY



FIU Research Review for DOE EM

Tuesday May 29, 2018	Wednesday May 30, 2018	Thursday May 31, 2018
10:00 - 12:00 D&D and IT for EM (FIU Project 3)	**10:00 - 12:00** Workforce Development & Training (FIU Project 4)	**9:00 - 11:00** **Wrap Up** (all FIU Projects)
2:00 - 4:00 High Level Waste / Waste Processing (FIU Project 1)	**1:00 - 3:00** Soil / Groundwater (FIU Project 2)	

Presentations available at doeresearch.fiu.edu

Florida International University

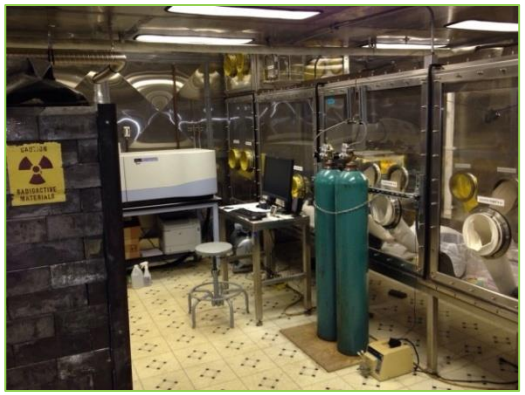
- FIU is among the 10 largest public universities in the U.S. (~56,000 students in 2016)
- Top tier research institution - R1 Carnegie Classification for Highest Research Activity
- ABET accreditation
- **First in nation in awarding bachelor's and master's degrees to Hispanic students.**
- Designated a Minority-Serving Institution.

The Applied Research Center

- Founded in 1995
- Executed over $100 million in research with DOE, DoD, other Federal and State agencies and private industry.
- Portal concept provides ease of access to FIU's Colleges and Centers to facilitate collaborative research.
- Multicultural and multilingual staff.
- Project Management Professionals (PMP®) and Professional Engineers (PE).
- Successful STEM Workforce Development Programs (DOE Fellows and Cyber Fellows).

Applied Research Center Facilities

FIU Applied Research Center

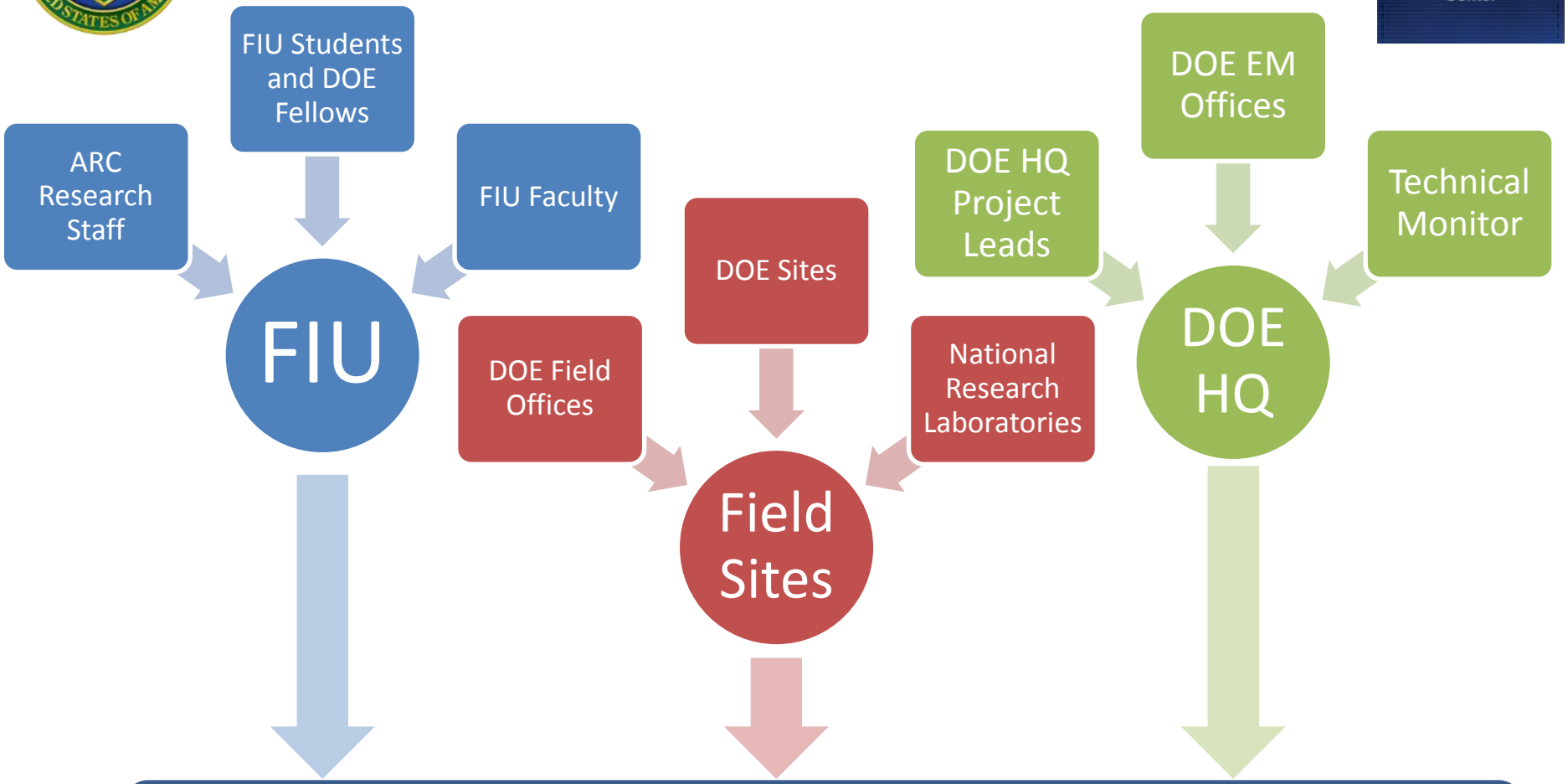







Robotics & Sensors Lab - Technology Testing & Demonstration Facility – Radiological Lab – Analytical Chemistry Lab – Soil & GW Lab – Multi-Function High Bay – GIS Lab – Cybersecurity Lab – Secure Server Room – Engineering Design Center – Machine Shop

Cooperative Agreement Team

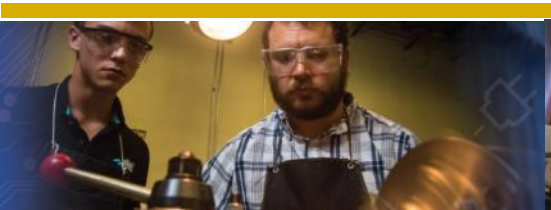


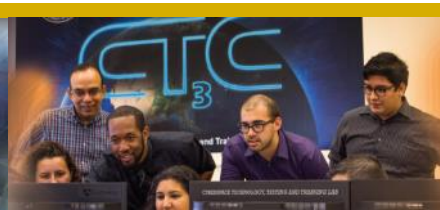
DOE-FIU Cooperative Agreement


FIU PROJECT 1: CHEMICAL PROCESS ALTERNATIVES FOR RADIOACTIVE WASTE

Dwayne McDaniel

FLORIDA INTERNATIONAL UNIVERSITY



FIU Personnel and Collaborators

Principal Investigator: Leonel Lagos

Project Manager: Dwayne McDaniel

Faculty/Staff: Amer Awwad, Anthony Abrahao, Aparna Aravelli, Reza Abbasi Bahranchi, William Tan, Jose Rivera

DOE Fellows/Students: Christopher Excellent, Anibal Morales, Michael DiBono, Clarice Davila, Sebastian Zanlongo, Manuel Losada, Joseph Coverston

DOE-EM: Gary Peterson, Kurt Gerdes, Rod Rimando, Genia, McKinley

DOE-ORP: Naomi Jaschke, Dustin Stewart

WRPS: Dennis Washenfelder, Ruben Mendoza, Jason Gunter, Kayle Boomer, Jason Vitale, Steven Kelly

SRNL: Michael Poirer, Connie Herman, Dave Herman, Ken Imrich, Bruce Wiersma

PNNL: Kayte Denslow, Carl Enderlin, Harold Atkins, Matt Fountain

Project Tasks and Scope

FIU Applied Research Center

Task 17 Advanced Topics for Mixing Processes

- experimental testing of flushing methods
  - multi-functional test loop development

Task 18 Technology Development and Instrumentation Evaluation

- development of inspection tools for waste transfer lines and DST primary tanks
- DST testbed for the evaluation of technologies

Task 19 Pipeline Integrity and Analysis

- pipeline corrosion and erosion detection
- nonmetallic materials evaluation

Task 17 - Advanced Topics for Mixing Processes

17.3 - Evaluation of pipeline flushing requirements for HLW at Hanford and Savannah River

FIU Applied Research Center

Site Needs:

According to the Defense Nuclear Facilities Safety Board, a number of issues still exist regarding the slurry transport and safety strategies at Hanford. Establishing an experimental test facility that can address a variety of technical gaps associated with critical velocities and flushing techniques would be beneficial to both Hanford and Savannah River.

Objective:

- Develop an experimental test loop to bridge technical gaps related to flushing requirements and particle re-suspension. The loop should also be capable of conducting studies related to critical velocities and bed formation.

- Test loop will expand on the current 270 ft system at FIU. The system will have multiple sections with loops ranging from 150 to 1500 ft to increase applicability.

Task 17 - Advanced Topics for Mixing Processes

17.3 Evaluation of pipeline flushing requirements for HLW at Hanford and Savannah River

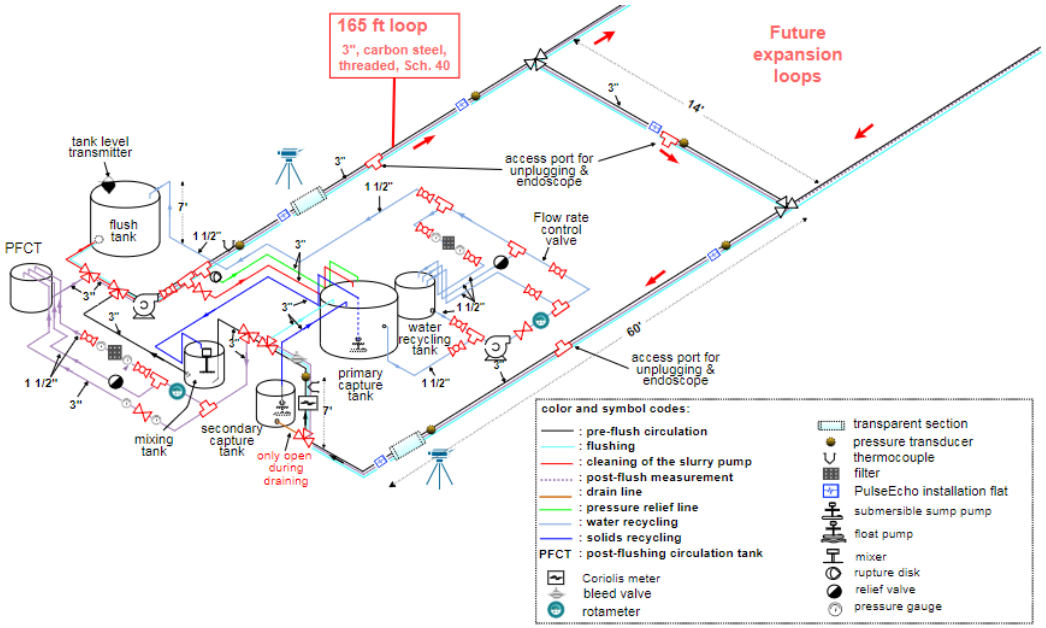
FIU Applied Research Center

Accomplishments Year 8:

- Conducted a literature review on previous efforts of flushing studies and current guidelines and standards.
- Developed a design of a modular test loop in consultation with SRNL and PNNL engineers. Defined simulant and strategies for creating the initial sediment bed.
- Finalized a test plan and operation procedures (system loading, draining, flushing, post flush circulation, pump cleaning water and sediment retrieval.
- Initiated the construction of the loop and procuring of components.

Matrix for Flushing Test Using 165 ft Test Loop

Test Number	Flush Mode	Number of flushes	FTLVR (per flush)	Resultant Duration Per flush (sec)	Resultant FTLVR
1	Constant	1	2	27.4	2
2	Ramped	1	2	-	2
3	Pulsed	1	2	-	2
4	Constant	2	1	13.7	2
5	Ramped	2	1	-	2
6	Pulsed	2	1	-	2
7	Constant	1	3	41	3
8	Ramped	1	3	-	3
9	Pulsed	1	3	-	3
10	Constant	2	1.5	20.5	3
11	Ramped	2	1.5	-	3
12	Pulsed	2	1.5	-	3
13	Constant	1	4	54.8	4
14	Ramped	1	4	-	4



Task 17- Advanced Topics for Mixing Processes

17.3 Evaluation of pipeline flushing requirements for HLW at Hanford and Savannah River

Currently:

- Assembly of pipe loop systems
- Evaluate functions of systems (pump operations, air removal, Coriolis meter, PulseEcho)
- Creation of initial conditions (fully flooded and gravity drained)

Proposed Scope for Performance Year 9

- Analysis of flushing performance under different velocity modes
  - Solids re-suspension (erosion) and full suspension during flushing (Imaging and PulseEcho)
  - Post-flush evaluations (fulfillment of flushing criteria)
    - Density monitoring and solids filtration during post-flush circulations, pipeline wall inspection (endoscope and PulseEcho transducer)
- Preliminary computational analysis to assist in
  - Creation of target initial conditions
  - Evaluation of flushing performance (predicting erosion with different boundary conditions. i.e., velocity modes)

Task 18 - Technology Development and Instrumentation Evaluation

FIU Applied Research Center

Site Needs:

In 2012, tank waste was found in the annulus of AY-102. In addition, thinning (up to 70%) of the secondary liner in the annulus region has also been observed in other double shell tanks (DSTs). Understanding of the structural integrity of all DSTs at Hanford is of paramount importance - thus, the significant need for development of tools/sensors that can provide information regarding the health of the tanks.

Year 8 Objectives:

- Develop cost effective inspection tools that can travel through the refractory pad air channels underneath the primary liner and the drain line channels underneath the secondary liner.
- Develop cost effective tools that can travel through the air supply line (3 and 4 inch diameter lines) and the drain lines (6 inches).

Present Tasks:

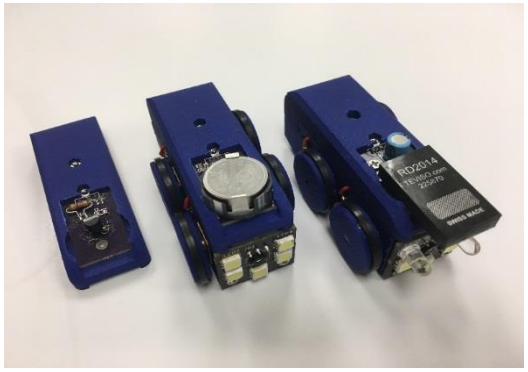
- Continue to develop our miniature rover and pneumatic crawler to provide information regarding the health of the primary and secondary liners. This includes optimization of the design, development of a cable management system, sensor integration and demonstration on a full scale mockup.
- Complete a full scale sectional mockup of the a DST that includes the drain lines, refractory channels and primary and secondary liners.
- Initiate the development of a marsupial type robotic system for the 6 inch drain lines

Task 18 - Technology Development and Instrumentation Evaluation

FIU Applied Research Center

Accomplishments Year 8:

- Completed a full-scale sectional mockup that is 8 feet wide and 38 feet in length and includes both the refectory slots, drain lines and secondary and primary liners.
- Developed modular sensor hoods for the miniature rover.
- Completed the cable management system and upgraded the control box for the mini rover.
- Conducted engineering scale tests for the in the DST mock up for the miniature rover.

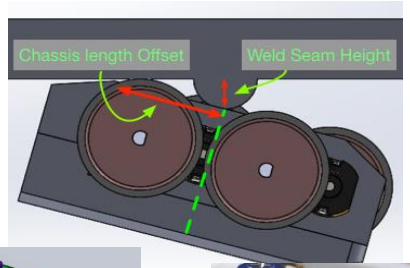


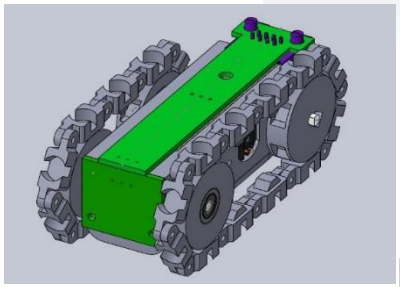
Task 18 - Technology Development and Instrumentation Evaluation

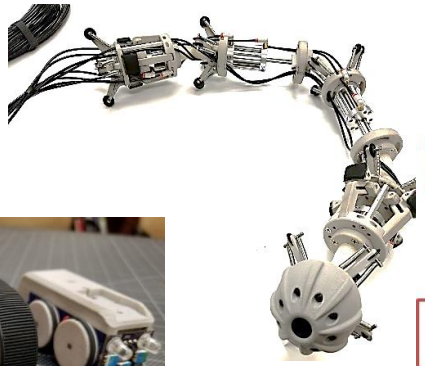
FIU Applied Research Center

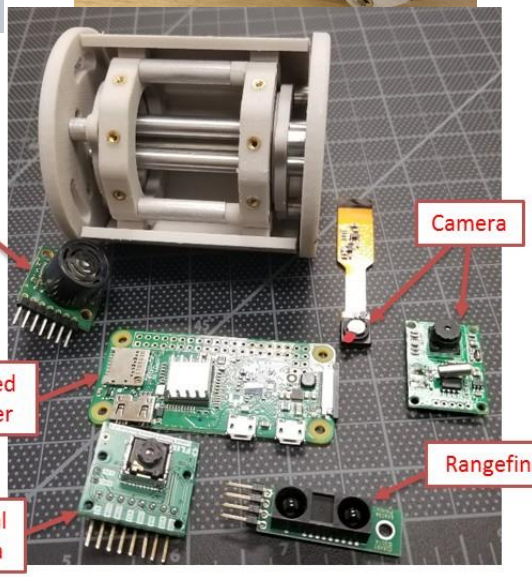
Accomplishments Year 8:

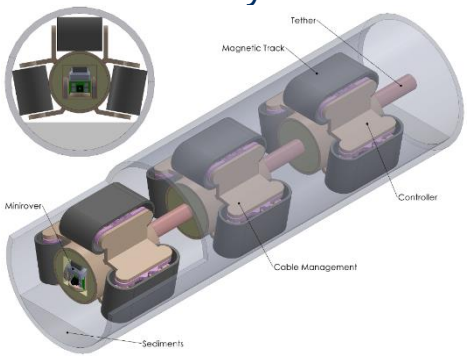
- After engineering scale testing, modifications have been implemented to allow for the mini rover to traverse weld seems.
- Developed an instrumentation module prototype for the pneumatic crawler.
- Investigated and procured a number of miniature sensors for the module including a range finder, thermal camera and embedded computer.
- Developed a conceptual design of the marsupial robotic system for the 6 inch drain system.

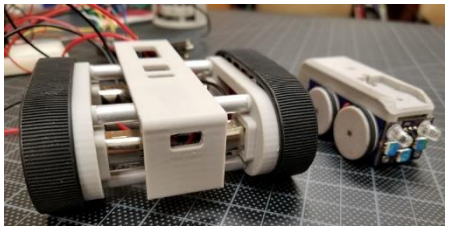












Task 18 - Technology Development and Instrumentation Evaluation

FIU Applied Research Center

Proposed Scope for Performance Year 9

Miniature Rover

- Continue tank track design and testing to overcome the weld seams.
- Continue the visual-based localization along the slot to provide semi-autonomous control.
- Make modifications to the system to integrate a UT sensor system for NDI
- Develop a smaller version of the system that can traverse around the corners in the refractory of A-101

Pneumatic Crawler

- Integrate UT sensor – develop a module that can house a means to prep the pipe surface and deploy the small UT sensor at any point on the circumference of the pipe.
- Continue to develop inspection tool for secondary liner that travels through 6 inch leak detection line.

Task 18 - Technology Development and Instrumentation Evaluation

18.3 – Support for H-Canyon (New)

FIU Applied Research Center

Proposed Task for Performance Year 9

Investigate approaches/coatings to protect the walls in the exhaust channel at H-Canyon.

- Conduct literature review on fixatives/coatings that can protect the wall surfaces and potentially mitigate the damage
- Investigate deployment strategies and robotics systems that can operate within the canyon.

Task 19 - Pipeline Integrity and Analysis

FIU Applied Research Center

Site Needs:

Due to uncertainties regarding the structural integrity of pipelines at Hanford, a Fitness-for-Service (FFS) program for the Waste Transfer System has been implemented. A direct inspection and assessment of the condition of buried pipelines is required to evaluate the corrosion and erosion wear rates.

In addition, nonmetallic materials are used in Hanford's waste transfer system that include inner primary hoses in the HIHTLs, Garlock® gaskets, and EPDM O-rings. These materials are exposed to β and γ irradiation, caustic solutions as well as high temperatures and pressure stressors. How they react to each of these stressors individually has been well established, but simultaneous exposure of these stressors is of great concern.

Year 8 Objectives:

- Investigate the use of remote permanently mounted Ultrasonic Transducer (UT) systems for measuring pipe wall thickness.
- Provide the Hanford with data obtained from experimental testing of the hose-in-hose transfer lines, Garlock® gaskets, EPDM O-rings, and other nonmetallic components under simultaneous stressor exposures.

Present Tasks:

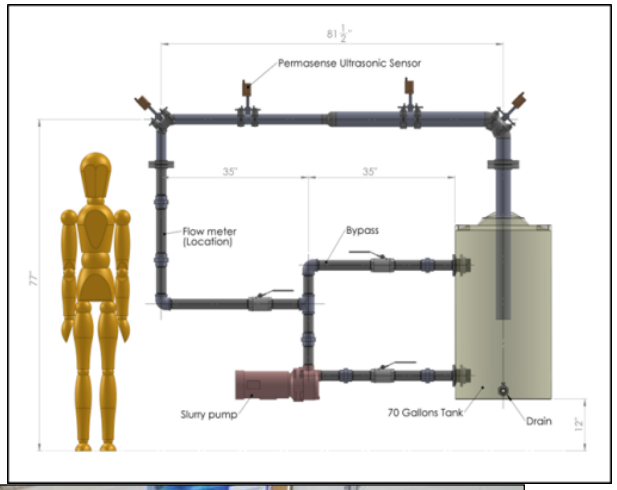
- Evaluate strength of non-metallic materials after aging for 6 and 12 months that have been subjected to elevated temperatures and exposed to caustic fluid. Conduct post failure analysis to assess levels of material degradation.
- Evaluate the long term reliability/accuracy of the Permasense guide wave sensors and SRNL's erosion coupons to provide real time thickness measurements of 2 and 3 inch diameter pipes on a bench scale test loop.

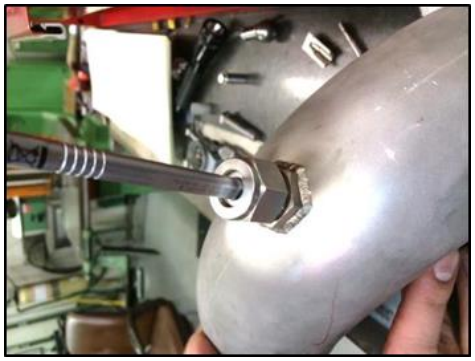
Task 19 - Pipeline Integrity and Analysis

FIU Applied Research Center

Accomplishments Year 8:

- Designed test loop for accelerated aging of pipes and real-time measurements.
- Assembled pipe loop with 2 and 3 inch diameter sections – including 4 Permasense sensors.
- Developed a test plan and test matrix for eroding the pipes with sand water slurry over 7 months
- Worked with SRNL to incorporate their mass loss erosion coupons into our loop.



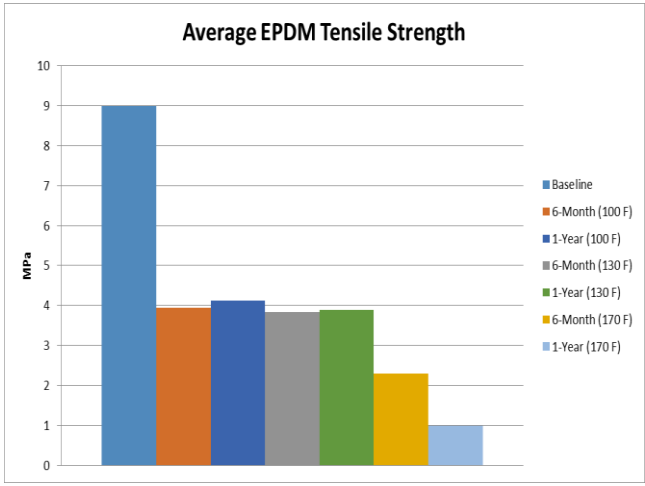


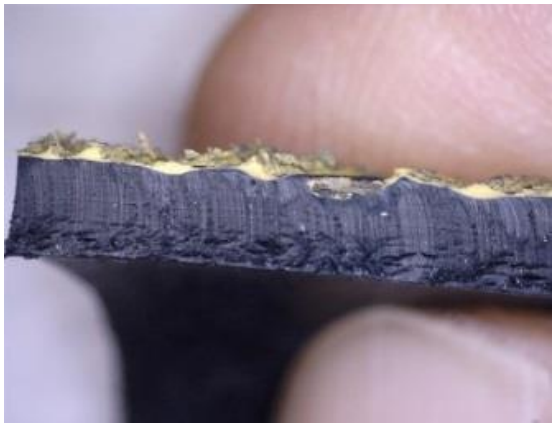
Task 19 - Pipeline Integrity and Analysis

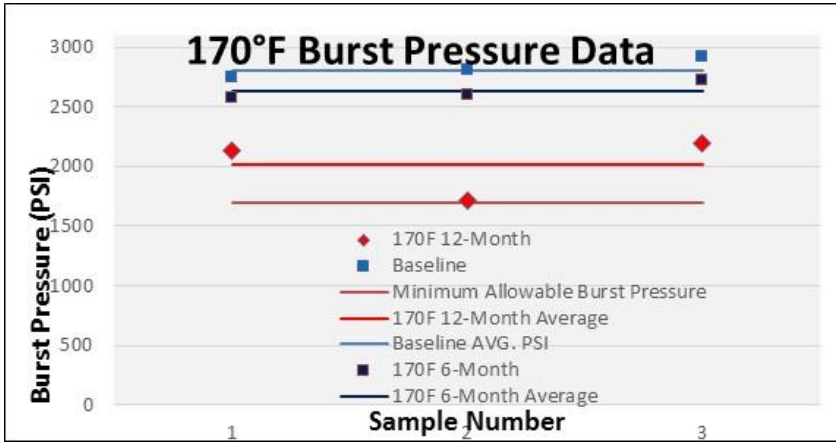
FIU Applied Research Center

Accomplishments Year 8:

- Completed 1 year aging of the HIHTL and EPDM and Garlock material coupons at 3 temperatures and exposure to NaOH (25%).
- Conducted burst pressure tests on the HIHTL coupons and tensile tests on the material coupons.
- Conducted visual inspection on cross sections of the material and HIHTL coupons.
- Conducted initial analysis using SEM-EDX.







Task 19 - Pipeline Integrity and Analysis

Proposed Scope for Performance Year 9

UT Sensor Evaluation

- Complete initial testing with the sand-water simulant (5% solids) and monitor real-time changes in pipe thicknesses.
- Complete subsequent testing with higher solids loading.
- Modify the test loop – capable of evaluating the sensors ability to withstand elevated temperature and humidity while providing accurate measurements.

Non-metallic Material aging

- Complete SEM-EDX on both the HIHTL coupons and the material coupons.
- Reconfigure aging loop to accommodate the two remaining hose sections as well as EPDM and Garlock® coupons. (Investigate obtaining additional HIHTL coupons)
- A single loop will be utilized to age the hose sections with water at 170°F with for a 12-month duration.
- After the 1 year of aging, specimens will be removed and tested to determine the level of degradation in strength and material properties.

Task 20 – Support for Technology Evaluation Using DST Mockup

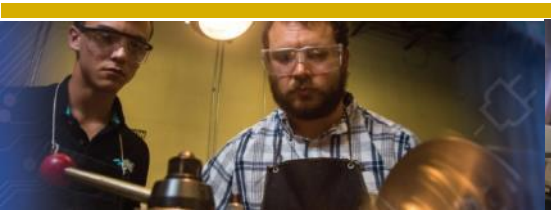
Proposed Scope for Performance Year 9

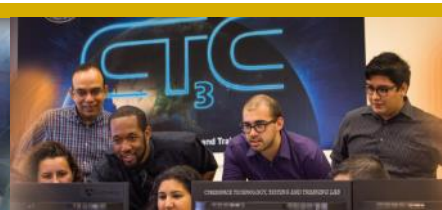
- Provide access to DOE-EM and its contractors to use FIU's DST sectional mockup to evaluate the viability of inspection tools, robotic systems and sensors.
- Provide support for the testing and evaluation
- Work with engineers to make modifications to the mockup, as needed.


FIU PROJECT 2:
YELENA KATSENOVICH

ENVIRONMENTAL REMEDIATION SCIENCE & TECHNOLOGY

FLORIDA INTERNATIONAL UNIVERSITY



FIU Personnel and Collaborators

Principal Investigator: Leonel Lagos

Project Manager: Yelena Katsenovich

Faculty/Staff: Angelique Lawrence, Ravi Gudavalli, Hilary Emerson

Postdoctoral Fellows: Mehrnoosh Mahmoudi

DOE Fellows/Students: Mohammed Albassam, Silvina Di Pietro, Alejandro Garcia, Hansell Gonzalez Raymat, Ron Hariprashad, Alejandro Hernandez, Juan Morales, Ripley Raubenolt, Alexis Smoot, Christine Wipfli, Frances Zengotita, Silvia Garcia, Katherine Delarosa, Ximena Lugo

DOE-EM: Genia McKinley, Kurt Gerdes, Paul Beam, Skip Chamberlain, Mathew Zenkowich, Jeff McMillan

DOE-SRS: Jeff Crenshaw, Nixon Peralta

SRNL: Brian Looney, Carol Eddy-Dilek, John Dickson, Elizabeth Hoffman, Hope Lee,

Luke Reid, Daniel Kaplan.

SREL: John Seaman

PNNL: Nik Qafoku, Jim Szecsody, Timothy Johnson, Vicky Freedman

LANL: Don Reed

DOE-CBFO: Russ Patterson, Anderson Ward

Project Tasks and Scope

Task 1: Remediation Research and Technical Support for the Hanford Site

- Laboratory-scale experiments to study impacts of potential *in situ* remediation techniques on the subsurface at Hanford.
- Investigation of geophysical techniques for tracking remediation progress.

Task 2: Remediation Research and Technical Support for Savannah River Site

- Laboratory-scale experiments to study contaminant fate and the impacts of potential *in situ* remediation techniques on the subsurface at SRS.

Task 3: Surface Water Modeling of Tims Branch

- Development of an integrated hydrology model to simulate flow characteristics and contaminant fate and transport under various hydrological conditions in Tims Branch watershed at SRS.

Task 5: Research and Technical Support for WIPP

- Laboratory-scale experiments to study the fate of actinides and lanthanides at the WIPP site.

Task 1 – Remediation Research and Technical Support for the Hanford Site

FIU Applied Research Center

Site Needs:

DOE-EM has a critical need to understand the biogeochemical processes influencing the behavior of contaminants (U(VI), Tc-99) and iodine in Hanford Site's deep vadose zone that can impact groundwater. Research to address environmental risks and remediation challenges involving Tc-99 is a high-priority activity for the DOE-EM complex. In addition, the DOE has no approved treatment technologies to control iodine mobility in the vadose zone (VZ) and groundwater. Manipulation of pH via ammonia gas is a potential remediation technology that can lead to incorporation of U(VI) into the sediments. Improving geophysical response for contaminant behavior and remediation performance can assist environmental remediation.

Year 8 Objectives:

- Identify physicochemical mechanisms controlling immobilization of U via NH_3(g) injection in Hanford vadose zone.
- Investigate spectral induced polarization (SIP) signatures of microbial activity to test if microbial actions are detectible via SIP and analyze the resulting SIP data.
- Investigate pertechnetate reduction by magnetite and Hanford soil in the absence and presence of bicarbonate and identify if the presence of bicarbonates facilitates dissolution of TcO_2.
- Investigate co-precipitation of iodine with calcium carbonate and study the effect of silica at different pH conditions.

Present (Year 8) Subtasks:

- Compare removal of U following base treatment with NaOH, NH_4OH and NH_3 gas in batch samples in the presence of Hanford-relevant minerals.
- Measure electrical geophysical responses to microbial activity in saturated environments via column experiments.
- Investigate if Tc(VII) precipitates as TcO_2 under reducing circumneutral conditions or forms soluble Tc(IV)- carbonate complexes.
- Study the effect of pH and different silica concentrations (0-20mM) on iodate co-precipitation with calcium carbonate.

Task 1 – Remediation Research and Technical Support for the Hanford Site

FIU Applied Research Center

Accomplishments Year 8:

Ammonia Gas for Uranium Remediation

- Finalized experiments with variable base treatments (NaOH, NH_4OH, and NH_3 gas) and submitted for publication!
- Showed significant reduction of U in solid phases via XANES.
- *Ongoing* – Characterizing solid phases to identify mineral phases controlling U.

Geophysical Response of Microbes

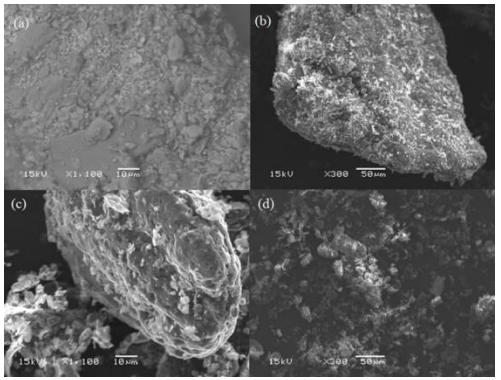
- Initiated small columns for basic experiments.
- *Ongoing* – Monitoring after injection of live bacterial culture along with pumping of glucose solution.

Technetium Chemistry

- No significant reduction of Tc-99 in Hanford soil but increased reduction in presence of magnetite at lower pH.
- Demonstrated HCO_3 does not affect TcO_2 dissolution rates.
- *Ongoing* – characterizing leachates and solids to identify factors responsible for mineral transformation.

Iodine incorporation in calcium carbonate

- Evaluated synthesis procedure for calcium carbonate with metasilicate.
- Completed sampling of solutions after iodate-carbonate co-precipitation.
- *Ongoing* – IC-ICP-MS installation for speciation analysis of iodine and characterization of dried solid phases via SEM/EDS.



SEM imaging of illite minerals following treatment with NH_3 gas and aeration

- **Published paper in peer-reviewed journal (*Applied Geochemistry* and under review in *Journal of Environmental Management).***
- **Presented results at WM2018 and ACS, Goldschmidt Fall 2018.**
- **WM17 Paper received award from DOE-NE's Innovations in Nuclear R&D.**

Task 1 - Remediation Research and Technical Support for the Hanford Site

Proposed Scope for Year 9

Site Needs:

DOE-EM faces a number of environmental challenges that are technically complex and unique to EM with tremendous associated cleanup costs. This project is focusing on basic science to fill knowledge gaps and validate potential remediation technologies to assist with environmental cleanup of Hanford Site's contaminated vadose zone and groundwater. This investigation will assist Hanford Site and other DOE EM sites in their efforts to better understand Tc-99 behavior in the presence of Fe(II)-bearing minerals and the fate and transport mechanisms of comingled contaminants including Tc-99, U(VI), Cr, and iodine.

Objectives:

- Continue to characterize mineral alterations following ammonia gas treatment and identify phases controlling U behavior.
- Study the reduction of pertechnetate in the presence of Hanford relevant Fe(II)-bearing minerals such as ilmenite, siderite and biotite; investigate for Tc(IV) re-oxidation rate.
- Conduct characterization of iodine-calcium carbonate solids; Investigate for the stability of contaminant-substituted calcite in the presence of silica; Initiate studies on co-mingled contaminants incorporation into calcium carbonate.
- Initiate a new subtask to support lysimeter studies on low-activity waste form degradation; discussion is in progress with PNNL scientists.

Task 2 - Remediation Research and Technical Support for Savannah River Site

FIU Applied Research Center

Site Needs:

DOE EM's current mission places emphasis on innovative approaches and novel technologies which help to address the significant challenges associated with the remaining cleanup of contaminated sites. Significant data gaps still exist regarding the behavior and chemistry of radionuclides of concern as well as the co-mingling of these contaminants that affect the groundwater remediation strategies at SRS and other DOE EM sites. Evaluation of the role of different environmental factors on the fate and transport of contaminants and co-contaminants in soil and groundwater will assist in the design and validation of novel in situ remediation technologies that support EM test bed demonstrations and benefit SRS cleanup initiatives.

Objectives:

- Understand I, Tc, and U fate in a wetland environment interacting with reactive oxygen species (ROS) formed due to co-mingled NO_3^- contamination interacting with natural organic matter and light.
- Investigate for synergistic interactions between U(VI) ions, HA, and colloidal silica in the presence of pure minerals relevant to SRS sediment.
- Determine if the low cost unrefined humic acid (Huma-K) and modified humic acid (KW15 modified Humics) can be used to control the mobility of uranium in groundwater and study the sorption/desorption of humic acid (Huma-K) and modified HA on SRS sediment at various pH via batch and column experiments.

Present (Year 8) Subtasks:

- Impact of NO_3^- and reactive oxygen species on the fate of Tc, I, and U in wetlands at Savannah River Site.
- The synergistic effect of humic acid and colloidal silica on the removal of U(VI).
- Humic acid batch sorption with pure minerals and column experiments with SRS soil.

Task 2 – Remediation Research and Technical Support for Savannah River Site

FIU Applied Research Center

Accomplishments Year 8:

Impact of reactive oxygen species on the fate of Tc, I, and U in SRS Wetlands

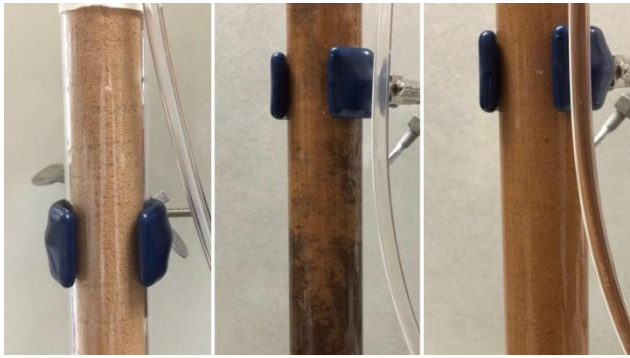
- Initiated experiments characterizing humic acid at pH 3, 5, and 7, 0 and 100 mM NO_3^-, and in the presence and absence of full sunlight (natural and in environmental chamber).
- *Ongoing*: Characterize humic acid via UV-vis, TOC, ATR-FTIR, FT-ICR-MS, and NMR; Compare changes in functional groups and total organic carbon content in humic acid.

The Synergistic Effect of Humic Acid and Colloidal Silica

- Completed batch studies on synergetic interactions between humic acid, colloidal silica, uranium (U) and pure minerals at pH 3, 5 and 8.
- *Ongoing to complete this task in year 8*: Perform batch experiments with Quartz, Kaolinite and Goethite; perform surface area analysis on pure minerals.

Batch and Column Experiments with Huma-K

- Conducted column experiments to study the sorption of uranium on to SRS sediment and influence of sorbed humate on uranium sorption.
- Completed uranium sorption experiments onto SRS sediments with and without Huma-K/Mod-HA coating at pH 4.
- *Ongoing*: Perform column experiments with Huma-K and modified humic acid and compare data with control column; Perform batch experiments using mix minerals (quartz + kaolinite and goethite) to compare U(VI) removal of with data for SRS sediment at different pH.



Humic acid column experiment

- Research presented at WM2018 Symposia.
- DOE Fellow Hansell Gonzalez won WM2018 Student Poster Contest.
- Published in the *Journal of Environmental Management*, "Unrefined humic substances as a potential low-cost amendment for the management of acidic groundwater contamination".

Task 2 – Remediation Research and Technical Support for Savannah River Site

FIU Applied Research Center

Proposed Scope for Year 9

Site Needs:

DOE EM's current mission places emphasis on innovative approaches and novel technologies which help to address the significant challenges associated with the remaining cleanup of DOE contaminated sites. Management of technetium (Tc) and iodine (I) contamination in particular is a high-priority. Significant data gaps still exist regarding the behavior and chemistry of radionuclides of concern such as Tc, I and uranium, as well as the co-mingling of these contaminants that affect groundwater remediation strategies at SRS and other DOE EM sites. Evaluation of the role of different environmental factors on the fate and transport of contaminants and co-contaminants in soil and groundwater will assist in the design and validation of novel in situ remediation technologies that support EM test bed demonstrations and benefit SRS cleanup initiatives.

Objectives:

- Investigate variable nitrate and light exposure on humic acid and consider chemicals that quench ROS to identify dominant degradation pathways; evaluate the behavior of I, Tc, and U both during and following interaction of humic acid with light and nitrate.
- Evaluate the effect of time, pH, and initial uranium concentrations on U(VI) sorption/ desorption behavior using experimental matrix that includes SRS sediment, U(VI) and modified humic substances.

Task 3 - Surface Water Modeling of Tims Branch

FIU Applied Research Center

Site Needs:

- DOE EM's Technology Plan to Address EM Mercury Challenge & DOE EM's Innovation & Technology Program indicate mercury & other heavy metal and radionuclide contamination at SRS and other DOE sites still exist.
- Long-term monitoring of heavy metals and radionuclides (e.g. Hg, U, Ni, Tc, etc.) required to evaluate effectiveness of implemented remediation technologies.

Objectives:

- Utilize Tims Branch as a test bed to develop a numerical modeling tool to evaluate the effect of extreme hydrological impacts on the fate and transport of major contaminants of concern (e.g. Hg, U, Ni, radionuclides).
- Develop a transferable technology that is potentially applicable in other contaminated stream systems at SRS and other DOE EM sites.
- Collect *in-situ* field data such as flow depth and velocity, suspended particle concentration and other water quality parameters to support model calibration and verification. This will be supported by in-person sampling and data collection as well as deployment of remote monitoring devices.

Present (Year 8) Subtasks:

- Modeling of Surface Water Flow and Contaminant Transport in the Tims Branch Ecosystem
- Application of GIS Technologies for Hydrological Modeling Support
- Data Collection, Sampling and Analysis in Tims Branch Watershed

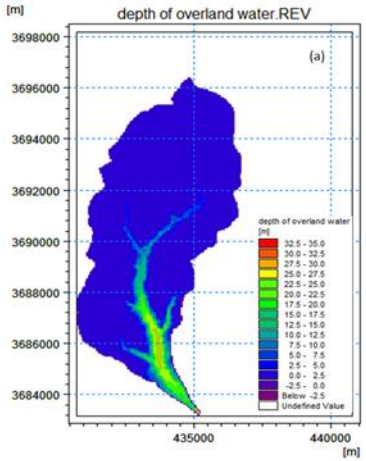
Task 3 - Surface Water Modeling of Tims Branch

Accomplishments (Year 8)

FIU Applied Research Center

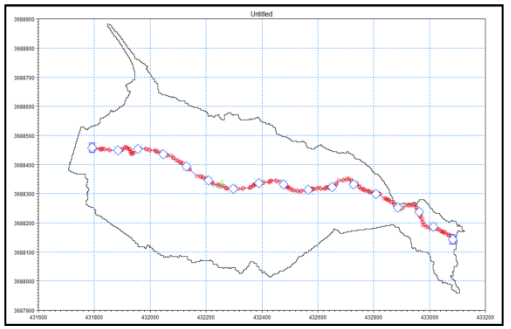
2-D Overland Flow (OL) & 1-D Stream Flow (SF) Models

- Completed 2-D OL flow model using MIKE SHE.
- Completed 1-D SF model of A-014 outfall tributary using MIKE 11; incorporated control structures (weir & culvert).
- Completed model calibration (sensitivity & uncertainty analyses) of both models.
- Coupled MIKE 11 (A-014) & MIKE SHE models.
- Simulation results indicate model capable of replicating steady state base flow within A-014 outfall tributary.
- Model can be used as a platform to develop flow simulations in Tims Branch and other streams in SRS.
- Model to be constantly updated and calibrated as data from stage gauges implemented.



MIKE SHE 2-D OL Flow Model

MIKE 11 1-D Stream Flow Model of A-014 OF Tributary

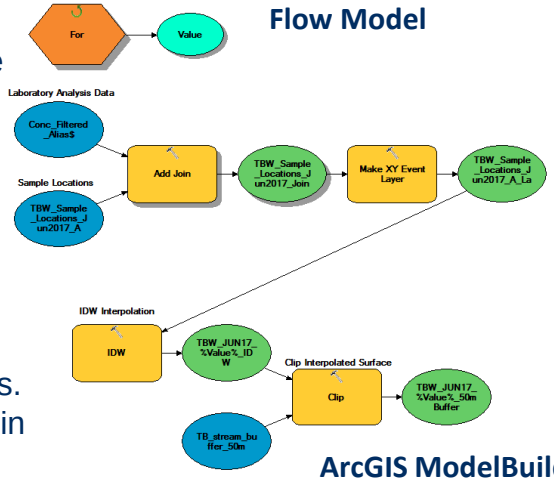


GIS Support

- Developed process flow models to automate repetitive tasks & shorten processing time.
- Processed field data & generated spatial distribution maps of contaminant conc./water quality.
- Delineated model domain used in A-014 stream flow model.

In-Situ & Remote Data Collection at Tims Branch

- Conducted field sampling, in-situ & remote data collection in collaboration with SRNL & SREL scientists.
- Deployed 2 solar powered remote monitoring stations in TB to collect water level data.
- Data supports model development & calibration.



ArcGIS ModelBuilder Process Flow Model

In-Situ & Remote Data Collection at Tims Branch, SRS

Task 3 - Surface Water Modeling of Tims Branch

FIU Applied Research Center

To be Completed in Year 8

- Develop MIKE 11 1-D stream flow model of main Tims Branch stream.
- Couple MIKE SHE & MIKE 11 models for Tims Branch (Milestone 2017-P2-M9).
- Perform simulations for time period October 1993 - September 1996 when USGS gauge station downstream Tims Branch was active and flow data from that station was available. This data will be used as a downstream calibration point.
- Conduct sensitivity analysis & calibration of coupled model.

Proposed Scope for Year 9

- Develop geochemical component of the model using ECO Lab.
- Develop advection-dispersion model for contaminant transport using MIKE 11.
- Couple geochemical, advection-dispersion & hydrology components and conduct sensitivity analysis.
- Examine groundwater/surface water interaction in TBW using historical time series of GW table. Assists in quantifying discharge/recharge as part of TBW water balance.
- Create raster hydrographs using GIS tools for visualization of hydrologic timeseries data so large temporal datasets (rainfall, discharge) can be more easily reviewed and interpreted.
- Conduct literature review to identify best remote sensing application for determining spatial and temporal variability in evapotranspiration across SRS; serves as indicator of environmental response to landscape disturbances and the effect these changes can have on the energy and water budget; Compliments and optimizes SRS resource managers' current long-term post remediation environmental monitoring activities.

Task 5: WIPP Collaboration

FIU Applied Research Center

Site Needs:

This research strives to help the LANL ACRSP team to better understand the long-term fate of the actinide elements in the Waste Isolation Pilot Plant (WIPP). Specifically, the effects of ligands in the waste stream (e.g. EDTA and oxalate) on near field mobility of actinides is still unknown (Dunagan, 2007; Brush, 1990). Complexation constants have been measured for most actinides and lanthanides (Thakur *et al*., 2014; 2015; Borkowski *et al*., 2001). However, their long-term stability and sorption are not yet understood in high ionic strength systems. EDTA is a significant risk factor as it is present in significant amounts in waste and could reach up to 0.3 mM in the repository (Roach *et al.,* 2008).

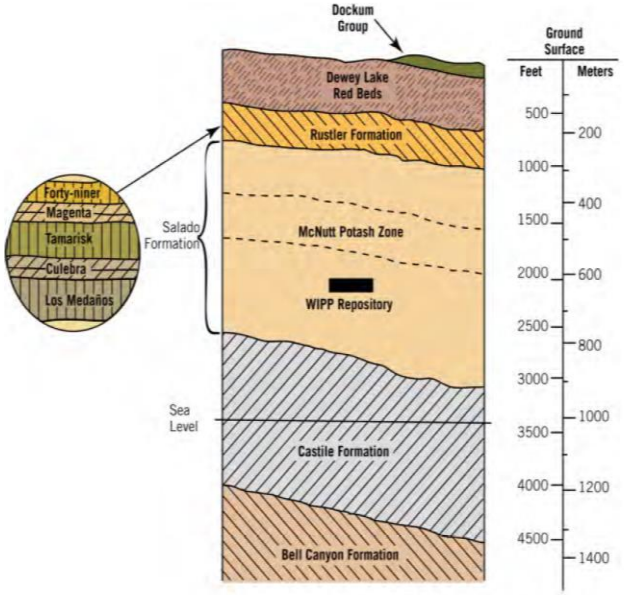
Year 8 Objectives:

To understand the ternary interactions between actinides and WIPP-relevant ligands and minerals and their potential fate in the subsurface.

- Measure sorption parameters for Nd/Am(III), Th(IV), and U(VI) complexed with EDTA at variable ionic strength.
- Measure Th(IV) and U(VI) sorption to dolomite without EDTA.
- Compare mobility of Nd (Year 7 results) and U, Th versus Nd/Th/U-EDTA complexes.

Present (Year 8) Tasks:

- Batch experiments with Nd(III), Th(IV), and U(VI) in 0.1 and 1.0 M NaCl, CaCl2, and MgCl2 with and without EDTA as a waste components.



Oxidation State Distribution of Key Actinides in WIPP Performance Assessment

Actinide	Oxidation State				Speciation Data used in Model Predictions
	III	IV	V	VI	
Uranium		50%		50%	Thorium for U(IV), 1 mM fixed value for U(VI)
Plutonium	50%	50%			Am/Nd for Pu(III) and thorium for Pu(IV)
Americium	100%				Americium/neodymium

Task 5: WIPP Collaboration

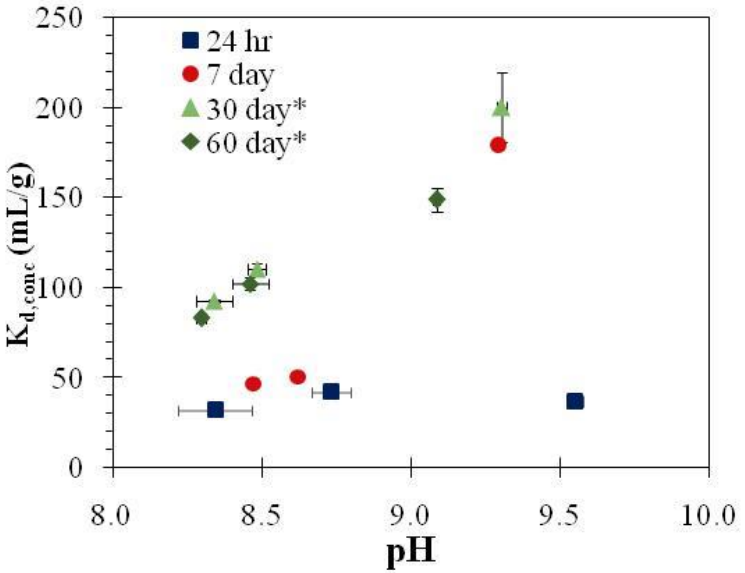
FIU Applied Research Center

Accomplishments Year 8:

- Finalized batch and mini-column experiments to investigate Nd(III) sorption as an analog to Am/Pu(III) in variable ionic strength 0.01 - 5.0 M NaCl
- Conducted batch experiments with Nd(III), Th(IV), and U(VI) in 0.1 and 1.0 M NaCl, $CaCl_2$, and $MgCl_2$

- ❖ Publication in the *Journal of Environmental Radioactivity* "Retention of neodymium by dolomite at variable ionic strength as probed by batch and column experiments".
- ❖ 2017 Internship report indexed on OSTI (LA-UR-17-30894) and received undergraduate award from DOE-NE's Innovations in Nuclear R&D program!
- ❖ Presented work at Waste Management 2018, FIU McNair Scholars 2018 Research Conference, Life Sciences South Florida 2018, 2018 ACS Fall Conference, and at the inaugural Young Investigators in Radiochemistry Webinar sponsored by NAMP (May 17th).

Crosscutting research bridges the basic and applied sciences



1000 ppb Nd partitioning in the presence of 5 mg/L EDTA and 5 g/L dolomite

Task 5: WIPP Collaboration

Proposed Scope for Year 9

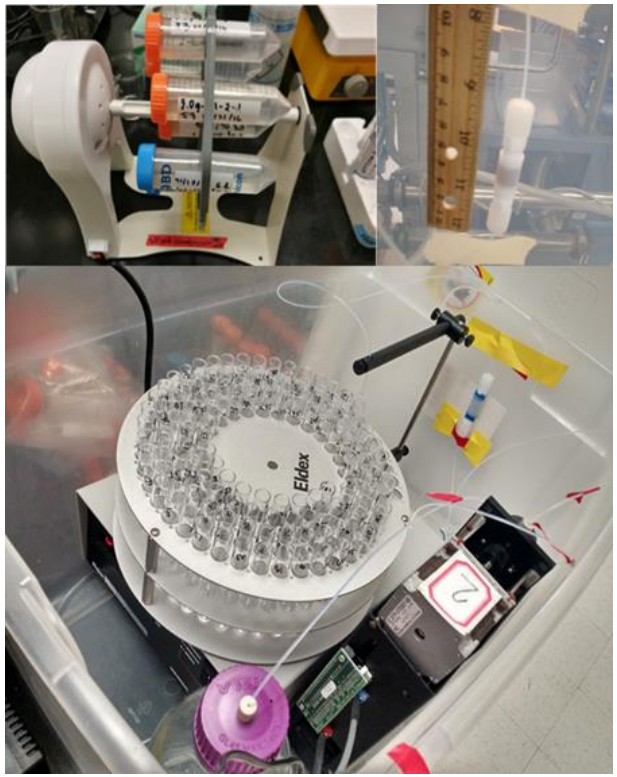
Site Needs:

The effects of ligands in the waste stream (e.g. EDTA and oxalate) on near field mobility of actinides is still unknown (Dunagan, 2007; Brush, 1990). Research is needed to include additional ligands: citrate (common plant and microbial exudate) and gluconate (plasticizer in cement). There is significant synergy with the LANL ACRSP focus on understanding microbial impacts to actinide fate at the WIPP as these ligands and EDTA may interact with local microbial populations

Objective:

To understand the impact of EDTA, citrate, and gluconate on the sorption of actinides in the +3, +4, and +6 oxidation states to dolomite and iron oxides in simplified systems via batch and column experiments. In addition, both Am and Pu will be included in the scope as these are the major risk drivers.

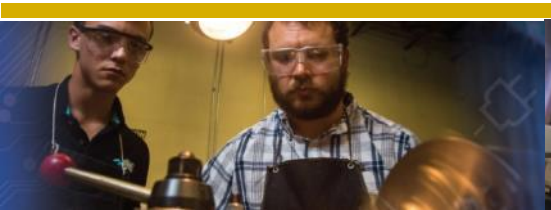
Crosscutting research bridges the basic and applied sciences

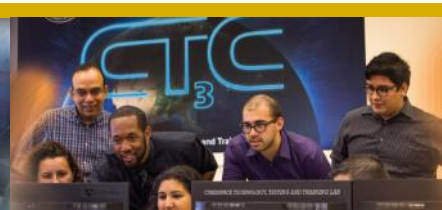


FIU Project 3 – Waste and D&D Engineering and Technology Development

Dr. Himanshu Upadhyay and Mr. Joseph Sinicrope

Florida International University





FIU Personnel and Collaborators

Principal Investigator: Leonel Lagos

Project Manager: Leonel Lagos

Faculty/Staff: Himanshu Upadhyay, Joseph Sinicrope, Walter Quintero, Clint Miller, Peggy Shoffner, Jesse Viera

DOE Fellows/Students: Joshua Núñez, Tristan Simoes-Ponce, Ryan Cruz, Alejandro Koszarycz

DOE-EM: Bart Barnhart, Andy Szilagyi, Dinesh Gupta, Rod Rimando, Genia McKinley, Jonathan Kang

SRNL: Mike Serrato, Aaron Washington, Connor Nicholson, Brent Peters

SRS: Jack Musall

Project Tasks and Scope

Task 1 Waste Information Management System (WIMS)

- Manage complex-wide waste forecast information for planned treatment/disposal
- Provide web-based tool to receive, organize, and report DOE waste forecast data via a common application

Task 2 D&D Support for Technology Innovation, Development, Evaluation and Deployment

- Address high priority fire resiliency and safety requirements in support of SRS 235-F D&D project in collaboration with SRNL
- Implement phased approach for standards development, testing/evaluation, and deployment of D&D technologies
- Identify broader applications for intumescent coatings to meet other challenges across DOE complex

Task 3 Knowledge Management Information Tool (KM-IT)

- Maintain and preserve D&D knowledge by enhancing communication, information sharing, and distribution to assist future D&D projects and workforce

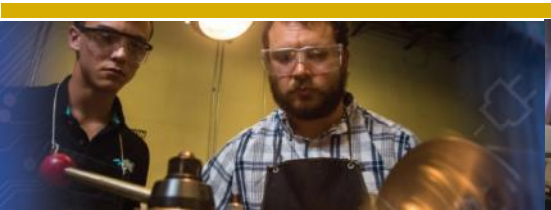
D&D Research Review

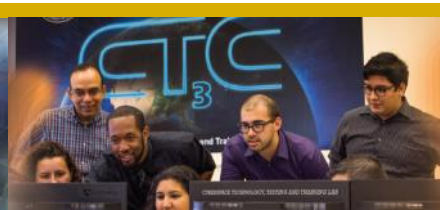
ARC Staff: Joseph Sinicrope, Peggy Shoffner, Leo Lagos, Jesse Viera

SRNL Collaborators: Connor Nicholson, Aaron Washington, Brent Peters, Michael Serrato

DOE Fellows: Joshua Nuñez, Tristan Simoes-Ponce

Florida International University





Activity 1 - Operational Tests and Evaluations (Hot Demo)

Incombustible Fixatives

FIU Applied Research Center

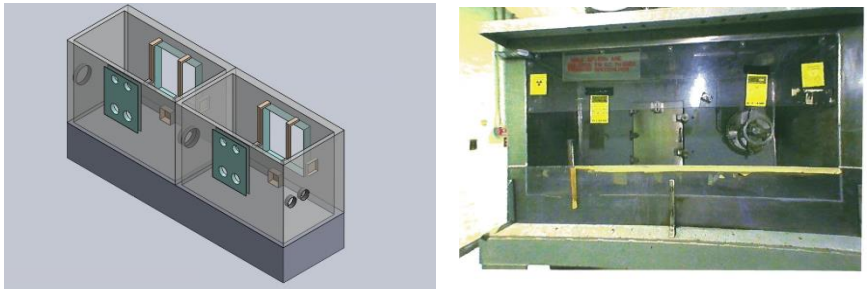
Scope

To develop and characterize a fire resistant radiological contamination fixating technology deployable in non-standard environments (e.g., hot cells, wing cabinets, etc.)

SRNL environmental testing (left) and FIU direct flame testing (right)

Down Selection

- Environmental (SRNL) – temperature/humidity effects
- Radiological (SRNL) – gamma irradiation, 5 MRad
- Adhesion (SRNL) –fixative remains adhered to substrate
- Fire (FIU) – performance under direct flame
- Mass Loss (FIU) – performance at discrete temperatures increasing to 800ºF



FIU cold test mockup (left) and potential hot test stand – contaminated wing cabinet at SRS 235-F PuFF Facility (right)

Field Testing

- Cold demo completed at FIU (Fall 2017)
- SRNL incorporated cold demo results and prepared hot demo test plan (Winter 2018)
- SRNL to conduct fixative hot test/demo at SRS 235-F PuFF Facility (Summer 2018)

Benefits

- Commercial fire resistant materials adapted for radiological application.
- Stabilization of residual contamination influences facility disposition approach.
- Reduces worker risk levels and technical uncertainty.

Activity 1- Operational Tests and Evaluations (Hot Demo)

Incombustible Fixatives

Purpose

To determine the performance of FireDam as a fixating material in a radiological area

Application Methods

- Slow pour
- Spray (Graco Ultra Max)

Application Areas

- Hot Cell Interior
  - Spray coat horizontal and vertical
  - Slow pour horizontal
- Wing Cabinet/Hood
  - Spray coat horizontal and vertical
  - Slow pour horizontal
- F/H Labs Coupons
  - Spray coat
  - Slow pour

Characteristics of Interest

- Hot Cell Interior – 235-F Personnel
  - Document lessons learned on application methods
  - Monitor subjective performance (adhesion, appearance, etc.) - pictures
- Wing Cabinet/Hood – 235-F Personnel
  - Document lessons learned on application methods
  - Monitor subjective performance (adhesion, appearance, etc.) – pictures
  - Monitor thickness over lifetime (Defelsko PosiTector-6000 FNTS)
- F/H Labs Coupons – SRNL Personnel
  - Heat testing – muffle furnace
  - “Fixating capacity” testing – how much material is released during heating

Activity 2 - Radiological Shielding Foams Fire Testing

Best in Class Two hour Direct Flame Test

Hilti

- Duration: 2 hours
- Flame and smoke propagation:
- Structural integrity:
- Thermal insulation:

3M

- Duration: 2 hours
- Flame and smoke propagation:
- Structural integrity:
- Thermal insulation:

Hilti

3M

Overall, the Hilti samples were the clear front runner for best in class

Activity 2 - Radiological Shielding Foams
Fire Testing
Fire-rated Foam-Two Hour Direct Flame Test

FIU Applied Research Center

23 FR

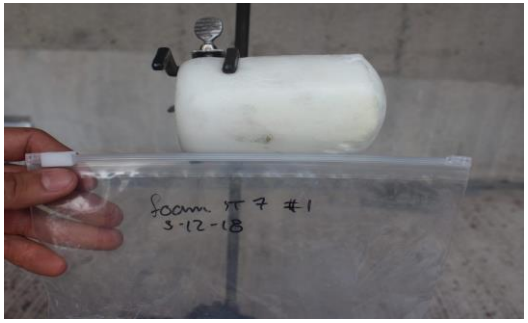
- Duration: 13 min & 25 seconds
- Flame and smoke propagation:
- Structural Integrity:
- Thermal Insulation:

7 FR

- Duration: 2 min & 37 seconds
- Flame and smoke propagation:
- Structural Integrity:
- Thermal Insulation:

23 FR

7 FR



Activity 2 - Radiological Shielding Foams Fire Testing

Non-Fire Rated Foam-Two Hour Direct Flame Test

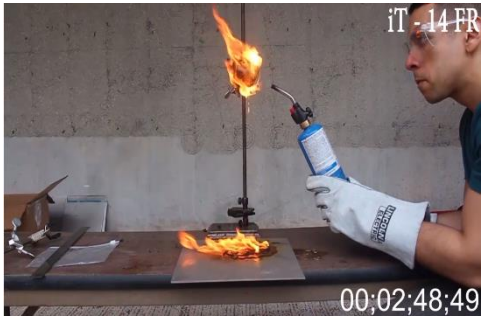
iT-14

- Duration: 3 min & 3 seconds
- Flame and smoke propagation:
- Structural integrity loss:
- Thermal insulation:

iT-8

- Duration: 14 min & 45 seconds
- Flame and smoke propagation:
- Structural integrity loss:
- Thermal insulation:

iT-14



iT-8

Activity 3 - Standards Development
Meeting Operational Requirements

FIU Applied Research Center

- First 2 x ASTM Standard Specifications for fixative technologies ISO D&D activities formally published in July 2017:
  - E3104-17: Specifications for Strippable & Removable Coatings to Mitigate Spread of Radioactive Contamination
  - E3105-17: Specifications for Permanent Coatings Used to Mitigate Spread of Radioactive Contamination
    - Referenced in SRNL'S Incombustible Fixative and ACE 2.0 Test Plan: Radiological Hot Field Test of Intumescent Coatings and Electrostatic Precipitators

- Standard Practice for Preparation of Fixed Radiological/Surrogate Contamination on Porous Test Coupon Surfaces for Evaluation of Decontamination Techniques being drafted
  - Currently being balloted for full Subcommittee concurrence

ASTM News Article Highlighting Newly Established ASTM Standards for D&D Technologies

***Link**: https://www.astm.org/standardization-news/?q=update/coatings-help-prevent-radioactive-contamination-decommissioning*

Proposed D&D Scope for Performance Year 9

- Testing and evaluation of technologies to support open air demolition
  - FD intumescent fixative
  - Resuspension rates, airborne release fractions (ARF), and respirable fractions (RF) when exposed to thermal/impact stressors
- FIU/SRNL radiological foams testing (cold demo)
  - Volume test in glovebox
  - Fire testing in pipes
- Continue support to SRNL (hot demo)
- Continue D&D standards development initiative with ASTM E10.03

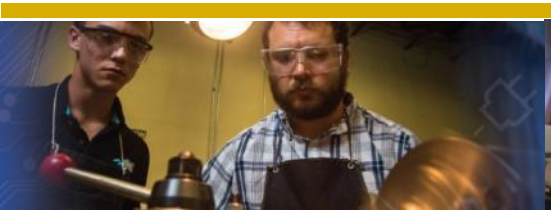
Demolition of the Plutonium Finishing Plant at the Hanford Site was halted in mid-December after radioactive dust was discovered far from the plant site. Vartabedian, R. (2018, April 16)

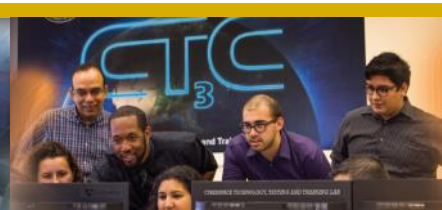
Knowledge Management Information Tool (KM-IT)

www.dndkm.org

Dr. Himanshu Upadhyay

Florida International University





KM-IT Modules

- D&D Hotline
- Technology Module
- Vendor Module
- Collaboration tools
- Mobile applications
- Lessons Learned
- Documents
- Pictures/videos
- Search tools
- Training
- Specialists
- Best Practices

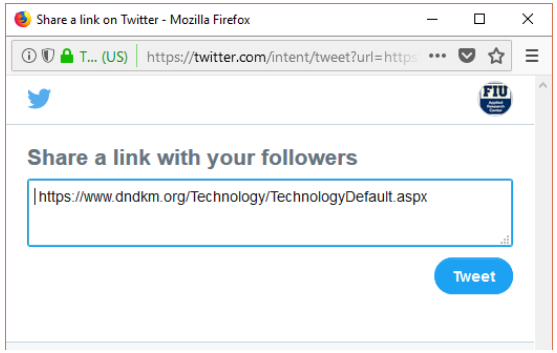
www.dndkm.org

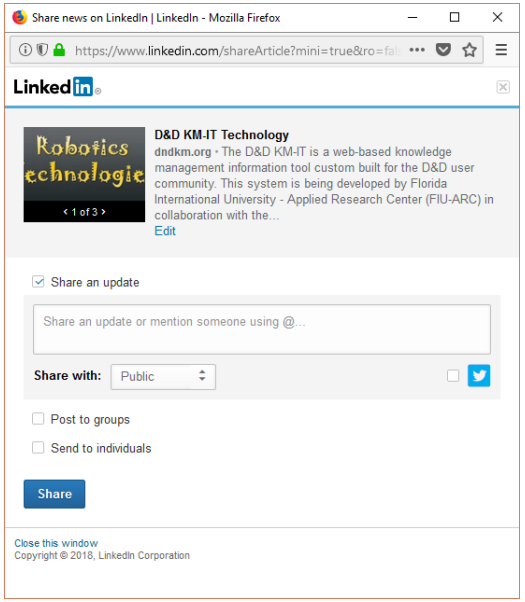
m.dndkm.org

Task 3 – Knowledge Management Information Tool (KM-IT)

Accomplishments Year 8:

- Integrated social media buttons to Like/Share on
  - Facebook
  - Twitter
  - Linked In
- Users can share KM-IT pages with their social media accounts





Task 3 – Knowledge Management Information Tool (KM-IT)

FIU Applied Research Center

Accomplishments Year 8:

- Pilot native mobile application for the D&D Fixatives Module
  - Android platforms
  - iOS platforms
  - Windows platforms

Task 3 – Knowledge Management Information Tool (KM-IT) – Fixative Mobile App

FIU Applied Research Center

About D&D KM-IT Fixative Mobile App

The D&D Fixatives module can assist in the selection of fixatives, strippable coatings, and decontamination gels for application during D&D activities. The module includes a comprehensive database of commercially available fixatives and other contamination control products and is capable of filtering and sorting the available products according to the criteria entered by the user.

Runs on iOS7 and newer
Minimum target iPhone7

Runs on Android 7.1 (Nougat)
Minimum target Android 4.4 (Kit Kat)

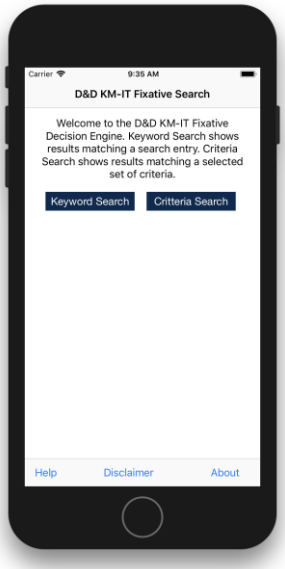
Runs on Windows 10
Minimum target Windows 8

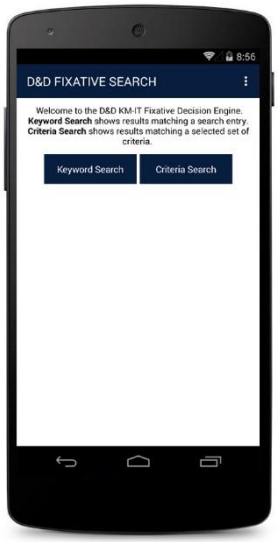
Task 3 – Knowledge Management Information Tool (KM-IT) – Fixative Mobile App

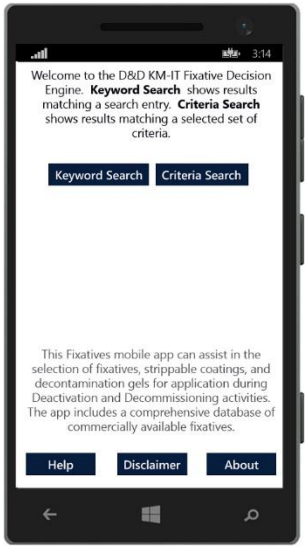
FIU Applied Research Center

Home Screen

- Welcome screen for app
- Users can choose to proceed by performing a Keyword search or Criteria search
- Mobile toolbar menu at the bottom of the screen shows additional information for the user

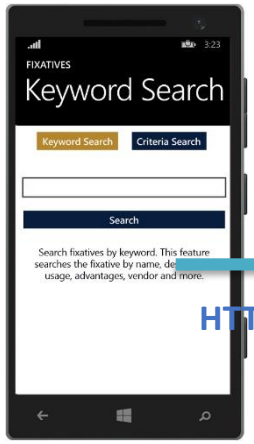






Task 3 – Knowledge Management Information Tool (KM-IT) – Fixative Mobile App

Web Service Architecture



HTTP GET

Interface
/GetFPLByKeyword/{key}

GET /query/{key} get results based on query Parameter: keyword

HTTP GET

Implementation
GetFixativePreviewsByKeyword

LinkedList<FixativePreview> GetFixativePreviewsByKeyword(string key)

[{ "productID": 20, "productName": "Decongel 1128 Spray", "productUse": "Decongel 1128 is recommended for decontamination of radioisotopes as well as particulates, heavy metals, water-soluble and insoluble organic compounds..." }]

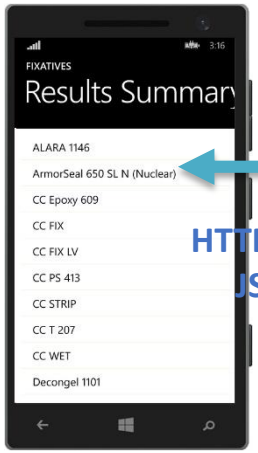
SELECT

D&D KM-IT Database

RECORDS

HTTP POST JSON

HTTP POST JSON

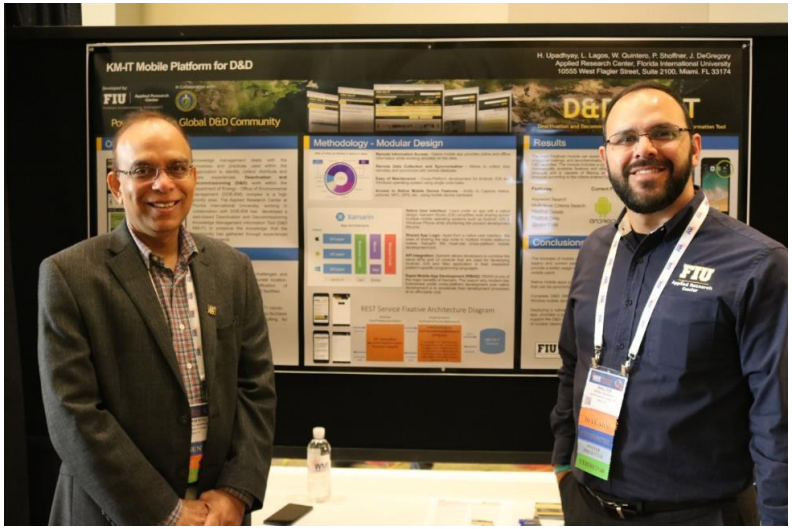


Task 3 – Knowledge Management Information Tool (KM-IT)

FIU Applied Research Center

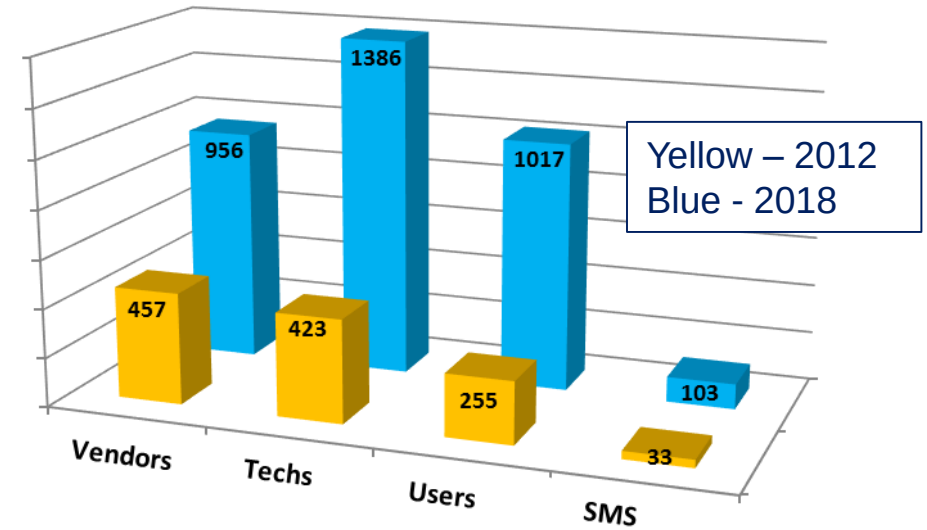
Accomplishments Year 8:

- Addition of current and relevant data to the KM-IT system, including news items, additional vendors, and technologies.
- Performance of website analytics and reporting to track usage metrics.
- Presentation and live demonstrations at WM18
- Development of articles, newsletters and infographics relevant to the D&D community



D&D KM-IT Statistics as of May 2018

- 1386 D&D technologies
- 1017 registered users
- 956 D&D vendors
- 195 Hotline questions/solutions
- 103 subject matter specialists



Growth from March 2012 to May 2018

Fully searchable resources – Original sources no longer available

- 169 ALARA Center reports archived (Hanford and SRS)
- 231 Innovative Technology Summary Reports archived

Task 3 – Knowledge Management Information Tool (D&D KM-IT)

FIU Applied Research Center

Proposed Scope for Year 9

- KM-IT Development and Enhancement
  - Enhance and optimize the web crawler to search and retrieve information related to D&D from identified internet sources/websites
  - Develop sub-module for FIU/SRNL fixative research
- Outreach and Marketing
  - Participation in industry conferences and workshops
  - Newsletters and mass communications (e.g., online promotion)
  - User support, including requested ad hoc specialized reporting
- Content Management and Data Analytics
  - Publish additional technologies and vendors on the KM-IT platform
  - Update News, Training, Document Library and other sections of KM-IT
  - Google analytics, visualization, server log analysis, and metrics reporting
- Cybersecurity research and testing of KM-IT infrastructure

NEW Task 4 – Analysis of EM Data Using Machine Learning and Big Data Technologies

FIU Applied Research Center

Proposed Scope for Year 9

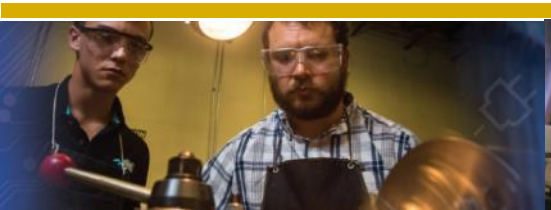
- Investigate specific applications of machine learning and big data technologies to satisfy DOE EM problem sets and challenge areas
- Develop a pilot-scale infrastructure to implement machine learning / big data
  - LiDAR technology will be used on FIU testbed mockups to collect structural image data and then processed/analyzed using machine learning and big data
  - Engage the DOE field sites on related data sets and their decision making needs

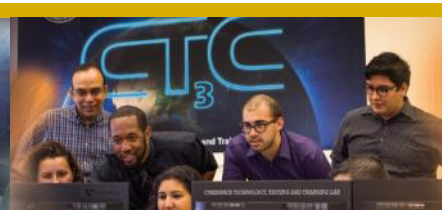

Waste Information Management System (WIMS)

www.emwims.org

Dr. Himanshu Upadhyay

Florida International University



Task 1 – Waste Information Management System (WIMS)

FIU Applied Research Center

Site Needs:

Accurate estimates of the quantity and type of present and future radioactive waste streams is critical to the development of tools to integrate the complex-wide management of LLW/MLLW treatment and disposal. A complex-wide LLW and MLLW database and reporting system is needed to communicate this information to local and national stakeholders and governmental groups.

Objectives:

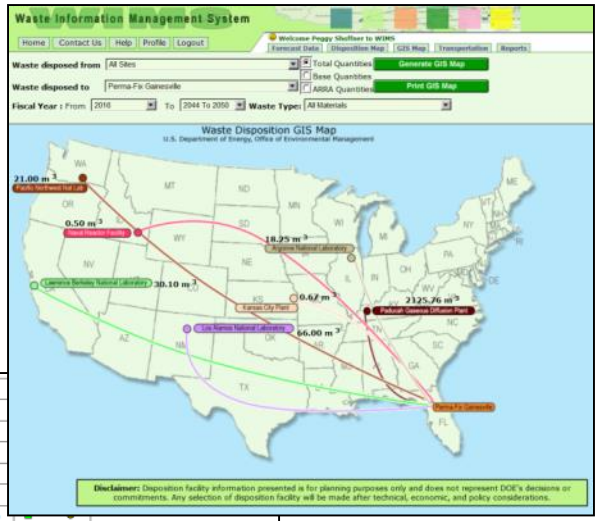
- Provide a central web-based location to access waste forecast data for sites across the DOE complex
- Provide easy-to-use tools to view the data in various formats
- Update data on an annual basis

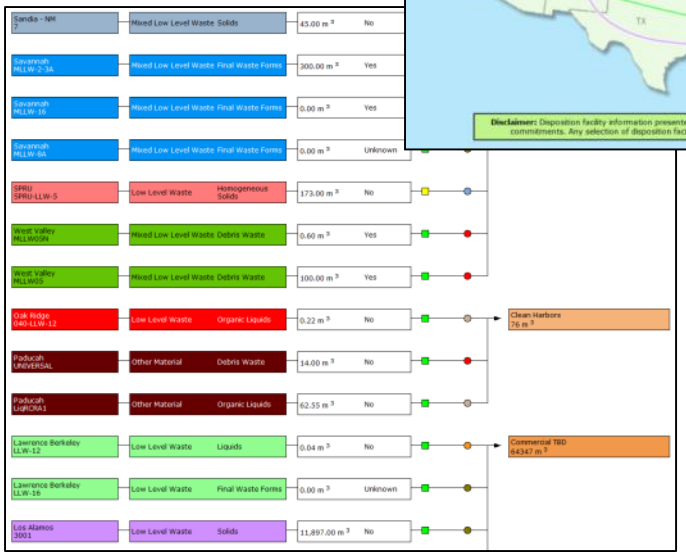
Task 1 – Waste Information Management System

FIU Applied Research Center

Accomplishments Year 8:

- Completed integration of 2018 waste forecast and transportation data into WIMS.
- **New 2018 dataset launched on public website on May 14.**
- WIMS is deployed and available at http://www.emwims.org
- Easy-to-use tool to visualize and understand the forecasted DOE waste streams.



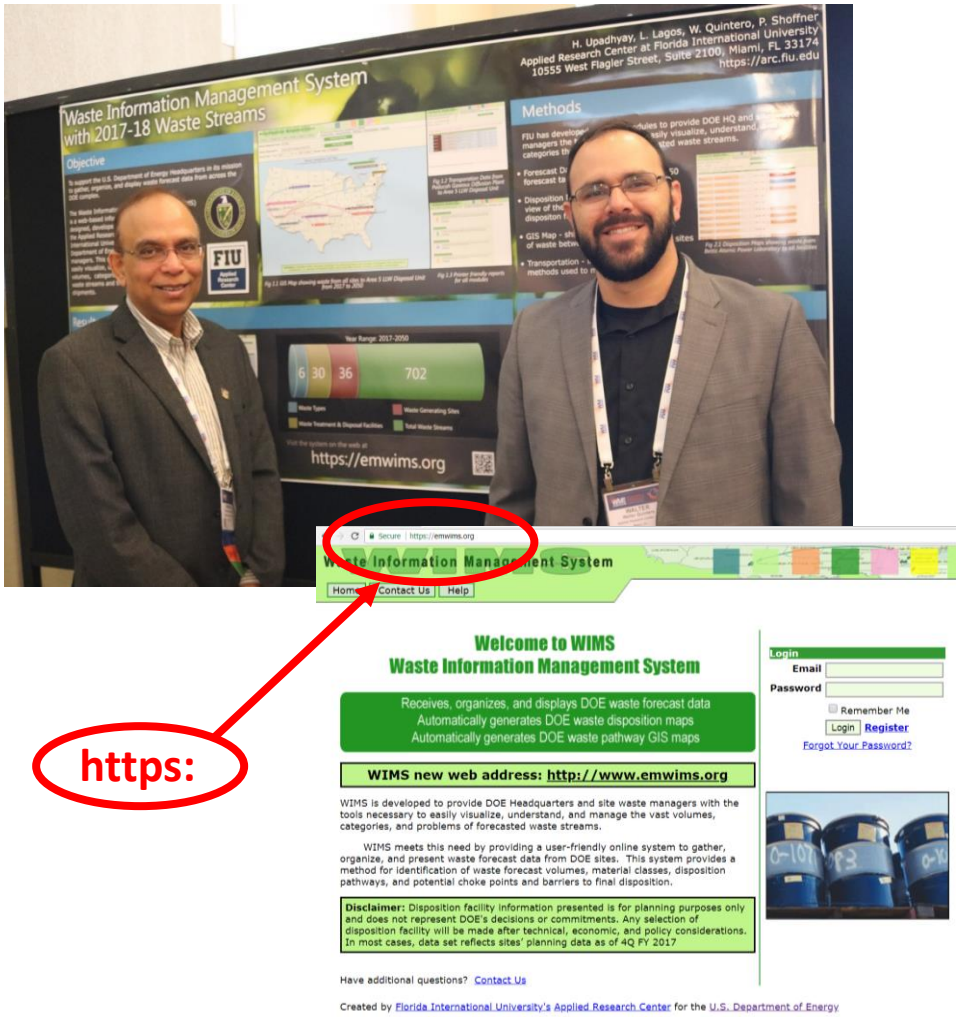


Task 1 – Waste Information Management System

FIU Applied Research Center

Accomplishments Year 8:

- Presented at WM18.
- Deployed a secure socket layer (SSL) on WIMS for enhanced security to establish an encrypted link to allow information to be transmitted securely.
- Performed cybersecurity, maintenance and administration of the application and the database servers to optimize performance.



Task 1 – Waste Information Management System

FIU Applied Research Center

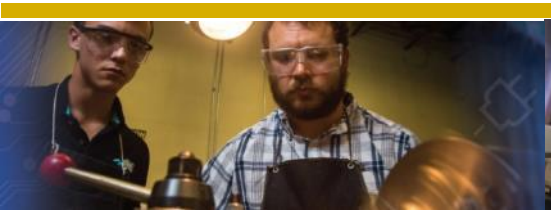
Proposed Scope for Year 9

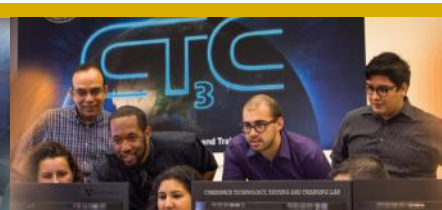
- Integrate annual update of waste forecast and transportation data into WIMS.
- Initiate upgrade of WIMS application framework using the latest Microsoft.Net, Visual Studio, and SQL database server tools.
  - increased reliability and cybersecurity of the system
  - increased efficiency for importing and deploying new data sets
  - improved user experience

FIU Project 4
DOE-FIU Science and Technology Workforce Development Program

Dr. Leonel Lagos
(Program Director)

Florida International University





STEM Minority Students Pipeline

DOE Fellow Induction Class of 2017

Joseph Coverston

Ryan Cruz

Katherine Delarosa

Christopher Excellent

Silvia Garcia

Alejandro Koszarycz

Manuel Losada

Ximena Lugo

Anibal Morales-Zambrana

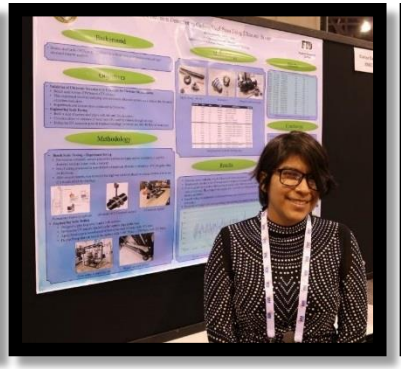
Joshua Núñez

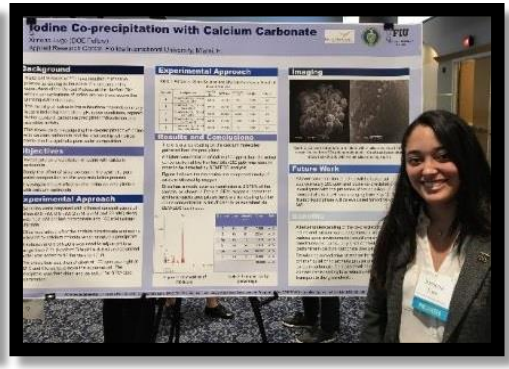
Tristan Simoes-Ponce

11 New DOE Fellows Inducted, 142 since program inception

Conference Presentations

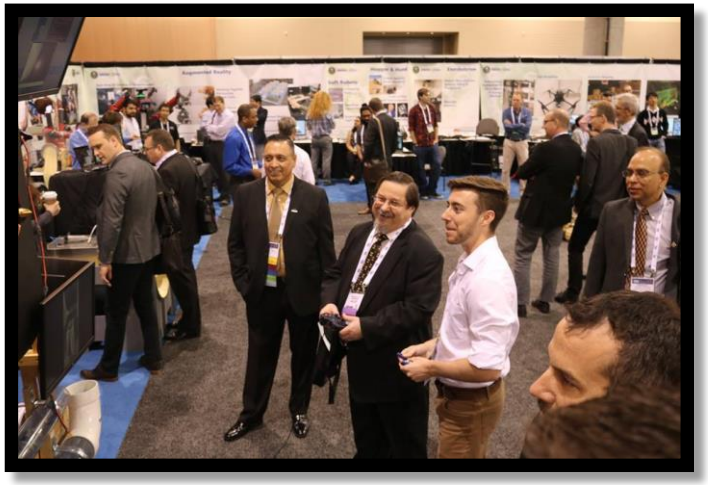
- Waste Management Symposia – 18 student technical posters, 2 professional presentations, and 1 panel member
- DOE Fellows Poster Exhibition and Competition at FIU – 17 Fellows
- Life Sciences South Florida Undergraduate Research Symposium – 7 Fellows
- Third Annual FIU Undergraduate Research Conference – 5 Fellows
- STEM Research & Career Symposium by Emory University in Atlanta – 1 Fellow
- American Geophysical Union fall meeting in New Orleans – 1 Fellow
- FIU McNair Scholars Research Conference – 4 Fellows

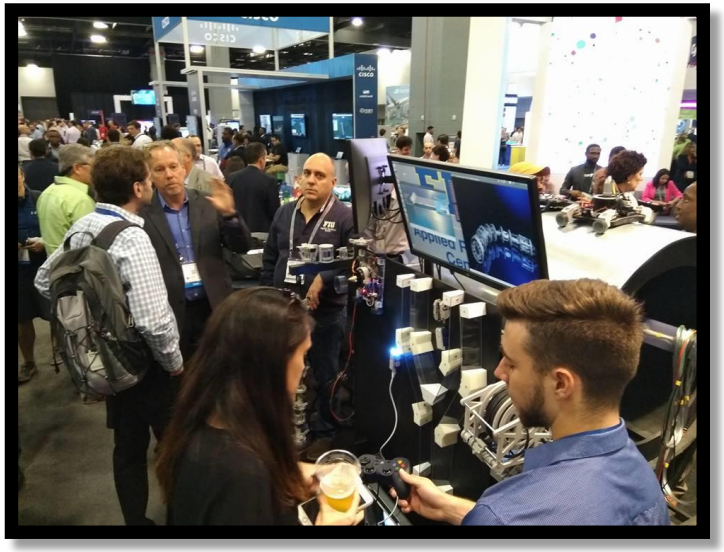


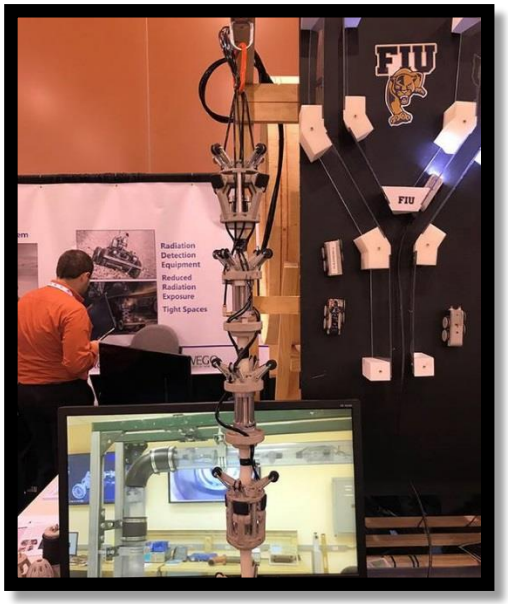


WM18 Robotics Pavilion

FIU Applied Research Center





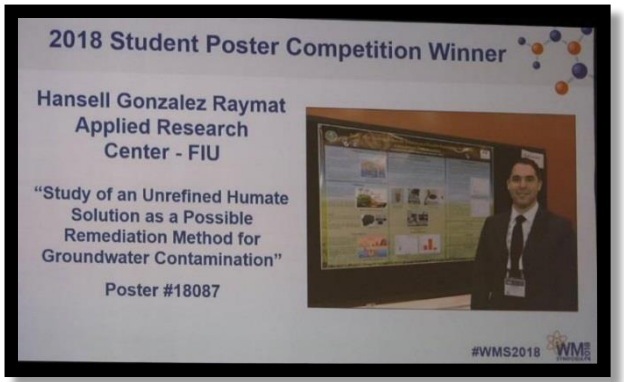


DOE Fellow Publications

- Emerson, H., **S. Di Pietro**, Y. Katsenovich, J. Szecsody, J. Uranium Immobilization in the Presence of Minerals Following Remediation via Base Treatment with Ammonia Gas. *Journal of Environmental Management* (submitted Feb 2018).
- Emerson, H., **F. Zengotita**, T. Dittrich, M. Richmann, Y. Katsenovich, D. Reed. Retention of neodymium by dolomite at variable ionic strength as probed by batch and column experiments. *Journal of Environmental Radioactivity* (accepted May 2018).
- **Gonzalez-Raymat, H.**, V. Anagnostopoulos, M. Denham, Y. Cai, Y. Katsenovich. 2018. Unrefined Humic Substances as a Potential Low-Cost Amendment for the Management of Acidic Groundwater Contamination. *Journal of Environmental Management*, 15, 212, 210-218.
- **Zengotita, F.**, H. Emerson. T. Dittrich, J. Swanson, D. Reed. The Role of *Chromohalobacter* on Transport of Lanthanides and Cesium in the Dolomite Mineral System. LA-UR-17-30894. Los Alamos National Laboratory, Carlsbad, NM.

DOE Fellow Awards/Recognitions

- Best student poster award at WM18 – Hansell Gonzalez
- 2018 Roy G. Post Foundation Scholarship (Undergraduate Level) – Christine Wipfli
- Young Professional Award at WM18 – Christine Wipfli
- Third place, life sciences track at FIU McNair Scholars Research Conference – Frances Zengotita
- Best posters at DOE Fellows Poster Exhibition and Competition – Jesse Viera (1st), Alejandro Garcia (2nd), Juan Carlos Morales (3rd)
- 2017 DOE Fellow of the Year Award – Ripley Raubenolt
- Cash award for poster at FIU's Undergraduate Research Conference – Ripley Raubenolt
- Monetary awards and sponsored travel from the Innovations in Nuclear R&D Program Workshop (DOE-NE) – Frances Zengotita and Silvina Di Pietro



SRS Field Work

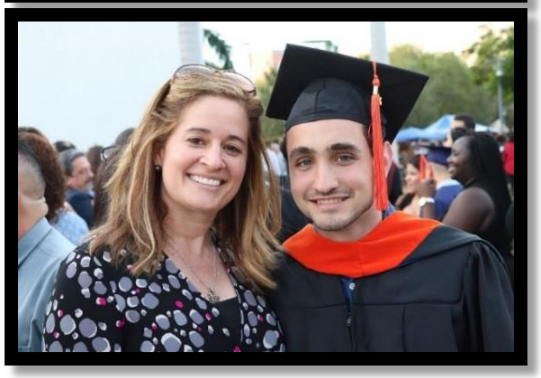
FIU graduate students Ron Hariprashad and Juan Morales deployed two state-of-the-art monitoring stations Tims Branch to automatically record and transmit stream flow data as part of their research to study movement of sediments and contaminants.

Next Generations of Tech Workforce

DOE Fellows demonstrating robotic technologies to middle and high school students during FIU's Engineering Expo

Academic Milestones

- **Mohammed Albassam:**
  - Submitted master's thesis proposal: *The Effect of Frequent Atmospheric Events on Flow Characteristics in Tims Branch and its Major Outfalls, Savannah River Site, SC*
- **Silvina Di Pietro**
  - Successfully passed Ph.D. candidacy exam based on dissertation: *Uranium Fate and Mineral Transformations upon Treatment with Ammonia Gas*
- **Maximiliano Edrei:**
  - Successfully defended master's thesis: *CFD Evaluation of Mixing Processes for High-Level Nuclear Waste Tanks*
- **Sebastian Zanlongo:**
  - Successfully passed Ph.D. proposal defense based on dissertation: *Multi-Robot Coordination and Scheduling for Deactivation & Decommissioning*



Graduates – December 2017

Claudia Cardona (Class of 2011) – Ph.D. Civil Eng.
Max Edrei (Class of 2014) – M.S. Mech. Eng.
Alexis Smoot (Class of 2015) – B.S. Env. Eng.
Jesse Viera (Class of 2014) – B.S. Mech. Eng.

Graduates – May 2018

Joshua Nunez (Class of 2017) – B.S. Mech. Eng.
Tristan Simoes-Ponce (Class of 2017) – B.S. Mech. Eng.
Christine Wipfli (Class of 2014) – B.S. Env. Eng.

Career Commencements

Alexis Smoot

B.S. Environmental Engineering

Position: Engineer I – Nexant, Chicago, IL

Alexis Smoot
DOE Fellow - Class of 2015

Alexis Smoot at DOE-HQ during her 2016 summer internship with Sarah Bird (left) and at ARC laboratory (right)

Career Commencements

Mohammed Albassam

B.S. Environmental Engineering

M.S. Environmental Engineering (expected graduation Summer 2018)

Position: Engineer I – City of Coconut Creek, FL

Mohammed Albassam
DOE Fellow - Class of 2016

Mohammed Albassam at DOE-HQ during his 2017 summer internship at DOE HQ with his mentor Kurt Gerdes and Juan Morales (left) and presenting his poster at WM2018 (right)

Career Commencements

Maximiliano Edrei

M.S. Mechanical Engineering

Position: Engineer II – Huntington Ingalls Newport News Shipbuilding Company, Newport News, VA

Maximiliano Edrei
DOE Fellow - Class of 2014

Maximiliano Edrei with his summer mentor Chris Guenther during his 2016 summer internship at NETL

Career Commencements

Jesse Viera

B.S. Mechanical Engineering

Position: Second Lieutenant – United States Marine Corps (USMC)
(after successfully completing USMC Officer Candidate School)

Jesse Viera
DOE Fellow - Class of 2014

Official commissioning of Second Lieutenant Jesse Viera into the U.S. Marine Corps (left) and with Dr. Inés Triay (Executive Director, FIU ARC) and Mr. Joseph Sinicrope (right).

Career Commencements

Christine Wipfli

B.S. Environmental Engineering

Position: Entry-level Nuclear Engineer – U.S. Department of Defense, Pearl Harbor Naval Shipyard, Hawaii

Christine Wipfli
DOE Fellow - Class of 2014

Christine Wipfli during her one-year internship at IAEA (right) and during her poster presentation at WM 2017 (left).

Career Commencements

Kiara Pazan

B.S. Environmental Engineering

Positions: Environmental Engineer, AECOM (2015)

Recently accepted position at U.S. Corps of Engineers' Coastal & Hydraulics Lab (2018)

Kiara Pazan
DOE Fellow - Class of 2014

Kiara Pazan with her poster at WM2015 (left) and dressed in PPE with Aref Shehadeh during a summer internship at SRS.

Summer 2018 Internships

DOE Fellow	Internship Location	Internship Mentor	
Joshua Nunez	DOE HQ (EM 3.2)	Rod Rimando	FIU-DOE Cooperative Agreement
Alejandro Koszarycz	DOE HQ (EM 4.11)	Andrew Szilagyi	
Silvia Garcia	DOE HQ (EM 4.12)	Skip Chamberlain	
Juan Carlos Morales	DOE HQ (EM 4.31)	Robert Seifert	
Ximena Lugo	DOE HQ (EM 4.31)	Robert Seifert	
Tristan Simoes-Ponce	SRNL	Connor Nicholson	
Katherine Delarosa	SRNL	Brian Looney	
Ryan Cruz	SRNL	Richard Poland	
Silvina Di Pietro	PNNL	Jim Szecsody	
Clarice Davila	WRPS	Ruben Mendoza	
Joseph Coverston	WRPS	Karthik Subramanian	
Anibal Morales-Zambrana	ANL	Young Soo Park	
Christopher Excellent	DOE HQ (EM 3.2) / CMU	Rod Rimando / Red Whittaker	FIU-DOE CA & CMU
Michael DiBono	CMU	Red Whittaker	
Sebastian Zanlongo	SRNL/MSIPP	Timothy Aucott, Robin Young	MSIPP
Manuel Losada	SRNL/MSIPP	Jean Plummer	
Frances Zengotita	LANL ACRSP	Don Reed, Julie Swanson	LANL, FIU McNair & FIU-DOE CA

Workforce Development Program Statistics

- 11 induction ceremonies held, inducting a total of 142 DOE Fellows
- 119 internships completed through summer 2017 and 17 internships starting summer 2018
- 1 DOE Fellow completed a 1-yr internship with IAEA
- Over 210 papers and posters presented at local, national, & international conferences and workshops
- Awarded six best student poster awards and one best professional poster award at WM Symposia
- 90 students hired by DOE, federal/local/state government and STEM industry
- 49 undergrad DOE Fellows earned their B.S. at FIU and continued their graduate education at FIU and other institutions
- 22 current DOE Fellows in the program

FIU Performance Year 9

Active hands-on research assisting ARC scientists/engineers during the execution of DOE-EM research in order to integrate education with practical experience in the DOE EM problem areas.

- Recruit qualified talented FIU minority STEM students
- Engage in DOE EM research under the technical projects
- Conduct poster exhibition & competition
- Host DOE Fellows induction ceremony
- Coordinate summer internship program and internship technical reports
- Conference participation & presentations, including WM Symposia
- DOE Fellows lecture series forum
- DOE EM HBCU collaboration/interactions - extend recruitment to include HBCU/MSI students interested in a Ph.D. at FIU
- Work closely with DOE nat. labs to identify opportunities for Ph.D. students including extended work assignments that can lead to post-doctoral positions
- Fostering opportunities for DOE Fellows research assignments at other institutions (i.e. CMU, UT-Austin, others)