YEAR-END TECHNICAL REPORT

For May 7, 2010 – May 17, 2011

DOE-FIU Science & Technology Workforce Development Initiative

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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 partnership with DOE EM supported the hands-on training of a large number of FIU students from 1995 to 2006.

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 and secure post Master or postdoctoral positions at DOE National Labs.

Since its inception, the DOE-FIU Science & Technology Workforce Development Initiative program has inducted 54 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), and current Assistant Secretary for Environmental Management, Ms. Ines Triay (2010). 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 2010, a total of 43 DOE Fellows have completed summer internship assignments and over ten DOE Fellows are directly working and supporting DOE sites personnel and/or DOE contractors. A total of 70 DOE Fellows have participated in the Waste Management 2008, 2009, 2010, and 2011 Symposia with a total of 43 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 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. The program has been featured in DOE EM publications such as the EM-20 Final Year Report, US DOE EM Highlights, and Diversity @ EM magazine.

Major key accomplishments for FY10-11 included:

- DOE Fellows, Edgard Espinosa, Charles Castello, and Lee Brady were selected by DOE EM as part of Student Career Experience Program (SCEP). These Fellows are currently at DOE-HQ working for EM-30, EM-32, and EM-44 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 43 internships at DOE sites, DOE national labs, DOE-HQ, and DOE contractors since 2007
- 54 presentations (posters and papers) at Waste Management conferences (2008, 2009, 2010, 2011)
- Twenty-one (21) 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 www.arc.fiu.edu/intern 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-33) 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 this year. A brief description of their work objectives is also provided.

- Mr. Lee Brady (DOE Fellows Class of 2009) - Mr. Brady began his appointment on May 8, 2011 in Washington D.C. He is working with the Office of Deactivation and Decommissioning (D&D) and Facility Engineering (EM-44) under Mr. Andrew Szilagyi. He is 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, and sustainability and greenhouse gas emission reduction. As opportunities present themselves, Mr. Brady will also spend time at Oak Ridge National Laboratory, where he will work with Ms. Paula Kirk on business-related matters such as strategic planning and budgeting and site specific D&D and technology development issues.

- Mr. Charles Castello (DOE Fellows Class of 2008) - Mr. Castello began his appointment on April 25, 2011 in Washington D.C. He is working in the Office of Groundwater and Soil Remediation (EM-32) 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.

- Mr. Edgard Espinosa (DOE Fellows Class of 2007) - Mr. Espinosa began his appointment on April 25, 2011 in Washington D.C. He is working in the Office of Technology Innovation and Development (EM-30) under the lead of Ms. Ana Han, lead of EM-30'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.

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 **21 DOE Fellows** are currently pursing 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 groomed 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, 6 DOE Fellows have graduated with Master's degrees, 13 DOE Fellows are pursuing Master's degrees and 2 DOE Fellow are 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 Based on DOE EM projects	Anticipated Date of Graduation
1	Amaury Betancourt	Environmental Eng.	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	**Graduated 04/11**
2	Lee Brady	Mechanical Eng.	Master		12/11
3	Elsa Cabrejo	Environmental Eng.	Master	Soil/Groundwater - Modeling of Mercury Contamination at ORNL	**Graduated 04/11**
4	Denny Carvajal	Biomedical Eng.	Master	Soil/Groundwater – Bacteria Interaction due to Polyphosphate	08/11

				Injection at Hanford	
5	Charles Castello	Electrical Eng.	Ph.D.	Soil/Groundwater - Sensor Development for Field Measurement of Mercury	08/11
6	Elicek Delgado-Cepero	Electrical Eng.	Master		08/12
7	Edgard Espinosa	Mechanical Eng.	Master	Waste Processing - CFD Modeling of NuVison's Power Fluidic Technology/Process	08/11
8	Heidi Henderson	Environmental Eng.	Master		08/12
9	Kanchana Iyer	Biomedical Eng	Ph.D.		08/13
10	Melina Idarraga	Environmental Eng.	Master	Soil/Groundwater - Uranium Sequestration Issues at Hanford	08/11
11	Merlin Ngachin	Environmental Sciences	Master	Waste Processing - Baltman-Lattice Method to Model HLW	08/11
12	Leydi Velez	Industrial Eng.	Master	Decision Modeling Tools D&D Surveillance & Maintenance	**Graduated: 12/10**
13	Jose Matos	Mechanical Eng.	Master		08/12
14	William Mendez	Engineering Mngmt.	Master		**Graduated: 04/11**
15	Mario Vargas	Mechanical Eng.	Master	Kinematic Control of Remote Characterization System	12/11
16	Melissa Sanchez	Environmental Eng	Master		05/12
17	Yulyan Arias	Environmental Eng	Master		05/12
18	Alex Lopez	Environmental Eng	Master		05/13
19	Duriem Calderin	Biomedical Eng.	Master		**Graduated: 08/10**
20	Jose Vasquez	Environmental Eng.	Master		**Graduated: 08/09**
21	Rosa Ramirez (Former DOE Fellow hired by DOE EM)	Environmental Eng.	Master		08/12

3.0 DOE FELLOWS RECRUITMENT & SELECTION

During the months of April 2011, a number of efforts were conducted to recruit the next class of DOE Fellows being inducted in November 2011. A recruitment video was shown at the recruiting tables placed at various locations inside the FIU College of Engineering building. DOE Fellows interacted with FIU engineering students and shared their experiences in the program (Figure 1).

Following recruitment efforts, the DOE Fellows Program held an information session for prospective applicants on April 15, 2011. During this session, the Director of the DOE Fellows Program, Dr. Leonel Lagos (Figure 2) and current DOE Fellows presented the program and spoke about the advantages of the DOE Fellows program and its contributions to ongoing research projects with the Department of Energy.

Figure 1. Students at the info session for the recruitment process.

Figure 2. Dr. Leonel Lagos, Director of the DOE Fellows Program, speaks to prospective students about the benefits the program offers for STEM students.

In addition, DOE Fellows made in-class presentations during their respective lectures. These short 5-minute presentations were performed at College of Engineering and College of Arts and Sciences undergraduate and graduate level courses. Application packages were made available via the DOE Fellows website (www.arc.fiu.edu/intern).

A DOE Fellows Selection Committee was established with the participation of Dr. Norman Munroe (Associate Dean, College of Engineering), Dr. Mike Sukop (Associate Professor, Department of Earth and Environment at the College of Arts & Sciences), Mr. Desi Crouther (Director, DOE EM Office Human Capital), and Dr. Leonel Lagos (Director, DOE Fellows Program).

4.0 DOE FELLOWS INTERNSHIPS (SUMMER 2010)

During FIU's Fiscal Year 2010, a total of 16 DOE Fellows travelled to DOE national labs, DOE sites, DOE contractors, DOE EM Field Offices, DOE-HQ, and DOE contractors sites to start their summer 2010 internships. The following students were placed at DOE facilities across the country:

- Oak Ridge EM Office (Elsa Cabrejo and Jose Vasquez), Oak Ridge, TN
- Oak Ridge National Laboratory (Amaury Betancourt, Charles Castello, William Mendez, and Mario Vargas), Oak Ridge, TN
- DOE Headquarters, Cloverleaf (Ramon Colon, Edgard Espinosa Alexander Henao, and Melina Idarraga), Germantown, Maryland
- DOE Headquarters, Forrestal (Serkan Akar and Leydi Velez), Washington, DC.
- Savannah River Site (Nadia Lima and Alessandra Monetti), Aiken, SC
- Pacific Northwest National Laboratory (Denny Carvajal), Richland, WA
- Hanford Site (Jose Matos), 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 (www.arc.fiu.edu/intern) under the following link (http://www.arc.fiu.edu/Intern/eventsNews_Summer10Reports.asp) or in Appendix A of this report.

4.1 Summer Internship Location: Oak Ridge DOE EM Office

Elsa Cabrejo (04/26/10-07/02/2010)

During the internship, Ms. Cabrejo was assigned a research project under the mentorship of Dr. Elizabeth Phillips, for innovative in situ remediation and stabilization technologies for mercury contaminated soils, with specific applicability to clay type soil characteristic of the Oak Ridge Reservation (ORR) located in the state of Tennessee, where mercury is a contaminant of concern specifically at the Y-12 National Security Complex. Elsa's study included four in situ remediation technologies, selected with the perspective of presenting a green remediation approach that removes or stabilizes mercury into mercury sulfide. Low energy use, no addition of harmful chemicals, and low overall expected cost for the implementation were the most important parameters in defining the technologies for the study.

While at Oak Ridge, Ms. Cabrejo had the opportunity to interact with the inventors of three of the technologies and received information directly from them. The importance of the study is that it presents new technologies that are ready for a pilot scale field test to further evaluate and define applicability parameters at DOE sites. Also, it can be used as an initial plan in the establishment of the new mercury engineering and technology demonstration center, under the supervision of the DOE Environmental Management office at Oak Ridge, TN.

Jose Vasquez (02/16/10-05/14/10)

Mr. Vasquez spent 13 weeks doing an internship at DOE Oak Ridge in the Office of Environmental Management under the supervision and guidance of Ms. Elizabeth Phillips. The DOE Fellow’s project was initiated in February 16, 2010, and continued through May 14, 2010, with the objective of assisting the coordination and management of contamination research and remediation activities for DOE’s Oak Ridge Reservation in Tennessee. The Remedial Action Work Plan addresses remediation of the S-3 Ponds site groundwater as set in the Record of Decision for Phase I Activities in Bear Creek Valley (BCV) at the Oak Ridge Y-12 plant, Oak Ridge.

Figure 3. DOE Fellows Jose Vasquez, Mario Vargas, Elsa Cabrejo, William Mendez and Elizabeth Phillips (DOE’s Oak Ridge Office of EM).

4.2 Summer Internship Location: Oak Ridge National Laboratory

Amaury Betancourt (06/07/10-08/13/10)

Mr. Betancourt interned under the mentorship of Dr. Dwayne Elias at Oak Ridge National Laboratory. He worked on how different forms of mercury affect the rates at which mercury is accumulated by sulfate-reducing bacteria (SRB) in the environment. Sulfate-reducing bacteria are studied because of the ability of some species of SRB to convert some forms of mercury to methylmercury, a much more toxic form of mercury. Mr. Betancourt worked on a species of SRB called Desulfovibrio desulfuricans G20, which has the ability to accumulate mercury.

Charles Castello (06/07/10-08/13/10)

Mr. Castello interned in the Biosciences Division, Nanoscale Science and Devices Group under the mentorship of Dr. Thomas G. Thundat at Oak Ridge National Laboratory. He researched an in situ detection methodology for methyl mercury (MeHg), which involves three steps: 1) on-line aqueous phenylation using sodium tetraphenylborate (NaBPh4), 2) preconcentration using on-line purge-and-trap (P&T), and 3) detection using quartz crystal microbalance (QCM) sensors. The proof-of-concept should result in a limit of detection (LOD) of at least 1 part-per-billion (ppb). The purpose of this work is to aid in the understanding of methylation and de-methylation processes of Hg by providing a fast, sensitive, and reliable means of measuring MeHg in the field.

William Mendez (04/26/10-07/02/10)

Mr. Mendez participated in a development project with the robotics group at Oak Ridge National Laboratory under the mentorship of Dr. François Pin. He developed a full alternative design of a core drill mechanism to be integrated into a fully developed characterization tool for nuclear stacks. The Stack Characterization System, or SCS, is a remotely operated tool that has been designed for characterization purposes of contaminated nuclear chimneys. The core drill mechanism to be integrated in the SCS will be remotely operated and will have the ability to take several core samples at different locations in the stack. Mr. Mendez worked on several aspects of this project, including material experimentation for the smear sampler, core drill mechanism design and controlling implementation for the interface of the system.

Mario Vargas (04/26/10-08/13/10)

Mr. Vargas worked with the Robotics and Energetic Systems Group at Oak Ridge National Laboratory on the development of a DOE EM-44 technology development initiative. Mario worked under the mentorship of Dr. François Pin on the development of remote technology called the Stack Characterization System (SCS). The development of a remotely controlled mechanism capable of characterizing nuclear stacks, the SCS will reduce safety concerns in D&D preparation of nuclear stacks. His work included design of a core drill capable of taking six core samples inside a stack, redesigning and testing the smear sampler which is capable of retrieving swiping samples for loose contamination in the stack and the mechanism that will hold the radiation detectors inside the instrument bay of the SCS. The new carousel design will aid technicians in the transportation of the carousel. New rod cross sections and supports have been added and the risk of stalling the actuator has been eliminated with the addition of a break off feature.

Figure 4. DOE Fellows Elsa Cabrejo, Mario Vargas, William Mendez, Charles Castello with Dr. Leonel Lagos with mentors Dr. Pin, Mr. Mark Noakes, and Ms Elizabeth Phillips at Oak Ridge National Lab.

4.3 Summer Internship Location: DOE Headquarters, Cloverleaf

Ramon Colon (06/21/10-08/27/10)

Mr. Colon assisted the Environmental Management Office of Deactivation and Decommisioning (EM-44) under the mentorship of Mr. Andy Szilagyi. He was responsible for the organization of the Working Party on Decommissioning and Dismantlement (WPDD) annual meeting. The WPDD 11th annual meeting took place in November 2010 in Washington D.C. Ramon also contributed to two technical task groups, Large Component Dismantlement and R&D needs in the WPDD participating countries.

Edgard Espinosa (06/01/10-08/06/10)

Mr. Espinosa supported the operation of EM-33 Office of Nuclear Materials Disposition for the summer of 2010. Mentored by Mr. Edgardo “Gary” Deleon and Hitesh Nigam, he was exposed to a tremendous amount of material dealing with spent nuclear fuel. He attended the Institute of Nuclear Material Management conference, which highlighted the issues dealing with non-proliferation and the safeguards necessary to understand if a country considers moving forward with nuclear energy. He has been exposed to politics and policy and has applied his knowledge of science to understand the complete framework of DOE EM-33.

Alexander Henao (06/21/10-08/27/10)

Mr. Henao was assigned the task of evaluating engineered barriers for GTCC (Greater than Class C) waste under the mentorship of Christine Gelles. DOE EM proposed an Environmental Impact Statement on several of the current DOE sites. Mr. Henao provided feedback on the engineered barriers that would take effect depending on the alternative solution selected for each particular site. An additional task involved gathering information on helium-3. This gas, obtained from tritium, is important for the detection of transuranic waste and radioactive waste.

Melina Idarraga (06/01/10-08/06/10)

Ms. Idarraga interned for the Office of Groundwater and Soil Remediation (EM-32). Ms. Idarraga was involved in a communication plan, which includes development of a Facebook page. She had the opportunity to work with other interns as well as EMPDC employees and the leader for this project, Mr. Skip Chamberlain. She worked under the mentorship of Mr. Kurt Gerdes. She also worked in developing the logic model for the Deep Vadose Zone Program with Dr. Dawn Wellman. She participated in leadership workshops, integrated planning, an Accountability and Budgeting System (IPABS) training class and attended the Quarterly Program Review for the EM-30 Office of Technology Innovation and Development.

4.4 Summer Internship Location: DOE Headquarters, Forrestal

Serkan Akar (06/01/10-08/06/10)

Mr. Akar obtained a broad-based knowledge of DOE functions under the mentorship of Mr. Tim Harms and Mr. Phil Ammirato. He was assigned to many projects, including the establishment and tracking of Standard Operating Policies and Procedures (SOPP), conducting research and making suggestions on Inspector General/Government Accountability Office (IG/GAO) audits to help DOE be removed from the high risk list, and development of an automated action tracking system using Microsoft Access, a tool for professionals to manage staff and assign open task actions.

Leydi Velez (06/21/10-08/27/10)

Ms. Velez interned in the EM-20 Safety and Security Program under the mentorship of Mr. James Hutton. She was actively involved in the implementation plan for the Defense Nuclear Facilities Safety Board (DNFSB) recommendation 2009-1, Risk Assessment Methodologies at Defense Nuclear Facilities. Her role was to assist in the review and concurrence with proposed changes to the Nuclear Safety Policy to appropriately manage and control risk assessments used by the Department. She conducted a literature review of current best practices in Risk Management and helped to coordinate a risk management symposium which was held in conjunction with CRESP (Consortium for Risk Evaluation with Stakeholder Participation).

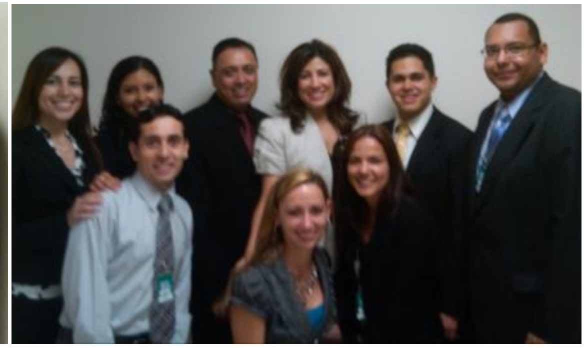



Figure 5 & Figure 6. DOE Fellows with Ms.Yvette Collazo and Dr.Leonel Lagos in Washington, D.C.

4.5 Summer Internship Location: Savannah River Site

Nadia Lima (06/21/10-08/27/10)

Ms. Lima worked on researching and testing cellular grout/concrete under the mentorship of Mr. Mike Serrato. This is the candidate grout selected for filling in a cavity located in the P-reactor Disassembly Basin D&E Canal at the Savannah River Site. She assisted in testing concrete for properties such as porosity, hydraulic conductivity, compressive strength, and density in order to confirm its use for the fill. Ms Lima also researched magnesium phosphate based grout as well as calcium aluminate based grout in order to use this material to fill the P-reactor vessel at Savannah River Site.

Alessandra Monetti (06/21/10-08/27/10)

Ms. Monetti worked on conducting research on cellular concrete/grout used for environmental remediation applications under the mentorship of Mr. Mike Serrato. This is the candidate grout selected for filling in a cavity located in the P-reactor Disassembly Basin D&E Canal in Savannah River Site. This study focused on mix, designs, fresh and cured properties, and geotechnical applications. She assisted in the testing of porosity, density, hydraulic conductivity, and compressive strength. Ms. Monetti also researched calcium aluminate based grout as a potential material to fill the P-reactor vessel at Savannah River Site.


Figure 7 & Figure 8. DOE Fellows Alessandra Monetti and Nadia Lima at Savannah River Site.

4.6 Summer Internship Location: Pacific Northwest National Laboratory

Denny Carvajal (06/01/10-/08/06/10)

Mr. Carvajal interned in the Geomicrobiological group under the supervision and guidance of Dr. A.E. Plymale, Dr. J. Friedrickson, and Dr. A. Konopka. He focused on the understanding and studying of the fate and mobility of uranium due to free uranium and uranium-mineral interactions with a native microbial culture found in the soil.

Figure 9. DOE Fellow Denny Carvajal, Dr. Leonel Lagos, A.E. Plymale and Dr. A. Konopka at PNNL.

4.7 Summer Internship Location: Hanford Site

Jose Matos (06/01/10-/08/06/10)

Mr. Matos worked for Washington River Protection Solutions, a contractor in charge of transferring high level waste from single-shell to double-shell tanks, under the mentorship of Mr. Eric Nelson. He worked directly for Central Standards and Design Authority, which reviews and verifies the correctness and validity of documents that affect the waste transfer process. He was involved with the in-house design team to perform failure analysis on pipelines. He assessed drawings and took measurements for each pipe to create an accurate model in AFT Impulse. The findings were used to determine how to run the pipeline to avoid further water hammer events and determine whether components or the pipeline needed replacement.

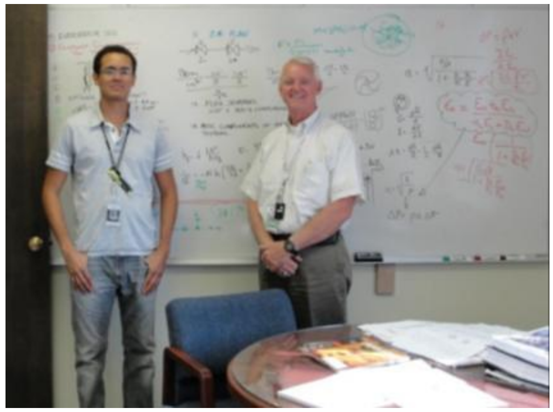


Figure 10. DOE Fellow, Jose Matos, with Mentor Eric Nelson.

5.0 DOE FELLOWS POSTER EXHIBITION AND COMPETITION

The third annual DOE Fellows Poster Exhibition and Competition took place on October 20, 2010. 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 16 posters were exhibited. Some of the projects showcased by the students were a result of their summer internship assignments at DOE Savannah River Site, Oak Ridge National Laboratory, 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. Jeff Griffin (Associate Director for Environmental Management, Savannah River National Laboratory), Dr. Ajamu Banjoko (Director of FIU's McNair Program), Dr. Michael Sukop (FIU Associate Professor, Department of Earth and Environment at the College of Arts & Sciences), and Dr. David Roelant (ARC's Associate Director of Research).

Figure 11. 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. One of the visitors and judges from Savannah River National Laboratories, Dr. Jeff Griffin, commented on his impression of the DOE Fellows Program via an email sent to ARC's Executive Director, Dr. John Proni:

> *"John, I wanted to express my thanks to you and Leo for the invitation to visit FIU as well as for the opportunity to help judge the DOE Fellows poster contest. That turned out to be an absolutely wonderful way for me to gain good insight into the details of the Fellows' work and the depth of their knowledge. As I told Leo during my visit, I was very impressed with the quality of the students - their level of knowledge, their poise, and their presentation skills were just outstanding. In addition, the work that I saw presented was very closely tied to real DOE EM needs (as you would hope) and to real-world problems."* - Dr. J. Griffin (Associate Director for Environmental Management, Savannah River National Laboratory).

Figure 12. Panel of judges for the third annual DOE Fellows poster exhibition and competition.

5.1 2010 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, 2010):

First place winner: Mr. Stephen Wood, DOE Fellows –Class of 2008, Mechanical Engineering

Poster title: "Unplugging of High Level Waster Transfer Pipelines: Method of Characteristics"

Figure 13. DOE Fellow Mr. Stephen Wood accepting his first place award for the 2010 student poster competition.

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

Poster title: "Numerical Simulation of Pulsed-Air Mixer Technology using Multiphase Computational Fluid Dynamics"

Figure 14. DOE Fellow Mr. Rinaldo Gonzalez accepting his second place award for the 2010 student poster competition.

Third place winner: Mr. Lee Brady, DOE Fellows –Class of 2008, Mechanical Engineering

Poster title: "Peristaltic Crawler for the Removal of High Level Waste Plugs"

Figure 15. DOE Fellow Mr. Lee Brady accepting his third place award for the 2010 student poster competition.

6.0 DOE FELLOWS 2010 INDUCTION CEREMORY

On November 23, 2010, FIU's Applied Research Center conducted the 2010 DOE Fellows Induction Ceremony. DOE EM distinguished guests, Dr. Ines Triay (Assistant Secretary for Environmental Management), Dr. Paul T. Deason (Deputy Director, Savannah River National Laboratory), Ms. Gloria Mencer (SPO Manager, Socioeconomic Program Office, Y-12 Security Complex), Mr. Charlie Barton (Manager, Mission Support Systems Management, Y-12 Security Complex), and Ms. Rosa Ramirez (Office of Groundwater and Soil Remediation, EM’s International Affairs Program) visited Florida International University (FIU) to participate in the induction ceremony. Dr. Triay was this year’s keynote speaker. FIU was represented by Dr. Douglas Wartzok (FIU Provost), Dr. Andres Gil (Vice President for Research), Dr. John Proni (ARC Executive Director), Dr. Leonel E. Lagos (Director, DOE Fellows Program), faculty, staff, and students.

Figure 16. Dr. Ines Triay (DOE's Assitant Secretaryfor Environmental Management) gave the key note speech at the 2010 Induction Ceremony.

Figure 17. Dr. Leonel Lagos gave welcoming remarks at the introduction ceremony.

Figure 18. FIU Provost, Dr. Douglas Wartzok.

Figure 19. ARC's Executive Director, Dr. John Proni.

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

- Ms. Yulyan Arias (Undergraduate, Environmental Engineering)

- Ms. Maite Barroso (Undergraduate, Civil Engineering)
- Mr. Givens Cherilus (Undergraduate, Electrical Engineering)
- Ms. Elicek Delgado-Cepero (Graduate, Electrical Engineering)
- Mr. Janty Ghazi (Undergraduate, Electrical Engineering)
- Ms. Heidi Henderson (Graduate, Environmental Engineering)
- Ms. Kanchana Iyer (Ph.D. Candidate, Biomedical Engineering)
- Mr. Alexander Lopez (Undergraduate, Environmental Engineering)
- Ms. Sheidyn Ng (Undergraduate, Biomedical Engineering)
- Ms. Shina Rana (Undergraduate, Electrical Engineering)
- Ms. Melissa Sanchez (Undergraduate, Environmental Engineering)

Figure 20. DOE Fellows Class of 2010.

Short bios and photos of the new inductees is presented in section 11 and also available on the DOE Fellows website (www.arc.fiu.edu/intern) under DOE Fellows Bios.

Additionally, awards for the 2010 DOE Fellows Poster Exhibition and Competition were presented. The 2010 DOE Fellow Mentor of the Year Award and the 2010 DOE Fellow of the Year Award were also presented. Nominations were requested from DOE Fellows for ARC mentors and from ARC mentors for the DOE Fellows. An ARC committee was established to review and select the winners. The DOE Fellow Mentor of the Year Award went to Dr. Yelena Katsenovich (mentoring and supervising Amaury Betancourt, Denny Carvajal, Melissa Sanchez, Sheidyn Ng, Yulyan Arias, and Maite Barroso). The 2010 FIU-DOE Fellow of the Year award was given to Mr. Denny Carvajal (mentored and supervised by Dr. Yelena Katsenovich).

Figure 21. DOE Fellow Mr. Denny Carvajal accepting the 2010 FIU-DOE Fellow of the Year Award.

Figure 22. ARC Mentor Dr. Yelena Katseovich accepting the 2010 FIU-DOE Mentor of the Year Award.

An additional award was presented this year to one of ARC's staff members in recognition and appreciation for her contribution to the DOE Fellows program. The award was given to Ms. Margoth Osco. Margoth is ARC's travel assistant and her hard work and coordination allows our DOE Fellows to travel to their internships and conferences throughout the year.

Figure 23. Ms. Margoth Osco accepting her award for Recognition and Appreciation and Dedication for her contributions to the DOE Fellows Program.

In addition, two Memorandum of Understanding (MOU) Signing Ceremonies were conducted to publicly announc the partnerships between FIU and Savannah River National Laboratory and also between FIU and Y-12 National Security Complex. Dr. Paul T. Deason (Deputy Director, Savannah River National Laboratory) represented SRNL during the signing and Mr. Charlie Barton represented Y-12 National Security Complex). FIU was represented by Dr. Andres Gil (FIU's Vice President for Research), Dr. John Proni (ARC Executive Director), and Dr. Leonel Lagos (DOE Fellows Program Director). Ms Triay was also asked to participate in the official signing ceremony.

Figure 24. Signing of the FIU/ Savannah River MOU.

Figure 25. Signing of the FIU/ Y-12 Security Complex MOU.

A DOE Fellows Poster Exhibition was also conducted at the end of this year's Induction Ceremony. Dr. Triay had the opportunity to interact with our DOE Fellows and review the students' posters after the ceremony.

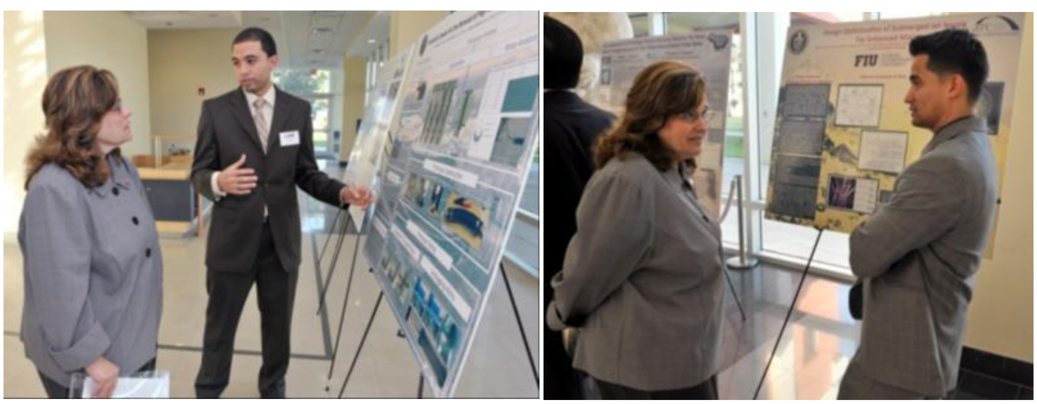


Figure 26 & Figure 27. DOE Fellows Lee Brady and Edgard Espinosa showcasing their research to Dr. Ines Triay.

7.0 WASTE MANAGEMENT CONFERENCE 2011 ACCOMPLISHMENTS

FIU's DOE Fellows participated in the 2011 Waste Management Symposia in Phoenix, AZ. A total of 23 FIU students participated in this year's Waste Management Symposia. Twelve DOE Fellows presented their research at the Student Poster Competition, 5 DOE Fellows, 1 ARC postdoctoral associate, and 7 ARC scientists presented their research at professional poster sessions. Three DOE Fellows and 3 ARC scientists made oral presentations.

Mr. Stephen Wood (Graduate Student. - DOE Fellow Class of 2008) won 1st place in the Student Poster Competition ("Unplugging of High Level Waste Pipelines: Method of Characteristics"). As part of his EM applied research and thesis topic, Mr. Wood is authoring software that enhances the accuracy of the method of characteristics in modeling pipeline transients and a web interface to facilitate its use.

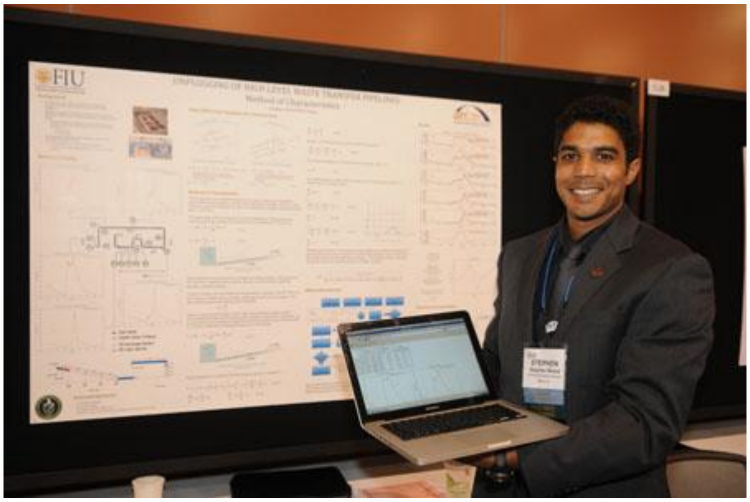


Figure 28. DOE Fellow Mr. Stephen Wood at WM 2011.

Dr. Siamak Halek (Applied Research Center Postdoctoral Associate) won 1st place for his Professional Poster within Track 7: Environmental Remediation, and was recognized as the winner of the best overall Professional Poster Competition.. Mr. Halek's work is entitled, "Numerical Simulation of Mercury Fate and Transport in Upper East Fork Poplar Creek, Oak Ridge, TN."

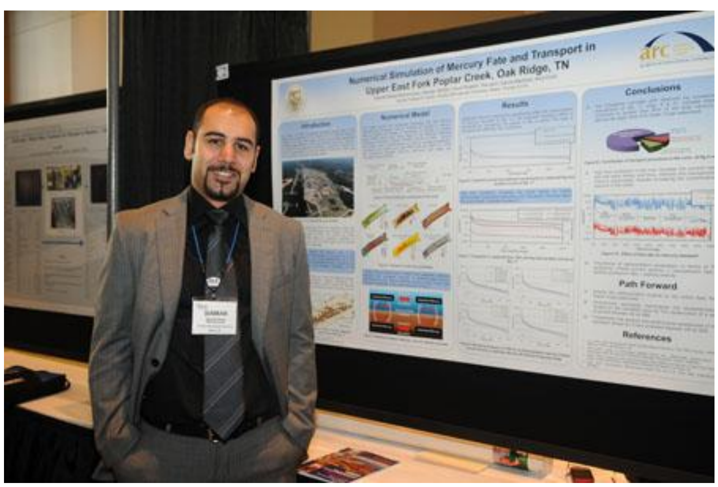


Figure 29. ARC Postdoctoral Associate Dr. Siamak Halek at WM11.

The rest of the students presented their DOE applied research in the areas of soil/groundwater, D&D, and high level waste. The DOE Fellows also participated as Student Assistants at the conference and helped conference organizers and presenters during the technical sessions.

The DOE Fellows also had the opportunity to meet Dr. Ines Triay (DOE's Principal Assistant Secretary for Environmental Management) and had a chance to describe their research work at FIU's Applied Research Center and the work they have performed during their internships at DOE sites and national laboratories. Two DOE Fellows, Ms. Nadia Lima and Mr. Stephen Wood, were featured in the WM Insight Newsletter distributed at the conference.

Many of the students also participated in a session entitled, "Graduating Students and New Engineers Wants and Needs – Are Companies Even Listening?" Ms. Nadia Lima was selected as a panelist for this session and she described companies' web sites that are difficult to navigate and provide little information to students seeking information about the company and job opportunities for interested students. In addition, 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.

Figure 30. Dr. Lagos with DOE Fellows at WM11.

7. 1 Student Poster Presentations at Waste Management 2011

The DOE Fellows presented their posters at WM11 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:

Understanding Mercury Transfer to the Sulfate-Reducing Bacteria Desulfovibrio desulfuricans- *Mr. Amaury Betancourt*

The focus of this research was to determine, through laboratory experiments and computer model simulation, the rates at which two different forms of mercury, mercury bound to natural organic matter and mercury chloride, are accumulated by a strain of sulfate-reducing bacteria that is not known to produce methylmercury, Desulfovibrio desulfuricans G20.

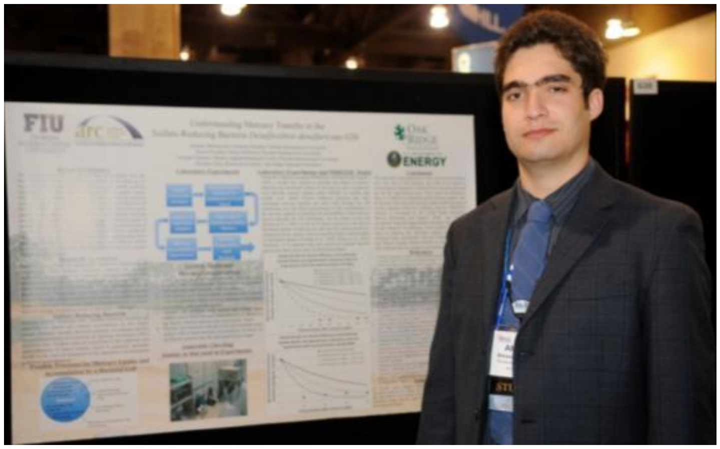


Figure 31. DOE Fellow Amaury Betancourt with his poster at WM11.

Peristaltic Crawler for the Removal of High Level Waste Plugs- *Mr. Lee Brady*

A pneumatic peristaltic pipe-crawler for the removal of high-level waste plugs is proposed. The design will serve as a versatile platform that will improve DOE's unplugging toolbox. The first prototype was manufactured, assembled and successfully tested, demonstrating potential for pipeline unplugging operations.

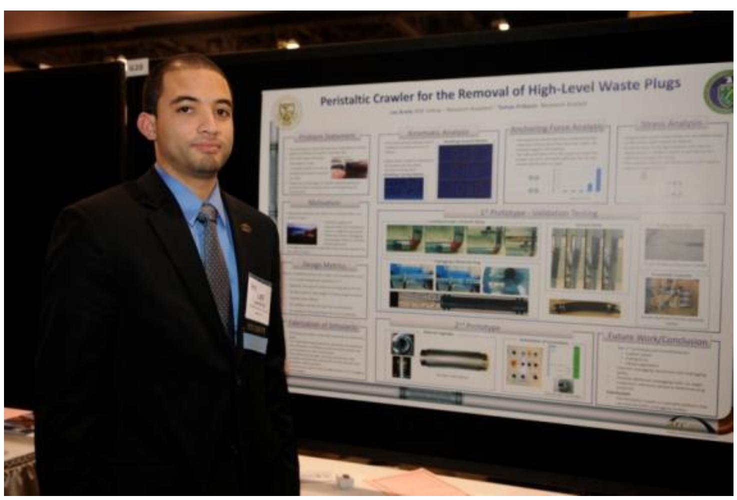


Figure 32. DOE Fellow Lee Brady with his poster at WM11.

Feasibility of Using Embedded Wireless Sensors for In-Situ Decommissioning Tasks and Environmental Monitoring*- Ms. Elicek Delgado-Cepero*

The feasibility of using wireless sensors embedded inside grout to measure and transmit monitoring data (temperature, corrosion, and humidity) through grout, water, and soil via microwave signals is being studied to support the in situ decommissioning activities for two reactor facilities at the Savannah River Site.

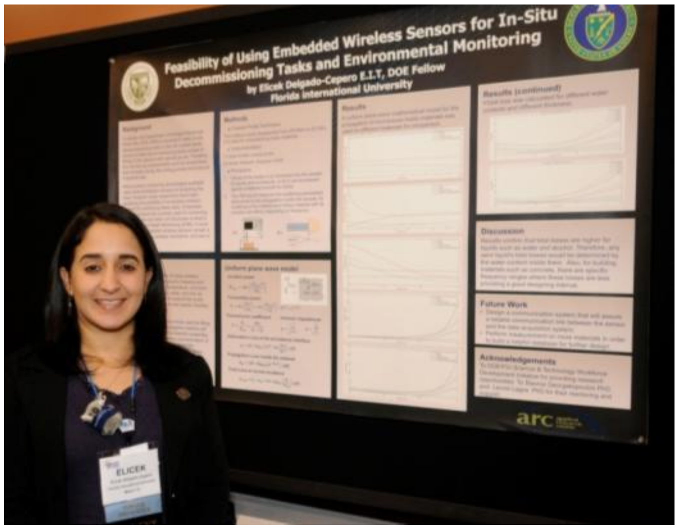


Figure 33. DOE Fellow Elicek Delgado-Cepero with her poster at WM11.

The Effect of Arthrobacter Bacteria on Uranium Release from Meta-autunite*- Ms. Sheidyn Ng*

This research is studying the release of uranium from the mineral meta-autunite in the presence of Arthrobacter bacteria. Variables include different bacterial strains, the concentration of HNO_3, and the initial and final concentrations of uranium.

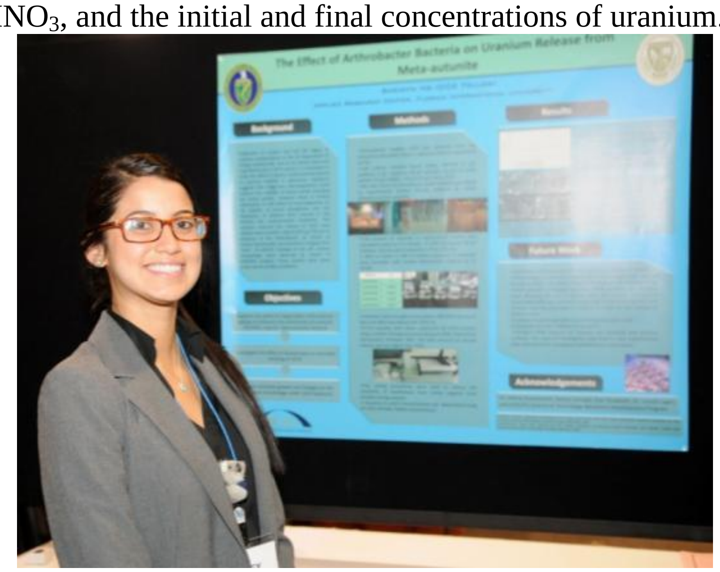


Figure 34. DOE Fellow Sheidyn Ng with her poster at WM11.

Asynchronous Pulsing as a Means of Unpluggling Pipelines*- Mr. Janty Ghazi*

Asynchronous-pulsing is a new technology being tested to determine its effectiveness in unplugging pipelines obstructed with radioactive slurry. A hydraulic pump with linear pressure transducers will be implemented to generate pressure waves inside a test pipeline. It will be controlled via a cRIO module using a program developed with LabVIEW.

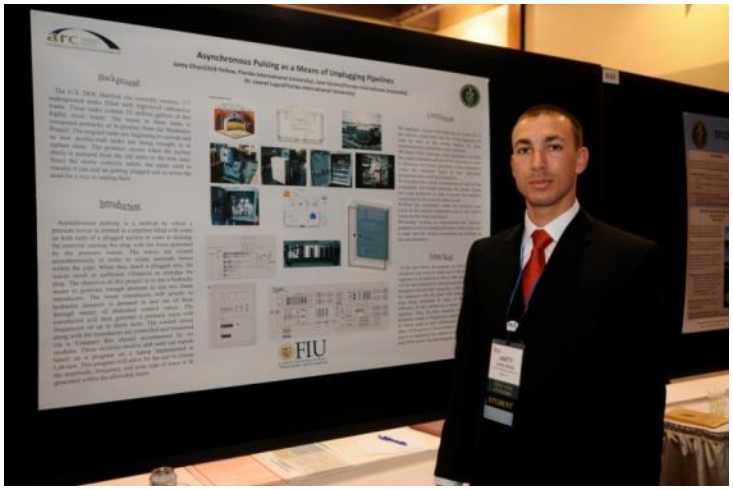


Figure 35. DOE Fellow Janty Ghazi with his poster at WM11.

EFCOG Lessons Learned and Best Practices*- Ms. Heidi Henderson*

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. One example is the Lawrence Livermore National Laboratory open air demolition of asbestos gunite which was deemed a best practice for safety and time management.

Figure 36. DOE Fellow Heidi Henderson with her poster at WM11.

A Mathematical model for Air Dispersion at the Moab Site*- Ms. Kanchana Iyer*

A mathematical model for air dispersion is being developed for the Moab site to predict the transport of contaminants caused by LandShark, an evaporator system used to dispose of nondomestic wastewater (snowmelt, runoff, and groundwater). The concentration of the contaminant mist will be estimated using the Gaussian Plume Model.

Figure 37. DOE Fellow Kanchana Iyer with her poster at WM11.

AFT ImpulseTM Modeling of Waterhammer Transients*- Mr. Jose Matos*

The purpose of this project was to use AFT Impulse to model a waterhammer event which took place in the SL-167 Pipeline located on the DOE Hanford site. An accurate model of the actual pipeline was input into the program and it was found that a waterhammer event took place.

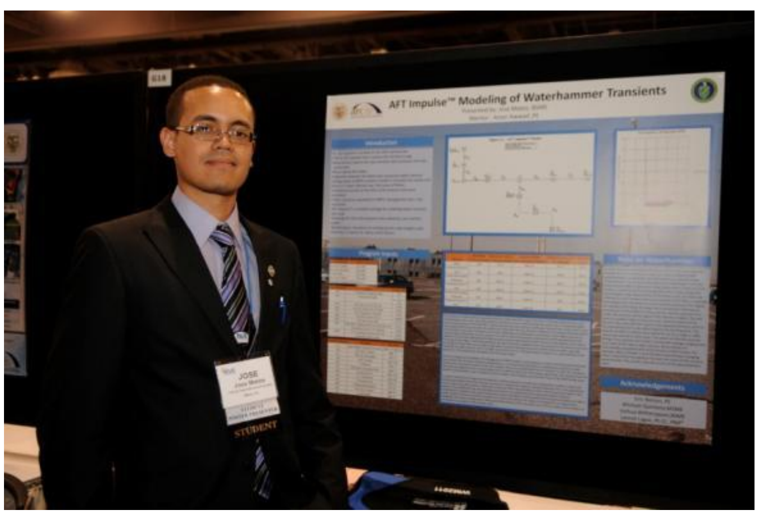


Figure 38. DOE Fellow Merlin Ngachin with his poster at WM11.

Cellular Concrete/Grout: An Innovative Material for In-Situ Decommissioning*- Ms. Alessandra Monetti*

In support of in situ decommissioning of the 105-P Reactor Disassembly Basin D & E Canal at the Savannah River Site, a series of tests were performed on a modified cellular concrete/grout. This research presents a working definition for cellular concrete/grout, a description of the components, historical uses, and experimental results.

Figure 39. DOE Fellow Alessandra Monetti with her poster at WM11.

Simulation of Rising Bubbles Using the Multiphase Lattice Boltzmann Method*- Mr. Merlin Ngachin*

In this research, 2D simulations of the buoyant bubbles used for high level waste processing are presented under various flow conditions characterized by the non-dimensional Eotvos and Morton numbers and using the multiphase Lattice Boltzmann method. Results are compared with both the theoretical shapes regime given in literature and with other available simulation results.

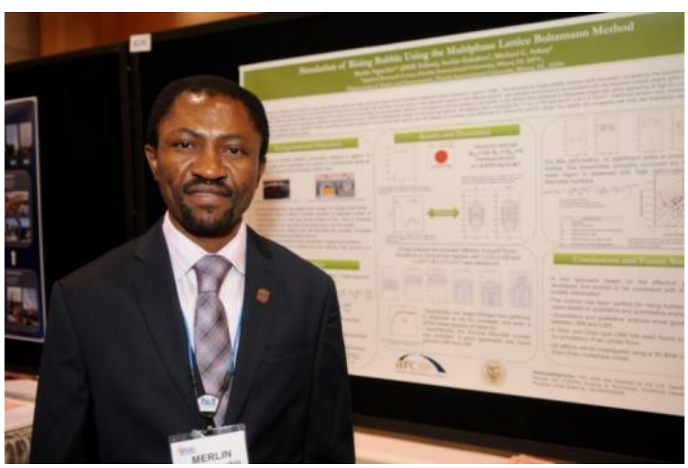


Figure 40. DOE Fellow Merlin Ngachin with his poster at WM11.

Study on Uranium (VI) Sorption on Hanford Sediment- *Ms. Melissa Sanchez*
Uranium stabilization through in-situ calcite dissolution and co-precipitation is one of the remediation tools under consideration at the Hanford Site. Availability of U(VI) for co-precipitation in the vadose zone largely depends on its adsorption to the sediment-matrix. This research studied the effect of varying pH on U(VI) adsorption on Hanford sediment.

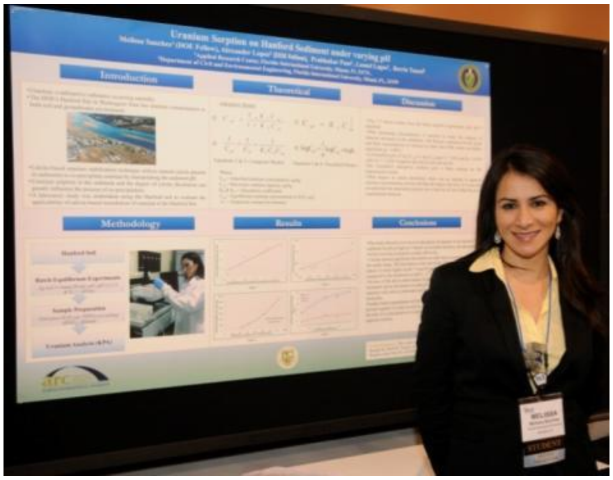


Figure 41. DOE Fellow Melissa Sanchez with her poster at WM11.

Unplugging of High Level Waste Pipelines: Method of Characteristics- *Mr. Stephen Wood*
The method of characteristics is utilized to model the pipeline transients generated by NuVision Engineering's Fluidic Wave-action Technology when it was evaluated for use in unplugging high level waste pipelines. The incorporation of elbow loss models and parameter optimization techniques are discussed and shown to improve the accuracy of pressure waveform prediction.

Figure 42. DOE Fellow Stephen Wood with his poster at WM11.

7.2 Professional Poster Presentations

A total of four professional posters were prepared and presented by DOE Fellows at WM11. 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.

UraniumToxicity to Native Microbial Communities in the Hanford300 Area Groundwater-
Mr. Denny Carvajal

An efficient and cost-effective remediation alternative for uranium contamination in the environment involves exploiting native microbes in the soil to remove highly soluble contaminants such as uranium, by reducing it from U(VI) to U(IV) as insoluble uraninite (UO_2•nH_2O). However, more information is needed about the role of microbes and the associated biogeochemical processes they catalyze involving uranium. As a result of the usual expense and difficulty of remediation efforts undertaken for uranium contamination, numerous basic and applied studies of uranium mobility have been undertaken in the USA and elsewhere.

The research presented in this paper is part of an effort to advance the understanding of the natural biogeochemical and mass transfer processes to identify corrective action strategies for the groundwater uranium plume in the Hanford 300 Area. The purpose of the laboratory work conducted as part of this research, was to study the toxic effects of different concentrations of uranium species on the native microbes in the Hanford 300 Area groundwater.

The research focused on studying the mobility of uranium due to reduction and sorption processes and the toxic effects of uranium on native microorganisms present in soil and groundwater of the Hanford 300 Area, near the Columbia River in the southeastern part of Washington State. Different factors can affect the reduction and sorption kinetic rates and bioavailability of free and complexed uranium (i.e., hydroxyl and carbonate complexes) in the environment. These factors include the uranium concentration, pH, bicarbonate concentrations, cell density, and calcium concentrations. Each of these factors could play a significant role in determining whether microbes influence or could influence uranium biogeochemistry at this site. For example, uranium could be mobilized back into the environment or could be reduced and sequestered by the microbes. In this paper, we determine the concentrations of uranium that were toxic to the native microbial populations in different aqueous environments (carbonate-free synthetic groundwater and carbonate-containing groundwater). 3H-Leucine incorporation into proteins was implemented to quantify microbial activity. Results show that carbonate is a dominant variable that determines the uranium speciation and toxicity to the microbial community. It is probable that natural groundwater carbonate concentrations safeguard the microbial population by increasing the uranium concentration required to inhibit 50% of the population activity compared to the control, from 0.3 μM when only approximately 0.25 mM HCO_3 from the atmospheric CO_2 is present, to ≈500 μM of uranium at natural 300 Area groundwater bicarbonate concentrations (~1-2 mM).

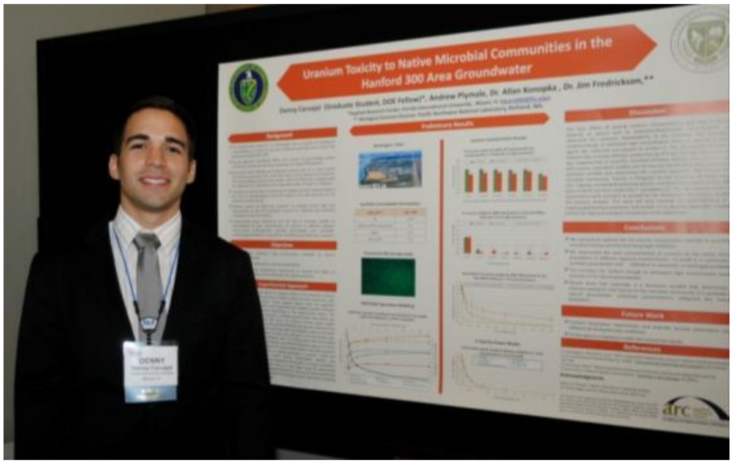


Figure 43. DOE Fellow Denny Carvajal with his poster at WM11.

Design Optimization of Submerged Jet Nozzle for Enhanced Mixing*- Mr. Edgard Espinosa*

Presented in Session 101 at WM11as a professional poster – No paper or abstract required

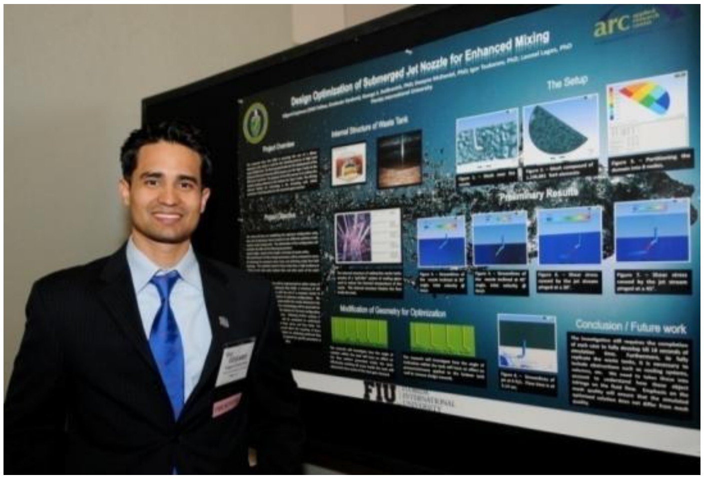


Figure 44. DOE Fellow Edgard Espinosa with his poster at WM11.

Numerical Simulations of Pulsed-Air Mixing Technology using Multiphase Computational Fluid Dynamics Methods*- Mr. Rinaldo Gonzalez and Mr. Stephen Wood*

COMSOL Multiphysics and OpenFOAM Computational Fluid Dynamics (CFD) methods are used to create a computational model of a pulsed-air mixer. First, results are provided for a benchmark problem with a single bubble rising due to buoyancy with density and viscosity ratios of 10. The numerical results are verified using the bubble circularity and the terminal bubble velocity at different meshing levels which is captured within 10% accuracy compared with the benchmark simulation.

After the verification of the numerical methods, the flow characteristics created by a pulsed-air mixer in a 1/12-scale tank based on Hanford double-shell tank dimensions are simulated using the proposed CFD methods. This scaled experiment was carried out by Pacific Northwest National Laboratory (PNNL) in 1996. The peak fluid velocities produced by the pulsed-air mixing plate are compared against the PNNL experimental data at various locations away from the plate. The simulations show that the proposed methods can predict the performance of the pulsed-air system accurately and they can be used as computational tools for scaling up the design of future pulsed-air mixing implementations at Department of Energy (DOE) waste tanks.

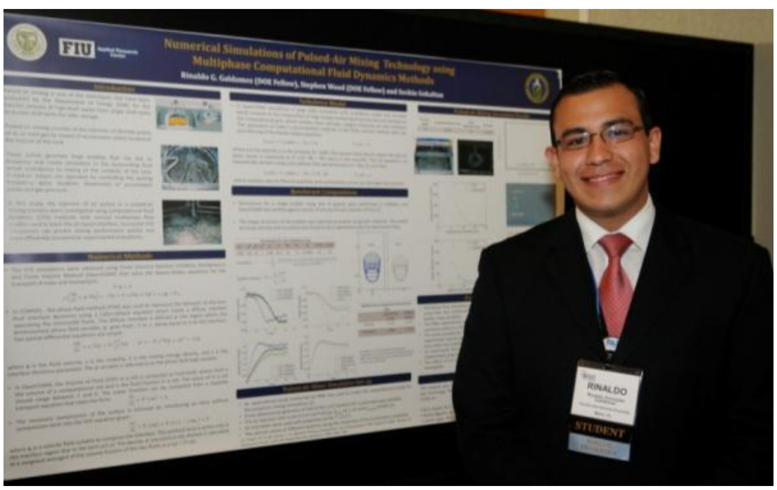


Figure 45. DOE Fellow Rinaldo Gonzalez with his poster at WM11.

Modeling of Scenarios to Predict the Amount of Loose Contamination Removed from Surfaces by Smearing Procedures*- Mr. Merlin Ngachin*

The objective of this research was to evaluate the influence of the interaction between contaminant and surface and the interaction between contaminant and wipe on predicting the amount of contamination removed from surfaces by wiping procedures. A method was developed to evaluate the contamination removed by weighing a thermo-plastic pigment of 4-5 μm average size on surfaces of plastic, tile and Formica. The cleaning of the surfaces was conducted with a hydrophobic wipe (Y-12) and an absorbent wipe (Multifold towels). With a hydrophobic wipe, 42.2%, 28.1%, and 14.4% more contamination was removed from Formica, plastic, and tile, respectively, as compared to the absorbent wipe. In addition, a uranium oxide powder of 38 µm size was spiked on surfaces of plastic, Formica, tile, concrete and stainless steel. Three wipes were used: two were hydrophobic and the third had a surfactant on its microfibers. The results showed that the three wipes removed similar amounts of contamination from the plastic, Formica, and tile surfaces. On plastic surfaces, the amount of contamination removed was 97% while 91% was removed from the tile and Formica surfaces. For concrete and stainless steel, the third wipe removed 69% and 80% of the contamination while the first two wipes removed less than 66%. Finally, a contaminant using Tc-99m labeled to a Dowex 50Wx2 resin in a 200 and 400 mesh size was spread on surfaces of PVC, concrete and glass, and two different wipes were used to remove the contamination. The results indicate that the roughness of the surface, the particle size of the contaminant and the interfacial energy between contaminant and surface significantly influence the amount of contamination removed. It was found that for particles of 5 µm diameter, the interaction contaminant-wipe and contaminant-surface were significant, whereas, for particles between 38-142 µm, the surface-particle interaction was the only significant interaction affecting the amount of contamination removed.

Figure 46. DOE Fellow Merlin Ngachin with his poster at WM11.

7.3 Oral Presentations

A total of four professional oral presentations were prepared and presented by DOE Fellows at WM11. 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.

Mercury Remediation using Dow's Experimental XUS-43604.00 Ion-Exchange Resin at Oak Ridge National Laboratory, Tennessee, USA*- Mr. Charles Castello*

Mercury contamination is a major concern at Oak Ridge National Laboratory, particularly at Building 4501, Sump I. In order to reduce mercury discharge, a mercury treatment system utilizing Dow's experimental XUS-43604.00 ion-exchange resin with thiol-active sites has been installed at Sump I. Two types of experiments were performed to determine the characteristics of the experimental resin: (1) a column test for removal efficiency and (2) batch equilibrium tests for adsorption limits. Results generated by this research will answer many unknowns when dealing with mercury removal efficiency, resin change-out frequency, and resin disposal costs of the treatment system.

Preliminary Study of a Prototype Methyl-Mercury Monitor for In-Field Pore Water Sample Analysis *- Mr. Charles Castello*

This study involves proof-of-concept research for an innovative, low-cost, and portable methylmercury (MeHg) monitor to be utilized at Oak Ridge Reservation (ORR) creek beds. The MeHg monitor comprises three primary steps: (1) chemical derivatization; (2) preconcentration using the purge-and-trap (P&T) method; and (3) sensing using Quartz Crystal Microbalance (QCM) sensors. This preliminary study deals with the measurement of only inorganic mercury (Hg) (e.g. Hg^{2+}) which was measured using a modified version of the U.S. Environmental Protection Agency's (U.S. EPA) Method 1631, Revision E for chemical reduction using stannous chloride ($SnCl_2$). Preconcentration was handled using a gold trap in the P&T method and Hg was released employing a variable voltage controller and heating coil at 450°C. Sensing was managed via utilization of QCM sensors functionalized with gold, which causes amalgamation when Hg comes into contact with the gold surface. This causes a change in mass on the sensor's surface, thereby translating to a resonant frequency shift. The characteristics of both polished and etched surface QCM sensors were studied in measuring inorganic Hg at different flow-rates (18 and 50 mL/min). The polished surface QCM sensors yielded linear ranges of detection of 5 mg/L to 10 mg/L and 1 mg/L to 10 mg/L with regression values of 0.9987 and 0.9736 for 18 mL/min and 50 mL/min respectively. The etched surface QCM sensors gave linear ranges of detection of 1 mg/L to 10 mg/L and 1 mg/L to 10 mg/L with regression values of 0.9888 and 0.9864 for 18 mL/min and 50 mL/min respectively. An etched surface QCM sensor with a flow-rate of 18 mL/min will be used for organic Hg determination due to it having at least 5 times the frequency response compared with other variations at higher flow-rates or utilizing polished surface QCM sensors. Regeneration of polished and etched surface QCM sensors was also investigated with microscopic imaging. The optimal settings of these integrated techniques were found and will be utilized in further experiments measuring concentrations of organic Hg.

Thermal Analysis of a Special Grout Mixture for In-Situ Decommissioning *- Ms. Nadia Lima and Mr. Cristian Acevedo*

The 105-R Reactor at Savannah River National Laboratory (SRNL) has been obsolete since 1964. The Department of Energy has set a goal to reduce its footprint at SRNL, therefore identifying the 105-R Reactor for decommissioning. Part of the decommissioning process involves filling all below grade areas with cementitious materials; this is referred to as in-situ decommissioning. The 105-R Reactor Disassembly Basin D & E Canal is one of these below grade areas that are being filled with special cementitious materials such as grout. The heat generated by the mixture is known as heat of hydration. Temperature differences can affect the curing properties of the grout as well as cause the material to expand and contract as it heats and cools, which may in turn cause thermal cracking. An experimental setup was performed at the Applied Research Center (ARC) at Florida International University (FIU) in order to measure the change in temperature along the radial and axial direction of the grout mixture with respect to time. The experiment focused on determining the presence of localized hot spots and determining the extent of thermal uniformity. The experiment also verified that the compressive strength of the grout was not under the minimum site requirement of 345 kPa (50 psi). Obtaining temperature changes as the grout cured had the additional benefit of providing understanding of the behavior of the grout along the radial direction; this is an area which has not been studied thoroughly and, therefore, is of interest to SRNL. The mixture used in the experiment was Zero-Bleed-Flowable-Fill-No. 8 Gravel-Diutan Gum grout (PR-ZB-FF-8-D), as prescribed by SRS and obtained from Cemex in Miami, Florida. This grout is intended for placement in uncongested dry areas.

Remote System for Characterizing, Monitoring, and Inspecting the Inside of Contaminated Nuclear Stacks*- Mr. Mario Vargas and Mr. William Mendez*

The Stack Characterization System (SCS) is a collaborative project with the Robotic and Energetic Systems Group at Oak Ridge National Laboratory (ORNL) and the Applied Research Center (ARC) at Florida International University (FIU). The SCS is a robotic system that will be deployed into off-gas stacks located around the central campus ate ORNL. The system will consists of surveying equipment capable of taking surface contamination samples, radiation readings, core samples and transmit live video to its technicians. Trait studies were conducted on varying concrete materials to determine the best way of retrieving loose contamination from the surface. The studies were performed at the ARC facility by DOE Fellows, where traditional cloth wipes were compared to adhesive material. The adhesive material was tested on the group's smear sampler to record how much loose surface material could be retrieved. The DOE Fellows completed a summer internship during which designs were created for a deployable radiation detector and core drill capable of retrieving multiple core samples.

7.4 Workforce Development for the Nuclear Industry – A Global Issue

A professional paper was submitted and presented at WM11 by Dr. Lagos. The paper discussed the global need for a workforce to support the renaissance of the nuclear industry around the world. The abstract for this paper is presented below:

The Department of Energy's Office of Environmental Management (DOE EM) oversees one of the largest environmental restoration projects in the word. DOE EM's labor statistics show that 91% of EM employees are 40 years old or older and only 1% of its workforce is under 30 old. In addition, it is estimated that within the next three years, DOE EM will lose as much as 30-35% of its technical workforce due to retirement. Likewise, a similar problem also affects other countries around the world such as the United Kingdom (UK). According to statistics provided by Whitmore et al, in the UK, 70% of the decommissioning sector workforce will retire by 2025, thus creating a gap in skilled workforce for the nuclear industry. This need in the UK translates to about 1,000 new recruits per year, mainly at the apprentice and college graduate level. At the same time, countries around the world are also experiencing a "renaissance" of the nuclear industry. The rebirth of the nuclear industry will require a new workforce, which compounds the aging workforce issue and increases the demand for skilled workers. The unfavorable public perception of nuclear power due to the Three Mile Island (1979) and Chernobyl (1986) accidents are becoming a thing of the past, and public confidence is building for the use nuclear energy. In the United States (US), DOE EM is responding to the aging workforce problem by proactively partnering with universities to train and develop the new generation of environmental restoration workers. In 2007, DOE

EM and Florida International University's Applied Research Center established the DOE-FIU Science and Technology Workforce Development Program. This is an innovative program designed to train and mentor students in STEM (science, technology, engineering, and math) disciplines and provide them with career paths in the environmental restoration and nuclear industry. The selected students (called DOE Fellows) perform hands-on environmental remediation research and participate in internships at DOE sites, national laboratories, and DOE contractors. Upon graduation and completion of the DOE fellowship, DOE Fellows pursue employment opportunities with DOE, and its contractors. By the same token, many universities and institutes in the US and UK are also establishing programs and centers in an effort to prepare a new generation of scientists, engineers, and students that will be the future of UK's nuclear industry. For example, the University of Manchester's Dalton Nuclear Institute (DNI) was established in 2005 and acts as the engine to drive the coordination and growth of the university's nuclear expertise. Besides the DNI's research capabilities in Nuclear Energy Technology, Radiochemistry and Materials, and engineering decommissioning and geological disposal, DNI also provides higher learning in nuclear related disciplines. DNI has also established a number of international strategic collaborations including US's institutes and national laboratories such as Battelle Memorial Institute, and DOE National Laboratories. In the US, Central Virginia Community College (CVCC) has developed nuclear technologies initiatives for STEM (science, technology, engineering, and math) disciplines under a grant from the National Science Foundation. China's nuclear energy ambitions will also require a massive workforce and universities such as South China University of Technology is already providing nuclear energy educational and training programs. These programs are producing well trained young professionals that will fill a gap in the US and UK aging workforce and providing the platform to launch a 21st century workforce for the nuclear industry. This paper will discuss efforts by these two listed institutions and other institutions around the world engaged in the workforce development activities for the environmental restoration and nuclear power industries.

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 2010-2011 Year End Report - Project 4, under Task 2.

8.1 DOE's Savannah River National Laboratories Support

DOE Fellows: Cristian Acevedo, Nadia Lima, Alessandra Monetti, Jose Rivera, Givens Cherillus, Elicek Delgado

Mentor: Leonel Lagos (FIU-ARC)

Project: 105-R Reactor Disassembly Basin D&E Canal- Heat of Hydration Experimental Mock up and Heat Transfer Analysis

In Situ Decommissioning Experiment #1: Thermal Analysis of a Special Grout Mixture

Savannah River National Laboratory (SRNL) is implementing in situ decommissioning (ISD) at two reactor facilities by filling all subsurface areas with Zero-Bleed-Flowable-Fill-Gravel No.8-Diutan Gum (ZB-FF-8-D) grout and placing a water resistant concrete slab over the filled area. The 105-R Reactor Disassembly Basin D & E Canal was one of these below grade areas that were filled with the special grout.

The heat generated by the mixture as it cures is known as the heat of hydration. Temperature differences can affect the curing properties of the grout as well as cause the material to expand and contract as it heats and cools, which may in turn cause thermal cracking. An initial experimental setup was performed at FIU ARC in order to measure and record the changes in temperature along the radial and axial direction of the grout mixture with respect to time. The experiment focused on determining the presence of localized hot spots and determining the extent of thermal uniformity.

The experimental set-up consisted of two reinforced concrete pipes (RCP), each measuring 3 feet in diameter and 8 feet in height (Figure 47). For support, a unistrut system was placed around the pipes to prevent any movement and a crack-filler was applied to the bottom of the RCPs to prevent grout from leaking out. A thermocouple tree was placed in the center of each pipe to measure the axial and radial temperatures.

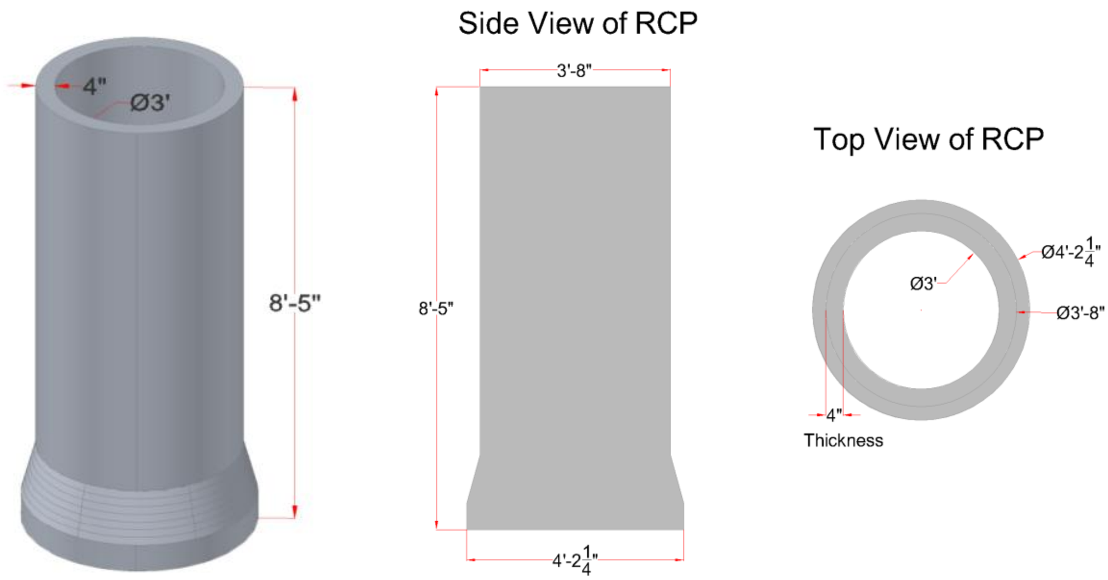


Figure 47. 3-D, side, and top view of the reinforced concrete pipe.

The thermocouples were placed at 4 different vertical levels: 1.5, 3.5, 6, and 7 feet from the base. At each vertical level, the thermocouples were placed at 4 different radial distances: 3, 7, 11, and 15 inches from the center of the RCP (Figure 48). In total, 16 thermocouples per RCP were used, each connected to a data acquisition system.

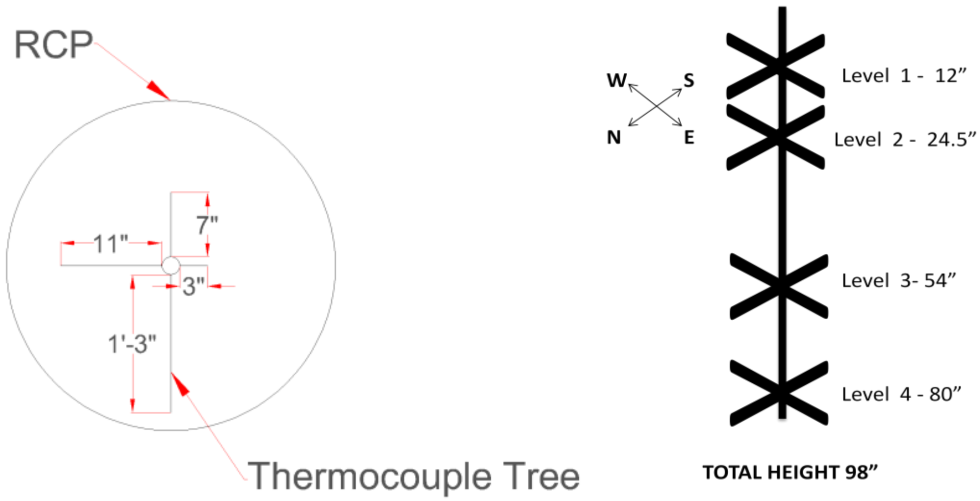


Figure 48. Vertical and radial distribution of thermocouples.

On July 26, 2010, the ZB-FF-8-D grout mixture was delivered and placed by Cemex. The grout mixture formulation had been provided by SRNL and is displayed in Table 2.

Table 2. ZB-FF-8-D Grout for Uncongested Dry Areas Mix

Material	Amount	Total (for 2.09 cu yd per RCP)
Portland Cement Type I/II	150 lbs/yd^3	315 lbs/yd^3
Fly Ash Type F	500 lbs/yd^3	1050 lbs/yd^3
Sand (Silica) C-33	1850 lbs/yd^3	3885 lbs/yd^3
Gravel (Granite) No. 8	800 lbs/yd^3	1680 lbs/yd^3
*ADVA CAST 575	79 fl. oz/ yd^3	165.90 fl. oz/ yd^3
*V-MAR 3	205 fl. oz/ yd^3	430.50 fl. oz/ yd^3
Water	50 gal/ yd^3	105 gal/ yd^3

*ADVA CAST 575 replaced Viscocrete 2100, V-MAR 3 replaced Diutan Gum.

The grout was placed in the RCPs via a pump and 2-inch hose. A series of fresh and cured tests were conducted using American Society of Testing and Materials (ASTM) standards to determine the quality of the grout. The results of the fresh and cured property testing are displayed in Table 3.

Table 3. Results for Fresh/Cured Grout Property Testing

Test	Day 1	Day 2
Temperature	90.8ºF	89.0ºF
Spread	19 inches	21-23 inches
Air Content	0.5%	0.3%
Solid Unit Weight	143.30 lb/ft^3	141.70 lb/ft^3
7-Day Compressive Strength	366 psi	343 psi
28-Day Compressive Strength	828 psi	789 psi

The grout's 28-day compressive strength values of 828 psi and 789 psi surpassed the material compressive strength requirement of 50 psi as set by SRNL. These values provide evidence that the grout was curing correctly.

After the RCPs were filled with grout, the temperatures measured by the thermocouples were recorded every minute. Figures 49 and 50 display the temperature fluctuation over time recorded for RCP 1 and RCP 2 for Day 1, Day 2, Day 6-7, Day 32-35, Day 90, and Day 180. Figures 51 and 52 display the radial temperatures for RCP 1 and RCP 2 for Day 1, Day 2, Day 90, and Day 180. Identified temperature peaks were found to occur on a weekly basis. Despite the fact that peaks were expected to occur due to the reaction of fly ash with lime, the pattern of the highest peaks observed was consistently taking place early morning on Mondays. It is believed that such behavior may be directly related to the FIU facility management practice of shutting off the air conditioning Friday evening to Monday morning.

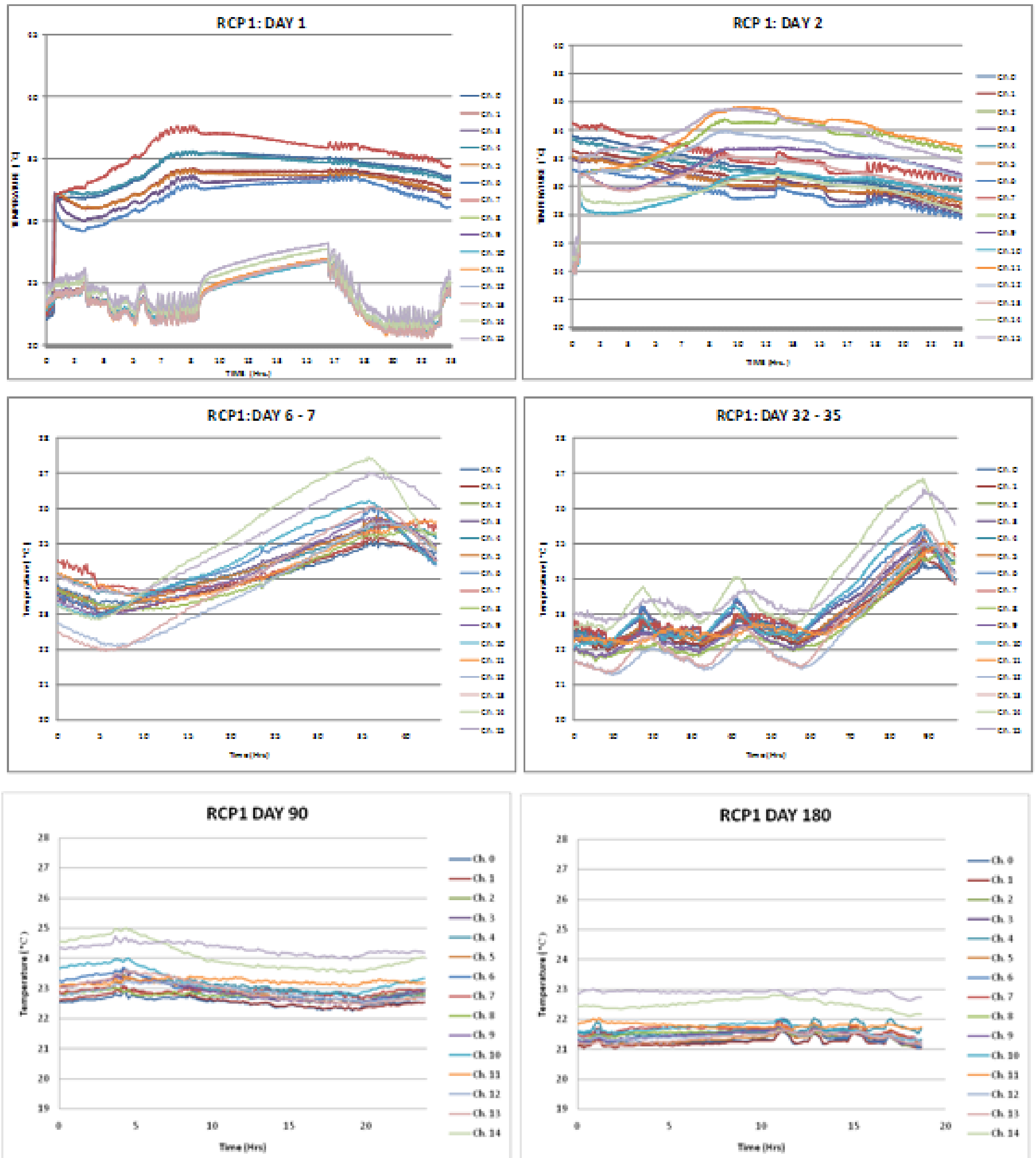


Figure 49. Temperature fluctuations over time for RCP 1.

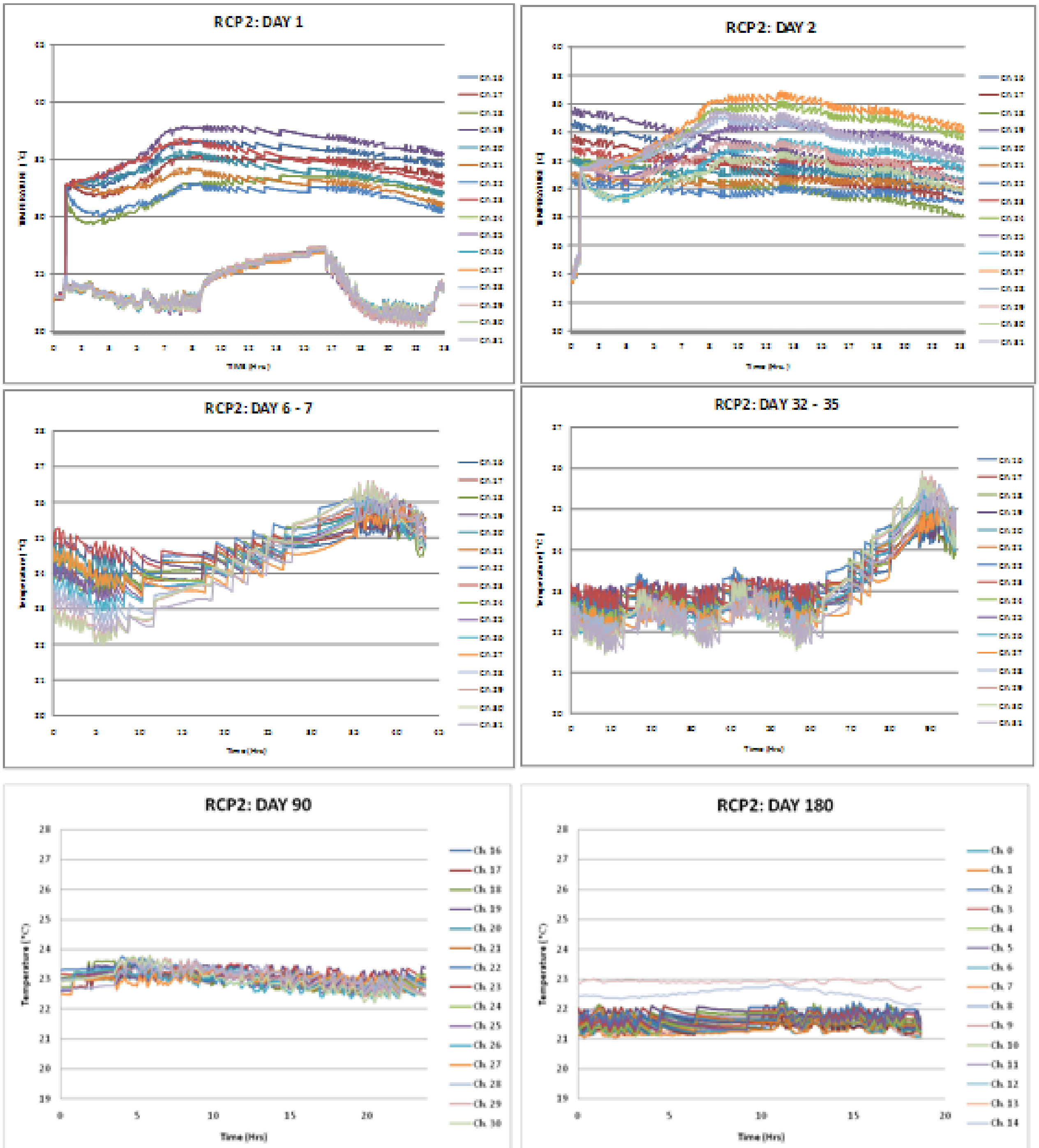


Figure 50. Temperature fluctuations over time for RCP 2.

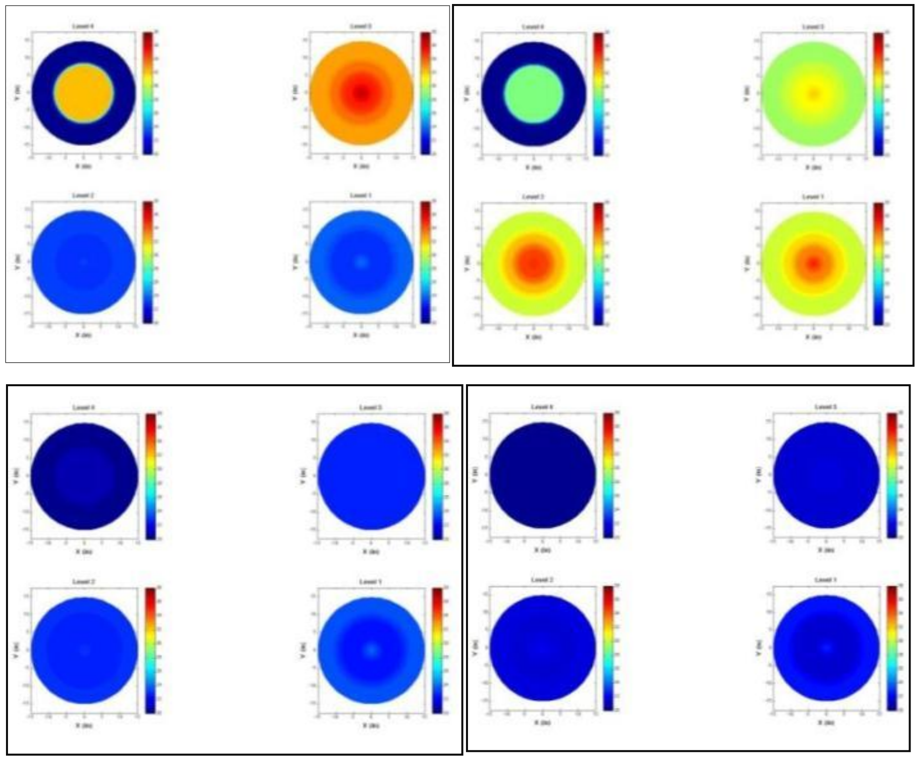


Figure 51. Radial Temperatures for RCP 1 on Day 1, 2, 90 and 180.

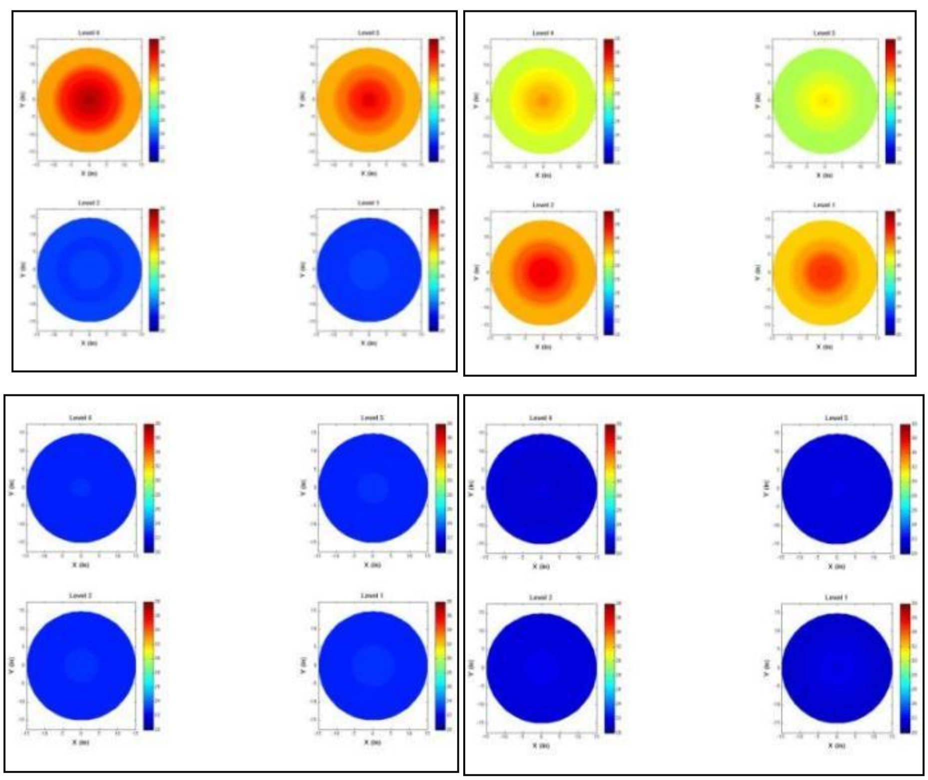


Figure 52. Radial Temperatures for RCP 2 on Day 1, 2, 90 and 180.

The experiment was successfully conducted and met the proposed objectives. The fresh and cured quality analysis testing of the grout was close to or within the range of the figures from those developed at SRNL. The maximum temperature the grout generated during the hydration was 100ºF, with subsequent lower peaks occurring after the first 24 hours. The maximum temperature found at SRNL was lower than that at FIU ARC due to the time of year the experiments were conducted. The pouring at SRNL took place between February and March when the ambient temperature was approximately 20-30ºF, while at FIU ARC the ambient temperature was around 85-100ºF. In addition, the presence of water was another factor that affected the behavior of the grout at SRS. These two factors (ambient temperature differences, and the presence of water), have an effect on the temperature behavior of the grout. The overall results of this experiment proved that the temperature generated by the grout does not significantly affect its properties, and therefore that the grout cured properly.

In Situ Decommissioning Experiment #2: Heat of Hydration Experimental Mock Up and Heat Transfer Analysis Using Cellular Grout

DOE has identified 84 facilities in the complex that are considered potential candidates for in situ decommissioning closures, representing a footprint of about 1.8 million square feet. Considering facilities that have not yet been placed out of operation and other factors, ISD closure could be beneficial for 100-125 facilities across the complex. With this in mind, FIU continued to work with SRS on this subtask to gain a better understanding on the performance of various cementitious materials that could be used during the process of ISD. For this second in situ decommissioning experiment, FIU used a similar experimental set-up with a cellular grout mixture.

SRS is implementing ISD by placing a modified cellular concrete/grout into a section of the 105-P Reactor Disassembly Basin D & E Canal. The section filled is on top of an underlying cavity (Figure 53) and needed to be filled with a light-weight/low-density concrete in order to avoid collapsing of the cavity. Cellular grout was the lead candidate for filling this space because of its light weight. Cellular concrete/grout is an innovative material to be used for in situ decommissioning. Cellular grout, otherwise known as foam grout, is a lightweight material containing gas cells. These gas cells are created by adding a foaming agent to the neat cement, which in turn decreases its density. The end product is a lightweight material with a density range of 15-120 lbs/ft^3. The selection of cellular grout was based upon its low density, thermal conductivity, and excellent flow properties. These characteristics were ideal for filling the area.

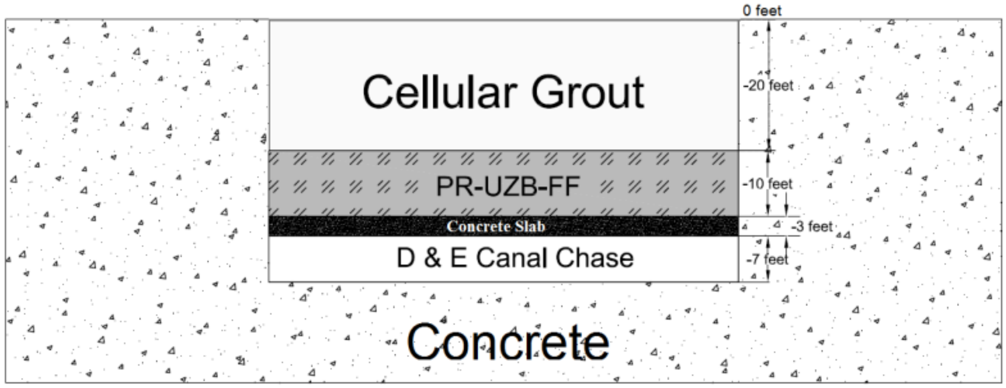


Figure 53. 105-P Reactor Disassembly Basin D & E Canal Cross Section.

As explained in the previous experiment, once the grout is poured, heat is anticipated due to the hydration of the mix and these temperature values need to be quantified. Therefore, a thermocouple tree and concrete maturity logger (CML) were developed to acquire the temperature data and strength of the grout as it cures. The second experimental setup was designed and developed by FIU-ARC in Miami, Florida, to investigate the temperature distribution and strength generated by this grout. The temperature and strength data obtained will be compared with the temperature data modeled by SRS. This experiment will validate the performance of the cellular concrete grout mix. In addition, FIU-ARC will develop a summary report providing the results and conclusions obtained from the experiment.

Similar to the first experiment, this set-up utilized an 8-ft tall by 36-inch diameter reinforced concrete pipe (Figure 47). However, the cellular grout mixture was poured in one continuous lift on a single day.

The two RCPs used for the second experiment were purchased from U.S. Precast located in West Palm Beach, Florida. Both RCPs were enclosed with trusses to support moments from lateral loads. Similarly, the flow of the grout was not fast enough to make the RCPs move. In addition, Crack-Stix Permanent Crack Filler was applied to the bottom of the RCPs to prevent grout from leaking out.

For support, the PVC pipe forming the skeleton for the thermocouples was attached perpendicularly to a 44 in. long 2x4 lumber resting on the top of the RCP. At each end of the 2x4, two smaller cuts of lumber were added to prevent slippage on the rim of the RCP. The smaller cuts had a 4.5 in. gap between them within which the rim of the RCP was held.

The experimental set-up consisted of two RCPs, each with a thermocouple tree at their center along with two concrete maturity loggers. The RCPs were filled with cellular concrete/grout (formulation provided by SRS). The temperatures generated by the cellular grout are currently being recorded for a period of 180 days. At the same time, the CMLs are recording the in-place strength of the grout. Compressive strength analysis was analyzed at days 3, 7, 14, 28. The data will be analyzed and compared to the tested values obtained by SRS. Figure 54 shows the setup of the experiment.

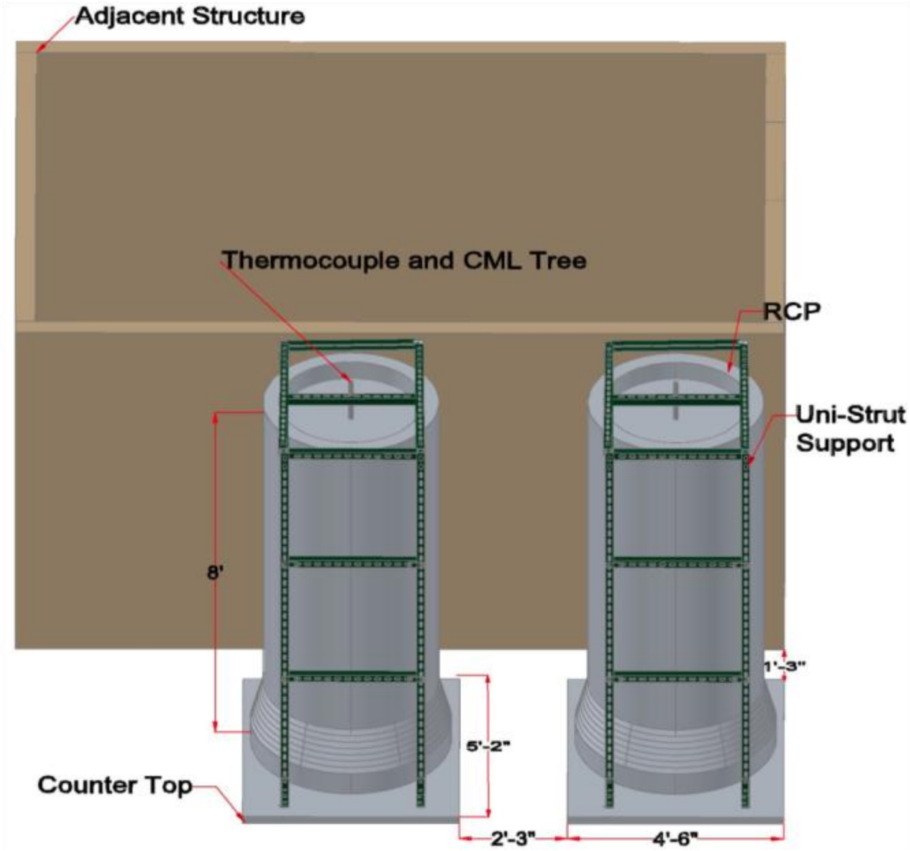


Figure 54. Design of the experimental test bed.

The experimental steps included the following (Figure 55):

1. RCPs were set up on epoxy resin countertops (used as the base).
2. The thermocouples were calibrated using a known temperature measured by a thermometer.
3. After thermocouple calibration, the thermocouple and CML trees were placed and secured at the center of each RCP.
4. The CMLs were calibrated once the concrete mixing truck arrived on site following ASTM C 1074.
5. Gibson's Pressure Grouting Service, Inc. arrived with Central Concrete Supermix (subcontractors that provided the slurry).
6. The slurry and the grout was then passed through a shear mixture to make sure it is clean.
7. Gibson's Pressure Grouting Service, Inc. prepared the liquid foam using a Viper Turbo-Air 50-1.0 Foam Generator.
8. The cellular concrete grout was mixed onsite using a mixing truck.
9. A grout hose was placed carefully inside of the RCPs so as not to damage the thermocouple tree.
10. Pouring took place at a rate of 3 ft/hr, until the RCPs were filled. The thermocouples recorded the initial temperature of the grout every minute as it entered the RCP. The CMLs recorded the in-place strength of the grout every hour.

11. The data acquisition will run for a period of 180 days.

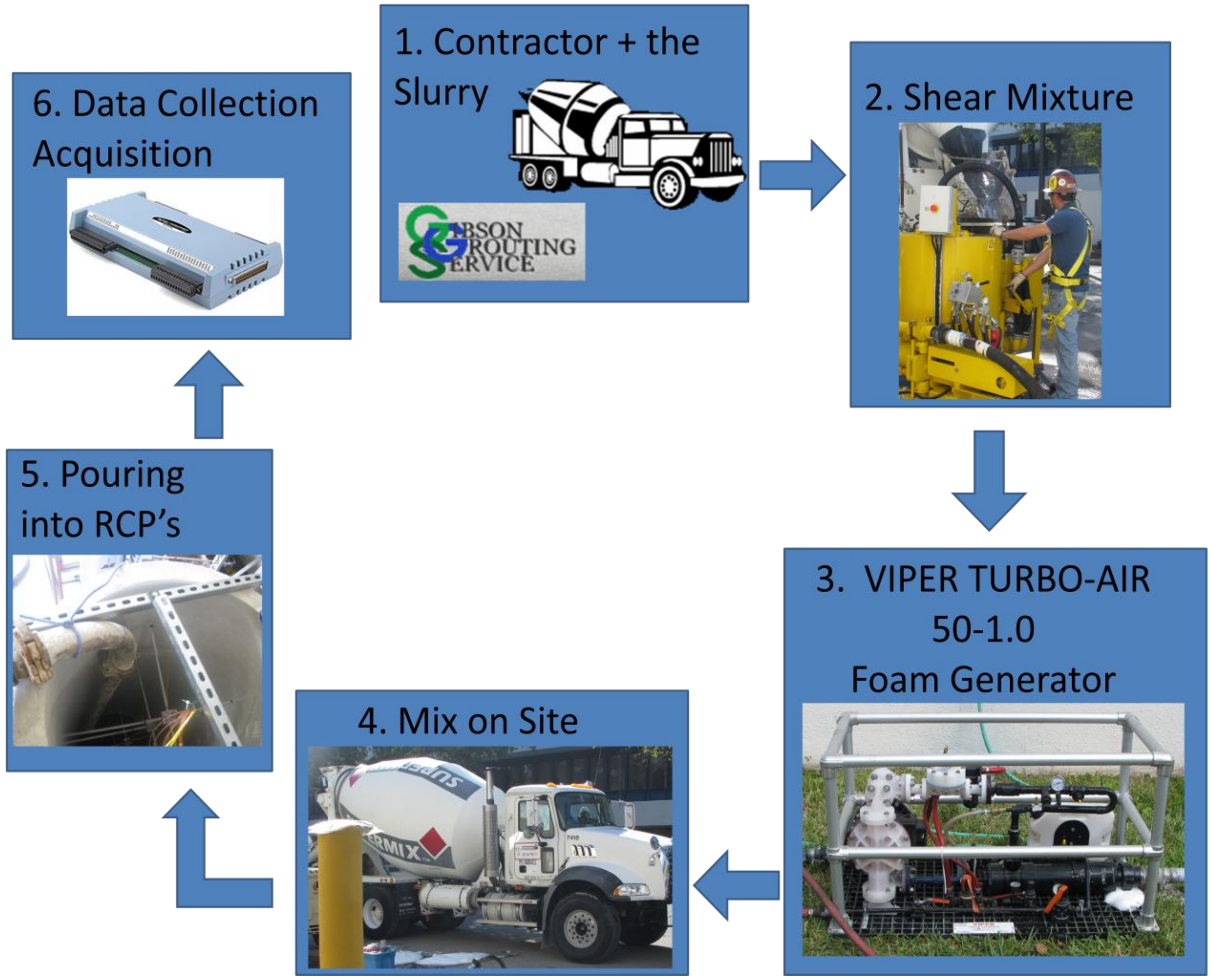


Figure 55. Steps of second ISD grout experiment.

Quality analysis testing of the grout was conducted as fresh and cured tests. Table 4 displays the results for temperature, unit weight, air content, and spread.

Table 4. Results from Quality Analysis Testing

Property	Grout	Grout with Foam
Temperature	90.5°F	84.5°F
Unit Weight	110 lb/ft^3	25 lb/ft^3
Air Content	0.22%	81-83%
Spread	N/A	37 inches

The compressive strength of the grout was also tested at Days 1, 3, 7, 14, 28, and 90. Figure 56 displays the maturity collected by the maturity sensors vs the compressive strength data collected during the compressive strength quality analysis tests.

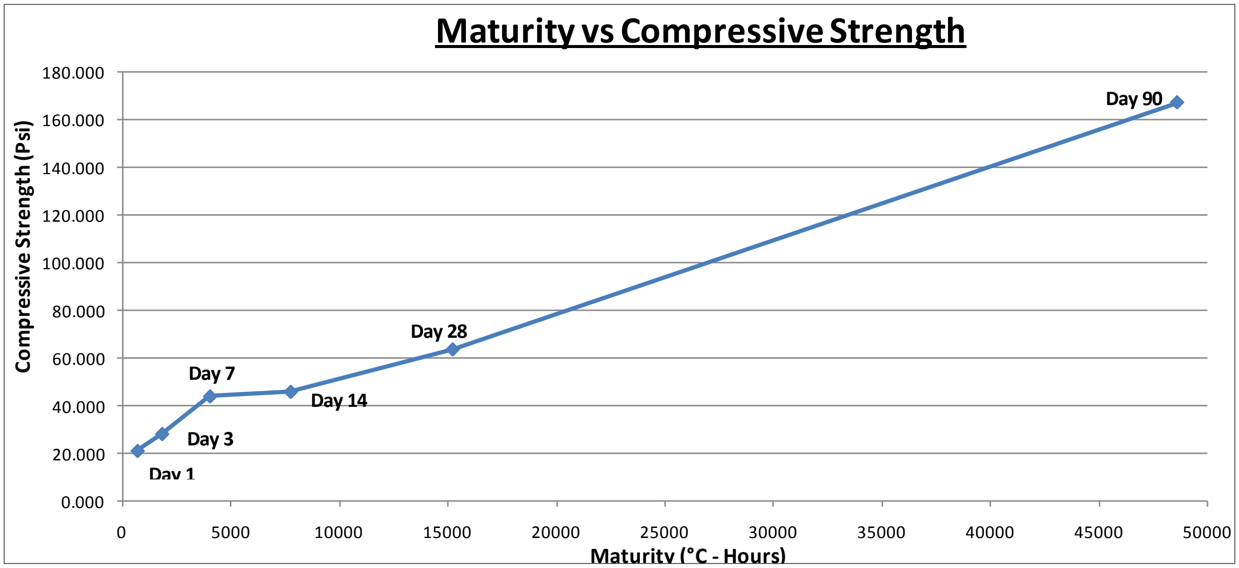


Figure 56. Maturity vs Compressive Strength.

Temperature data collection is in progress. Figures 57 through 60 depict temperature fluctuations for Day 1 and Week 1 for RCP 1 and RCP 2.

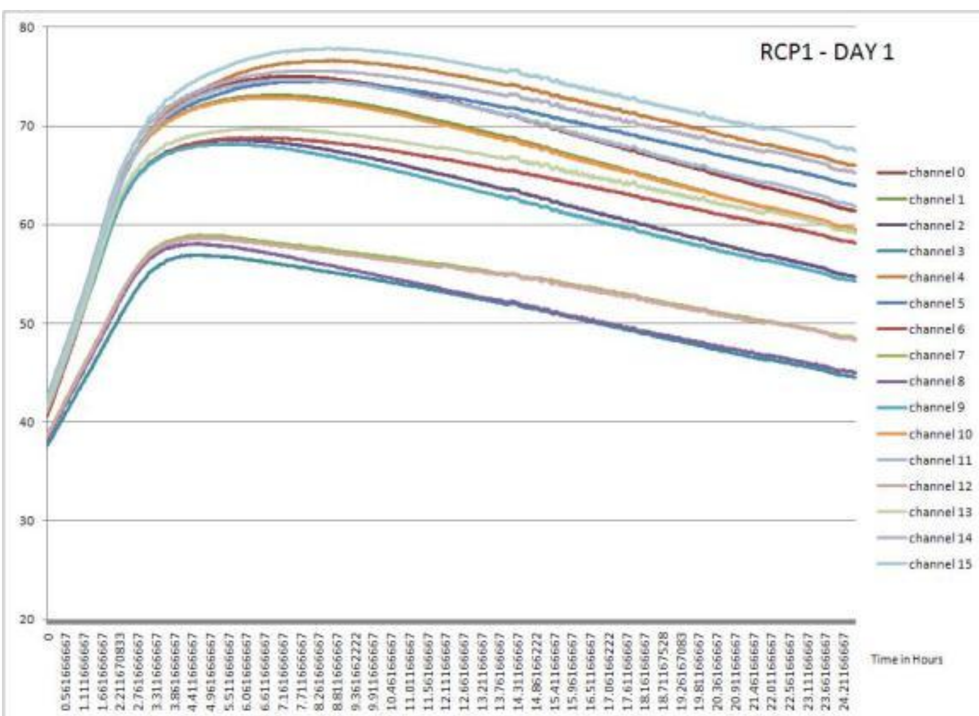


Figure 57. Day 1 RCP 1 Temperature vs Time.

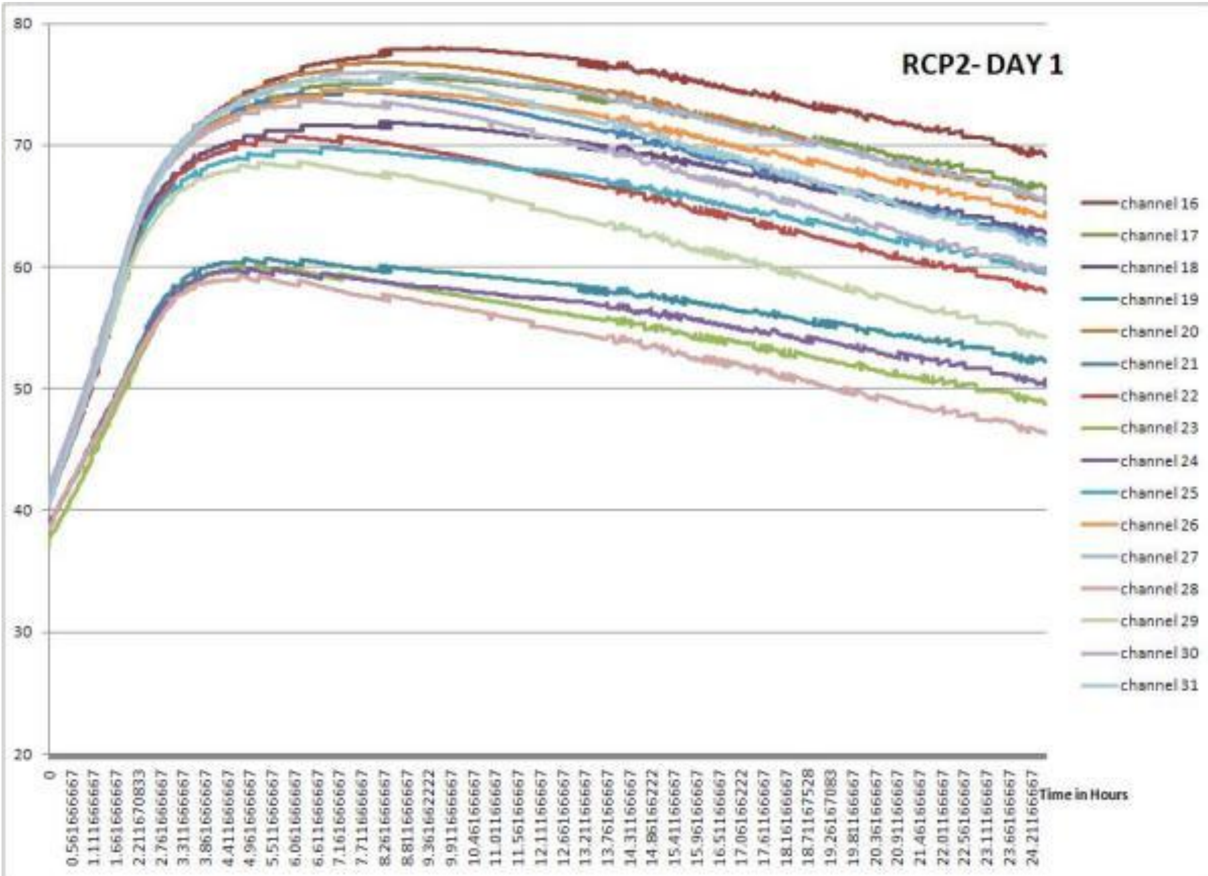


Figure 58. Day 1 RCP 2 Temperature vs Time.

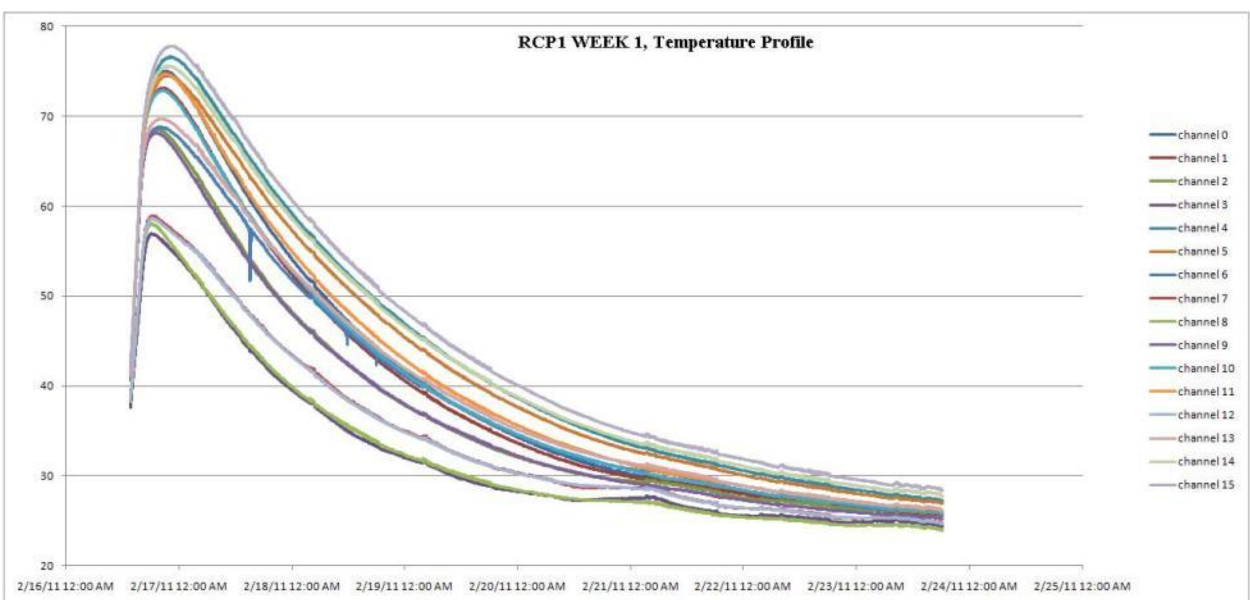


Figure 59. Week 1 RCP 1 Temperature vs Time.

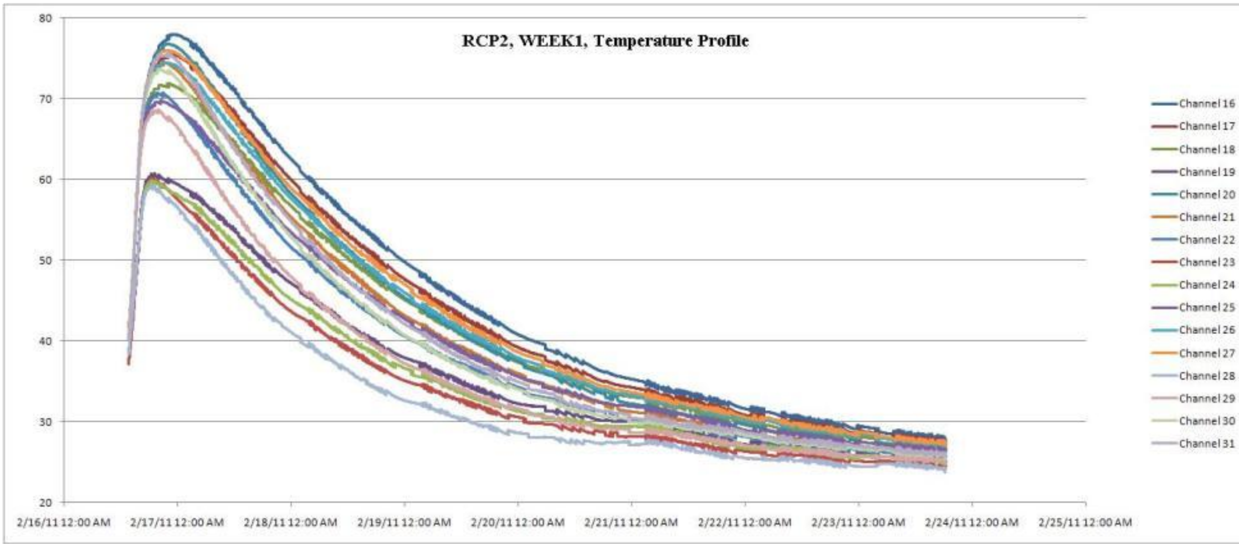


Figure 60. Week 1 RCP 2 Temperature vs Time.

At the end of the data acquisition period, FIU will analyze and report the data in a final report.

8.2 Oak Ridge National Laboratory Support

DOE Fellows: William Mendez and Mario Vargas
Mentor: Mark W Noakes (Robotic and Energetic Systems Group Oak Ridge National Laboratory)
Project Title: Development of Stack Characterization System for EM-44

The Central Campus Closure Project at ORNL focuses on demolishing a large number of facilities including off-gas stacks. The stacks are located in a densely populated area of ORNL, next to currently active operating facilities. Before demolition of the stacks, the stack must be characterized. However, it is hazardous to place workers in close proximity to or inside stacks with unknown structural integrity. Typical alternatives are to sample just around the top of the stack and at access points near the bottom of the stack. Characterization coverage is thus limited to available areas and these areas are not necessarily the ones most likely to be contaminated.

The Stack Characterization System (SCS) is a collaborative project between the Robotics and Energetic Systems Group (RESG) at Oak Ridge National Laboratory (ORNL) and ARC at FIU. The SCS is a remote system which can characterize the quantitative and qualitative levels of contamination inside off-gas stacks, protecting workers from the physical, radiological and chemical hazards. Data collection targets the pre-demolition survey needs for structural, health physics and waste management analysis. The system will deploy into the top of stacks via an external overhead crane. The SCS consists of two stages of tripod sections connected in line by a rotating positional joint. The upper tripod is used for stabilization against the stack walls. The lower bipod section, controlled independently from the upper section, is used to position survey instruments against the inside stack walls. Survey instruments include alpha/beta/gamma radiological detectors, smear sampling, and core sampling. Position information, depth in the stack and rotation within the stack, is recorded and identified for each survey position. An array of real-time video cameras provides guidance for remote systems operators for entrance and egress in the stack and for targeting areas of interest inside the stack for inspection and survey

Two DOE Fellows completed summer internships at ORNL in 2010 during which conceptual designs for the SCS were created for a deployable radiation detector and core drill capable of retrieving multiple core samples. Upon their return to FIU, they continued to work on the system, including the development of conceptual designs for a containment system that will be capable of protecting the surrounding environment near the stacks from contamination, and the performance of studies on varying concrete materials to determine the best way of retrieving loose contamination from the surface. The DOE Fellows presented the overall system at two conferences, the DD&R 2010 and WM2011, and technical papers were submitted to each.

Radiation Detector System Design

FIU performed work on the conceptual design for the radiation detector deployment mechanism. The radiation detector head must be deployed from the instrument bay to the stack wall at a distance of 6.35 mm (¼ inch) with a tolerance of ± 3.17 mm (± 1/8 inch). However, it must be retracted and protected during movement of the SCS. The detector positioning assembly is shown in Figure 61. A small linear actuator is used to move the detector in and out. A limit switch manages the standoff distance from the wall.

The radiation sensor bay deploys both of the radiation detectors. The dedicated rad sensor bay PLC controls deployment of the radiation detectors to the stack wall after the SCS bipod has deployed. Limit switches act as feelers to control the detector standoff distance during measurement. The detector is powered during the entire stack entry. One of two detectors can be deployed: a RadEye SX head with a Ludlum 43-1-1 detector to discriminate alpha from beta-gamma or a RadEye GX head with a Ludlum 44-88 detector for alpha-beta-gamma. Procurement of the detectors has been coordinated with ORNL Health Physics. Data is acquired through the Ethernet network using an USB to Ethernet converter tied to the detector head.

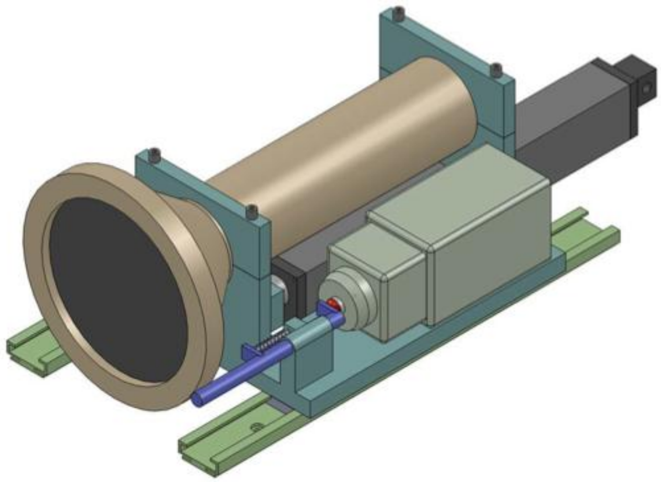


Figure 61. Detector positioning system, assembly view.

Smear Sampling System Design

The “smear” sampler is an automated mechanism capable of deploying 20 individual sample pads to collect removable contamination at a target location. The sampler uses an adhesive pad approach validated by FIU to be at least as effective as smear wipes at collecting removable contamination. The size and form factor of the pads is the same as currently used so that it will fit in the same Health Physics analytical equipment. The sample pads are arranged radially around the outer edge of a carrousel and actuated in a manner such that only two actuators are required: one to rotate the drum and one to actuate the plunger. The design limits the pressure of the sample pad to the target to 3 lbs. There are detents in the plungers to permit the sample pad to sacrificially break away if it becomes accidentally attached to the wall. The same mechanism will be used to remove the samples from the plungers for analysis. The tray of 20 will be removed for analysis after the SCS is retrieved from the stack. The cover and shutter window protect the samples and minimizes cross contamination concerns. The controls are external to the sampler itself but are contained in the bipod bay for the radiation instrumentation. Figure 62 shows the automated smear sampler mechanism with its cover and shutter window installed and also shows the shutter window opened and the sample plunger deployed to take a sample. The detail design phase for the automated samples has been completed. The prototype has been tested and final fabrication is in progress.

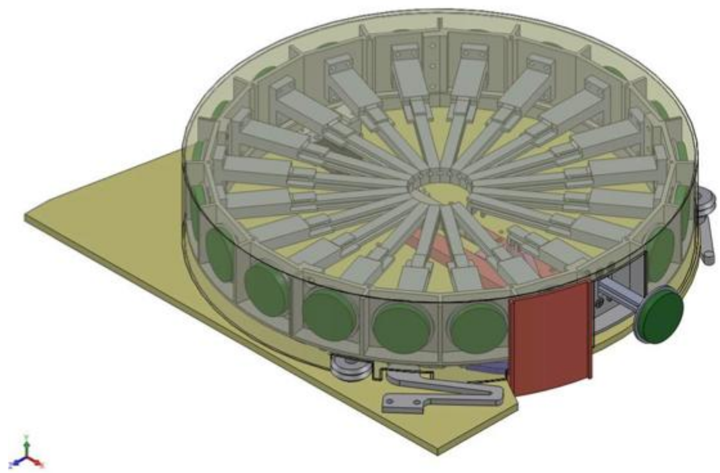


Figure 62. Smear sampling system.

The DOE Fellows performed tests at ORNL with the smear sampler. The first physical smear sampler was prototyped by the Robotics and Energetic Systems Group. Upgrades were made to the original prototype by FIU under the supervision of ORNL staff. Instead of using a rotational geared motor to rotate the carousel, another linear actuator was added. The actuator is located below the base. A detent was added at the base of the carousel as shown in the lower end of Figure 64. A detent is a mechanical component that prevents rotation. The detent was added to keep the carousel from rotating in the opposite direction and to allow it to rotate forward only when the bottom actuator is energized. Testing of the prototype took place after the collection medium was added to it. The collection medium, the double-sided adhesive foam tape, was added to the end of the push rods. For the preliminary testing, the adhesive sides of the pads were kept covered until it would be used for collection. The sampler and its base were mounted on a cart along with its voltage supply and the controller hardware (OPTO 22 PAC Controller), for preliminary testing of the design on outdoor surfaces. The original smear sampler prototype was tested on the same outdoor surfaces that the collection medium materials were tested on. Large grain particles were collected during the testing. One of the main objectives of the outdoor testing with the sampler was to observe if the actuator that extends the push rods with the pads would stall. The concrete block had enough surface particles to be collected by the sampler. As expected, the sampler did not stall when taking samples from the concrete block. The limit switch was tested during preliminary lab testing but was also tested again with the concrete block. Instead of allowing the push rod to extend out fully, an obstruction was set in front of it and the limit switch tripped the actuator to retract the rod as soon as it touched the obstruction. A semi-rough outside concrete wall was tested next; the outside wall did not have large particles but had much finer dust particles on it. The semi-rough surfaces also had enough particles to be collected by the sampler. Afterwards, the sampler was tested on a smoother concrete wall, the same results were yielded. The qualitative results yielded from the sampler testing proved that if there are any loose particles on the surface selected for sampling that:

- The adhesive pads would be able to collect it.
- The linear actuator would not stall.

- The limit switch would retract the push rod if the full stroke of the actuator could not be accomplished.

The carousel on the sampler is transportable and an independent component of the sampler. The carousel is removed from the base when the campaign is over and a new one is added for the next campaign. The sample pads will be removed from the carousel and analyzed for characterization. Because the carousel will be moved around, all the push rod stems need to be in their retracted position before it can be added to the base. The original carousel design was not able to keep the rods retracted while the carousel was being transported. Also, the rods have a circular cross section that allows the rods to rotate, making it harder for the linear actuator to extend the rod. It was also noticed that the carousel itself did not have a location for the technician to pick up the carousel. The carousel design was the main objective to be completed during the summer internship as set by FIU and the Robotics and Energetic Systems Group. The first change made to the carousel was the cross section of the push rods. The circular rods were prone to rotating in place while the carousel was being moved. The new rods used a rectangular cross section. A support was also added to guide the rod and the rod has a slot on each side so that the support can act as rail for the rod. The rod also has a groove on the top surface; the support has an extruded circular section on it, the detent that fits into the groove on the rod. The detent prevents the rod from sliding out when the carousel is being moved. The support has a flexible cantilever end that is able to flex up and down as the groove on the support passed by it. If the detent is in the groove, the rod is not able to slide out until it is pushed forward by the actuator. The detent allows the rods to stay in their retracted position at all times until they are pushed forward by the actuator. The detent facilitates the transportation of the carousel. At the end of the stem, there is a cut out rectangular section. That cut out section allows the actuator to engage the stem when the stem is rotated in front of it and it also allows the actuator to push and pull on the stem. On the opposite end of the stem, there is a disk that the adhesive pad sticks to. The adhesive pad is protected from cross contamination by the arced sections that make up the circle of the carousel.

Changes were also made to the disk pads but these changes were minor. The original rod design had a circular cross section; the new design uses a square cross section that reduces any rotation of the pad while a sample is taken. Because there is a change to the rod design, the disk pad design also needed to change. The new design has a detent built into it. The detents main purpose is to replace the pin that is currently being used to hold the disk to the rod. Previous testing of the adhesive pads with varying concrete surfaces showed that if a smooth clean surface is used, the adhesive pad could not be removed. The previous design of the carousel did not prevent the sample pad from remaining adhered to a surface. In other words, the linear actuator provides 3.4 lb of pushing and pulling force and the pads are so adhesive that they will remain adhered to a dust-free surface, requiring more than 13.34 N (3 lb) of force to detach. The new rod and disk design does not require a connecting pin and will snap off if more than 11.12 N (2.5 lb) of force are required to detach the pad from the surface.

Containment Package Design

The SCS containment concept consists of a flexible collapsible bag in the shape of a cylinder with a base and top cover. The base is designed so that it centers on the top of the stack. The bottom of the SCS includes a disk that fits into the base of the bottom of the SCS containment to provide a bottom seal. The top of the SCS containment structure will be made of fiberglass to permit wireless communications through the structure. While the crane cable penetrates the fiberglass top, the opening is kept to a minimum to minimize the possibility of contamination outside of the containment package. As part of cold testing, ORNL will work with LANCS Industries to adapt the material used in their containment tents to the SCS containment task based on actual hardware. The focus and order of priorities will be on functional containment, durability, and minimum cost. Hot deployment of the SCS will require a trailer for transport and storage before and after each stack campaign. The trailer can also double as the operator station if it were divided into two sections.

There are no specific requirements that dictate the trailer design. The ORNL Work Plan system and ORNL Radiological Work Permit system will drive final design criteria. Consultation with ORNL personnel indicate that the primary concern is the ability to access the SCS while it is in its trailer for survey, decontamination, and sample recovery. A request was made that the interior surfaces of the trailer consist of smooth metal for decontamination ability. Constraints such as maintenance, equipment checkout, and post survey access to sampling equipment dictate that the SCS be stored and transported in a vertical position. The SCS is approximately 3.66 m (12 ft) high in its folded position. This places unusual constraints on the transportation trailer. Addressing the need to minimize permitting concerns for movement on site and/or public roads, the ORNL Transportation Management Organization recommended that the SCS trailer be no more than 2.6 m (8.5 ft) wide and less than 4.57 m (15 ft) high. Anything over 4.11 m (13.5 ft) tall will still require a special permit. To maintain these dimensions, a custom “low boy” trailer with a high ceiling in one section may be suitable. The top will have to open to lower the SCS in from the crane. The operator station portion of the trailer would be at normal height. If additional metal needs to be added to aid decontamination ability, it may increase the trailer weight substantially.

The conceptual and preliminary designs for the containment package must be sufficiently mature to address and analyze the projected safety systems. In order to properly seal off the surrounding environment near the stacks, the containment system needs to be able to provide a holding compartment for the robotic system before and after each deployment. In order to avoid strong wind forces encountered at the top of the stack, the containment system will collapse as the robot is lowered into the stack. The forces in the containment system will be analyzed as the robot and the containment system are held in the air on the end of a crane cable. Failure theory will be implemented as part of the validation for designs being evaluated. Failure can mean a part has separated into two or more pieces, become permanently distorted ruining its original geometry, had its reliability downgraded or had its function compromised.

Core Drill Design

A core from the inside of the stacks may be needed. The SCS will have several cameras and a radiation detector located inside its instrument bays. The detectors and cameras will provide real time data back to the operators; if a location is found to have a high level of radiation, a core sample will be taken from the wall. Also, if the onsite HP decides that a particular location needs to be cored, a sample will be taken.

Current core drills are motorized units that are able to core to a certain distance. Almost all core drills are operated by workers and are able to take one core at a time. A core sample within the stack needs to be taken remotely; no unit has been found that is able to take samples remotely or able to take more than one sample. During the summer 2010 internship, much of the work was designing a core drill mechanism capable of retrieving six core samples. A total of eight core drill designs were created. After the first design, a second better design was created; that process continued until the eighth and final design was completed.

Preliminary components for the core drill were provided by the group at the beginning of the internship. The core drill design needs to be modeled using initial dimensions for the components that will be used. The entire drill assembly needs to be 24 inches long and the bits need to core 6 inches into the concrete.

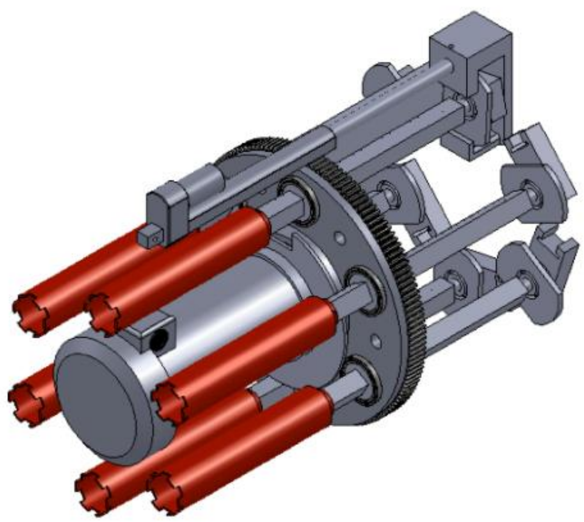


Figure 63. Core drill.

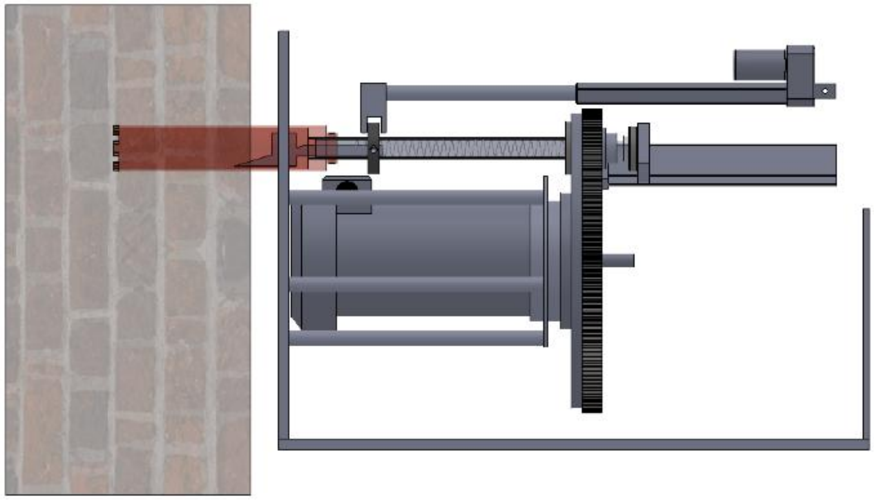


Figure 64. Wall core.

After the core drill reaches its 8 inch depth into the concrete, the core sample needs to be removed from the wall. Because the drill is coring in the horizontal direction, the core needs to be broken off and held in the core bit while the bit is being retracted to its initial position. In order to achieve the needed outcome, a combination of a break-off tool and a vacuum will be used. The vacuum will ensure that the dust created from the drilling is not allowed to spread inside the stack and further contaminate the SCS or cross contaminate the other core samples. The break-off tool is a stainless steel wedge that will be actuated in order to break the end of the core sample from the wall (Figures 63 and 64).

SCS Conclusion

The summer internship provided a chance to assist an in-progress project that requires the work of different engineers and engineering disciplines. The work completed during the internship included a core drill design capable of retrieving six core samples, a design for a radiation detector deployment mechanism, re-designs to a currently designed mechanism capable of collecting loose material from concrete surfaces and experimental testing to determine the best collection material for the sampler. Before the end of the internship, a re-design for the smear sampler was created, modeled in a 3D CAD software and actual fabrication and assembly of the carousel took place. The core drill design was completed and, along with lessons learned on the design, was used on a final design completed by the head mechanical engineer of the Robotics and Energetic Systems group. The work currently being done on the containment system will be evaluated by the group once completed and will be re-designed if needed. Final designs of the system will be given back to the RESG at which time they will determine best implementation uses.

8.3 DOE Headquarters Support

DOE Fellow: Heidi Henderson
Mentor: Leonel Lagos and Peggy Shoffner (Supporting EM-44)
Project: D&D Technology/Methodology Impacts from DDFA Activities

At the request of and in direct support of EM-44, FIU DOE Fellows began this task in FY10 and will complete the work in FY11. The objective of this task is to investigate the number of subsequent successful deployments of technologies and methodologies that were demonstrated under the Deactivation and Decommissioning Focus Area (DDFA) programs, including the Large-Scale Demonstration and Deployment Program (LSDDP) and the Accelerated Site Technology Deployment (ASTD) Program. The subtasks include the following:

1. Review the documents provided by DOE and compile a spreadsheet of the technologies and methodologies demonstrated under LSDDP and ASTD.
2. Contact personnel associated with each demonstration as well as the technology vendor, when feasible, to collect information on deployments of the technology/methodology subsequent to the demonstration under LSDDP or ASTD.
3. Information gathered during subtask 2 will be compiled into the spreadsheet developed during sub-task 1. A brief summary of the information gathered will be written and sent to DOE along with the completed spreadsheet.

FIU completed subtask 1 on May 13, 2011, and sent the draft spreadsheet of 171 technologies/methodologies to DOE. Subtasks 2 and 3 will be completed in FY11 and submitted to DOE for review and input. The task will also be reported in detail in the FY11 Year End Report.

8.4 EFCOG Support

DOE Fellow: Leydi Velez, Lee Brady, Heidi Henderson
Mentor: Leonel Lagos amd Peggy Shoffner (Supporting EFOCG 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-30 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 Human Capital Working Group Meeting on June 21-22, 2010 as well as the EFCOG D&D and Facility Engineering Working Group that met in Idaho Falls, Idaho on September 1, 2010. The topics covered at the latter included FIU's draft D&D promotional video, status of the working group's lessons learned to be published, gathering comments for a draft guidance document to help clarify D&D requirements for structural and electrical codes, and review of a field-generated list of D&D issues for the working group to consider taking action. Also, Dr. Lagos participated and presented at the EFCOG Chair Meeting held in Washington, DC, on December 7, 2010. Dr. Lagos provided an update for the D&D and Facility Engineering working group 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 establish a data collection process where Subject Matter Specialists (SMS) from various sites 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 similar standardized process, as shown in Figure 65.

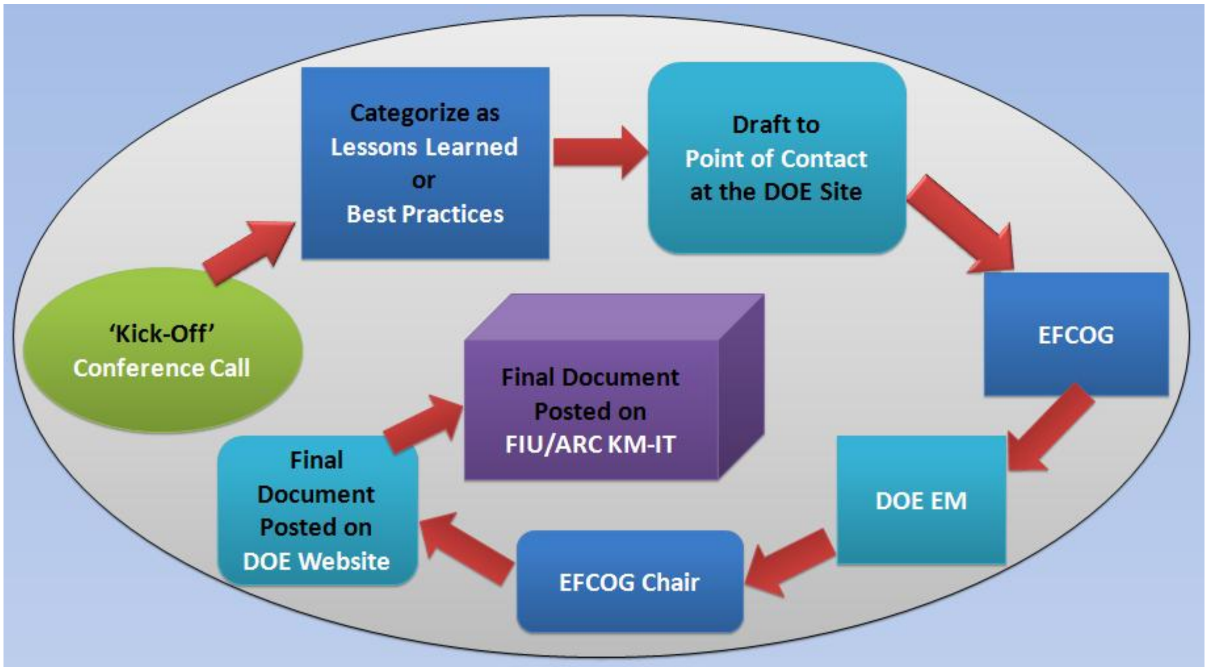


Figure 65. Process for developing Best Practice and Lessons Learned documents.

FIU completed the development, review, and approval for 2 best practice documents and developed an additional 2 best practices and 1 lesson 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 in FY10 included:

1. Washington Closure Hanford Site Explosive Demolition of Buildings 337 and 337B Best Practice
2. Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunite 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: American Recovery and Reinvestment Act-Funded Acceleration of Demolition and Lessons Learned – 11157

The first four of these Best Practices and Lessons Learned are attached to this report in the Appendix. The first two have been finalized and the second two are in draft form. The fifth document is in progress and being drafted and reviewed internally by FIU.

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 66). 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 66. demolition of Buildings 337 and 337B at the Hanford Site.

The Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunite 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 67). 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 gunite and metal layer of the building during demolition.

Figure 67. 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 (Figure 68). 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 68. 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 EFCOG point-of-contact with National Security Technologies, NSTec, provided FIU with a paper entitled *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*.

FIU is in the process of drafting the lessons learned document from this paper before it undergoes review and approval.

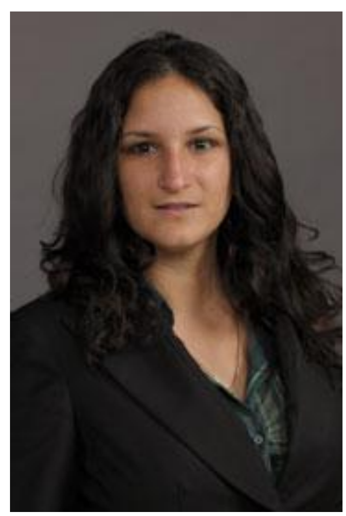
9.0 INTRODUCTION TO DOE FELLOWS AND THEIR RESERCH WORK

9.1 DOE Fellows and their Research: Class of 2010-2011 - Fourth Cohort

Yulyan Arias (Environmental Engineering)

Ms. Yulyan Arias is an undergraduate student at Florida International University pursuing her Bachelor’s degree in Environmental Engineering. She is a transfer student from Miami Dade College, where she graduated with an A.A. in Chemical Engineering. Her interests include solid waste management, soil remediation, and drinking and waste water treatment. She plans to continue her graduate studies at FIU with a Master’s degree in Environmental Engineering. Yulyan is the current Vice-President of Internal Affairs of Engineers Without Borders, USA FIU Chapter. She is involved in the development of a water supply system for an indigenous community in Costa Rica. In the Summer 2010, she was part of the first implementation trip for the project. Other organizations she is a member of include: Golden Key International Honour Society and Tau Chi Alpha (Secretary). Ms. Arias is mentored by Dr. Yelena Katsenovich. She is working on Project 2: Rapid Deployment of Engineered Solutions to Environmental Problems with a focus on Task 1: Sequestering Uranium at 200 Area by In Situ Subsurface pH Manipulation Using NH_3 Gas.

Maite Barroso (Civil Engineering)



Ms. Maite Barroso is pursuing her Bachelor’s degree in Civil Engineering with a concentration in Environmental Engineering at Florida International University. She serves as the FIU Chapter Secretary of the American Society of Civl Engineers. Following graduation, Ms. Barroso plans to obtain her Master’s degree in Environmental Engineering. Her interests include water pollution control and water and wast water treatment. Ms. Barroso is currently under the mentorship of Dr. Yelena Katsenovich on Project 2: Rapid Deployment of Engineered Solutions for Environmental Problems at Hanford, Task 4: Investigation of Uranium Contamination in Hanford Soil. She is investigating the insolubility and immobility of uranium having precipitated or co-precipitated with aluminum and silicon by means of pH manipulation using NH_3 and silicone under site specific conditions, and is assisting with Subtask 4.1: Effect of pH and Temperature on the Carbonate Promoted Dissolution of Meta-Autunite.

Givens Cherilus (Electrical Engineering)

Mr. Givens Cherilus is currently a senior working towards completing his Bachelor's degree in Electrical Engineering while in the Honor's College. After graduation he plans to further his education by pursuing a Master's degree. He is eager to contribute to a DOE project. His interests include clean and renewable energy, especially solar power, and electronics design.

Elicek Delgado-Cepero (Electrical Engineering)

Ms. Elicek Delgado-Cepero's research interests include remote powering of sensors via rectifying antennas and their optimization, wireless communications in free space and harsh environments, sensor networks, and communications systems.

In the Summer of 2009, she was one of the students selected for the Summer Undergraduate Program in Engineering Research at Berkely (SUPERB) at UC Berkeley. She interned at the Berkeley Wireless Research Center (BWRC). Her research goals were improving the design method for on-chip spiral inductors by introducing a multilayer approach that would save space inside integrated circuits (ICs).

Ms. Delgado-Cepero is currently pursuing her Master's degree in Electrical Engineering with a focus on microwave engineering and telecommunications. Her research goals are focused on development of a wireless monitoring system and instrumentation for the DOE in-situ decommissioning tanks.

Janty Ghazi (Electrical Engineering)

Mr. Janty Ghazi is working towards his Bachelor's degree in Electrical Engineering with a specialization in both power and communications. He is interested in renewable energies, the development of more efficient power distribution systems, as well as the development and use of cleaner forms of energy production. Mr. Ghazi works under the mentorship of Mr. Jose Varona, on the use of Electrical Capacitance Tomography (ECT) as a potential means to determine the solid concentration of a mixture.

Heidi Henderson (Environmental Engineering)

Ms. Heidi Henderson is currently pursuing her Master's degree in Environmental Engineering. She has 5 years of consulting experience in land development throughout Central and South Florida. Her true passion lies within keeping our waters clean, discovering reusable energy resources, and providing a sustainable environment for the future ahead.

Ms. Henderson has been responsible for gathering information from DOE on previous technologies and methodologies used for decontamination and decommissioning of nuclear waste, and making that available to the D&D community via the D&D Knowledge Management Informational Tool (KM-IT). She will also be identifying and demonstrating new technologies for future application of DOE D&D projects.

Kanchana Iyer (Biomedical Engineering)

Ms. Kanchana Iyer is currently a Ph.D. Candidate in Biomedical Engineering. She has conducted her research under the support of the RISE Program, sponsored by the National Institutes of Health (NIH). Ms. Iyer has been investigating blood compatibility of novel polymers and metal alloys for potential use in cardiovascular devices. She has also been involved in the development of protocols for in vitro and in vivo experimentation of hemocompatibility, as no standardized protocols currently exist. Ms. Iyer is a member of the Biomedical Engineering Society, Alpha Eta Mu Beta Biomedical Engineering Honor Society, and Golden Key International Honour Society.

Alexander Lopez (Environmental Engineering)

Mr. Alexander Lopez has a Bachelor of Science degree in Environmental Engineering from Florida International University. Mr. Lopez participated in a summer internship with the Florida Department of Environmental Protection (DEP) as a Water Facilities Intern. He studied the Lake Worth Lagoon ecosystem, and investigated any correlation between wastewater spills/leaks in Palm Beach County and the health of the Lagoon. He is currently pursuing a Master's degree in Environmental Engineering. Mr. Lopez worked with Dr. Prabhakar Pant, researching the 200 Area of the Hanford Site in Washington. His focus included assessing levels of contamination present in the vadose zone and which contaminants are of greatest concern. Mr. Lopez was using the HYDRUS-1D program, which is a modeling software to aid in research efforts and provide models of uranium and other contaminants fate and transport through the unsaturated zone.

Sheidyn Ng (Biomedical Engineering)

Ms. Sheidyn Ng is currently a senior undergraduate student. She has worked on nanotechnology projects as a laboratory assistant with mechanical engineering. She plans to continue her education by getting her Master's degree.

Ms. Ng is currently working under the mentorship of Dr. Yelena Katsenovich on the uranium bioremediation of the 200 Area at the Hanford Site in Washington State. She is studying the effect in which Arthrobacter bacteria has on uranium concentration. Due to the different bacterial strands, the effect on the uranium mobility might vary. With varying uranium concentrations, the Arthrobacter may affect the uranium mobility.

Shina Rana (Electrical Engineering)

Ms. Shina Rana is pursuing her Bachelor's degree in Electrical Engineering with concentration in Communications. She is a member of IEEE. She plans to obtain her Master's degree in Electrical Engineering. Her interests include control systems and efficient clean energy. Ms. Rana is working under the supervision and mentorship of Mr. Jose Varona on Project 1: Asynchronous pulse unit.

Melissa Sanchez (Environmental Engineering)

Ms. Melissa Sanchez is currently pursuing her Bachelor's degree. She plans to continue her studies and obtain her Master's degree in Environmental Engineering with an emphasis in water resources. She is also interested in studying possibility of reusing waste water and the new technologies to achieve this.

Ms. Sanchez worked with Dr. Prabhakar Pant on uranium remediation of the 200 Area at the Hanford Site in Washington State, specifically on the vadose zone.

10.0 SUMMER 2011 DOE FELLOWS INTERNSHIPS

A total of 11 DOE Fellows are participating (or will be participating) in internships at DOE Headquarters, DOE sites, and DOE national laboratories during summer 2011. Two DOE Fellows will be going to DOE-HQ (Forrestal and Germantown) this summer. In addition, one DOE Fellow will be working at Oak Ridge National Laboratory and one DOE fellow will intern at Lawrence Livermore National Laboratory. One DOE Fellow will be interning at Pacific Northwest National Laboratory and an additional two DOE Fellows will be interning with Washington River Protection Solutions/Areva Federal Services. One DOE Fellow will be going to the Moab Site in Utah. Finally, three DOE Fellows will be supporting the Savannah River Site this summer. The table below describes the DOE Fellows participating in internships, the site/national lab, their assigned mentors, and the timeframe of the internship.

Table 5. List of DOE Fellows Participating in Internships during 2011

DOE Fellow Intern	Site/Office/Lab	City	Supervisor/Mentor	Date
Sheidyn Ng	DOE-HQ EM20	Washington DC	Kenneth Picha	06/06/11-08/12/11
Heidi Henderson	DOE-HQ EM30	Washington DC	Ana Han	06/06/11-08/12/11
Mario Vargas	Lawrence Livermore Nat. Lab	Livermore, CA	Mark Bronson/John Kerns	06/09/11-08/12/11
Jose Matos	Washington River Protection Solutions /Areva Federal Services	Richland, WA	Ruben Mendoza P.E.	06/06/11-08/12/11
Janty Ghazi	Washington River Protection Solutions /Areva Federal Services	Richland, WA	Ruben Mendoza P.E.	06/06/11-08/12/11
Rinaldo Gonzalez	Pacific Northwest Nat. Lab	Richland, WA	Kenneth Johnson	06/06/11-08/12/11
Alex Henao	Moab Site	Moab, Utah	Mr. Ryan Barker and Mr. Ken Pill	06/06/11-08/12/11
Givens Cherilus	Savannah River Site	Aiken, SC	Dr. Marissa Reigel/Alex Cozzi	06/06/11-08/12/11
Amaury Betancourt	Savannah River National Lab	Aiken, SC	Dr. Brian Looney SRNL	06/06/11-08/12/11
William Mendez	Savannah River Site	Aiken, SC	Luke Reid, Manager,	06/13/11-08/19/11
Stephen Wood	Oak Ridge National Lab	Oak Ridge, TN	Dr. Ralf Deiterding	06/06/11-08/12/11

11.0 OTHER PROGRAM ACTIVITIES

11.1 Engineering Expo 2011

On February 24, 2011, FIU's College of Engineering and Computing hosted the tenth 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 third year in a row, the DOE Fellows gave tours of ARC's 4 laboratories in which they presented their current research (Figures 69 through 72).

Figure 69. DOE Fellows at the Engineering Expo Booth outside of FIU's Applied Research Center.

Figure 70. DOE Fellow, Alex Henao, presenting his work at the Analytical Lab to a group of high school students.

Figure 71. DOE Fellow, Amaury Betancourt presenting at the Soil and Ground Water Lab to a group of high school students.

Figure 72. DOE Fellow, Nadia Lima, presenting the cellular concrete mock up test at the High Bay Lab to a group of high school students interested in pursuing an engineering career.

11.2 Baynanza 2011

Eleven (11) DOE Fellows participated in the Biscayne Bay Cleanup Day on April 16, 2011. Volunteers from across the community gathered to clean up garbage from the shores and islands of the bay.

Figure 73. DOE Fellow, Janty Ghazi, picking up trash at the Biscayne Bay shore.

Figure 74. A few of the DOE Fellows that participated in the Baynanza Event.

11.3 Website and Facebook

Program information can be found at http://arc.fiu.edu/Intern. 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.

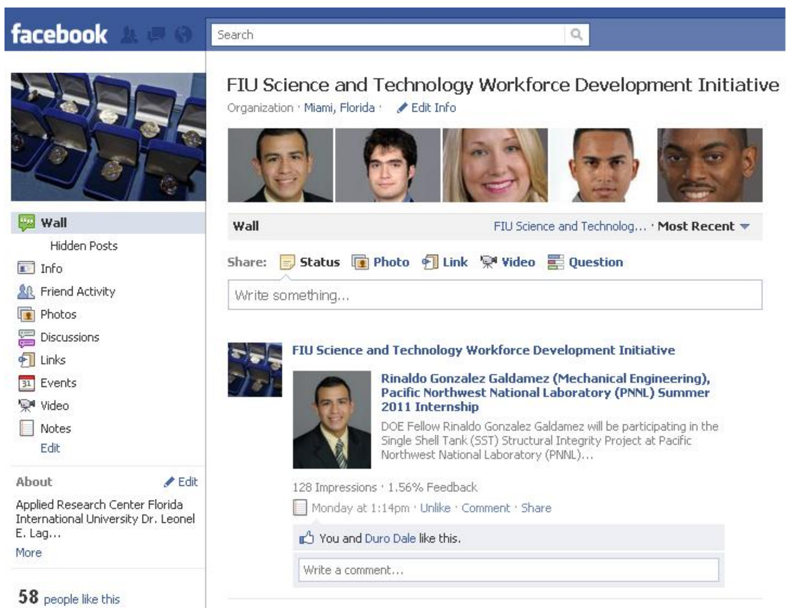


Figure 75. Preview of the DOE Fellow's Facebook page.

11.4 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, prepared an 8-minute video describing what it means to be a DOE Fellow (Figure 76). 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-30 quarterly program review in Aiken, SC.

Figure 76. 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 16-week internships at ORNL, PNNL, Savannah River, Hanford, DOE Field Office at Oak Ridge, and DOE HQ in Washington, DC. In addition, DOE Fellow Stephen Wood won best student poster at the Waste Management Symposia 2011. Finally, six DOE Fellows applied to DOE EM's Student Career Experience Program (SCEP) and three were selected and are currently working at DOE-HQ in Washington, DC. Additional information about the entire program and the DOE Fellows can be found on the website http://arc.fiu.edu/Intern/.

Major key accomplishments for FY10-11 included:

- DOE Fellows, Edgard Espinosa, Charles Castello, and Lee Brady were selected by DOE EM as part of Student Career Experience Program (SCEP). These Fellows are currently at DOE-HQ working for EM-30, EM-32, and EM-44, 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 44 internships at DOE sites, DOE national labs, DOE-HQ, and DOE contractors since 2007
- 54 presentations (posters and papers) at Waste Management conferences (2008, 2009, 2010, 2011)
- Twenty-one (21) DOE Fellows (FIU minority students) continuing to Master/Ph.D. degrees at FIU
- Eight (9) DOE Fellows applied to 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 www.arc.fiu.edu/intern 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).

- Successfully organized and conducted the 2010 Induction Ceremony (November 2010). DOE HQ was represented by Ms. Ines Triay (DOE's Assistant Secretary for Environmental Management), FIU was represented by Dr. Douglas Wartsok (FIU Provost), Dr. Andres Gil (Vice President for Research), Dr. John Proni (ARC Executive Director), Dr. Leonel E. Lagos (Director, DOE Fellows Program), faculty, staff, and students.
- Successfully established and executed a Memorandum of Understanding Signing Ceremony. MOUs were put in placed with Savannah River National Laboratory and Y-12 National Security Complex. The signing ceremony immediately followed the 2010 DOE Fellows Induction Ceremony
- Prior to the Induction Ceremony and Poster Exhibition, the DOE Fellows presented their work/research by making formal oral presentations and conducting a lab tour.

APPENDIX A
DOE FELLOWS INTERNSHIP REPORTS – SUMMER 2010

[DOE Fellows Summer Intership Reports will be added once reviews to this document are completed. These reports are also available at the program's website, www.arc.fiu.edu/intern