PROJECT TECHNICAL PLAN

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

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INTRODUCTION

Florida International University (FIU), the largest Hispanic serving research-extensive institution in the continental United States, is one of the nation's leading producers of scientists and engineers from underrepresented groups. In 1995, the U.S. Department of Energy created a unique partnership with FIU to support environmental cleanup technology development, testing and deployment at DOE sites. This partnership spawned a research center at FIU dedicated to applied environmental R&D. The center, now known as the Applied Research Center, has tackled and helped solve multiple problems at many DOE sites. The DOE-FIU Science and Technology Workforce Development 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. Since its inception, the DOE-FIU Science & Technology Workforce Development Initiative program has inducted 108 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 EM, Mr. Jim Rispoli (2008); Ms. Yvette Collazo (2009); former Assistant Secretary for EM, Ms. Ines Triay (2010); Acting Principal Assistant Secretary for EM, Ms. Tracy Mustin (2011); Associate Principal Deputy Assistance Secretary for EM, Ms. Alice Williams (2012); Senior Advisor to the U.S. Secretary of Energy for Environmental Management, Elizabeth Connell (2013), and Acting Deputy Assistant Secretary for Tank Waste and Nuclear Materials Management, DOE Office of Environmental Management Mr. Kenneth Picha (2014). All of 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 U.S. As of summer 2015, DOE Fellows have completed over 95 summer internship assignments. Since the program inception in 2007, DOE Fellows have given over 142 poster and oral presentations at national and international conferences such as the Waste Management Symposium (2008-2014), the

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American Nuclear Society conferences, and International Conference on Environmental Remediation and Radioactive Waste Management (ICEM). DOE Fellows from FIU won the Student Poster Competitions at WM09, WM10, WM11, WM14, and WM15 and one DOE Fellow received the award for the best poster out of all the professional poster sessions presented at WM09. In 2011, three DOE Fellows joined DOE-EM via the Student Career Experience Program (SCEP), and two continued with DOE-EM on a fulltime basis. DOE Fellows' activities are showcased via a specially developed website available at http://fellows.fiu.edu.

TECHNOLOGY NEEDS

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 DOE and within DOE 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. This shortage could lead to real potential risks to DOE's environmental programs. If not addressed, this will translate into knowledge gaps (discontinuity of lessons learned) within the department and the lack of skilled personnel to carry out its cleanup mission effectively.

PROJECT DESCRIPTION

Objectives

The DOE-FIU Science and Technology Workforce Development Initiative has been designed to build upon the existing DOE/FIU relationship by creating a "pipeline" of minority engineers specifically trained and mentored to enter the Department of Energy workforce in technical areas of need. The main objective of the program is to provide interested students with a unique opportunity to integrate course work, DOE field work, and applied research work at FIU into a well-structured academic program that leads to entry into DOE EM's Pathways Program. Students selected as DOE Fellows perform research at FIU and at DOE sites, national laboratories, and DOE contractors. Upon graduation and completion of this fellowship, the students will submit an application to join the DOE federal internships programs such as the Pathways Program, apply to DOE contractors, pursue post-master or postdoctoral positions at DOE national labs, or apply to private industry in their field of study.

Benefits

Benefits to DOE:

- Involve students in active DOE EM applied research projects to develop a future pool of scientists and engineers specially trained and mentored on DOE-EM technical issues;
- Maintain and transfer DOE –EM knowledge to future generation of EM's workforce; and
- Leverage cost savings to DOE EM by utilizing student participation in projects.

Benefits to FIU/ARC:

- Train future workforce on DOE-EM technical issues/areas which will enhance their career opportunities and marketability;

- Increase the number of minority undergraduate students (U.S. citizen or permanent residents) going into graduate studies in STEM disciplines;
- Promote, create, and secure career opportunities for FIU students in critical government areas;
- Enhance faculty engagement in applied technology applications;
- Enhance academic opportunities with the FIU College of Engineering & Computing and College of Arts & Sciences by developing programs under which students and faculty may receive academic credit for work on DOE research projects (thesis, PhDs, senior design projects, independent research credits, etc.);
- Promote and improve students' interest in science, technology, engineering and mathematics (STEM); and
- Advance undergraduate, graduate, post-doctorate fellows, and faculty efforts with mentors.

PROJECT EXECUTION PLAN

The FIU minority students selected for this program, coined "**DOE Fellows**," are being mentored and trained through a combination of internships at DOE sites and/or national laboratories, DOE related hands-on applied research at FIU-ARC, workshops, seminars, and conferences. To achieve the objectives of this program, the following subtasks have been identified for FIU Year 6:

Task 1: Recruitment Efforts

During this performance year, FIU-ARC will conduct recruitment efforts during Fall Semester 2015 and Spring Semester 2016. The plan for identification and recruitment of DOE Fellows includes the following:

1. DOE Fellows Information Sessions at College of Engineering and College of Arts & Sciences;
2. Posters/flyers placed across the FIU campus;
3. Setup recruitment tables at College of Engineering and College of Arts & Sciences. Tables will be manned by current DOE Fellows;
4. Conduct in-class room presentations of DOE Fellows Program at selected STEM classes (undergraduate and graduate levels);
5. Advertisements placed in the student newspaper and in the University-wide, daily e-mail notices;
6. Members of the DOE Fellowship Committee attend faculty meetings and meetings of several relevant student societies to explain program and seek referrals and nominations;
7. Conduct an ARC Open House at beginning of Fall and/or Spring semester;
8. Announcements on webpages designed and dedicated to the DOE-FIU Science and Engineering Workforce Development Initiative program. The webpage (http://fellows.fiu.edu) contains information related to the program and is constantly being updated with new information and DOE Fellows research updates.

It is projected that ten (10) additional Fellows from the College of Engineering and the College of Arts and Sciences will be selected for this program. The Fellows will be asked to demonstrate their commitment to the program by completing the DOE-FIU Science and Engineering Workforce Development Initiative Acceptance Packets. Each acceptance packet will consist of: (a) faculty mentor agreement form, (b) research abstract form, (c) Fellow's biographical sketch form, (d) research project summary form, (e) guidelines for completing the acceptance packet, and (f) an application form.

The Fellows will be first interviewed one-on-one and given a packet of information and an application. Upon completion of the application and forms, the student applicant will be interviewed by the DOE Fellowship Committee, who will rate the student on academics, aptitude, interpersonal skills, and any additional selection criteria developed by the Committee.

The final selection of students will occur in October 2015 (Fall recruitment effort) and in May 2016 (Spring recruitment effort) after all applicants have been interviewed and assessed.

Task 2: Work Identification and Assignments

FIU's Applied Research Center will provide leadership in the development and management of this program. Under the Cooperative Agreement, FIU provides support in the areas of waste management, soil/groundwater modeling and research, deactivation & decommissioning, and IT development for environmental applications. The DOE Fellows directly support FIU-ARC staff in the development of the technical work under this agreement. The Fellows are assigned to supervisors/mentors and support the ongoing research by working on a part-time basis (approximately 20 hrs/week). The DOE Fellows support all tasks under the Cooperative Agreement while pursuing their STEM degrees at FIU.

It is expected that the applied research being conducted will provide the basis for the development of master theses and/or PhD dissertations for Fellows pursuing graduate degrees. The applied research will also provide senior research project and Capstone project opportunities for DOE Fellows pursuing undergraduate technical degrees.

Task 3: ARC Poster Competition

FIU-ARC will coordinate and host the DOE Fellows Poster Exhibition & Competition in October 2015. DOE Fellows will prepare posters to be presented at this annual event to showcase their research accomplishments in the areas of high-level waste, soil and groundwater, deactivation & decommissioning (D&D), and information technology (IT) in support of the Department of Energy's Office of Environmental Management.

Task 4: Induction Ceremony

FIU-ARC will coordinate and conduct the ninth (9th) DOE Fellows Induction Ceremony in November 2015 during which the newly selected FIU minority students will be inducted as DOE Fellows. DOE-HQ officials, DOE site mentors; FIU faculty and administrators, FIU-ARC scientists, and DOE Fellows will be invited to participate in this event. The day's activities will include a review of the workforce development program, presentations by the students of their summer and ARC research, tours of FIU-ARC facilities and laboratories, and a poster exhibition.

Task 5: Summer Internship Program

FIU-ARC personnel will assist in the selection, planning, and coordination of Summer Internship Program (SIP) at DOE facilities. In this program, Fellows will participate in a 10-week summer internship at a DOE facility. Approximately 6-10 DOE Fellows will be paired with scientists/engineers at DOE facilities and/or national laboratories and DOE contractors (e.g., Washington River Protection Solutions, Savannah River Nuclear Solutions, etc). During the ten weeks, the Fellows will work on environmental research projects under the guidance of their site scientist mentors. FIU personnel will provide assistance in monitoring the progress of summer interns and their research work. FIU personnel, with the help of DOE site internship program coordinators, will identify mentors at selected DOE sites to work with FIU summer interns. At Oak Ridge, FIU students will be integrated into existing summer internship programs managed

by the Oak Ridge Institute for Science and Education (ORISE). At Hanford, the students will be integrated into existing internship programs managed by DOE Richland. Idaho National Laboratory, DOE-HQ (Forrestal and Cloverleaf), and the Savannah River Site will also be targeted for summer internships.

Task 6: Summer Internship Technical Reports

At the completion of the summer internships, the DOE Fellows will prepare Summer Internship Technical Reports on the research work they performed over the summer. Each DOE Fellow will seek input and review of the report from their site scientist mentors and final reports will be submitted to DOE HQ and made available on the DOE Fellows website (http://fellows.fiu.edu).

Task 7: Conference Participation and Presentations

DOE Fellows will attend and participate in industry conferences during FIU Year 6, including the Waste Management Symposia in Phoenix, AZ and other conferences. The students will submit abstracts and develop student and professional posters and oral presentations based on their research performed at FIU ARC and during their summer internships.

Task 8: Professional Development & Nuclear Industry Knowledge

During the execution of FIU Year 6 scope, DOE Fellows will be exposed to a series of professional development opportunities such as nuclear related training and classroom work. ARC will work with FIU's chemistry, physics, and engineering departments to identify existing course/class work that would expand the DOE Fellows knowledge of DOE-EM's nuclear history and legacy. ARC will facilitate the transfer of knowledge by encouraging and arranging opportunities for DOE Fellows to have access to these courses. As an example, ARC will reach out to the DOE complex, DOE-HQ, EPRI, INPO and other organizations to identify courses or course material to facilitate the DOE Fellows. The concept of this task is to increase the knowledge of our Fellows on the topics of nuclear cleanup legacy, nuclear energy, and the nuclear industry in general. A list of courses/opportunities (webinars, lectures, courses, etc.) will be identified and provided to the Fellows. Based on their professional and academic interests, the Fellows will select the course(s) to engage in.

Task 9: HBCU Integration

During FIU Year 6, FIU will expand communication and engagement with DOE EM HBCU STEM programs to promote collaborative synergistic research and STEM development efforts between FIU and HBCU universities related to EM technical issues and challenges. FIU will also initiate and support Minority Serving Institutions (MSI) Student Poster Competitions. FIU will work with Savannah River National Lab, Pacific Northwest, and Los Alamos National Lab to integrate participation of HBCUs and FIU students. Students will showcase their DOE EM research during this competition. The best posters will be presented to DOE EM leadership in Washington DC and/or displayed at DOE HQ.

Task 10: Promote Career Opportunities

FIU will engage EM-70 (Human Resources) to enhance the recognition across the DOE EM complex of the DOE Fellows as they finish the Program, graduate from FIU, and enter the workforce. Employment opportunities at DOE HQ, DOE sites, DOE national laboratories, and DOE contractors will be actively sought. In addition, FIU will engage in the human resource contacts at both DOE and the contractors to highlight the special knowledge and skills these trained DOE Fellows bring with them. ARC mentors will work with individual DOE Fellows as they enter their last terms at FIU to assess their career goals, identify target employers, develop job profiles (e.g., USA Jobs) and resumes, complete employment applications, and practice for interviews.

Task 11: DOE EM Student Challenge

In an effort to obtain innovative, out-of-the-box, and sustainable solutions to DOE EM's technical challenges, FIU-ARC will work closely with EM-13 to establish a pilot project to engage FIU students in a DOE EM Student Challenge. This challenge will leverage the imagination and intellect of young minds to gain a fresh perspective for potential new solutions that utilize sustainability principles to overcome DOE EM's most challenging problem sets.

The following steps are envisioned for this pilot program:

- DOE HQ will solicit DOE sites and national laboratories to pose technical challenges being faced at DOE EM's cleanup sites based on categories selected by HQ. For FIU Year 6, the initial pilot's category will be Facility Engineering with a focus on sustainable solutions to the technical challenges of surveillance and maintenance (S&M) activities.
- The challenge would be opened to DOE Fellows who will select a topic from the proposed challenges, form a multi-disciplinary student team consisting of DOE Fellows as well as other FIU STEM students, and conduct the necessary **preliminary** research to identify potential solutions. The team will then develop a research plan for their proposed DOE Fellow Challenge Project. Limits and rules on the use of other FIU student resources to form teams will be established prior to announcing the challenge project.
- A selection panel made up of representatives from the DOE sites and national labs will select three of the proposed DOE Fellow Challenge Projects.
- The selected teams will execute their projects within set parameters (time, allowed resources, etc.) that will be established.
- At the end of the Challenge, each team will submit their results via presentation to a panel of representatives from DOE sites, national labs, and DOE HQ.
- Selected winners will be recognized at a meeting in DOE HQ and/or at the annual DOE Fellows Induction Ceremony hosted at FIU each November.

The research approach of the Challenge teams may include the identification of new *cutting-edge technologies* that can offer a unique opportunity for EM's S&M activities. Student team activities may include:

- **Identify** within and outside of EM where new cutting-edge technology innovations are being introduced to address S&M
    - Consider other enterprises where cutting-edge tech applications might be adaptable to EM S&M which provide -
        - Natural "fits" while being
        - Innovative and crosscutting
    - Propose new applications for cutting edge technologies (what/where) for optimizing S&M activities with a focus on increasing sustainability as well as:
        - increasing safety,
        - lowering operational costs,
        - improving operational efficiencies, and
        - improving schedules.
- **Technology** – examples to consider include but are not limited to:
    - *Drones* (to include identifying potential regulatory issues/impacts, e.g., FAA)
        - Orthofotos - a scaled, geometrically corrected aerial photo
        - Miniature UAV - http://en.wikipedia.org/wiki/Miniature_UAV
        - Swarm technology and applications
    - *Robotics*
        - Autonomous surveying and mapping
        - Single and/or dual arm robotic platforms – multiple applications
    - *Sensor and mobile device integration* (e.g., smartphones & tablets interfaced with sensors - thermal, rad, seismic, etc.)
        - Sensory arrays for drones and robotic platforms
        - Geo-fencing where users set boundaries to create a "virtual box" for the drone to stay within
    - *Augmented Virtual Presence*
        - Glasses at Work (Google) - https://developers.google.com/glass/distribute/glass-at-work
        - Microsoft Hololens - https://www.microsoft.com/microsoft-hololens/en-us]
    - *Mobile device applications*
        - Command & control functionality integration
        - Sensor interface
        - Task management
        - Records management
        - Document control

Green and sustainability principles will be an integral part of the Challenge teams' technical solutions to the problem set being studied. The students will share their findings with EM-13 and EM-10 for potential cross-cutting applications and knowledge transfer. The acquired knowledge will also be shared by developing a final report at the end of the Challenge. In addition, monthly and quarterly progress reports will be developed. Project information and final reports will be posted in the DOE Fellows website (http://fellows.fiu.edu) and the FIU's DOE Research website (https://doeresearch.fiu.edu/). In addition, final reports meeting the criteria for submission to the Office of Science and Technical Information (OSTI) shall be identified. With guidance from their team mentors, DOE Fellows shall be encourage to submit papers to conferences, such as the Waste Management Conference, as well as for journal submissions.

Project Milestones

The following table describes the milestones for this project during FIU Year 6.

Milestone No.	Milestone Description	Completion Criteria	Due Date
2015-P5-M1	Draft Summer Internships Reports Completed	E-mail notification to DOE	10/16/15
2015-P5-M2	Selection of new DOE Fellows – Fall 2015	E-mail notification to DOE	10/30/15
2015-P5-M3	Conduct Induction Ceremony – Class of 2015	Completion of Ceremony	11/05/15*
2015-P5-M4	Waste Management Symposium 2016	Submit student poster abstracts to conference	1/16/16

**Completion of this milestone depends on availability of DOE-HQ official (s)*

Deliverables*

Client Deliverables	Responsibility	Acceptance Criteria	Due Date
Draft Project Technical Plan sent to DOE	Program Director	Acknowledgement of receipt via E-mail two weeks after submission	10/05/15
Deliver Summer 2015 Interns reports to DOE	Program Director	Acknowledgement of receipt via E-mail two weeks after submission	10/30/15
List of identified/recruited DOE Fellow (Class of 2015)	Program Director	Acknowledgement of receipt via E-mail two weeks after submission	10/30/15
Update Technical Fact Sheet	Program Director	Acknowledgement of receipt via E-mail two weeks after submission	30 days after end of project
Draft Year End Report	Project Manager	Acknowledgement of receipt via E-mail two weeks after submission	10/14/2016
Monthly Progress Report	Project Manager	Acknowledgement of receipt via E-mail two weeks after submission	Monthly
Quarterly Progress Reports	Project Manager	Acknowledgement of receipt via E-mail two weeks after submission	Quarterly
Presentation overview to DOE HQ/Site POCs of the project progress and accomplishments (Mid-Year Review)	Project Manager	Presentation to DOE HQ and Site POCs	02/29/2016 **
Presentation overview to DOE HQ/Site POCs of the project progress and accomplishments (Year End Review)	Project Manager	Presentation to DOE HQ and Site POCs	8/31/2016 **

**Final documents will be submitted to DOE within 30 days of the receipt of comments on the draft documents.*

***Completion of this deliverable depends on availability of DOE-HQ official(s)*

COMMUNICATION PLAN, ISSUES, REGULATORY POLICES AND HEALTH AND SAFETY

Communication Plan

The project has some elements that require significant information and/or action from the site in order to proceed with proposed scope. Therefore, the communication with the clients and relevant experts at DOE sites, DOE contractors and DOE-HQ is a critical component of the project. The mode of communication will be e-mails, telephone/conference call, and meeting at the site. Though site-specific contact persons have been identified, constant communication will be maintained with client stakeholders at DOE HQ, DOE sites, and DOE contractors to ensure all parties involved are aware of the project progress.

Information Item	Client Stakeholder	When?	Communication Method	Responsible Stakeholder
Status Update Teleconferences	DOE-HQ, EM-70	Monthly	Phone	Program Director/Principal Investigator
EM-HQ Status Update Phone Call	DOE EM-13	Bi-Weekly	Phone	Principal Investigator
Quarterly Report	DOE EM-13 and EM-70	End of Q1, Q2, Q3, Q4	E-mail notification	Program Director/ Principal Investigator
Draft Year End Report	DOE EM-13 and EM-70	30 working days after completion of performance period	E-mail notification	Program Director/ Principal Investigator
Milestone completion E-mails	DOE EM-13 and EM-70	At completion of milestone	E-mail notification	Program Director

Anticipated Issues

Much one-on-one mentoring will be given to students in order to minimize the potential for students dropping out. The student selection process will also review maturity of students in order to assess their ability to join and complete the DOE EM Fellow Program. Finally, by crafting challenging research projects both at ARC and at DOE sites, students will remain more engaged.

Due to the large pool of undergraduate engineers and scientists at FIU, there will be a great focus in getting undergraduates interested in graduate school and in a STEM career. During their graduate studies, they will be presented with the opportunities and benefits of a career with the federal government and in environmental cleanup in general.

DOE Fellows who are graduate students usually base their master's thesis or PhD dissertation on the research they perform for DOE EM while employed at ARC. Research for a master's thesis typically needs one (1) solid year of research to support the development of the thesis, with a PhD dissertation needing a somewhat longer period of research time. A sudden re-direction of project scope could impact graduate students who are using that research scope as the basis of their graduate studies. FIU will communicate closely with DOE HQ and site contacts throughout the performance of the research tasks in order to accurately forecast the duration of the research tasks and minimize the potential negative impact of scope redirection on the graduate studies of any students working on that task.

Ultimate success of this program will depend on the ability of DOE-EM and its contractors to hire the extremely qualified and EM groomed DOE Fellows. Highly qualified and trained DOE Fellows will apply to DOE EM programs such as the federal Pathways Program. The program director will work closely with the DOE-EM Human Capital Office (EM-70) and DOE mentors to enhance the chances for hiring of DOE Fellows. The director will also work with DOE contractors and DOE national laboratories to secure position for our DOE Fellows.

Regulatory Policies and Safety Concerns

This project involves research projects conducted at DOE sites, DOE contractor facilities, and in existing facilities at the Applied Research Center designed specifically for R&D and technology demonstrations. All primary, secondary, and tertiary waste generated by these activities will be disposed of according to local, state, and federal regulations. In-house testing will be conducted, and necessary health and safety precautions will be followed in accordance with FIU and ARC procedures. All student employees will complete FIU online safety courses as well as a briefing for the safety in the laboratory in which they are performing research. In addition, the DOE Fellows program will require the DOE Fellows to take the hands-on radiation safety course offered by FIU. No undergraduate student will perform research in a laboratory without direct oversight of faculty, staff, or a qualified graduate student. In addition, during internships, DOE Fellows will receive site specific training from the hosting DOE site or facility as needed for the work that they will be performing. The interning DOE Fellows will follow the health and safety policies and procedures of the hosting site/facility.