

YEAR-END TECHNICAL REPORT

For May 18, 2011 – May 17, 2012

DOE-FIU Science & Technology Workforce Development Initiative

<http://fellows.fiu.edu/>

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This document represents one (1) of five (5) reports that comprise the Year End Reports for the period of May 18, 2011 to May 17, 2012 prepared by the Applied Research Center at Florida International University for the U.S. Department of Energy Office of Environmental Management under Cooperative Agreement No. DE-EM0000598.

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

1. Chemical Process Alternatives for Radioactive Waste
Document number: FIU-ARC-2012-800000393-04b-211
2. Rapid Deployment of Engineered Solutions for Environmental Problems at Hanford
Document number: FIU-ARC-2012-800000438-04b-208
3. Remediation and Treatment Technology Development and Support
Document number: FIU-ARC-2012-800000439-04b-210
4. Waste and D&D Engineering and Technology Development
Document number: FIU-ARC-2012-800000440-04b-212
5. DOE-FIU Science & Technology Workforce Development Initiative
Document number: FIU-ARC-2012-800000394-04b-059

Each document has been submitted to OSTI separately under the respective project title and document number as shown above.

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PROJECT 5 OVERVIEW

There is a national need for more careers in science, technology, engineering and mathematics (STEM). This shortage is felt not only in the private industry sector but also across many federal agencies. Across the Department of Energy (DOE) and within DOE Environmental Management (EM), there is a similar critical shortage of entry-level STEM personnel. The effects are already being felt across DOE EM and new ways to stimulate interest in STEM are being initiated by the federal government. If this shortage is not addressed, the risks include knowledge gaps (discontinuity of lessons learned) within the department and a lack of skilled personnel to carry out its cleanup mission effectively.

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

The DOE-FIU Science and Technology Workforce Development Initiative is designed to build upon this relationship by creating a pipeline of minority engineers specifically trained and mentored to enter the DOE workforce in technical areas of need. This innovative program was designed to help address DOE's future workforce needs by partnering with academic, government and DOE contractor organizations to mentor future minority scientists and engineers in the research, development, and deployment of new technologies addressing DOE's environmental cleanup challenges. The main objective of the program is to provide interested students with a unique opportunity to integrate course work, DOE field work, and applied research work at FIU into a well structured academic program that leads to entry into DOE EM's Professional Development Corps Program. Students selected as DOE Fellows perform research at FIU and at DOE sites, national laboratories, and DOE contractors. Upon graduation and completion of this fellowship, the students will submit an application to join the DOE federal internships programs such as Student Career Experience Program (SCEP), apply to DOE contractors, pursue post Master or postdoctoral positions at DOE National Labs, or apply to private industry in their field of study.

Since its inception, the DOE-FIU Science & Technology Workforce Development Initiative program has inducted 65 FIU minority STEM (science, technology, engineering, and math) students. DOE Induction Ceremonies have been attended by DOE EM officials including Mr. Mark Gilbertson (2007), former Assistant Secretary for Environmental Management, Mr. Jim Rispoli (2008), Ms. Yvette Collazo (2009), former Assistant Secretary for Environmental Management, Ms. Ines Triay (2010), and Acting Principal Assistant Secretary for Environmental Management, Ms. Tracy Mustin (2011). All these students have been exposed to DOE EM applied research efforts being conducted at FIU-ARC, DOE sites, DOE national labs, and DOE contractor facilities across the US. As of summer 2011, a total of 53 DOE Fellows have completed summer internship assignments and over ten DOE Fellows have directly supported DOE sites personnel and/or DOE contractors. During summer 2012, 11 additional DOE Fellows were placed in summer internships at DOE sites, DOE national labs, and DOE contractors. Since the program inception in 2007, a total of 87 DOE Fellows have participated in the Waste

Management 2008, 2009, 2010, 2011, and 2012 Symposia with a total of 58 poster presentations and 11 professional oral presentations. At the WM09, WM10, and WM11 conferences, three DOE Fellows have won the Student Poster competitions and one DOE Fellow received the award for the best poster out of all the professional poster sessions presented at WM09. A total of 9 DOE Fellows have applied to the DOE EM Professional Development Program (1 in 2009 and 8 in 2010) with one of our Fellows (Rosa Ramirez – Class of 2008) being selected for the EMPCD program in September 2009. Also, in 2010, DOE Fellow Duriem Calderin was hired by a DOE Contractor (Columbia Energy Environmental Services) in Richland, WA. In addition, during the spring of 2011, 6 DOE Fellows applied to DOE EM's Student Career Experience Program (SCEP) program and 3 were selected. A DOE Fellow (Edgard Espinosa – Class of 2007) was selected into the SCEP program and has successfully converted to a full-time federal employee in 2011. A second DOE Fellow (Lee Brady – Class of 2008) will be converted in the summer of 2012. Another Fellow (Charles Castello – Class of 2008) completed the SCEP program but selected to accept a position at Oak Ridge National Laboratory under the Alvin M. Weinberg Fellowship program. Also DOE Fellow, Merlin Ngachin, was hired by Waste Control Specialist this past year and is currently working at WCS facility in Texas. The program has been featured in DOE EM publications such as the EM-20 Final Year Report, US DOE EM Highlights, Diversity @ EM magazine, and EM Program Update.

Major key accomplishments to date:

- DOE Fellows supported the Energy Facility Contractors Group (EFCOG) and contributed to the development of 7 Lessons Learned and Best Practices documents
- DOE Fellow (Charles Castello) was hired by DOE's Oak Ridge National Laboratory under the Alvin M. Weinberg Fellowship program
- DOE Fellow (Stephen Wood) joined Oak Ridge National Laboratory's Bredesen Center for Interdisciplinary Research and Graduate Education as a Energy Science & Engineering PhD Fellow
- DOE Fellow (Edgard Espinosa) was hired by DOE-EM and is working for EM-22 (Nuclear Materials Disposition) under the direction of Mr. Gary Deleon
- DOE Fellow (Lee Brady) has graduated and will be hired by DOE-EM and will work for EM-13 (D&D and Facility Engineering) under the direction of Mr. Andrew Szilagyi
- DOE Fellow, (Merlin Ngachin) was hired by Waste Control Specialists (WCS) in Texas
- Eleven (11) other DOE Fellows graduated FIU with Bachelors or Masters degree and obtained employment at Boeing Company (2 Fellows), Florida Department of Environmental Protection (1 Fellow), Florida Power & Light (2 Fellows), Mount Sinai Medical Center (1 Fellow), Internal Revenue Service (1 Fellow), PriceSmart Inc. (1 Fellow), Bouygues Civil Works Florida (1 Fellow), Crane Aerospace and Electronics (1 Fellow), HP Foundation (1 Fellow)
- DOE Fellows, Edgard Espinosa, Charles Castello, and Lee Brady were selected by DOE EM as part of Student Career Experience Program (SCEP). These Fellows completed SCEP assignments working for EM-2.1, EM-12, and EM-13 respectively
- DOE Fellow (Rosa Ramirez) was hired into the EM Professional Development Corps program

- DOE Fellow (Duriem Calderin) was hired by DOE Contractor Columbia-Energy Environmental Services, Duriem is working in Richland, WA
- DOE Fellow (Leydi Velez) won Best Professional Poster at WM09
- DOE Fellow (Stephen Wood) won Best Student Poster at WM11
- DOE Fellow (Denny Carvajal) won Best Student Poster at WM10
- DOE Fellow (Denisse Aranda) won Best Student Poster at WM09
- Completed 53 internships at DOE sites, DOE national labs, DOE-HQ, and DOE contractors since 2007
- 69 presentations (posters and papers) at Waste Management conferences (2008, 2009, 2010, 2011, 2012)
- Twenty-one (26) DOE Fellows (FIU minority students) continuing to Master/Ph.D. degrees at FIU.
- Nine (9) DOE Fellows applied to the DOE EMPDC program in 2009 and 2010
- Six (6) DOE Fellows applied to DOE EM SCEP in spring 2011
- Development of DOE Fellows web site <http://fellows.fiu.edu/> and Facebook page

RESULTS AND DISCUSSION

1.0 DOE FELLOWS ENTERING TO DOE'S STUDENT CAREER EXPERIENCE PROGRAM (SCEP)

The vision of this program is to create a “**pipeline**” of minority FIU students who will be trained and mentored as DOE Fellows and enter DOE's workforce. This vision became a reality when our first DOE Fellow (Rosa Ramirez) was hired by DOE in September 2009 and entered DOE's Professional Development Corps Program. Rosa is currently working for DOE EM's Soil and Groundwater group (EM-12) in Germantown, Maryland. Rosa continues to be a FIU graduate student and is continuing her work towards completing a master's degree in environmental engineering. The success story of the program continued in summer 2010 when DOE Fellow, Duriem Calderin, was hired by a DOE contractor (Columbia-Energy Environmental Services) in Richland, WA. The “pipeline” continued to work during the spring of 2011 when six DOE Fellows applied to the Student Career Experience Program (SCEP) in February/March 2011. This federal internship program allows our DOE Fellows to work as federal employees during work assignments at DOE-HQ and return to FIU to complete their respective degrees. Once the DOE Fellows graduate from FIU and complete the SCEP program requirements, they are eligible for full time employment with DOE EM. The following 3 DOE Fellows were selected for the program and started their work assignments at DOE-HQ in Washington, DC during April/May in 2011. Two Fellows (Edgard Espinosa and Lee Brady) completed SCEP program and joined DOE-EM as fulltime employees. The third Fellow (Charles Castello) completed SCEP program but obtained an alternative offer from Oak Ridge National Laboratory. A brief description of their work objectives including their current employment status are provided below:

- **Mr. Lee Brady** (DOE Fellows Class of 2008) - Mr. Brady began his appointment on May 8, 2011 in Washington D.C. He was working with the Office of Deactivation and Decommissioning (D&D) and Facility Engineering (EM-13) under Mr. Andrew Szilagyi. He was involved in a broad range of program elements, including identification and development of new technologies for deactivation and decommissioning, D&D policy and guidance elements. After his summer assignment, Mr. Brady returned to FIU where he completed his Masters in Engineering Management in April of 2012. He will be converted into a full-time federal employee over the summer and will report to the Office of Deactivation and Decommissioning (D&D) and Facility Engineering (EM-13).
- **Mr. Charles Castello** (DOE Fellows Class of 2008) - Mr. Castello began his appointment on April 25, 2011 in Washington D.C. He worked in the Office of Groundwater and Soil Remediation (EM-12) on the Advanced Simulation Capability for Environmental Management (ASCEM) project, which develops state-of-the-art scientific tools and approaches for understanding and predicting contaminant fate and transport in natural and engineered systems. This project is a collaboration between multiple offices within DOE EM, national laboratories, and universities. However, after his SCEP appointment Mr. Castello received and accepted a position at the Oak Ridge National Laboratory in the Alvin M.

Weinberg Fellowship program. Charles started working at ORNL in September 2011. The Weinberg Fellowship is a two-year appointment meant to transition recent Ph.D. graduates in engineering and science disciplines to permanent positions at ORNL. Mr. Castello is working in the Energy & Transportation Science Division with the Whole-Building and Community Integration (WBCI) research group.

- **Mr. Edgard Espinosa** (DOE Fellows Class of 2007) - Mr. Espinosa began his appointment on April 25, 2011 in Washington D.C. He worked in the Office of Technology Innovation and Development (EM-2.1) under the lead of Ms. Ana Han, lead of EM-2.1's International Program. The International Program links DOE EM to the world's evolving environmental remediation and radioactive waste management practices by connecting government, university, and industry technology development efforts to address EM's technical and strategic challenges. After his SCEP appointment, Mr. Espinosa joined DOE-EM as a full-time federal employee during Fall 2011. Mr. Espinosa continues to contribute to the mission of EM as an engineer in the Office of Nuclear Materials Disposition (EM-22).

1.1 Other DOE Fellows Hired During 2011

During 2011, an additional twelve (12) DOE Fellows in science, technology, engineering, and math (STEM) disciplines were hired by DOE national laboratories and private industry. The following DOE Fellows were hired:

- **Mr. Rinaldo Gonzalez** (Pacific Northwest National Laboratory & Crane Aerospace and Electronics – Richland, Washington) - In January 2012, Mr. Gonzalez received and accepted an offer from the Pacific Northwest National Laboratory to conduct a 16 week co-op in Richland, Washington. After completing his internship at PNNL, Mr. Gonzalez obtained employment as a Computational Fluids Dynamics Engineer at Crane Aerospace and Electronics in Seattle, WA
- **Mr. Denny Carvajal** (Mount Sinai Medical Center - Miami, Florida) - In January 2012, Mr. Carvajal received and accepted an offer from the Mount Sinai Medical Center in Miami Beach, FL.
- **Mr. Amaury Betancourt** (Florida Department of Environmental Protection – Tampa, Florida) - In December 2011, Mr. Betancourt accepted a position as an Engineering Specialist I at the Florida Department of Environmental Protection (FDEP) in the Division of Air Resource Management, where he will conduct inspections and engineering calculations on air emissions at different locations in Florida.
- **Mr. William Mendez** (Boeing Company – Seattle, Washington) - In December 2011, Mr. Mendez received and accepted an offer from the Boeing Company in Seattle. Mr. Mendez works as a mechanical engineer at Boeing.

- **Mr. Mario Vargas** (Boeing Company – Seattle, Washington) - In January 2012, Mr. Vargas accepted a position as a Structural Analysis Engineer with the Boeing Company in Everett WA. Mr. Vargas works as a mechanical engineer at Boeing.
- **Mr. Merlin Ngachin** (Waste Control Specialists – Andrews, Texas) - In November 2011, Mr. Ngachin accepted a position as a Health Physicist with Waste Control Specialists (WCS) in Texas. WMS is a treatment, storage, and disposal facility for radioactive, hazardous, and mixed wastes. The facility handles Class A, B, and C low-level radioactive waste.
- **Mr. Givens Cherilus** (Florida Power & Light, Miami, Florida) - In January 2012, Mr. Cherilus received and accepted a position as an engineer for NextEra Energy (Florida Power & Light).
- **Ms. Shina Rana** (Florida Power & Light, Miami, Florida) - In January 2012, Ms. Rana received and accepted a position as an engineer for NextEra Energy (Florida Power & Light) working in their Miami office.
- **Mr. Alex Henao** (Internal Revenue Service - Louisville, Kentucky) - In the Fall of 2011, Mr. Henao received and accepted a position of employment with the Internal Revenue Service (IRS) in Kentucky.
- **Ms. Leydi Velez** (PriceSmart Inc., Miami, Florida) - In January 2011, Ms. Leydi Velez obtained employment at PriceSmart Inc., in Miami, Florida. She works as an Industrial Engineer overseeing operations for Latin America
- **Mr. Ramon Colon** (Bouygues Civil Works Florida, Miami, Florida) - In 2011, Mr. Ramon Colon was hired by Bouygues Civil Works Florida in Miami and works as a Plant Engineer in the Miami Tunnel project
- **Ms. Nadia Lima** (HJ Foundation, Miami, Florida) - In 2012, Ms. Lima was hired by HJ Foundation headquartered in Miami, Florida working as a civil engineer.

2.0 INCREASING THE RETENTION OF MINORITY STUDENTS IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH (STEM) DISCIPLINES

2.1 DOE Fellows Continuing onto Graduate Degrees at FIU in the Areas of Science, Technology, Engineering, and Math (STEM) Education

A total of **26 DOE Fellows** are currently pursuing or have completed master's or Ph.D. STEM degrees at FIU. Most of these DOE Fellows started the DOE-FIU Science & Technology Workforce Development Program as undergraduates and have been successfully encouraged and prepared to continue onto graduate studies at FIU. The research conducted at ARC, DOE sites, DOE national laboratories, and DOE private contractors serve as the basis for their master's thesis or Ph.D. dissertation topics. Currently, 14 DOE Fellows have graduated with master's degrees and 1 with a Ph.D. Currently, 9 DOE Fellows are pursuing master's degrees and 1 DOE Fellow is pursuing a Ph.D. Table 1 below shows all the DOE Fellows pursuing graduate level work. In addition, several undergraduate DOE Fellows incorporate their EM applied research into their Senior Design or Capstone Projects at FIU.

Table 1. DOE Fellows in STEM Graduate Programs

	DOE Fellow	Discipline	Degree	Research Topic/Work Based on DOE EM projects	Anticipated Date of Graduation
1	Claudia Cardona	Environmental Eng.	Ph.D.	TBD	12/14
2	Eric Inclan	Mechanical Eng.	Master	Mesh adaptation for use in Lattice Boltzmann code	12/12
3	Lilian Marrero	Environmental Eng.	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	12/12
4	Jaime Mudrich	Mechanical Eng.	Master	Development of a Lee-Lin, Multiple Relaxation Time, parallel lattice Boltzmann method multiphase CFD solver	04/13
5	Janty Ghazi	Electrical Eng.	Master	Control, through Sensors and Labview, of the Asynchronous Pulsing Unit	04/13
6	Amaury Betancourt	Environmental Eng.	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	Graduated 04/11
7	Lee Brady	Engineering Mngmt.	Master	D&D Best Practices/Lessons Learned Development for EFCOG	Graduated 04/12
8	Elsa Cabrejo	Environmental Eng.	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	Graduated 04/11
9	Denny Carvajal	Biomedical Eng.	Master	Soil/Groundwater – Bacteria Interaction due to Polyphosphate Injection at Hanford	Graduated 08/11
10	Charles Castello	Electrical Eng.	Ph.D.	Soil/Groundwater - Sensor Development for Field Measurement of Mercury	Graduated 08/11
11	Elicek Delgado-Cepero	Electrical Eng.	Master	Development of Remote	12/12
12	Edgard Espinosa	Mechanical Eng.	Master	Waste Processing - CFD Modeling of NuVison’s Power Fluidic Technology/Process	Graduated 12/11
13	Serkan Akar	Biomedical Engineering	Master	Design and Development of an Enzyme-Linked Biosensor for Detection and Quantification of Phosphate Species	Graduated 05/10

14	Stephen Wood	Mechanical Eng.	Master	Modeling of Pipeline Transients: Modified Method of Characteristics	Graduated 05/11
15	Melina Idarraga	Environmental Eng.	Master	Dissolution rate of natural meta-autunite: effects of aqueous bicarbonate, pH and temperature	Graduated 12/11
16	Heidi Henderson	Environmental Eng.	Master	Surface water and contaminant transport within the Oak Ridge National Laboratory	12/12
17	Merlin Ngachin	Environmental Sciences	Master	Waste Processing - Baltman-Lattice Method to Model HLW	Graduated 08/11
18	Leydi Velez	Industrial Eng.	Master	Decision Modeling Tools D&D Surveillance & Maintenance	Graduated: 12/10
19	Jose Matos	Mechanical Eng.	Master	Development of improved Bodies for a Peristaltic Crawler for Radioactive Pipeline Unplugging	12/12
20	William Mendez	Engineering Mngmt.	Master	Development of Remote Stack Characterization System	Graduated: 04/11
21	Mario Vargas	Mechanical Eng.	Master	Kinematic Control of Remote Stack Characterization System	08/12
22	Melissa Sanchez*	Environmental Engineering	Master	Non-thesis option	Graduated: 05/12
23	Yulyan Arias*	Environmental Engineering	Master	Non-thesis option	Graduated: 05/12
24	Duriem Calderin	Biomedical Eng.	Master	Modeling of Loose Contamination Scenarios to Predict the Amount of Contamination Removed	Graduated: 08/10
25	Jose Vasquez	Environmental Eng.	Master	Effects of temperature and pH on volatilization of mercury after chemical reduction	Graduated: 08/09
26	Rosa Ramirez (Former DOE Fellow hired by DOE EM)	Environmental Eng.	Master	TBD	TBD
*Left DOE Fellows program but completed master's degree at FIU					

3.0 DOE FELLOWS RECRUITMENT & SELECTION

The DOE Fellows Spring recruitment period was initiated on March 19, 2012 and continued until April 13, 2012. During this period, the current DOE Fellows and program director will host an Information Session for potential candidates, conduct recruitment campaigns by placing recruitment tables at College of Engineering, participate in the FIU College of Arts and Science’s Job and Internship Fair, and make short presentations at targeted classes within the College of Engineering and College of Arts and Sciences. A DOE Fellows Information Session was also scheduled for April 4, 2012.

A total of 23 application packages were received and reviewed by the DOE Fellows Selection Committee integrated by representatives from DOE-HQ, FIU’s College of Engineering and Art & Sciences, and ARC staff. A pre-selection process was conducted and 16 applicants were selected for formal interviews. Interviews were conducted during the last week of April and first week in May. A total of 12 students were expected to be hired as DOE Fellows.

Table 2. New Students Entering the DOE Fellows Program

First Name	Last Name	Classification	Major
Jennifer	Arniella	Undergraduate	Mechanical Engineering
Francisco	Bolanos	Undergraduate	Mechanical Engineering
Dania	Castillo	Undergraduate	Structural Engineering
Robert	Lapierre	Undergraduate	Chemistry
Joel	McGill	Undergraduate	Civil Engineering
Lucas	Nascimento	Undergraduate	Electrical Engineering
Raul	Ordonez	Undergraduate	Electrical Engineering
Mariela	Silva	Graduate	Engineering Management
Vanessa	Vargas	Undergraduate	Electrical Engineering
Gabriela	Vazquez	Undergraduate	Mechanical Engineering
Revathy	Venkataraman	Graduate	Information Technology
Ashley	Wardlow	Undergraduate	Biochemistry & Criminal Justice

4.0 DOE FELLOWS INTERNSHIPS (SUMMER 2011)

During FIU's Fiscal Year 2011, a total of 10 DOE Fellows travelled to DOE national labs, DOE sites, DOE-HQ, and DOE contractor's sites to start their summer 2011 internships. The following students were placed at DOE facilities across the country:

- Savannah River Site (Givens Cherilus and William Mendez) Aiken, SC
- Savannah River National Laboratory (Amaury Betancourt) Aiken, SC
- DOE Headquarters, Forrestal (Heidi Henderson and Sheidyn Ng), Washington, DC.
- Lawrence Livermore National Laboratory (Mario Vargas), CA
- Moab Site (Alex Henao), Utah
- Pacific Northwest National Laboratory (Rinaldo Gonzalez), Richland, WA
- Hanford Site (Jose Matos and Janty Ghazi), Richland, WA

The following section provides a description of the students' summer assignments. A complete version of their DOE Fellows Summer Internship Technical Reports can be found at our DOE Fellows website (<http://fellows.fiu.edu>) under the following link (http://fellows.fiu.edu/eventsNews_SummerInternships.asp) or in Appendix A of this report.

4.1 Summer Internship Location: Savannah River Site

William Mendez (06/13/2011 – 08/19/2011)

DOE Fellow William Mendez interned at the Savannah River Site owned by the United States Department of Energy (DOE) and managed by Savannah River Nuclear Solutions LLC (SRNS). During his internship, Mr. Mendez assisted researchers at SRS with two different projects: the testing of the Form Core Sampler System and the development of a new Cell Buret Drive System for Saltstone and the Defense Waste Processing Facility (DWPF), respectively. The Form Core Sampling System is being developed by SRNL to take grout samples from the Saltstone monoliths at varying elevations for analysis. A full scale mock-up of the sampling system, has been built and installed at the Research & Development Engineering facility highbay. Saltstone grout simulant is being poured in multiple lifts to simulate the process in the Saltstone facility. After all the grout pours are complete, the material will be allowed to cure for six weeks, at which time the samplers will be removed from the sampler sleeve for analysis.

Mr. Mendez also assisted in the design of the second generation of the sampler sleeve system and sampler installation equipment to include improvements identified during testing. The need for a new Cell Buret Drive System emerged after recent changes in the communication protocol between the titrator controller and the in-cell buret drive. Mr. Mendez assisted in the development of a new Cell Buret Drive System that will allow for its remotely controlled operations within a shielded cell. The cell buret is used in the analysis of sludge samples collected from the waste tanks.



Figure 1. Finalist and DOE Fellow, William Mendez with mentor Mark Noakes (right) at the 3rd Annual Joint Topical Conference on Emergency Preparedness & Response and Robotics and Remote Systems.

Mr. Mendez’s Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/William%20Mendez%20Internship%20Rpt%20Summer%202011%20Rev%200.pdf>

Givens Cherilus (06/06/2011 – 08/12/2011)

DOE Fellow Givens Cherilus interned at Savannah River Site under mentor Alex Cozzi. As part of the SRNL support of the Z-Area Saltstone facility, a program is underway to evaluate different vault pouring strategies (curing conditions) on various properties of the grout. One of the tasks was to measure the hydraulic conductivity of saltstone samples made with simulated waste salt solution using ASTM D 6527. Subtasks associated with this task include: centrifuge permeability, prepare simulated Saltstone samples, test the permeability using centrifuge, prepare multiple permeants, test the permeability of samples as a function of permeant used, document results in a report, and prepare a final presentation to the customer.



Figure 2. DOE Fellow Givens Cherilus and his mentor Alex Cozzi.

Mr. Cherilus' Summer Internship Technical report can be found at:

http://fellows.fiu.edu/doc/Summer11Reports/Givens%20Cherilus_Internship%20Rpt%20Summer%202011%20Rev%201.pdf

4.2 Summer Internship Location: Savannah River National Laboratory

Amaury Betancourt (06/06/2011 – 08/12/2011)

DOE Fellow Amaury Betancourt recently graduated in the Spring of 2011 from Florida International University (FIU) with a Master of Science (M.S.) degree in environmental engineering. Mr. Betancourt interned at the United States Department of Energy (DOE) Savannah River National Laboratory (SRNL) in South Carolina. During his 10-week internship at SRNL, Mr. Betancourt assisted SRNL scientist Dr. Brian B. Looney in evaluating the effects of an innovative mercury remediation strategy on a real ecosystem.

Historically, industrial operations in the A/M Area of the SRS released chlorinated solvents into the environment. In 1985, a groundwater extraction and air stripper system was set up to remove chlorinated solvents from the subsurface. The treated groundwater is discharged to headwaters of Tims Branch. The full scale M-1 air stripper has operated continuously since start up in 1985. In 2007, a supplementary process was added to treat the trace mercury co-contamination (approximately 250 nanograms per liter, ng/L) that is present in the groundwater. This system adds tin chloride (SnCl_2 , or stannous chloride) to the groundwater entering the air stripper. Tin chloride chemically reduces dissolved ionic mercury (Hg^{2+}) to elemental mercury (Hg^0), which is more volatile and which can then be removed from the groundwater by the air stripper. Since 2007, mercury levels in the treated groundwater released to Tims Branch have dropped to approximately 10 ng/L.

Operation of the mercury treatment system results in the release of inorganic tin to the headwaters of Tims Branch. Research related to the behavior and fate of this tin is important to assessing the net effectiveness of the process. Mr. Betancourt is assisting Dr. Brian B. Looney of the SRNL in taking samples of the sediments and water along Tims Branch and determining the distribution of tin along Tims Branch. Furthermore, fish samples from 2006 and 2010, which represent times before and after tin chloride treatment, respectively, will be analyzed for tin and mercury and compared. This research project allows the study of the relatively long-term (three and a half years) effects of this remediation strategy on a real ecosystem. The primary goal of the present research is to determine if tin accumulation in Tims Branch is adversely impacting the ecosystem. Research that demonstrates positive impacts, such as lower mercury concentration in fish, and minimal negative impacts, such as minimal tin uptake, would support the treatment concept and the potential for implementation at similar sites that are contaminated with mercury, including the East Fork Poplar Creek (EFPC) in Oak Ridge, Tennessee.



Figure 3. Amaury Betancourt and his mentor Dr. Brian Looney.

Mr. Bentancourt's Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Amaury%20Betancourt%20Internship%20Rpt%20Summer%202011%20Rev%200.pdf>

4.3 Summer Internship Location: DOE Headquarters, Forrestal

Heidi Henderson (06/06/2011 – 08/12/2011)

DOE Fellow Heidi Henderson interned this summer with Ana Han in Foreign Affairs, Office of Environmental Management (EM-2.1). Ms. Hernderson coordinated EM's participation in the International Conference on Environmental Remediation and Radioactive Waste Management (ICEM) 2011 that will take place in Reims, France, this September. Heidi assisted in keeping EM updated on foreign visits and foreign travel that takes place within the EM Department as well as attending EM meetings. She was very pleased with her experience.



Figure 4. DOE Fellow, Heidi Henderson, with her mentor Ana Han (left) and her boss Ivette Collazo (right).

Ms. Henderson's Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Heidi%20Henderson%20Internship%20Rpt%20Summer%202011%20Rev%2003%20em.pdf>

Sheidyn Ng (06/06/2011 – 08/12/2011)

DOE Fellow Sheidyn Ng worked with the U.S. Department of Energy Headquarters (DOE-HQ) for the Environmental Management Office of Safety and Security Program (EM-40) under the mentorship of Mr. Kenneth Picha. The mission of the Office of Safety & Security Program (EM-40) is to manage DOE/EM-wide Integrated Safety Management implementation oversight activities, the Defense Nuclear Facilities Safety Board (DNFSB) recommendations and issues, standards assurance for major project planning and execution, operational safety and awareness programs, and quality assurance programs. Sheidyn will be assisting in communication between safety national laboratory personnel and DOE, analyzing DOE contractors safety programs, organizing memorandum archives, and national laboratory personnel training programs. These tasks ensure the integrity and efficiency of the EM-40 mission and function.



Figure 5. DOE Fellow, Sheidyn Ng, with Secretary of Energy Steven Chu.

Ms. Ng's Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Sheidyn%20Ng%20Fermin%20Internship%20Rpt%20Summer%202011%20Rev%200.pdf>

4.4 Summer Internship Location: Lawrence Livermore National Laboratory

Mario Vargas (06/09/2011 – 08/12/2011)

Mario Vargas, DOE Fellow, was assigned to work under the Nuclear Materials Technology Program (NMTP). NMTP works to assure the safety and reliability of the nation's nuclear stockpile. NMTP provides management of all special nuclear material operations at the Laboratory, including those involving highly enriched uranium, plutonium, and tritium. This work is conducted at LLNL's Superblock facility, one of just two defense plutonium research and development facilities in the U.S.

Mario's work is on the design of the airflow system of a glove box capable of processing transuranic waste barrels. The glove box's vitalization system will be designed to always

displace air into the clean section of the glove box and then into the contaminated section. That ensures that no loose contamination is able to exit when the doors are open. Because workers will be present and in close proximity to the glove box, all the air flowing around them must also flow past them and into the glove box. In order to test the amount of air and the direction of air flow around the open doors, smoke testing will be conducted. The qualitative data gathered from the smoke testing will be used to validate the data gathered from the calculation end of the project. There always needs to be a flow of 500 cfm in the glove box, whether it's in the ducting or through the open doors. The current task being worked on is to determine the pressure drop throughout the system and to incorporate the proper means of maintaining the required flow rate if it were to have a substantial drop. Each section of the duct is being evaluated in each of the eight possible open door configurations.

Mr. Vargas' Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Mario%20Vargas%20Internship%20Rpt%20Summer%202011%20Rev%200.pdf>

4.5 Summer Internship Location: Moab Site

Alex Henao (06/06/2011 – 08/12/2011)

DOE Fellow Alexander Henao interned at the Moab Site in Utah, a national laboratory under the U.S. Department of Energy. Mr. Henao was under the mentorship of Ryan Barker, the Re-vegetation Manager, and Ken Pill, the Ground Water Program Manager. Mr. Henao's duties included assisting in developing soil collection and analysis protocols for use in wildland restoration planning; assisting in developing vegetative cover sampling protocols; actual data collection and analysis of the data; assisting in wildlife surveys that will include visual transects, wildlife trapping, and monitoring infrared cameras; assisting with surface and ground water sampling; monitoring ground water changes in ground water chemistry as the river stage decreases after the peak runoff; performing a literature search for historical ammonia and nitrate concentrations at the site; and investigating different scenarios using the ground water flow model.



Figure 6. DOE Fellows Alex Henao with his mentor Mr. Ryan Barker.

Mr. Henao's Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Alex%20Henao%20Internship%20Rpt%20Summer%202011%20Rev%200%20%282%29.pdf>

4.6 Summer Internship Location: Pacific Northwest Laboratory

Rinaldo Gonzalez (06/07/2011 – 08/12/2011)

For the summer of 2011, DOE Fellow Rinaldo Gonzalez participated in the Single Shell Tank (SST) Structural Integrity Project at Pacific Northwest National Laboratory (PNNL). He was assigned to the Engineering Mechanics and Structural Materials Group, Computational Mechanics Team, under the mentorship of Kenneth Johnson. The SSTs are beyond their estimated design life, and several are known to have leaked. The continued safe use and decontamination operations by the tank farm contractor are necessary until the tanks are cleaned and decommissioned by the Department of Energy (DOE).

The project is performing an analysis of record (AOR) to assess the structural soundness of the underground waste storage tanks at the Hanford Site. The results of the AOR will be used to guide the waste retrieval efforts in the future. PNNL is conducting a finite element analysis (FEA) using the commercial software ANSYS to evaluate thermal and operation loads as well as seismic load analysis. Part of Rinaldo's responsibilities include the review and execution of the FEA model used for Type III and IV tank models, sensitivity analysis of results by varying selected model parameters, assistance with post-processing of results, and data transcription into technical reports.

Specifically, the mesh resolution for the type IV model will be optimized in order to perform a thermal tank-to-tank interaction simulation as well as the respective structural analysis. Transient thermal studies will be conducted and results will be included into both a technical report and poster. The poster will be presented at the PNNL Summer Undergraduate Poster Session.



Figure 7. DOE Fellow, Rinaldo Gonzalez with engineers from PNNL Computational Mechanics Team. From left to right: Naveen Karri, his PNNL mentor Kenneth Johnson, Siva Pilli and Scott Sanborn.

Mr. Gonzalez’s Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Rinaldo%20G%20Galdamez%20Internship%20Rpt%20Summer%202011%20Rev%200.pdf>

4.7 Summer Internship Location: Hanford Site

Jose Matos (06/06/2011 – 08/12/2011)

DOE Fellow Jose Matos interned at Washington River Protection Solutions. He is supporting the Agitated Thin Film Evaporator (ATFE) project under Ruben Mendoza and Whitney Dobson. The ATFE is a new evaporation method for Hanford and is being used to validate the Wiped Film Evaporator (WFE) which functions under the same concept. The WFE is meant to provide assistance to the 242-A Evaporator facility on the site. The goal is to provide risk mitigation by providing extra evaporative capacity which reduces the overall load on the 242-A as well as providing backup if the 242-A facility was to shut down. Its intended use is to evaporate the supernatant liquids in the Hanford tanks. The ATFE is essentially a smaller scale WFE and it will be tested with actual tank waste once simulant testing has been completed.



Figure 8. Jose Matos with his mentors Ruben Mendoza and Whitney Dobson.

Mr. Matos' Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Jose%20Matos%20Internship%20Rpt%20Summer%202011%20%20Rev%200.pdf>

Janty Ghazi (06/06/2011 – 08/12/2011)

DOE Fellow Janty Ghazi completed an internship with Washington River Protection Solutions (WRPS), a contractor to the United States Department of Energy, located in Hanford, Washington. The Hanford site currently stores about 53 million gallons of highly toxic radioactive waste. WRPS is currently trying to control and eliminate this waste. As an electrical engineering intern, Mr. Ghazi worked with the engineering design team and assisted them with the various tasks they are charged with. One of the more notable contributions Janty has made includes assisting with the wiring lists for the de-misters that are going to be implemented in the ventilation systems of the waste tanks at the various tank farms. Mr. Ghazi also worked on the relay replacements for the leak detectors being used for the waste tanks. In addition, he designed the control enclosures as well as the mounting hardware for the HVAC system to be installed on the 2750E building. Finally, he worked to design a panel board schedule for the wiring being done as part of an upgrade project in the D-wing of 2750E.

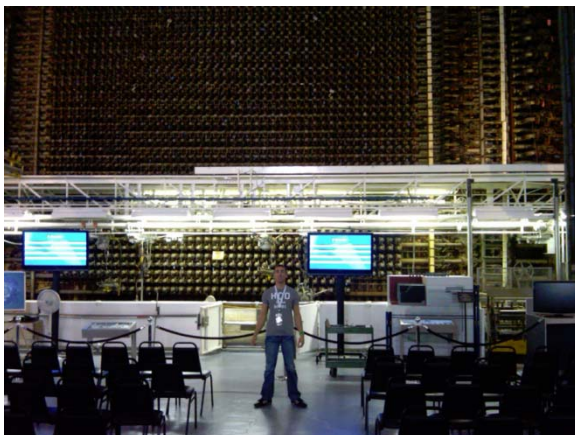


Figure 9. DOE Fellow Janty Ghazi in front of the core of the B reactor at the Hanford Site.

Mr. Ghazi's Summer Internship Technical report can be found at:

<http://fellows.fiu.edu/doc/Summer11Reports/Janty%20Ghazi%20Internship%20Rpt%20Summer%202011%20Rev%200.pdf>

5.0 DOE FELLOWS POSTER EXHIBITION AND COMPETITION

The fourth annual DOE Fellows Poster Exhibition and Competition took place on October 25, 2011. The purpose of this event was to showcase the students' research accomplishments for the past year as a result of their participation in various U.S. Department of Energy - Environmental Management (DOE EM) related projects. A total of 14 posters were exhibited. Some of the projects showcased by the students were a result of their summer

internship assignments at DOE Headquarters, Lawrence Livermore National Laboratory, DOE Savannah River Site, Pacific Northwest National Laboratory, or Hanford Site, and also their contributions to projects at the Applied Research Center (ARC). For some of the graduate students, these projects are also a part of their thesis for a Master's degree. This year's panel of judges comprised of Dr. David Roelant (ARC's Associate Director of Research), Dr. Michael Sukop (FIU Associate Professor, Department of Earth and Environment at the College of Arts & Sciences), Ms. Ines Triay (former Assistant Secretary for Environmental Management), and Dr. Norman Munroe (Associate Dean, College of Engineering).



Figure 10. Poster Exhibition and Competition participants and judges.

The poster exhibition and competition was attended by FIU faculty, ARC's personnel and FIU students. Following the event, the judges had the opportunity to tour ARC's laboratories and see the hands-on research work performed by the DOE Fellows.



Figure 11. Panel of judges for the fourth annual DOE Fellows poster exhibition and competition.

5.1 2011 Student Poster Competition Winners

This year, the distinguished panel of judges evaluated the posters presented at the third DOE Fellows Poster Exhibition and Competition and selected 1st, 2nd, and 3rd place winners. The certificates and cash awards were presented at this year’s DOE Fellows Induction Ceremony (November, 2011):

First place winner: Mr. Rinaldo Gonzalez, DOE Fellows –Class of 2009, Mechanical Engineering

Poster title: “Soil Mesh Optimization and Preliminary FEA Study of Tank-to-Tank Interaction for Hanford Type IV SST”



Figure 12. DOE Fellow Mr. Rinaldo Gonzalez accepting his first place award for the 2011 student poster competition.

Second place winner: Mr. Jose Matos, DOE Fellows –Class of 2009, Mechanical Engineering

Poster title: “Agitated Thin Film Evaporator”



Figure 13. DOE Fellow Mr. Jose Matos accepting his second place award for the 2011 student poster competition.

Third place winner: Ms. Alessandra Monetti, DOE Fellows –Class of 2009, Civil Engineering

Poster title: “Heat of Hydration Experimental Mock Up Using Cellular Concrete/Grout”



Figure 14. DOE Fellow Ms. Alessandra Monetti accepting her third place award for the 2011 student poster competition.

6.0 DOE FELLOWS 2011 INDUCTION CEREMONY

On November 16, 2011, FIU's Applied Research Center (ARC) conducted the fifth (5th) DOE Fellows Induction Ceremony. This year, Ms. Tracy Mustin (Acting Principal Assistant Secretary for Environmental Management) was one of the keynote speakers for the ceremony. Ms. Mustin welcomed the FIU students to the DOE Fellows program and encouraged them to continue to hone their communication skills as well as their technical skills. Ms. Mustin emphasized the needed ability to articulate their research aims, results and significance.

Other distinguished guests included Dr. Jeff Griffin (Associate Director for Environmental Management, Savannah River National Laboratory) and Dr. Ines Triay (Former Assistant Secretary for DOE Office of EM). FIU was represented by Dr. Andres Gil (Vice President for Research), Dr. John Proni (ARC Executive Director), and Dr. Leonel E. Lagos (DOE Fellows Program Director), as well as FIU faculty, staff, and students. Ms. Mustin and Dr. Griffin had the opportunity to participate in morning tours of the ARC research laboratories and listen to DOE Fellows presenting their research work. In addition, the distinguished guests and FIU faculty had the opportunity to interact with the DOE Fellows during a poster exhibition following the induction ceremony.



Figure 15. Ms. Tracy Mustin (Acting Principal Assistant Secretary for Environmental Management) gave the key note speech at the 2011 Induction Ceremony.



Figure 16. Dr. Leonel Lagos giving welcoming remarks at the Induction Ceremony.



Figure 17. Dr. Andres Gil (FIU Vice President for Research).



Figure 18. ARC's Executive Director, Dr. John Proni.

During this Induction Ceremony, 11 new FIU STEM minority students were inducted as DOE Fellows:

- Claudia Cardona (Graduate, Environmental Engineering)
- Nel Ciurdar (Undergrad, Electrical Engineering)
- Eric Inclan (Graduate, Mechanical Engineering)
- Lilian Marrero (Graduate, Civil Engineering)
- Joshua Midence (Undergraduate, Civil Engineering)
- Carol Moreno-Pastor (Undergrad, Biomedical Engineering)

- Jaime Mudrich (Graduate, Mechanical Engineering)
- Ximena Prugue (Undergraduate, Mechanical Engineering)
- Paola Sepulveda (Undergraduate, Biomedical Engineering)
- Frank Silva (Undergraduate, Electrical Engineering)
- Bryant Thompson (Undergraduate, Biomedical Engineering)



Figure 19. DOE Fellows Class of 2011.

Short bios and photos of the new inductees are presented in section 11 and also available on the DOE Fellows website (<http://fellows.fiu.edu/>) under DOE Fellows Bios tab.

For the third year, the DOE Fellow of the Year Award and the Mentor of the Year Award were presented in the ceremony. DOE Fellows were requested to nominate their ARC mentors and ARC mentors were requested to nominate the DOE Fellows. An ARC committee was established to review and select the winners from the submitted nominations. The 2011 Mentor of the Year Award went to Ms. Peggy Shoffner and the 2011 DOE Fellow of the Year Award was given to Ms. Heidi Henderson (DOE Fellows Class of 2010).



Figure 20. DOE Fellow Ms. Heidi Henderson accepting the 2011 FIU-DOE Fellow of the Year Award.



Figure 21. ARC Mentor Ms. Peggy Shoffner accepting the 2011 FIU-DOE Mentor of the Year Award.

A DOE Fellows Poster Exhibition was also conducted at the end of this year’s Induction Ceremony. Dr. Jeff Griffin and Ms. Tracy Mustin had the opportunity to interact with our DOE Fellows and review the students’ posters after the ceremony.



Figure 22 & Figure 23. DOE Fellows Janty Ghazi and Denny Carvajal showcasing their research to Dr. Jeff Griffin and Ms. Tracy Mustin.

7.0 WASTE MANAGEMENT CONFERENCE 2012 ACCOMPLISHMENTS

Seventeen Department of Energy – Florida International University (FIU) Fellows attended the Waste Management 2012 Conference in Phoenix, Arizona, from February 26 to March 1, 2012. The DOE Fellows from the DOE – FIU Science and Engineering Workforce Development Initiative met with Mr. David Huizenga (DOE Senior Advisor for Environmental Management) while at the conference to discuss their EM applied research work being performed at FIU’s Applied Research Center as well as their summer internship experiences at DOE sites, national laboratories, and site contractors. The DOE Fellows Program is being supported by EM in order to create a pipeline of minority students and engineers to help span the science and engineering talent gap necessary to complete EM’s mission. This event appeared in an article in the March 1 EM Program Update (<http://fellows.fiu.edu/doc/EM Program Update EM Renews Information-Sharing Agreement 03-01-12.pdf>).



Figure 24. David Huizenga (DOE Senior Advisor for EM, 8th from left) with FIU’s DOE Fellows and Dr. Leo Lagos (DOE Fellows Program Director, 10th from left) at WM2012.

Fourteen of the DOE Fellows also presented their research via technical posters during the session entitled, “Student Poster Competition: The Next Generation – Industry Leaders of Tomorrow” (Session 30). The students presented their DOE applied research in the areas of soil/groundwater, D&D, and high level waste.

In addition, DOE Fellows Director (Dr. Lagos) and DOE Fellow (Ms. Heidi Henderson) participated in two panel sessions dedicated to students and young professionals - “Graduating Students and New Engineers – Wants and Needs – Are Companies Even Listening?” (Session 44) and “Young Professionals” (Session 45).



Figure 25. Dr. Leonel Lagos and Heidi Henderson with panel members at WM12.

The Fellows also help out at the conference by working as student assistants during the various presentations and panel session at WM12. Also, our DOE Fellows women attended the Women of Waste Management panel and had a chance to interact with a working group of professional women working in the environmental engineering field.

7. 1 Student Poster Presentations at Waste Management 2012

The DOE Fellows presented their posters at WM12 showcasing their EM related research at a session entitled “The Next Generation, Industry Leaders of Tomorrow.” A list of the posters presented and a short abstract is provided below:

Investigation on Uranium Biosorption by DOE-Hanford Site Soil Isolates: Effects of Calcium and Bicarbonate
– Mr. Bryant Thompson

This investigation set out to evaluate the uranium (VI) bioaccumulation by *Arthrobacter* G975 sp. in synthetic groundwater (SGW) set to pH 7.35, with varying calcium & bicarbonate concentrations, in order to further understand the effects on mobility of uranyl species in the subsurface.

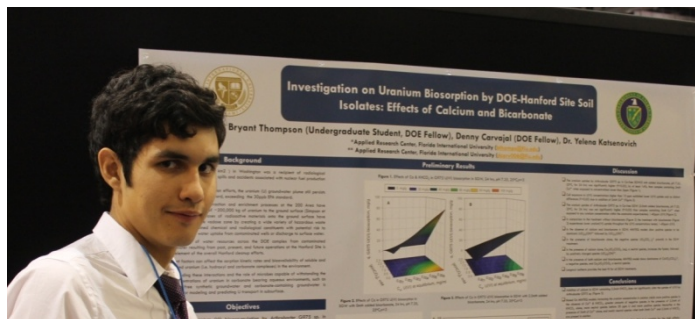


Figure 26. DOE Fellow Bryant Thompson with his poster at WM12.

***Energy Facility Contractors Group Lessons Learned and Best Practices
– Mr. Lee Brady***

The Applied Research Center at Florida International University is collaborating with DOE’s Energy Facility Contractor’s Group (EFCOG) to develop lessons learned and best practices in the field of D&D. The goal is to improve the cost effectiveness of DOE operations by sharing lessons learned and best practices across corporate and program lines.

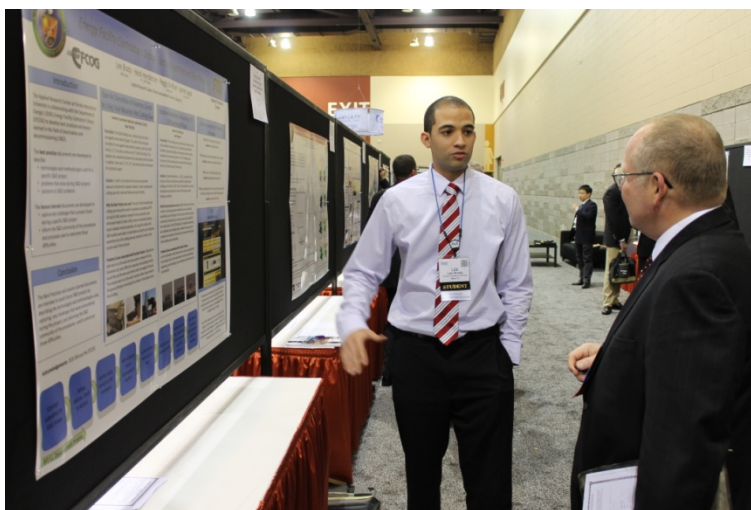


Figure 27. DOE Fellow Lee Brady with his poster at WM12.

Investigation of Effect of Water Quality Parameters on the Dissolution of Sodium Meta-Autunite

– Mr. Ravi Gudavalli

The release of uranium from synthetic sodium meta-autunite, a mineral formed via polyphosphate injection at the Hanford Site 300 Area, occurs during the slow dissolution of its mineral structure. The research objective is to quantify the effect of bicarbonate on autunite dissolution under varying pH and temperature conditions.

Peristaltic Crawler for Pipeline Unplugging at DOE Hanford Site
 – Mr. Jose Matos

Hanford's radioactive waste transfer lines have been known to suffer from clogs. Several unplugging technologies have been tested in the past and have proven unsuccessful. For this reason, a fully pneumatic crawler robot which can come directly up to a blockage and apply abrasive techniques to it has been designed.



Figure 28. DOE Fellow Jose Matos with his poster at WM12.

Embedded Wireless Sensors for In-Situ Decommissioning Tanks and Environmental Monitoring

– Ms. Elicek Delgado-Cepero

The feasibility of using wireless sensors for monitoring temperature, corrosion, and humidity inside concrete and grout used for decommissioning of nuclear facilities is being studied. The dielectric permittivity of concrete and grout are also being measured using an open-probe coaxial method. The results will influence the design and position of the sensors inside the structure.

Improvements in the Suspended Sediments Interactions Module of an Integrated Flow and Mercury Transport Model for East Fork Poplar Creek Watershed, Oak Ridge, TN

– Ms. Lilian Marrero

An integrated surface and subsurface flow and transport model has been developed for the East Fork Poplar Creek watershed to determine the effect of hydrological events on mercury transport. Simulations were calibrated for the main hydrologic and transport parameters. Results indicate high flow conditions intensify the re-suspension of mercury particulates.

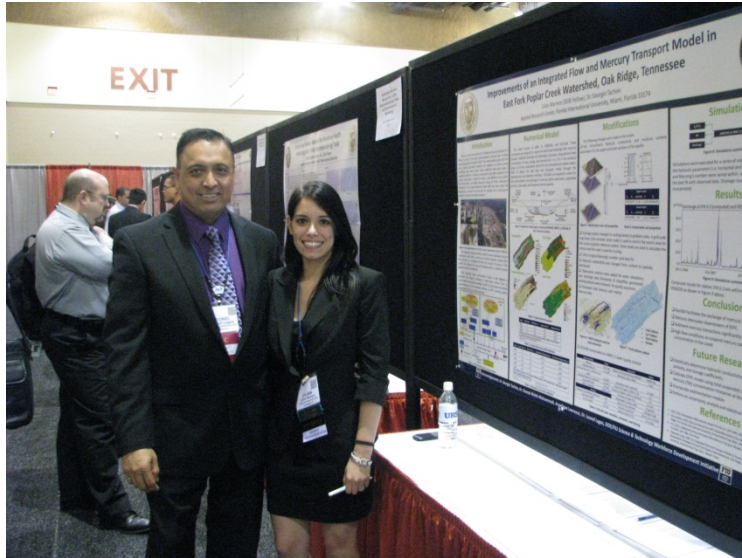


Figure 29. DOE Fellow Lilian Marrero with her poster at WM12.

Implementation of Parallel Computing for Multiphase Flows using the Lattice Boltzmann Method

– Mr. Jaime Mudrich

In this research, a parallel algorithm is presented based on the 2D multiphase lattice Boltzmann method for high density ratio systems. Simulations are carried out for buoyant bubbles present in high level waste processing. Results are compared to theoretical shape regimes. The performance difference between the serial and parallel codes is also evaluated.

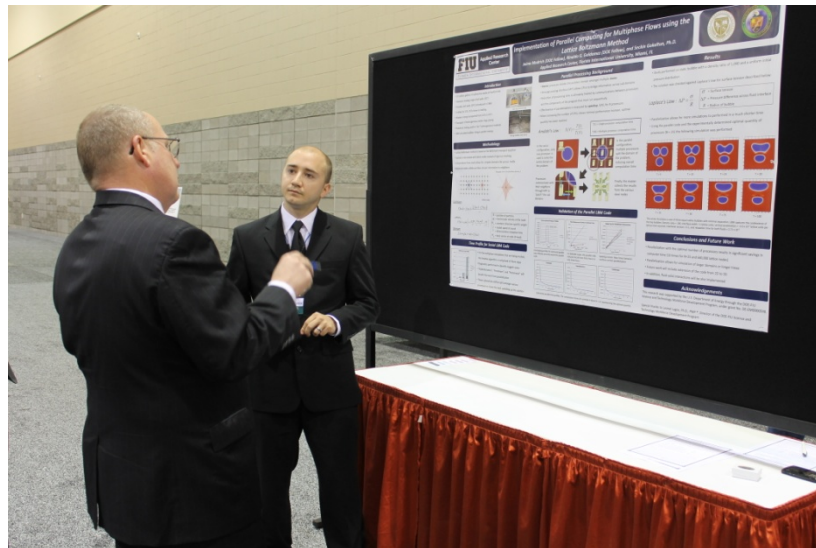


Figure 30. DOE Fellow Jaime Mudrich with her poster at WM12.

In-Situ Decommissioning Sensor Network: Meso-Scale Test Bed

– Ms. Nadia Lima

To aid in-situ decommissioning at the Savannah River Site, a meso-scale test bed is being installed at Florida International University to test sensors embedded in grout to measure site-specific environmental parameters. Principal investigators shall be providing and testing these sensors to determine their limitations when used at the Savannah River Site.



Figure 31. DOE Fellow Nadia Lima with her poster at WM12.

Heat of Hydration Experimental Mock Up Using Cellular Concrete/Grout –

Ms. Alessandra Monetti

In support of in-situ decommissioning of the 105-P Reactor Disassembly Basin D & E Canal at Savannah River Site, an experimental setup was designed and developed by ARC-FIU in Miami, Florida to validate the performance of a cellular concrete grout mix with respect to temperature distribution generated and its strength



Figure 32. DOE Fellow Alessandra Monetti with her poster at WM12.

Evaluation of Asynchronous Pulsing Unit Pipeline Unplugging Technology
 – Mr. Eric Inclan

Asynchronous pulsing is a technique for unplugging pipelines utilizing waves of high pressure. These waves are varied in frequency and intensity. This study evaluates the effectiveness of this technology in clearing pipelines plugged with various materials. A description of current research and future work is presented.

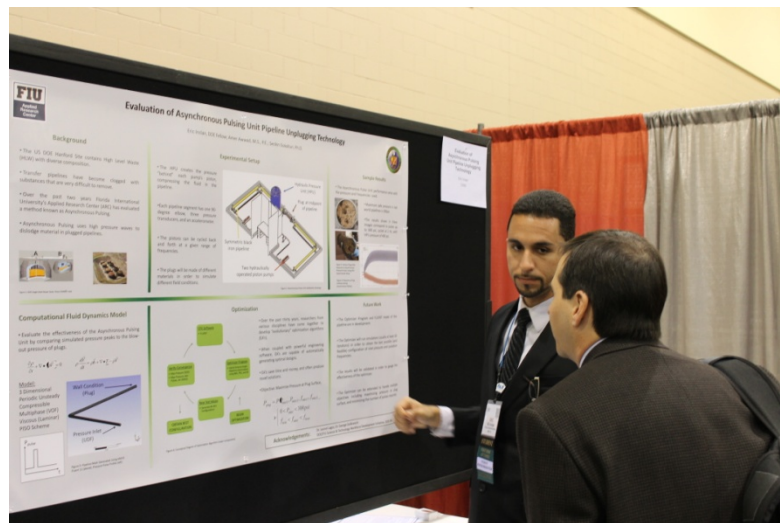


Figure 33. DOE Fellow Eric Inclan with his poster at WM12.

Uranium Remediation in the Hanford 200 Area by In Situ Subsurface pH Manipulation Using NH₃ Gas

– Ms. Carol Moreno

The role of major pore water constituents on the formation and solubility of uranium-bearing precipitates created after NH₃ gas injection are being investigated. Characterization analysis of the precipitates includes metal speciation software Visual MINTEQ, X-ray diffraction, Fourier Transform Infrared Spectroscopy, and Scanning Electron Microscope-Energy Dispersive Spectroscopy.

Sensor Implementation and Data Acquisition for Thermal Analysis of Special Grout –
Mr. Sainath Munavalli

The Savannah River Site is implementing in situ decommissioning of the 105-R Reactor by filling sub-grade areas of the Disassembly Basin D & E Canal with modified cellular grout. A thermocouple tree and concrete maturity logger mock-up test will quantify the anticipated rise in temperature and strength of the grout as it cures.

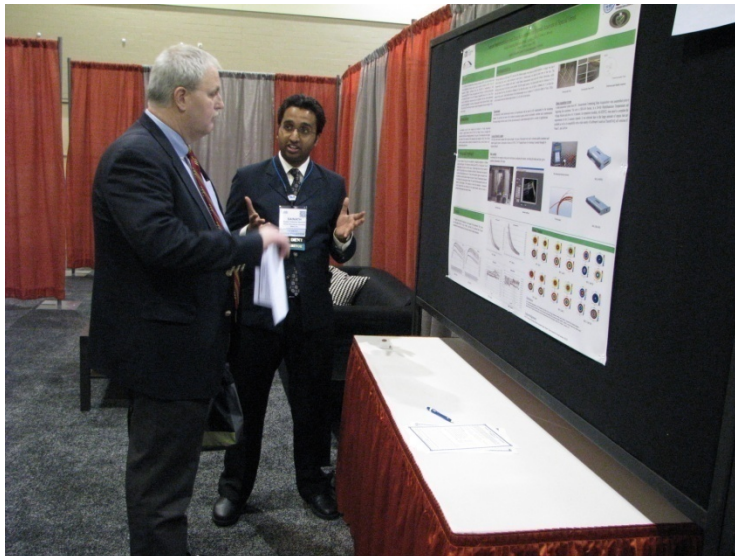


Figure 34. Sainath Munavalli with his poster at WM12.

Power and Communication Bus Topology for In-Situ Decommissioning Sensor Network
– Mr. Frank Silva

Proper organization of power and communication utilities is necessary to successfully deploy a sensor network in an in-situ decommissioning monolith. Challenging issues include remote radioactive sites in need of continuous monitoring and energy. Therefore, an analysis has been conducted to explicitly address this situation.

Asynchronous Pulsing as a Means of Unplugging Pipelines

– Mr. Janty Ghazi

In order to unplug radioactive waste pipelines, a technology known as asynchronous pulsing is being tested. A hydraulic pump connected to linear pressure transducers is used to generate pressure waves inside a test pipeline. The unit will be controlled and data will be acquired using LabVIEW.



Figure 35. DOE Fellow Janty Ghazi with his poster at WM12.

7.2 Professional Poster Presentations

A professional poster was prepared and presented by DOE Fellow Heidi Henderson in WM12. The following section provides the title, author (DOE Fellow), and abstract for these papers. The papers submitted by DOE Fellows were peer reviewed by WM PAC members.

Impact of D&D Technology and Methodology Demonstrations from D&D Focus Area Activities

– Ms. Heidi Henderson

In 1994, the Department of Energy (DOE) Office of Science and Technology (OST) established and staffed a program referred to first as the Decontamination and Decommissioning Focus Area and later as the Deactivation and Decommissioning Focus Area (DDFA). The objective of the DDFA was to identify and promote deployment of improved D&D technologies for the cleanup of DOE sites. The DDFA was formed to assure that adequate technologies were available to support Environmental Management's (EM's) task to deactivate and decommission facilities across the DOE complex.

The emphasis in the DDFA was to select and demonstrate technologies that were mature enough to be implemented in actual cleanup activities. The DDFA looked first at commercial technologies that had never been used in the DOE complex or that had been used in the

complex but not applied to D&D. The DDFA applied the term “innovative” technology to those technologies that 1) were being used commercially but not yet applied in the DOE environment, 2) were being used in a new way, or 3) were still under development. The basis being that technology development would result in substantial reductions in time and cost and in increased effectiveness of the cleanup work as compared to the baseline case which used available baseline technologies

To encourage DOE sites to use innovative technologies and to develop cost comparison data, the Large-Scale Demonstration Program (LSDP) was established in 1995. This program was later dubbed the Large-Scale Demonstration and Deployment Program (LSDDP) and formed the cornerstone of the DDFA effort. The purpose of the LSDDP was to validate the performance of D&D technologies and introduce the application of alternative technologies in parallel with baseline technologies. The demonstrations were carried out as part of an actual ongoing D&D project at a DOE site and information on the results of the demonstrations was disseminated through fact sheets and detailed summary reports to encourage deployment of successful new technologies. The LSDDPs were integrated by DOE site representatives, DOE site main contractors, private industry, academia, international partners, and the Army Corps of Engineers.

To further encourage the deployment of new technologies, OST began the Technology Deployment Initiative (TDI) in early 1997. This program was renamed the Accelerated Site Technology Deployment (ASTD) Program in early 1998. The objectives for the ASTD Program included

- Provide for accelerated multiple deployment of technologies or processes to conduct cleanup (including D&D) in ways to reduce EM cleanup costs and support *Ten Year Plan* goals,
- Provide third-party validation of cost savings and incentives to site participation through reinvestment of cost savings,
- Break down barrier that inhibit implementation of technologies or processes,
- Achieve closer coordination through joint ownership and funding of projects across DOE EM organizations.

ASTD projects were required to include commitment on the part of a DOE site or facility to use the proposed technology in actual remediation operations. The purpose of ASTD was to bridge the gap between development and deployment of new technologies for environmental cleanup across the DOE weapons complex. Within the ASTD program, DOE sites and OST shared project costs and ownership, including the risks associated with deployment of an innovative technology. ASTD acted as a catalyst to bring together problem holders, regulators, developers, and stakeholders to achieve rapid deployment of environmental cleanup technologies.

The DDFA performed activities from 1995 through 2002. In 2011, the D&D Division (EM-13) of DOE EM requested that the Applied Research Center (ARC) at Florida International University (FIU) investigate the number of subsequent successful deployments of technologies and methodologies that were demonstrated under the DDFA programs, including the LSDDP and the ASTD Programs. The overall objective was to evaluate the

impact that these programs have had on the technologies and methodologies that are now considered baseline for performing D&D activities across the DOE complex.

FIU reviewed reports, fact sheets, and other documents that were generated during the active period of the DDFA to compile a database of technologies and methodologies that were generated under the LSDDP and ASTD programs. Using this information and some assistance from EM-13, FIU contacted commercial technology vendors as well as DOE and site personnel that were associated with the technology or the demonstration. FIU compiled information on approximately 150 technologies and pursued the collection of data from the vendors and the DOE sites to determine which technologies and methodologies were subsequently deployed and which are still being used today.

8.0 DOE FELLOWS DIRECTLY SUPPORTING DOE EM PROJECTS

The following sections report the direct DOE Fellows support to DOE EM projects around the complex. This information is also reported in 2011-2012 Year End Report - Project 4, under Task 2.

8.1 DOE's Savannah River National Laboratories Support

DOE Fellows: Jose Rivera, Nadia Lima, Alessandra Monetti, Elicek Delgado, Joshua Midence, Eric Inclan, Janty Ghazi, Frank Silva

Mentor: Leonel Lagos (FIU-ARC)

Project: In-Situ Decommissioning Sensor Network Meso-Scale Test Bed (ISDS-MSTB)

In an effort to aid the various in-situ decommissioning projects at SRS, a meso-scale concrete test bed has been designed and is being installed at FIU-ARC in order to test various sensors imbedded in grout. This experiment consists of using various sensors including Electrical Resistivity Tomography, Advanced Tensiometers, Piezoelectric Sensors, and Fiber Optic Sensors (ERT, AT, PES, FOS) to measure various parameters including strain, crack detention, corrosion, fluid mobility, moisture, as well as a variety of others. Principal Investigators (PIs) from Idaho National Laboratory (INL), Mississippi State University (MSU), University of Houston (UH), and University of South Carolina (USC) will be providing the sensors as well as testing them. The main purpose is to recognize the limitations of these sensors for their future use in monitoring closed nuclear facilities.



Figure 36. Assembly of ISDSN sensor racks and sensor racks support assemblies.

Sensor frames and sensor racks were completed by FIU staff and students. In addition, PIs from all four institutions came to FIU facilities in Miami to install their sensors onto the FIU designed and constructed racks. DOE Fellows and graduate students as well as FIU staff provided support to the various PIs during the installation of the sensors. Over 250 remote sensors were placed on 9 panel racks.

In addition, FIU coordinated the efforts of the test site development. An FIU contractor was hired to develop the test site, provide the test “cube” structure and prepare the test site. An office trailer was also rented to accommodate the data acquisition system being used by the four institutions.



Figure 37. Preparation of the “cube” test site.

In January 2012, FIU staff and students continued to work with the PIs from all four institutions in the final installation, connections and systems check. During the week of January 9, 2012, PIs and graduate students from all four institutions and Mr. Mike Serrato from Savannah River Site gathered at FIU for the final installation of the sensors and grouting of the concrete monolith. A total of 270 sensors were installed in the 10 ft x 10 ft x 8 ft cube. PIs worked alongside FIU personnel and DOE Fellows during the troubleshooting, connections, and placement of 9 sensor racks into the concrete monolith. On January 12, 2012, CEMEX delivered 32 cubic yards of a special grout formula to encapsulate the sensors in the precast monolith test bed. Sensors began collecting data and will continue to collect data for a period of six months. FIU also began drafting the Final Construction Report for the Meso-Scale Test Area and Cube. In addition, an interim report was drafted for the sensor remote access system (SRAS) installation.

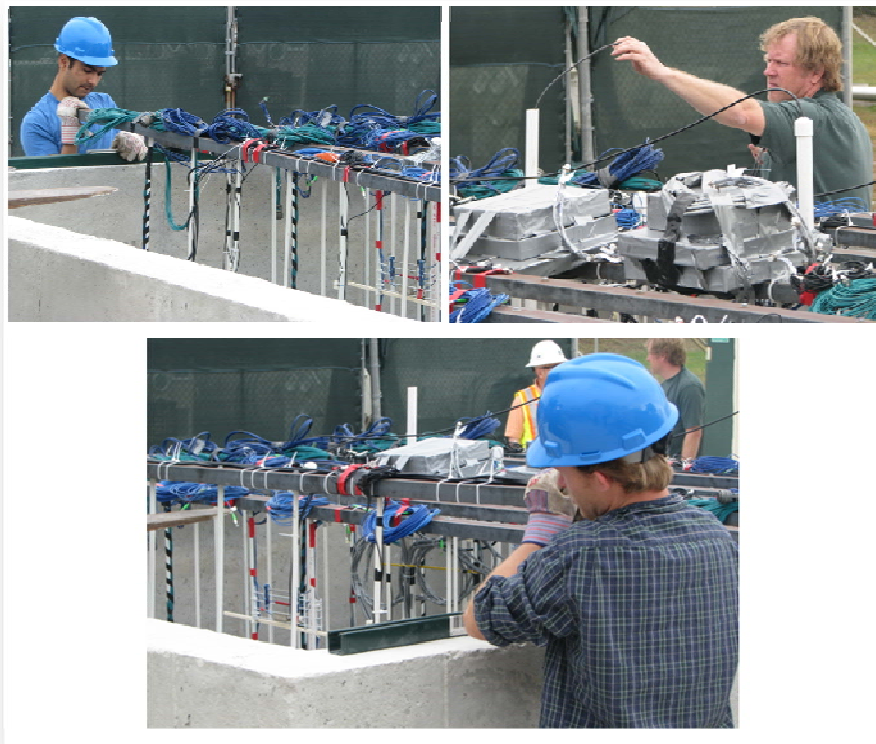


Figure 38. PI's testing sensors.



Figure 39. Grout pump and filling the cube with grout.

During the months of February and March, FIU staff and students continued supporting SRS and the four institutions in the monitoring the experimental setup and data collection tasks. FIU also completed the draft of the Final Construction Report for the Meso-Scale Test Area and Cube and the Sensor Remote Access System (SRAS) Installation Report. Both reports

were sent to SRS for review and comments. Comments received from SRS on the Final Construction report were resolved and incorporated into the final draft of the report.

During the month of March, FIU staff and students continued supporting SRS and the four institutions in the monitoring the experimental setup and data collection tasks. FIU also received SRS comments and worked on revising the Final Construction Report for the Meso-Scale Test Area and Cube and the Sensor Remote Access System (SRAS) Installation Report.

FIU has been regularly inspecting the curing process of the grout and taking photos of the cube's surface and shell to identify visible cracks formed on the surface of the monolith. Three days after the grout dried and started to shrink, some cracks became visible around the edges of the cube and on the shell. By the end of March, some cavities had formed around some of the rods of the sensor racks. See photos below showing location of formed cracks.



Figure 40. Cracks developing on cube surface.



Figure 41. Cavities developing around rods.

During the month of April, FIU staff and students continued supporting SRS and the four institutions in monitoring the experimental setup and data collection tasks. FIU also continued regularly inspecting the curing process of the grout and taking photos of the cube's surface and shell to identify visible cracks formed on the surface of the monolith. Three days after the grout dried and started to shrink, some cracks became visible around the edges of the cube and on the shell. By the end of March, some cavities had formed around some of the rods of the sensor racks. Inspections and documentation of the curing process continued through April.

8.2 EFCOG Support

DOE Fellow: Lee Brady and Heidi Henderson

Mentor: Leonel Lagos and Peggy Shoffner (Supporting EFCOG Working Group)

Project: Technical D&D support to DOE EM International Program & EFCOG's D&D Lessons Learned/Best Practices

The DOE Fellows are currently supporting FIU-ARC and EFCOG in the development of the Lessons Learned/Best Practices Module of the D&D Knowledge Management Information Tool. In an effort to capture the lessons learned and best practices acquired at most DOE sites, FIU worked with EFCOG to establish a formal data collection process where technical

points of contact (TPC) from various sites are able to share their experiences and lessons learned with the rest of the D&D community using the KM-IT system. Three types of information are being collected from the TPC:

1. **Feedback on technology used at the sites:** The TPC will provide details on their experience using a particular technology.
2. **Official lessons learned and best practices documents from each site:** Site-specific official lessons learned and best practices documents are being collected from the TPC to be published in the Lessons Learned and Best Practices modules in KM-IT.
3. **Site experience from the TPC perspective:** General experience in the field that the TPC would like to share with the D&D community.

FIU-ARC support included the development of web based data collection and management as well as active participation of DOE Fellows during the data mining and interaction with the SMS identified by EFCOG.

Under this support, FIU-ARC provided support to the DOE EM-2.1 international partnerships and support to the DOE Bi-Lateral Agreement by providing D&D expertise, knowledge and support. In addition, FIU-ARC continued active support to DOE’s Energy Facility Contractor’s Group (EFCOG) by collaborating in the development of Lessons Learned and Best Practices, and other activities as identified and agreed by EFCOG and FIU-ARC. In addition, FIU-ARC participates in monthly conference calls as well as Fall, Spring, and Annual EFCOG meetings and presentations.

EFCOG Participation

FIU participated in the EFCOG D&D and Facility Engineering Working Group meetings and teleconferences during FY11, and reported on the progress of the Lessons Learned and Best Practices documents being developed by FIU.

EFCOG Lessons Learned and Best Practices

This subtask focused on capturing the manager experience through the EFCOG points-of-contact. In an effort to capture the lessons learned and best practices acquired at DOE sites, FIU worked with EFCOG to identify various sites who were able to share their experiences and lessons learned with the EM D&D community. The development of each lessons learned and best practice was conducted with a standardized process, as shown in Figure 42.

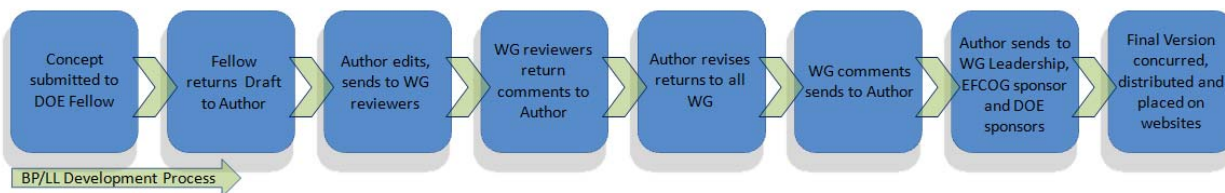


Figure 42. Process for developing Best Practice and Lessons Learned documents.

FIU has completed the development, review, and approval for 4 best practice documents and developed an additional 3 lessons learned that are in the review and approval stages. The objective of these efforts was to capture previous work performed by the D&D community and facilitate the transfer of knowledge and lessons learned. The lessons learned and best practices developed by FIU to date include:

1. The Washington Closure Hanford Site Explosive Demolition of Buildings 337 and 337B
2. Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunitite by Using Track Mounted Wet Cutting Saw Best Practice
3. Savannah River Site 185-3K Cooling Tower Demolition Best Practice
4. Lawrence Livermore National Laboratory Historical Hazard Identification Process for D&D Best Practice
5. Closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site
6. Unanticipated High Dose During the Removal of Wire Flux Monitor Cabling from the Heavy Water Component Test Reactor (HWCTR) Vessel
7. Radiological Contamination Event During Demolition of the Separations Process Research Unit (SPRU) Building H2

The Washington Closure Hanford Site Explosive Demolition of Buildings 337 and 337B Best Practice

The 337 facility and adjacent buildings were built in the early 1970s to support the Fast Flux Test Facility and the Liquid Metal Fast Breeder Reactor Program at Hanford. On October 9, 2010, Buildings 337, 337B, and the 309 Exhaust Stack located in the 300 Area at the Hanford Site, were safely razed by explosive demolition (Figure 43). The best practice was chosen because it provided industrial safety, height of the building, and because of the concrete construction techniques (cast in place and per cast). The problems/issues associated with the best practice included the utilization of hazard controls, providing guidance for the workforce to safely perform the work, the demolition preparation activities and the final implosion. The facilities came down exactly as planned and there were no safety issues, for example, with dust control limits, flying debris, heavy equipment incidents, or uncontrolled releases. The benefits of the best practice included the safety of the workers, easy access on-site, and cost effectiveness.



Figure 43. Demolition of Buildings 337 and 337B at the Hanford Site.

The Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunitite by Using Track Mounted Wet Cutting Saw Best Practice

To size reduce the structure and prevent exposure of personnel to asbestos material, a track mounted wet cutting saw with a diamond blade was used (Figure 44). First, the roof was cut off and lifted off the building using a crane. Once the roof was at ground level it was cut into smaller sections. When the wet saw became too cumbersome, a hydraulic wet chainsaw was used for the final cut. The best practice allowed controlling, containing, and the preventing the asbestos from becoming airborne. Problems and issues associated with the best practice included long horizontal cuts that were difficult to execute as the building structure would flex and the saw would bind under the weight of the wall. The success was measured by the safety of the workers. The benefits include the containment of the asbestos between the gunitite and metal layer of the building during demolition.



Figure 44. Track mounted wet cutting saw at LLNL with a diamond blade used at LLNL.

The Savannah River Site 185-3K Cooling Tower Demolition Best Practice

SRS's massive K Cooling Tower was safely demolished on May 25, 2010 as part of the Site-wide Footprint Reduction Initiative funded by the American Recovery and Reinvestment Act. The cooling tower became obsolete and no other economical use was available due to its unique and dedicated design and location. In 2003, the DOE selected implosion as the safest approach to ensure the fewest number of man hours at risk for demolishing this unique structure at one of the DOE's premier facilities. Problems/issues associated with the best practice include the height of the building not allowing for typical self-propelled man-lifts to be utilized for drilling at all of the explosives locations, health concerns with the potential carcinogenic effects of silica, and air monitoring noise. The success of the project was measured by clocking 7,000 man hours without a lost time accident and achieving a zero incident rating. The benefits of the best practice was measured by safety, schedule, and the controlled and efficient demolition of the 185-3K Cooling Tower.



Figure 45. Implosion demolition of cooling tower at SRS.

Lawrence Livermore National Laboratory Historical Hazard Identification Process for D&D Best Practice

Facility hazard identification is the critical first step in the D&D) process. The hazard identification process presented in this best practice is the result of eight years of refinements at the Lawrence Livermore National Laboratory (LLNL). The process is not presented as a one-size-fits-all solution. The current process at LLNL can be used as either a starting point for applicability to other U.S. Department of Energy (DOE) sites without a process in place, or as a benchmark for other sites to evaluate their current processes. It is similar to all planning processes in that it is a living document, changing with the experience of use, new requirements, and lessons learned. The existing process identifies four broad categories of information resources including: facility information, hazard information, environmental information, and general information related to the facility.

The use of this process at LLNL has led to both a level of confidence in hazard identification and a defensible level of due diligence, without excessive sampling and characterization. The hazard identification map has also proven to be an efficient and effective way to communicate existing conditions, potential areas of contamination, and a guide for both sampling and project plans.

Closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site: American Recovery and Reinvestment Act-Funded Acceleration of Demolition and Lessons Learned

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office received funding from the American Recovery and Reinvestment Act to demolish two Nevada National Security Site facilities. These facilities are the Reactor Maintenance, Assembly, and Disassembly (R-MAD) Facility and the Pluto Disassembly Facility.. They

were both constructed in the late 1950s and early 1960s to support design and testing of nuclear reactor-powered components. Both facilities were previously closed under the Federal Facility Agreement and Consent Order (FFACO).

Using ARRA funds to accelerate work scope and maintaining the same subcontractor and site workers across several projects resulted in identification of more efficient methods for performing work that were applied to R-MAD, Pluto, and Test Cell C. Lessons learned on these projects included identifying efficiencies in waste packaging and shipment, and the importance of a rigorous approach for identification of asbestos-containing materials. These lessons learned are being used to plan for future demolition activities. Utilizing this experience allows for more effective and efficient planning for other demolition activities.



Figure 46. R-MAD Facility (left) and Pluto Facility (right).

Unanticipated High Dose During the Removal of Wire Flux Monitor Cabling from the Heavy Water Component Test Reactor (HWCTR) Vessel

An unanticipated high dose was experienced during the removal of wire flux monitor cabling during the Heavy Water Component Test Reactor (HWCTR) deactivation at the Savannah River Site (SRS). The potential radiation dose was not fully understood, because despite the review of over 1,400 drawings as part of the planning for the work, the presence of the ion chambers had not been identified. The lesson learned was developed to ensure that issues or concerns that are identified to individual members of a project team are shared with the entire team to ensure that they are adequately reviewed, the associated hazards are analyzed, and appropriate controls are identified and implemented during the work planning phase.

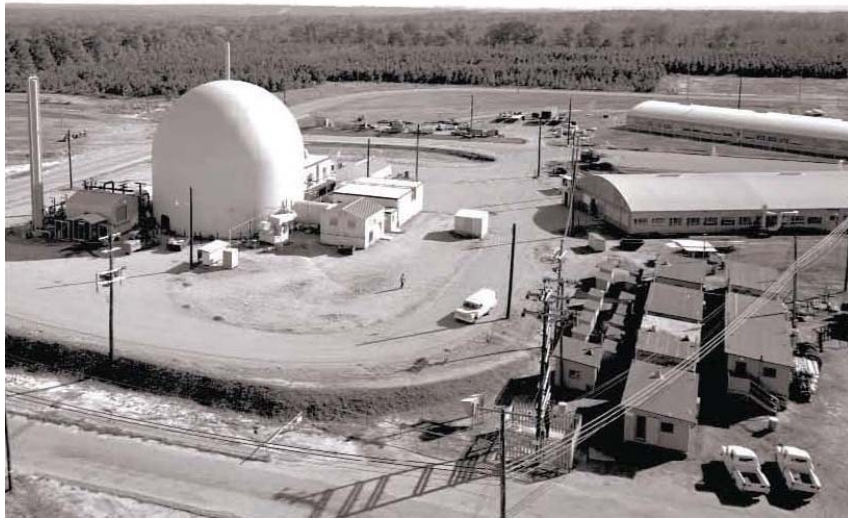


Figure 47. Heavy Water Component Test Reactor at SRS.

Radiological Contamination Event During Demolition of the Separations Process Research Unit (SPRU) Building H2

The EFCOG D&D working group referred FIU to a report entitled *Type B Accident Investigation Report: Radiological Contamination Event During Separations Process Research Unit Building H2 Demolition, September 29, 2010*. FIU is in the process of drafting the lessons learned document from this report before it undergoes review and approval.

9.0 INTRODUCTION TO DOE FELLOWS AND THEIR RESEARCH WORK

9.1 DOE Fellows and their Research: Class of 2011-2012 – Fifth Cohort

Claudia Cardona (Environmental Engineering)

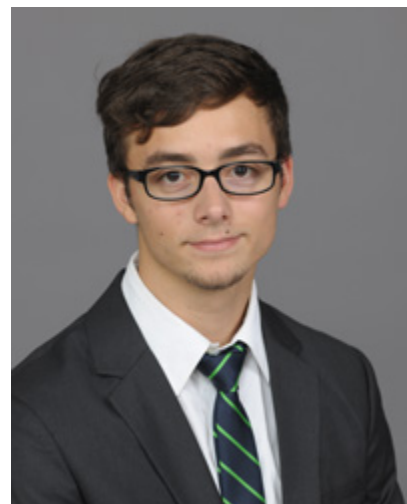


Claudia Cardona graduated from Florida International University (FIU) with a Master of Science in Environmental Engineering in the fall of 2003. She obtained her bachelor's degree in civil engineering from EAFIT University in Medellin, Colombia. Her passion for environmental engineering began during her bachelor studies while taking elective courses in environmental studies. She is currently focused on completing her Doctoral studies which began in 2005 and were postponed in 2006 while she dedicated time for raising her son. During her Doctoral studies, Claudia worked at the Applied Research Center (ARC) on evaluating the effectiveness of emerging technologies for mercury removal in support of an Oak Ridge National Laboratory project. She is interested

in the remediation of hazardous waste to prevent damage to ecosystems and human health. She is also a member of the American Society of Civil Engineers (ASCE) and FIU alumni. The unique Hanford Site in Washington State contains a wide variety of hazardous waste streams and uranium (VI) is of major concern at this site. FIU-ARC is conducting a project to evaluate a remediation approach for uranium removal from the Hanford Site vadose zone. Currently, Claudia is working under the supervision of Dr. Yelena Katsenovich on the remediation of the uranium-contaminated subsurface in the deep vadose zone. Her work is focused on evaluating the effects of Si and Al concentration ratios on the removal of uranium under the Hanford Site 200 Area.

Nel Ciurdar (Electrical Engineering)

Nel Ciurdar is currently pursuing a Bachelor of Science in electrical engineering at Florida International University. His expected graduation date is Fall of 2013. Previously, he has worked as a mathematics learning assistant in the Mathematics Department at FIU. Nel's professional interests include sensor communication, music equipment and audio amplifier designing, and eco-friendly engineering that prevents hazardous nuclear waste from contaminating the environment. After obtaining his bachelor's degree, he plans to continue his education by getting a master's degree in electrical engineering. Nel is currently working under Jose Varona in supporting the Savannah River National Laboratory and DOE Office of Environmental Management in the development of a test site for the evaluation and



deployment of over 250 remote sensors to be used in the decommissioning of nuclear facilities at DOE sites. DOE has established a goal to reduce waste emissions at SRS and is concerned with identifying many of its reactor buildings for decommissioning. One part of the in-situ decommissioning process is to fill below grade areas with cement and, in order to aid these projects, a meso-scale concrete test bed was designed and is currently being tested at the Florida International University Applied Research Center (FIU-ARC). Nel is also working under Jose Varona in supporting Mississippi State University (MSU) specifically, in the area of fiber optic sensors to measure parameters such as water movement, crack detention, moisture, and temperature. During the course of several months, Nel will be working at FIU-ARC to complete this research project and further realize the issues, concerns, and limitations of in-situ decommissioning projects and the various technologies and sensors that they incorporate.

Eric Inclan (Mechanical Engineering)

Eric Inclan graduated from Florida International University with a bachelor's degree in mechanical engineering in 2006. Upon graduation, he worked as a project manager for Florida Power & Light, where he was responsible for all of the new construction projects located within a highly populated region of Broward County (including the cities of Deerfield Beach, Coconut Creek, Parkland, Pompano Beach, Margate, and Lighthouse Point). He is currently completing a master's degree in mechanical engineering, with a focus on fluid mechanics and non-linear problem solving (fuzzy logic, neural networks, and multi-objective optimization). He is a member of the American Society of Mechanical Engineers (ASME), American Institute of Aeronautics and Astronautics (AIAA), and the Institute of Electrical and Electronics Engineers (IEEE). The US DOE Hanford Site in Washington State contains high-level waste (HLW) whose chemical composition is more complex and diverse than at any other site. Consequently, transfer pipelines can and have become completely obstructed by substances that possess a variety of properties (high radioactivity sludge and crystallized precipitates, among others) which make them very difficult to remove. Over the past four year's Florida International University's Applied Research Center (ARC) has evaluated two technologies proposed for pipeline unplugging. Of the two technologies currently being investigated, Eric's research will focus on the Asynchronous Pulsing Method (APM). Working under the supervision of Tomas Pribanic, Eric will assist in designing a device to clear transfer pipelines by modeling the device and fluid flow field surrounding it, and simulating its performance using CFD programs such as Fluent and Abaqus.



Lilian Marreno (Civil Engineering)

Lilian graduated from Florida International University with a Bachelor's of Science in civil engineering in the spring of 2011. As an undergraduate Research Assistant for NASA's Water Science of Coupled Aquatic Processes and Ecosystems from Space (WaterSCAPES), her focus was in assessing the impact of sea level rise (SLR) within South Florida. She was a keynote speaker at the Association of Environmental Engineering and Science Professors (AEESP) 2011 conference for her research in forecasting the impacts of sea level rise on salt water intrusion in the Biscayne Aquifer. During her past internship at NASA's Goddard Space Flight Center (GSFC), she performed an assessment of water level fluctuations for the Chesapeake Bay using MIKE 21 HD FM via a variety of hydrodynamic simulations. Simulations results were compared to existing data from the National Oceanic & Atmospheric Administration (NOAA) and satellite data (ICESat). Additional projects included assistance in peat soil characterization for specific sites within the Everglades National Park (ENP), and a literature review for the Sian Ka'an Biosphere in Mexico. The fall of 2011 marks the beginning of her Master's of Science in civil engineering with a concentration in water resources engineering. Her interests include water modeling, hydraulic engineering, hydraulic structures, open channel flow resistance, computational fluid dynamics, turbulence modeling, hurricane storm surges and philanthropic projects. An estimated 2.4 million pounds of elemental mercury were released into the East Fork Poplar Creek (EFPC) watershed in Oak Ridge, Tennessee. The Applied Research Center (ARC) at Florida International University (FIU), in collaboration with the Department of Energy (DOE), has developed a numerical model for the site using MIKE 11 with the purpose of forecasting mercury transport and contamination within the watershed. As indicated by previous studies, eighty-five percent of the mercury currently being released into the watershed results from stream sediments contaminated by pore water. Throughout the past year, a sediment transport module was created for the site by other researchers. The next project phase would be to improve the modeling interactions of suspended sediment within the module. Upon joining the DOE Fellows Class of 2011, Lilian began working under the supervision of Dr. Georgio Tachiev on improving the modeling of mercury and suspended sediments for the watershed. The purpose is to effectively and accurately forecast mercury transport and contamination within the watershed to best identify remediation processes.

Joshua Midence (Civil Engineering)

Joshua E. Midence was inducted into the D.O.E Fellowship 2011. He is currently working on a bachelor's degree in Civil Engineering. Joshua was also inducted into Delta Epsilon Iota honor society in the fall of 2011. After completing his bachelor's degree, he plans to pursue a Masters in Structural Engineering. His interests include dancing, golf, drawing, school, and any form of free expression. Joshua is being considered for "FlipsideKings" (FSK) Miami, Fl. Joshua is a member of "Team 305" golf team in Miami, Fl. Josh is currently works under the supervision of his mentor, Amer Awwad, M.S, P.E. He has also contributed to the *Mesoscale Test bed project* on the day of the pour. The *Mesoscale Test Bed project* consists of a decommissioning process involves filling all below grade areas with cementitious materials. This experiment consists of using various sensors including Electrical Resistivity Tomography, Advanced Tensiometers, Piezoelectric Sensors, and Fiber Optic Sensors (ERT, AT, PES, FOS) to measure various parameters including strain, crack detention, corrosion, fluid mobility, moisture, as well as a variety of other possible circumstances. This project was in coalition with Mississippi State University, University of South Carolina, University of Houston and Idaho National Laboratory



Carol Moreno-Pastor (Biomedical Engineering)

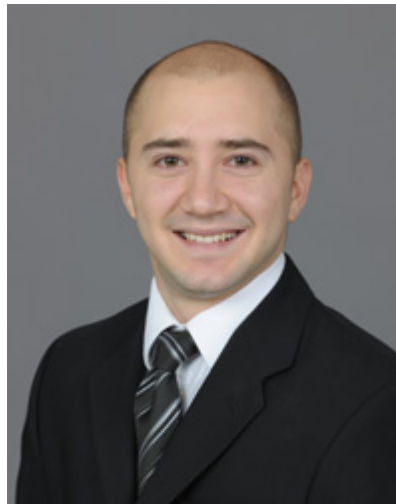


Carol Moreno-Pastor is a junior undergraduate student pursuing a Bachelor of Science degree in biomedical engineering at Florida International University. After the completion of her bachelor's degree, she plans to continue her education in pursuit of a master's degree. Born and raised in Venezuela, Carol moved to the U.S in 2005. She is the current events coordinator for the Society of Hispanic Professional Engineers (SHPE) at the FIU Chapter, and she is also a member of the Biomedical Engineering Society (BMES). During the summer of 2011, Carol worked as an intern at the Department of NanoScience and MicroSystems in the Center for Microengineered Materials at The University of New Mexico. The project title was: "Formation of multilayered biofilm by *Shewanella oneidensis* for microbial fuel cells." Her focus was to examine the environmental conditions that stimulate the formation of multilayered biofilm of the bacteria under flow. She was able to determine the effects of media flow vs. no flow, slow flow rate vs. fast flow rate, and low carbon concentration vs. high carbon concentration, on the growth of *Shewanella oneidensis* in an aerobic environment. Additionally, she initiated experimental manipulation for the study of the bacteria in an anaerobic environment. Carol is currently working under the

mentorship of Dr. Yelena Katsenovich, on the project “Sequestering Uranium at the 200 Area by In Situ Subsurface pH Manipulation Using NH₃ Gas.” Uranium (VI) is a key contaminant of concern at the U.S. DOE Hanford Site in Washington State, where a variety of hazardous waste streams were disposed in the subsurface and have now contaminated the soil and groundwater. The injection of a NH₃ gaseous mixture causes the formation of NH₄OH and a subsequent increase in pH. This manipulation significantly alters the pore water chemistry and promotes the formation of various aluminosilicates during recrystallization of minerals followed by co-precipitation of U(VI) and Al at higher pH conditions. These chemical reactions can potentially control the mobility of uranyl cations in soil systems since co-precipitated contaminants are less available for migration. The scope of this research assists in the uranium remediation of the vadose zone. Carol's research focuses on the role of major pore water constituents such as Al, Si, bicarbonate, and Ca on the formation and solubility of uranium-bearing precipitates created after NH₃ gas injection.

Jaime Mudrich (Mechanical Engineering)

Jaime Mudrich graduated from Florida International University in August of 2011 with a bachelor's degree in mechanical engineering and a minor in chemistry. His research interests include semi-autonomous robotics for domestic applications, mechanical design of power systems, topology optimization, and computational physics. Jaime will begin pursuit of a master's degree in mechanical engineering at Florida International University in January 2012. The focus of the degree will be on finite element methods for structural analysis. From January to September 2011, Jaime participated in an internship program with Integrated Medical Systems International, Inc. During the internship, he participated in the analysis of commercial medical equipment and the design of replacement mechanical components, with the intent of providing affordable, quality, third-party repairs to hospitals. Jaime is currently working on the development of a three-dimensional, multiphase, lattice Boltzmann CFD solver under the mentorship of Dr. Seckin Gokaltun. The solver will be used for simulations of multiphase flows related to radioactive waste mixing in HLW storage tanks.



Ximena Prugue (Mechanical Engineering)

Ximena Prugue is pursuing a Bachelor's Degree in Mechanical Engineering at Florida International University. She is currently the founder and President of Giving the Green Light, a non-profit organization that works towards alleviating energy poverty in rural India with renewable energy. Her interests include design, solar energy, and social engineering. After completing her Bachelor's, she plans to continue her studies to obtain a Master's. Ximena is currently working on the Asynchronous Pulse Unit under Amer Awwad and Jairo Crespo. The Asynchronous Pulsing System is connected to two hydraulic piston pumps that use a hydraulic pulse generator to create pressure disturbances from both sides of a blockage in a pipeline, asynchronously, to maximize the resulting force on the blockage. By connecting the testing pipeline in a loop with a plug between them, Prugue is analyzing the individual pipeline section pulse characteristics to determine how each pulse influences the total plug dynamic loading. She is performing asynchronous pulsing unplugging trials that vary the static pressures, frequencies, and percentage of water in the pipeline to unplug the blockage. The experiments included the placement of 2-foot plugs within the test pipeline loop and using the system to unplug the pipeline. The plugs were made by mixing potassium magnesium sulfate (K-mag) and water at a ratio of 90% K-mag to 10% water by weight.

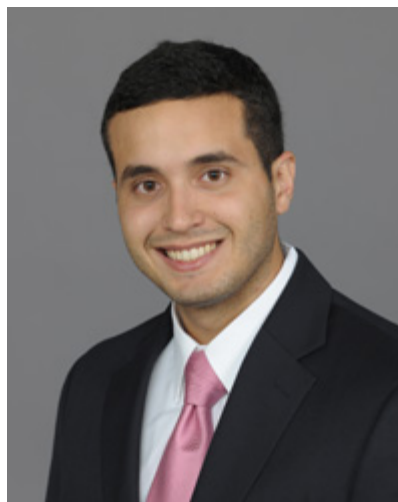
Paola Sepulveda (Biomedical Engineering)

Paola Sepulveda is currently a senior undergraduate student in the Biomedical Engineering Department at Florida International University. During the summer of 2010, she interned at the Micro and Nanomechanics Lab at Northwestern University where she performed a preliminary investigation of the cytotoxic effect of nanoinjection of various cell lines using the Nanofountain Probe (NFP). The NFP is an innovative nanoscale fluidic delivery probe design to pattern and inject nanomaterials at the single cell level. Later that year, she worked in the Nanobioengineering and Bioelectronics Lab at FIU where she assisted two PhD students with their experimental design of the quantitative analysis of the interaction of nano-sized drug carriers with whole cells using atomic force microscopy. In the summer of 2011, Paola worked in the Olfactory Physiology/Computational Neuroscience Lab at Carnegie Mellon University. During this internship, she analyzed if plasticity could be observed in granule cells in the olfactory bulb by developing a classifier to categorize the cells using the statistical method of supervised learning through MATLAB. After obtaining her bachelor's degree from FIU, she

plans to continue her education. Paola is currently working closely with Dr. Yelena Katsenovich on the uranium bioremediation of the 200 Area at the Hanford Site in Washington State. She is studying the effect of *Arthrobacter* bacteria on uranium concentration and mobility. Uranium mobility may be effected by different bacterial strands as well as varying concentrations of uranium. Successful immobilization of uranium will reduce the spread of contamination at the site. Future research on this project will emphasize using ammonia injections for uranium bioremediation.

Frank Silva (Electrical Engineering)

Frank Silva is pursuing a bachelor's degree in electrical engineering at Florida International University. He plans to graduate in December 2012 and intends to then pursue a graduate degree in electrical engineering. His interests include analog and digital design, power systems, communication systems and electromagnetic theory. Currently, Frank is working with Applied Research Center (ARC) and Savannah River National Laboratory (SRNL) staff, as well as with principal investigators from select universities and the Idaho National Laboratory (INL), in the implementation of the In Situ Decommissioning Sensor Network, Meso-Scale Test Bed. The purpose of this research is to demonstrate the capability of sensor networks to monitor fluid flow and transport through grout and concrete by installing embedded sensors in an offsite meso-scale test bed. Specifically, Frank will assist Mr. Jose Varona with the power, weather, and utilities requirements for the test site. Additionally, he will aid Mr. Gail Heath from INL in the implementation of the electrical resistivity tomography (ERT) sensor



Bryant Thompson (Biomedical Engineering)

Bryant Thompson is a junior undergraduate student in the Biomedical Engineering Department at Florida International University. After the completion of his bachelor's degree, Bryant plans to continue his education in pursuit of a master's degree. Currently, Bryant is working under the supervision of Dr. Yelena Katsenovich on the uranium bioremediation of the 200 area (vadose zone) at the Hanford Site in Washington State. Bryant's research seeks to investigate the effects of bicarbonate on the autunite mineral microbial leaching and uranium (IV) biosorption by *Arthrobacter* bacteria found in soil isolated from the Hanford Site. The scope of this research assists in the uranium remediation of groundwater and soil.



10.0 SUMMER 2012 DOE FELLOWS INTERNSHIPS

A total of 11 DOE Fellows are participating (or will be participating) in internships at DOE Headquarters, DOE sites, DOE national laboratories and Sullivan International Consulting during summer 2012. Two DOE Fellows will be going to DOE-HQ (Cloverleaf) this summer. In addition, four DOE Fellows will be working in the Oak Ridge, TN area. Two of those going to Oak Ridge will work at the Oak Ridge National Laboratory; the third will work with Oak Ridge National Reservation and the fourth with the Y-12 Security Complex. In addition one DOE fellow will intern at the Savannah River Site. One DOE Fellow will be interning at Pacific Northwest National Laboratory and an additional DOE Fellow will be interning with Washington River Protection Solutions. Finally, two DOE Fellows will be supporting the Sullivan International Consulting Company. The table below describes the DOE Fellows participating in internships, the site/national lab, their assigned mentors, and the timeframe of the internship.

Table 3. List of DOE Fellows Participating in Internships during 2012

DOE Fellow Intern	Site/Office/Lab	City	Supervisor/Mentor	Date
Janty Ghazi	DOE-HQ EM-23	Washington DC	James Poppiti	06/04/12-08/10/12
Claudia Cardona	DOE-HQ EM-12	Washington DC	Kurt Gerdes	06/18/12-08/17/12
Joshua Midence	Savannah River Site	Aiken, SC	Alex Cozzi	06/18/12-08/24/12
Eric Inclan	Oak Ridge National Laboratory	Oak Ridge, TN	Dr. Prashant Jain	06/04/12-08/10/12
Jaime Mudrich	Oak Ridge National Laboratory	Oak Ridge, TN	Dr. Prashant Jain	06/04/12-08/10/12
Heidi Henderson	Oak Ridge Reservation	Oak Ridge, TN	Dr. Eric Pierce	06/04/12-08/10/12
Revathy Venkataraman	Y-12 Security Complex, Oak Ridge	Oak Ridge, TN	Charlie Barton	06/04/12-08/10/12
Ximena Prugue	WRPS, Hanford Site	Richland, WA	Leo Thompson	06/04/12-08/10/12
Robert Lapierre	Pacific Northwest National Lab	Richland, WA	Dr. Dawn Wellman	06/04/12-08/10/12
Lillian Marrero	Sullivan International Consulting	Chicago, IL	JD Campbell	06/04/12-08/10/12
Elicek Delgado	Sullivan International Consulting	Chicago, IL	JD Campbell	06/04/12-08/10/12

11.0 OTHER PROGRAM ACTIVITIES

11.1 Former New Jersey Governor Christine Whitman Visits with DOE Fellows

On September 27, 2011, former New Jersey Governor Christine Whitman met with leaders at the Florida International University (FIU) College of Engineering and at FIU’s Applied

Research Center (ARC). Gov. Whitman is currently a co-chair of the *Clean and Safe Energy Coalition* (CASEnergy), founded in 2006 to promote nuclear energy. Gov. Whitman spoke with the Department of Energy (DOE) Fellows at the Applied Research Center about career opportunities in the nuclear energy industry. New nuclear reactors planned by Progress Energy and Florida Power & Light would produce 1,400-1,800 jobs during construction and 400-700 jobs during operation. Six of our Fellows had the opportunity to present posters showcasing their EM research conducted at ARC or during summer internships at DOE sites.



Figure 48. Gov. Whitman and Dr. Ines Triay (former DOE's Assistant Secretary for Environmental Management) with DOE Fellows and program director, Dr. Lagos.



Figure 49. Gov. Whitman and DOE Fellow Mr. Jose Matos showcasing his summer internship work conducted at DOE's Hanford Site.

11.2 DOE Fellows Lecture Series 2011

The DOE Fellows program at FIU hosted Dr. Soon-Heung Chang during his visit to FIU. Dr. Soon-Heung Chang is the current President of the Korean Nuclear Society, as well as the Dean and Vice President at the prestigious Korea Advanced Institute for Science and Technology (KAIST). During his visit to FIU, Dr. Chang had the opportunity to visit FIU's laboratories and facilities where DOE Fellows and Applied Research Center (ARC) staff showcased on-going applied research projects sponsored by the US Department of Energy's Office of Environmental Management (DOE-EM).

Dr. Chang also participated as a distinguished lecturer at the DOE Fellows Lecture Series conducted at MARC International Pavilion on February 12, 2012. Dr. Chang's presentation, "Perspective on Korea's Nuclear Future after Fukushima," discussed the cutting edge research being conducted at KAIST as well as provided a perspective on Korea's nuclear energy program after the Fukushima Daiichi nuclear accident in Japan.

In addition, Mr. James Auld (Director, College Coordinator Nuclear Programs), representing Florida Power & Light Company (FPL), attended the DOE Fellows Lecture Series and provided his perspective on an aging nuclear workforce and the need to train and mentor the new generation of college students in nuclear science and engineering disciplines. He also made comments on the plans of FPL to construct two new nuclear reactors at FPL's facility in Homestead, Florida.



Figure 50. Dr. Leonel Lagos (Program Director) and FIU/DOE Fellows with Dr. Soon-Heung Chang.

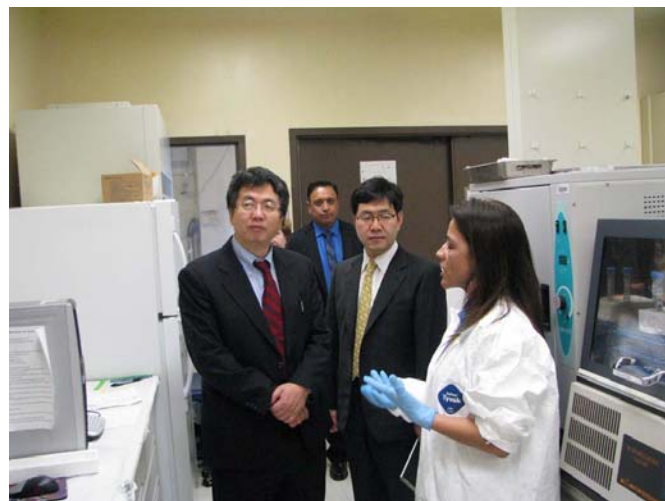


Figure 51. DOE Fellow Claudia Cardona presents her research to Dr. Soon-Heung Chang.



Figure 52. DOE Fellows present the “cube” to Dr. Soon-Heung Chang.

11.3 Engineering Expo 2012

On February 25, 2012, FIU’s College of Engineering and Computing hosted the eleventh annual Motorola Foundation Engineering Expo. The purpose of this event is to stimulate an interest in mathematics, science and technology for future generations. Over 20 school busses arrived with students from different middle schools and high schools that were eager to tour each Engineering Department including the Applied Research Center’s laboratories. For the fourth year in a row, the DOE Fellows gave tours of ARC’s Radiation Lab, High-Bay and the Cube project in which they presented their current research.

11.4 Website and Facebook

Program information can be found at <http://fellows.fiu.edu/>. This website contains updated accounts of DOE Fellows biographies, participation within the scientific community, including conferences and internships, as well as DOE Fellows program events and accomplishments.

DOE Fellows Program now has a Facebook page under FIU Science and Technology Workforce Development Initiative. This page provides up-to-date information and photographs from DOE Fellows events and accomplishments.

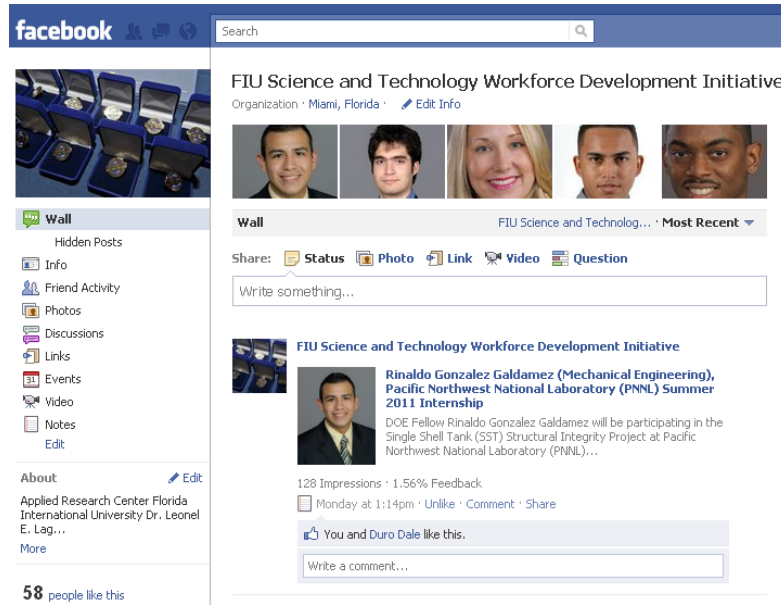


Figure 53. Preview of the DOE Fellow’s Facebook page.

11.5 DOE Fellow’s Experience Video

DOE Fellows Edgard Espinosa, Nadia Lima, Leydi Velez, and Melissa Sanchez, along with collaboration from the rest of the DOE Fellows and ARC staff, prepared an 8-minute video describing what it means to be a DOE Fellow. The video showcases all of the DOE Fellow program components such as internships, conferences, research, and other activities. It also details the DOE EM’s environmental restoration missions due to 7 decades of nuclear research, development, and production of nuclear weapons in the United States. The video was premiered at the 2010’s DOE Fellow’s induction ceremony and was presented at the Waste Management Conference and at the EM-2.1 quarterly program review in Aiken, SC. The Video has since been refined and the latest version was shown at the last induction ceremony, many DOE Fellow events, and used also for recruitment purposes.

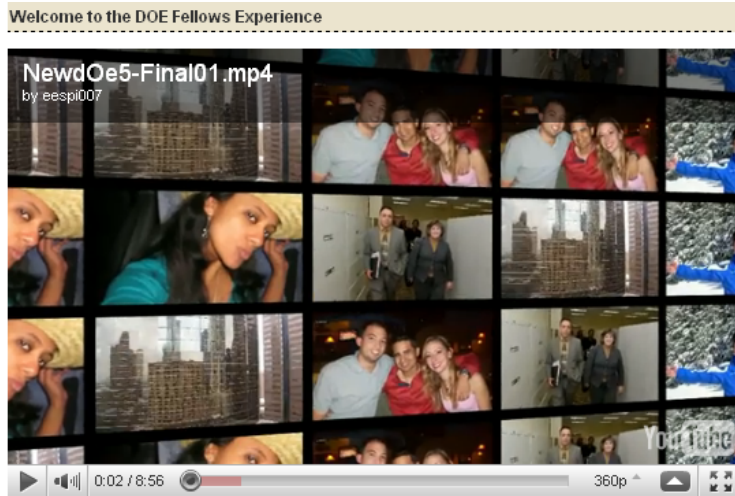


Figure 54. The DOE Fellow’s Experience Video published on the DOE Fellow’s website and on YouTube.

CONCLUSIONS

This new innovative program was officially established in March 2007. This project is successfully meeting its objectives by providing research training and mentoring for students from underrepresented groups on environmental problems at DOE sites in addition to providing several new formal recruitment and retention mechanisms for qualified students from underrepresented groups to pursue advanced studies, research training, and eventual career placement at DOE sites. During this year, students participated in 10-week internships at PNNL, Savannah River, Hanford, Lawrence Livermore National Laboratory, Moab Site, and DOE HQ in Washington, DC. Additional information about the entire program and the DOE Fellows can be found on the website <http://fellows.fiu.edu/>.

Major key accomplishments to date:

- DOE Fellows supported the Energy Facility Contractors Group (EFCOG) and contributed to the development of 7 Lessons Learned and Best Practices documents.
- DOE Fellow (Charles Castello) was hired by DOE's Oak Ridge National Laboratory under the Alvin M. Weinberg Fellowship program
- DOE Fellow (Stephen Wood) joined Oak Ridge National Laboratory's Bredesen Center for Interdisciplinary Research and Graduate Education as a Energy Science & Engineering PhD Fellow
- DOE Fellow (Edgard Espinosa) was hired by DOE-EM and is working for EM-22 (Nuclear Materials Disposition) under the direction of Mr. Gary Deleon
- DOE Fellow (Lee Brady) has graduated and will be hired by DOE-EM and will work for EM-13 (D&D and Facility Engineering) under the direction of Mr. Andrew Szilagyi
- DOE Fellow, (Merlin Ngachin) was hired by Waste Control Specialists (WCS) in Texas
- Eleven (11) other DOE Fellows graduated FIU with Bachelors or Masters degree and obtained employment at Boeing Company (2 Fellows), Florida Department of Environmental Protection (1 Fellow), Florida Power & Light (2 Fellows), Mount Sinai Medical Center (1 Fellow), Internal Revenue Service (1 Fellow), PriceSmart Inc. (1 Fellow), Bouygues Civil Works Florida (1 Fellow), Crane Aerospace and Electronics (1 Fellow), HP Foundation (1 Fellow)
- DOE Fellows, Edgard Espinosa, Charles Castello, and Lee Brady were selected by DOE EM as part of Student Career Experience Program (SCEP). These Fellows completed SCEP assignments working for EM-2.1, EM-12, and EM-13 respectively
- DOE Fellow (Rosa Ramirez) was hired into the EM Professional Development Corps program
- DOE Fellow (Duriem Calderin) was hired by DOE Contractor Columbia-Energy Environmental Services, Duriem is working in Richland, WA

- DOE Fellow (Leydi Velez) won Best Professional Poster at WM09
- DOE Fellow (Stephen Wood) won Best Student Poster at WM11
- DOE Fellow (Denny Carvajal) won Best Student Poster at WM10
- DOE Fellow (Denisse Aranda) won Best Student Poster at WM09
- Completed 53 internships at DOE sites, DOE national labs, DOE-HQ, and DOE contractors since 2007
- 69 presentations (posters and papers) at Waste Management conferences (2008, 2009, 2010, 2011, 2012)
- Twenty-one (26) DOE Fellows (FIU minority students) continuing to Master/Ph.D. degrees at FIU
- Nine (9) DOE Fellows applied to the DOE EMPDC program in 2009 and 2010
- Six (6) DOE Fellows applied to DOE EM SCEP in spring 2011
- Development of DOE Fellows web site <http://fellows.fiu.edu/> and Facebook page
- DOE Fellows program featured in DOE EM publications such as EM-20 Annual Report (November 2009), US DOE EM Highlights (September 2009), and Diversity @ EM magazine (January/February 2010).

APPENDIX A

DOE FELLOWS INTERNSHIP REPORTS – SUMMER 2011

The following reports are available at the DOE Fellows website, <http://fellows.fiu.edu>.

DOE Fellow Intern	DOE Site/Office/Lab	City	Supervisor/Mentor	Summer Internship Technical Report
Sheidyn Ng	DOE-HQ EM20	Washington DC	Mr. Kenneth Picha	US DOE-HQ EM-20 Office of Safety & Security Program
Heidi Henderson	DOE-HQ EM2.1	Washington DC	Mrs. Ana Han	US DOE-HQ EM's International Program
Mario Vargas	Lawrence Livermore Nat. Lab	Livermore, CA	Mr. Mark Bronson/ Mr. John Kerns	Air Flow Calculations for the Centralized Waste Processing Glovebox
Jose Matos	Washington River Protection Solutions /Areva Federal Services	Richland, WA	Mr. Ruben Mendoza P.E.	Agitated Thin-Film Evaporator
Janty Ghazi	Washington River Protection Solutions /Areva Federal Services	Richland, WA	Mr. Ruben Mendoza P.E.	Electrical Upgrades for Hanford Supporting Facilities
Rinaldo Gonzalez	Pacific Northwest Nat. Lab	Richland, WA	Mr. Kenneth Johnson	Soil Mesh Optimization and Preliminary FEA Study of Tank-to-Tank Interaction for Hanford Type IV SST
Alex Henao	Moab Site	Moab, Utah	Mr. Don Metzler (Federal Project Director)	Preliminary Studies of Nitrogen Concentration in Wells 0437, 0438, and 0439
Givens Cherilus	Savannah River Site	Aiken, SC	Dr. Marissa Reigel & Mr. Alex Cozzi	Saltstone Liquid Permeability Formed Core Group Sampler
Amaury Betancourt	Savannah River National Lab	Aiken, SC	Dr. Brian Looney SRNL	Tin Distribution and Fate in Tims Branch
William Mendez	Savannah River Site	Aiken, SC	Mr. Luke Reid, Manager	Formed Core Sampler