QUARTERLY PROGRESS REPORT

October 1, 2011 to December 31, 2011

Florida International University's Continued Research Support for the Department of Energy's Office of Environmental Management

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Introduction

The Applied Research Center (ARC) at Florida International University (FIU) executed work on five major projects that represent FIU-ARC's continued support to the Department of Energy's Office of Environmental Management (DOE-EM). The projects are important to EM's mission of accelerated risk reduction and cleanup of the environmental legacy of the nation's nuclear weapons program. The information in this document provides a summary of the FIU-ARC's activities under the DOE Cooperative Agreement (Contract # DE-EM0000598) for the period of October 1 to December 31, 2011.

Project 1
Chemical Process Alternatives for Radioactive Waste

Project Manager: Dr. Dwayne McDaniel

Project Description

Florida International University has been conducting research on several promising alternative processes and technologies that can be applied to address several operational shortcomings in the current high-level waste processing strategy. The implementation of advanced technologies to address challenges faced with baseline methods is of great interest to the Hanford site. Specifically, the use of field or *in situ* technologies, as well as advanced computational methods can improve several facets of the retrieval and transport processes of HLW. FIU has worked with site personnel to identify three technology and process improvement needs that can benefit from FIU's core expertise in HLW. These needs are being addressed by the following tasks:

- Task 2: Pipeline Unplugging and Plug Prevention
- Task 12: Multiple-Relaxation-Time, Lattice Boltzmann Model for High-Density Ratio, Multiphase Flows
- Task 15: Evaluation of Advanced Instrumentation Needs for HLW Retrieval

Task 2: Pipeline Unplugging and Plug Prevention

Task 2 Overview

Over the past few years, FIU has found that commercial technologies do not meet the needs of DOE Sites in terms of their ability to unplug blocked HLW pipelines. FIU has since undertaken the task of developing alternative methods/technologies with the guidance from engineers at the national laboratories and site personnel. The new approaches that are being investigated include an asynchronous pulsing method and a peristaltic crawler. Both technologies utilize lessons learned from previous experimental testing and offer advantages that other commercially available technologies lack. The objective of this task is to continue efforts on the development of the two novel technologies for pipeline unplugging. The first phase of experimental testing conducted during the previous performance period demonstrated the technologies' potential for successful pipeline unplugging operations. The research that is being carried out during this performance period focuses on the experimental testing of the technologies on a larger scale.

Task 2 Quarterly Progress

- Results from the finite element analysis (FEA) of the peristaltic crawler were utilized to design a hydroformed bellow and an edge-welded bellow for the system. In addition, the bellow flanges were re-designed to accommodate the new bellow design. The flange design was sent to several vendors for quotes, but had to undergo revisions to meet manufacturing limitations.
- Designs of the inner bellow and associated flanges were completed and procured from a down-selected manufacturer. The outer bellow was received from the selected manufacturer. Discussions on design requirement for bellow flange welds were held with

subject matter experts. Inner bellows with welded flanges for the 3rd generation crawler were received from the manufacturer. FIU has completed the final design and engineering drawings of the rims that attach the inner and outer bellow flanges. Bench-scale tests have been conducted to evaluate the cycle time performance of the new bellows. Additional bench-scale tests to determine the maximum anchor force of the rims when the cavity is inflated are in progress. Bullet-type miniature pneumatic valves were investigated and procured for consideration to improve the cycle time of the crawler. Purchase orders for ancillary equipment including the tether and reel system have been issued. The next performance period will focus on the design, manufacturing and welding of the rims to the inner and outer bellows.

- An analysis of the pressure losses with tether length and possible tether designs was performed. The goal is to reach a design that can accommodate the pneumatic, hydraulic and fiber optic lines while keeping pressure losses to a minimum. Possible options for flexible lines and line jackets are under evaluation with input from several manufacturers.
- Evaluation of an on-board fiber optic camera, and the placement of the pneumatic control valves on the crawler itself, was performed
- For the Asynchronous Pulsing System (APS), a revised test plan was sent to the Hanford Site on October 12, 2011. Parametric testing was performed on the modified pipeline loop to determine if the established operating parameters needed revision due to the redesigned system. Also, unplugging trials were performed on the bench-scale pipeline loop utilizing K-mag-based plugs. Several successful unplugging trials were achieved with a combination of a fully flooded system, hydraulic drive pressure of 500 psig, loop static pressure of approximately 50 psig and a pulsation frequency of 2 Hz. Unplugging trials with a partially flooded loop have been inconclusive thus far. All bench-scale tests were completed and a summary document was provided to Hanford Site engineers and the EM-31 lead. The system's major components were disassembled to check for wear and the system's piston pumps were sent out to be overhauled. Work has commenced on the design of the large scale loop and pressure system.

Task 12: Multiple-Relaxation-Time, Lattice Boltzmann Model for High-Density Ratio, Multiphase Flows

Task 12 Overview

This task uses the knowledge acquired at FIU on implementing the Lattice Boltzmann Model (LBM) for multiphase flow modeling to create a multi-phase LBM using multiple-relaxation-time (MRT) collision models in three-dimensions having high performance computing capabilities. Focus is given to bubble dynamics in liquids, and the simulation results are being validated against the analytical and experimental data published in the literature for buoyant bubbles rising in liquid columns under the influence of gravity. The objective of this task is to provide the sites with mathematical modeling, validation, and testing of computer programs to support critical issues related to HLW retrieval and processing.

Task 12 Quarterly Progress

- The 2D MRT serial code was converted into a parallel version and the validation tests were conducted. 3D bubble rising simulations were conducted using the 3D LBM MRT code for validation purposes. Experimental images and empirical correlations for rising bubbles were used as benchmark solutions. The theory and the numerical method used for the 3D LBM MRT code were documented in a report and a Waste Management Symposia paper.
- The 280-core parallel computer at FIU has been maintained and prepared in order to run the parallel 2D and 3D LBM codes that are being generated.
- The debugging of the parallel 2D MRT LBM code was performed in order to locate the errors in the source code. 50% of the 3D LBM MRT code was documented line-by-line with references to scientific publications in order to obtain a technical manual for the users of DOE. Some errors in the 3D LBM MRT code have been fixed. IT management of the high performance computer cluster at FIU has been performed.
- Additionally, a journal manuscript is being developed for publication covering the experimental and computational analysis of NuVision Engineering Incorporation's wave erosion technology by FIU.
- A Waste Management Symposia paper related to the 3D bubble simulations has been submitted and revised. An abstract regarding the parallelization of the 2D MRT LBM code has also been submitted by a DOE Fellow.

Task 15: Evaluation of Advanced Instrumentation Needs for HLW Retrieval

Task 15 Overview

The purpose of this task is to evaluate the maturity and applicability of commercial and emerging technologies capable of addressing several instrumentation needs for HLW feed mixing and retrieval. During FY2011, this task continues the laboratory evaluation of the identified candidate technologies that began during the previous performance period. The objective of this year's work is to continue laboratory investigations of the identified alternative and promising instrumentation for HLW mixing and retrieval. Specifically, the task continues the evaluation of the Ultrasonic Spectroscopy (USS) and the Coriolis-based as viable techniques for the measurement of bulk density directly within the tank. Also, FIU is assessing additional prototype and conceptual instrumentation alternatives in an infancy stage through modeling, computer simulation and laboratory evaluation.

Task 15 Quarterly Progress

- FIU completed testing of the ultrasonic spectroscopy system (USS) with additional slurry simulants. The tests included the use of stainless steel, zirconium oxide and aluminum trihydrate mixtures with various carrier fluids. The solid simulants were mixed with a solvent to achieve up to 10% by volume solids loading. The carrier fluids used were water and water-sodium nitrate solutions to adjust the fluid density.
- FIU completed the data analysis phase of the USS evaluation. The USS test data collected were analyzed for agreement with the reference Coriolis Meter measurement of

bulk density. Summary statistics were calculated for each data set as a function of frequency, and the results were compared among individual test runs to determine the response change as slurry media was changed. Finally, the datasets were normalized to look for critical frequencies at which agreement with the Coriolis measurement occurred.

- There are several issues that came to light during the analysis that require input from the technology vendor. These issues were submitted to the vendor for clarification and response.
- At the request of Hanford Site representatives, FIU prepared a summary report to provide some of the preliminary results based on the data analysis performed. The report covered the frequency and normalized analysis, and provided several preliminary conclusions for moving forward with the technology development. Also, FIU continued with the development of a more detailed test report, and will await completion until feedback from the USS vendor is received.
- In addition to the test reports, FIU continued discussions and data sharing with the USS vendor on the issues that became known during the data analysis phase. One of the issues is the parabolic shape of the spectral response. FIU provided various data sets to vendor via email and FTP. FIU also provided several plotted results for comparison. The vendor continues to perform additional hardware testing to determine the reason for the spectral response shape.

Milestones and Deliverables

The milestones and deliverables for Project 1 are shown on the following table. Milestones and deliverables for Task 2, Task 12, and Task 15 were reached during this quarter. The specific items and their associated completion dates are indicated in the table. All upcoming milestones and deliverables are on target for their scheduled completion date.

Work Plan for Next Quarter

- Task 2: Continue to develop and assemble the 3rd generation crawler. Additional modifications to the APS will also be evaluated so that the system can be tested on engineering scale testbed.
- Task 12: A parallel 2D, then 3D code will continue to be developed for the LBM MRT method.
- Task 15: Discussions with the USS vendor and Site engineers will be conducted to decide whether to proceed with this option as a viable technology. Data will continue to be analyzed to determine if fixes in the software or hardware are needed to address the present short comings.
- All Tasks: Research results for all tasks will be presented at the WM Symposia. FIU will travel to Hanford to discuss all tasks to ensure the research meets the site's needs.

Milestones and Deliverables for Project 1

Task	Milestone/ Deliverable	Description	Due Date	Status
Task 2: Pipeline Unplugging and Plug Prevention	Deliverable	Draft Verification Test Plan for bench scale asynchronous pulsing	09/16/2011 Re-forecasted to 10/12/2011	Completed 10/12/2011
	2011-P1-M2.1	Complete bench scale pipeline unplugging using the asynchronous pulsing system	11/18/2011 Re-forecasted to 12/9/2011	Completed 12/9/2011
	Deliverable	Summary Document for 2011-P1-M2.1	11/18/2011 Re-forecasted to 12/9/2011	Completed 12/9/2011
	Deliverable	Draft Verification Test Plan for engineering scale asynchronous pulsing	02/10/2012	On target
	2011-P1-M2.2	Complete experimental testing of third generation peristaltic crawler	5/06/2012	On target
	Deliverable	Summary Document for 2011-P1-M2.2	5/06/2012	On target
	2011-P1-M2.3	Complete engineering scale pipeline unplugging testing using the asynchronous pulsing system	5/11/2012	On target
	Deliverable	Summary Document for 2011-P1-M2.3	5/11/2012	On target
Task 12: Multiple-Relaxation-Time Lattice Boltzmann Model for Multiphase Flows in Three Dimensions	2011-P1-M12.1	Development of the multiphase MRT LBM in 3D	10/17/2011	Completed 10/17/2011
	Deliverable	Summary Document for 2011-P1-M12.1	10/17/2011	Completed 10/17/2011
	2011-P1-M12.2	Verification of the multiphase SRT LBM in 3D for dynamic bubbles in closed domains	12/22/2011	Completed 12/22/2011
	Deliverable	Summary Document for 2011-P1-M12.2	12/22/2011	Completed 12/22/2011
	2011-P1-M12.3	Parallelization of the 3D multiphase MRT LBM	05/09/2012	On target
	Deliverable	Summary Document for 2011-P1-M12.3	05/09/2012	On target
Task 15: Evaluation of Advanced Instrumentation Needs for HLW Retrieval	2011-P1-M15.1	Complete candidate technology testing at FIU	9/30/2011 Re-forecasted to 10/31/2011	Completed 10/31/2011
	Deliverable	Summary Document for 2011-P1-M15.1	9/30/2011 Re-forecasted to 10/31/2011	Completed 10/31/2011
Project-wide	Deliverable	Draft Project Technical Task Plan	09/17/2011	Complete
	Deliverable	Quarterly Progress Reports (all tasks and projects combined)	End of Q1, Q2, Q3,Q4	On target
	Deliverable	Draft Annual Progress Report	06/17/2012	On target

Project 2
Rapid Deployment of Engineered Solutions to Environmental Problems

Project Manager: Dr. Leonel E. Lagos

Project Description

This project focuses upon delivering solutions to environmental challenges at the DOE Hanford Site. During FY11, FIU ARC continues to provide support on uranium contamination and remediation at the Hanford Site with research under Project 2. This project includes two subtasks for FY11: continued research on uranyl mineral formation and co-precipitation by soil pH manipulation (Task 1.1) and microbial- uranium interactions that include dissolution of autunite mineral and bio-adsorption of uranium (VI) in the presence of bicarbonate and Ca ions (Task 1.2).

Task 1.1: Sequestering Uranium at the Hanford 200 Area by In Situ Subsurface pH Manipulation using Ammonia (NH_3) Gas Injection

Task 1.1 Overview

The study under subtask 1 involves a series of batch experiments to evaluate the mechanisms and effectiveness of NH_3 gas injection, which has significant uncertainties under Hanford VZ site-specific conditions. The injection of a NH_3 gaseous mixture causes the formation of NH_4OH and a subsequent increase in pH. This manipulation will significantly alter the pore water chemistry and promote the formation of various aluminosilicates during recrystallization of minerals followed by co-precipitation of U(VI) [as uranyl (UO_2^{2+})] and Al at higher pH conditions. These chemical reactions can potentially control the mobility of uranyl cations in soil systems since co-precipitated contaminants are less available for migration. This study is evaluating the role of major pore water constituents such as Al, Si, bicarbonate, and Ca on the formation and solubility of uranium – bearing precipitates created after NH_3 gas injection.

Task 1.1 Quarterly Progress

- Performed batch experiments using 2 ppm of U(VI), the bicarbonate concentration of 50 mM, and Si solutions of 5 mM, 50 mM, 150 mM, 200 mM and 250 mM with no Al present. Conducted data analysis for the obtained results to evaluate the effect of Al on the Si precipitation reactions and the removal of uranyl ion.
- Continued ongoing investigation for X-ray diffraction (XRD) analysis of the dried precipitates obtained from the experiments using 2 ppm of U(VI), 50 mM of bicarbonate at a Si/Al ratio of 50.
- Completed batch experiments and conducted data analysis for the obtained results evaluating the effect of Al on the removal of uranyl ion in solutions prepared with 2 ppm of U(VI), the bicarbonate concentration raging between 5-100 mM and no Si present in solutions.

- Set up and completed batch experiments using 5 mM of Al, the highest concentration observed in pore water due to pH manipulation in soil according to the literature data, 2 ppm of U(VI), bicarbonate concentration ranging between 5-100 mM and Si in the range of 5-250 mM. Obtained results for the U(VI) removal and ICP-OES analysis to determine the change in Si and Al concentrations.
- Continued Fourier transform infrared spectroscopy (FTIR) analyses that, in combination with thermodynamic modeling of the experimental systems using Visual MINTEQ chemical speciation software, allows us to describe the structural characteristics of the amorphous precipitates. Sample preparation required ordering of KBr plates and Nujol mineral oil. Once the KBr plates and Nujol mineral oil were obtained, sample preparations were completed. Fourier transform infrared spectroscopy (FTIR) analyses were run for the sample prepared with 30 ppm of U(VI). Analysis didn't identify any peaks for U(VI) probably due to a low atomic percentage of U(VI) in the sample composition.
- Continued experiments to determine structure and composition of obtained U-bearing precipitates. Prepared dried samples of precipitates collected from the solution with 30 ppm of U(VI). Conducted SEM/EDS analysis to obtain data on morphology and composition, specifically to determine the atomic percentage of U(VI) in dried precipitates. This information is necessary for the future analysis using XPS. The U atomic percentage in the composition was found in the range of 0.02-0.05, which is low for the XPS. Procedures were repeated using higher concentration of U to obtain at least 0.1 atomic %. The repeated samples of the precipitates were collected from the solution with 130 ppm of U(VI). These were allowed to dry in preparation for future SEM/EDS analysis, FTIR, and then XPS.
- Continued searching for literature and web-based mineralogy databases for the XRD phase identification for previous analysis on dried precipitates.
- A paper entitled "The Effect of Si and Al Concentration Ratios on the Removal of U(VI) under Hanford Site 200 Area Conditions " was prepared, submitted and accepted ***as is*** for the Waste Management 2012 Symposia.

Task 1.2: Investigation on Microbial Meta-Autunite Interaction – Effect of Bicarbonate

Task 1.2 Overview

Research under subtask 2 continues to investigate the effect of bicarbonate on the autunite mineral microbial leaching and U(VI) biouptake by *Arthrobacter* sp., soil bacteria previously isolated from Hanford Site soil. The obtained data suggests that bacteria is responsible for autunite dissolution and is able to influence U(VI) leaching while are even not in direct contact with the mineral. The G975 strain U(VI) biouptake, found in the 83-90% range for the aqueous solutions at equilibrium with CO_2 atmospheric pressure, was shown to exponentially reduce as the bicarbonate concentration was increased. Experiments are exploring other *A.* sp strains on autunite bioleaching and U(VI) biouptake and determining possible mechanisms for their efficacy.

Task 1.2 Quarterly Progress

- Completed preparations of bicarbonate-bearing 5% PTG media, *Arthrobacter* sp. G968 strain culture, and initiated bioleaching experiments using mixed bioreactors amended with 4.4 mM of autunite. Completed sample collection from these experiments. Bottles were inoculated with *Arthrobacter* sp. G968 strain after autunite leaching reached equilibrium. Procedures included aseptically collecting samples followed by wet/dry ashing to prepare the samples for KPA and ICP-OES analysis.
- Calibrated the KPA instrument and conducted samples analysis for U(VI), Ca, and P using KPA and ICP-OES instruments on samples collected from the bioleaching experiments using mixed bioreactors amended with 4.4 mM of autunite in bicarbonate-bearing 5% PTG media. Developed graphs on the data results obtained for U(VI), Ca, and P leaching. The data has high standard deviations due to contamination of some bottles. The experiment needs to be repeated.
- Repeated controls for U(VI) biosorption based on effects of calcium and also repeated treatments for U(VI) biosorption in the presence of 5 mM of Ca ion and bicarbonate ranging between 0-2.5 mM to ensure the quality and repeatability of the results.
- Completed experiments on the total organic carbon (TOC) consumption after 24 hours for 5 mM and 0 mM Ca at 0 mM and 2.5 mM of bicarbonate. Results indicated that the highest TOC consumption occurred in the presence of 2.5 mM of bicarbonate with 5 mM added Ca, followed with 2.5 mM bicarbonate in the absence of added Ca. These combinations also showed the greatest cell viability, when compared to solutions absent in bicarbonate.
- Drew conclusions based on comparison between U(VI) speciation results based on the effects of Ca in the concentration of 5 mM at 0 and 2.5 mM of bicarbonate and TOC results.
- Continued data analysis and graphing for biosorption results that incorporate new data and taking into account the effect of calcium. Drew conclusions via a factorial design analysis on the effects of Ca and HCO_3 on the biosorption of U(VI) by *Arthrobacter* G975. Also conducted statistical analysis by comparing the K_d values for 0 and 5 mM of Ca with and without bicarbonate ion added.
- Began preparation of the progress report on results of U(VI) biosorption in the presence of bicarbonate and calcium ions. The report is due in January 2012.
- Completed resolution of peer-review comments on a manuscript prepared for the *Geomicrobiology Journal* and submitted the revision. Additional comments were received and subsequently resolved. The journal manuscript "Assessment of the Resistance to Uranium (VI) Exposure by *Arthrobacter* sp. Isolated from Hanford Site Soil" has been accepted for publication by the *Geomicrobiology Journal*.
- Prepared and submitted a manuscript on bioleaching titled "Enhanced U(VI) bioleaching from autunite mineral by aerobic *Arthrobacter* sp. in the presence of aqueous bicarbonate" to the *Chemical Geology Journal.*

Milestones and Deliverables

The milestones and deliverables for Project 2 are shown on the following table. The project is on schedule to meet all milestones and deliverables.

Work Plan for Next Quarter

- Task 1.1: Obtain SEM/EDS analysis on morphology and composition, and the atomic percentage of U(VI) in dried precipitates prepared with 130 ppm of U(VI). Obtain XPS data on atomic composition and chemistry of precipitates. Complete kinetics experiments on U reduction in solution vs. time. Present results of the study on the WM12 Symposia.
- Task 1.2: Set up bioleaching experiments with *Arthrobacter* sp. G968 strain. Continue a study on the effect of Ca on biosorption and viability of *Arthrobacter* G968 bacteria. Conduct microscopic studies on bacterial cells exposed to U in the presence of bicarbonate and Ca. Finalize autunite bioleaching experiments with G968 strain. Submit a progress report on results of U(VI) biosorption in the presence of bicarbonate and calcium ions. Present a student poster on U(VI) biosorption results using G975 strain at WM12 Symposia.

Milestones and Deliverables for Project 2

Task	Milestone/ Deliverable	Description	Due Date	Status
Task 1: Sequestering Uranium at the Hanford 200 Area Vadose Zone by In Situ Subsurface pH Manipulation Using NH3 Gas	2011-P2-M1	Completion of testing on the removal efficiency of U(VI) using various Si:Al ratios in the presence of bicarbonate	2/28/2012	On target
	Deliverable	Progress report on results on biosorption and bacterial tolerance to uranium in the presence of bicarbonate ion	1/11/2012	On target
Task 2: Effect of bicarbonate on the autunite mineral bioleaching and U(VI) biouptake by Arthrobacter sp	2011-P2-M2	Completion of assessment of the role of bacteria on U(VI) leaching from autunite using *Arthrobacter* sp. strains	4/30/12	On target
Project-wide	Deliverable	Draft Project Technical Plan	6/17/2011	Complete
	Deliverable	Draft Year End Report	6/18/2012	On target

Project 3
Remediation and Treatment Technology Development and Support

Project Manager: Dr. Georgio Tachiev

Project Description

The overall objective of this project is to provide technical assistance and perform research in support of the remediation efforts at the Oak Ridge Reservation. Student support for research at the Moab Site will also be provided. Research efforts will be executed in collaboration with DOE EM and DOE ORO and will be closely aligned with the ASCEM program objectives. The numerical modeling and experimental work will provide a better understanding of the fate and transport of inorganic and organic pollutants.

A PowerPoint presentation of project progress was prepared and delivered to DOE personnel and site contractors during an ORR site visit in November 2, 2011. The presentation covered the following:

- Introduction to the FIU Water Resources and Environment Research Group
- A summary of FIU's work to date
- Hydrologic modeling, surface, groundwater, river, sedimentation including WOC, EFPC, Y12-NSC, building 81-12
- Fate and transport of contaminants
- Support for remediation activities
- Benchmarking, sensitivity and uncertainty analysis
- Experimental mercury speciation studies
- Results
- Path forward

Task 1: EFPC model update, calibration & uncertainty analysis

Task 1 Overview

The main objectives of this task are to extend the existing EFPC model by adding a reactive transport and sedimentation module, and use the model to perform numerical simulations. The simulations will provide a better understanding of the flow and transport within the watershed on a regional scale. Simulations will be conducted using historic observations of rainfall, evapotranspiration, and contaminant distribution, within the watershed to determine transport patterns within the domain. During FY11, the focus is on extending the sedimentation module to include the entire EFPC and Bear Creek. In addition, the proposed research will provide stochastic modeling of the system and will include an analysis of the spatial and temporal patterns as a result of the stochastic variations of selected properties of the sub domain.

Task 1 Quarterly Progress

Subtask 1: Extension of the water quality and sedimentation module
The sedimentation module which was developed for the UEFPC (the section of EFPC upstream of Station 17) was extended to include the entire EFPC down to EFK 6 and Bear Creek. The sedimentation module will provide the coupling between the flow and transport within the creek and the overland flow which will be used to analyze the significance of floodplain contamination downstream EFPC. Fifty-two (52) outfalls were added to the EFPC model. Van Genuchten parameters for the unsaturated flow in the aquifer were updated. The model was reconfigured following the incorporation of the sedimentation module and outfalls. A series of numerical simulations have been performed using a range of manning number values, threshold run-off water depth, and drainage coefficients to calibrate the flow for the period of 2000 – 2008.

MATLAB scripts have been prepared for the statistical analysis of observed and computed data. Laboratory and field data on surface water level and discharge, groundwater level, and mercury contamination in soil, groundwater and surface water were obtained from OREIS database. Data was organized and incorporated into the numerical model for calibration and verification purposes.

A report was drafted outlining the incorporation of the sedimentation module, assignment of specific parameters, download, organize and analysis of field and laboratory data from OREIS database, and incorporation into the numerical model.

Subtask 2: EFPC model uncertainty and sensitivity analysis
The probabilistic distribution of critical subsurface parameters, such as hydraulic conductivity, porosity, pore size distribution, and storage coefficients were defined specifically for the karst areas. MATLAB's statistical toolbox and scripting tools was used to develop a series of functions for a random generation of distributed hydrologic parameters based on a selected probability density function and statistical parameters. Randomly grids were generated using Matlab toolbox for the uncertainty analysis. Numerical simulations are in progress for each randomly generated input grid. The output will be used to generate daily timeseries for selected hydrological, fate and transport parameters, including groundwater flow velocity at selected points, potential head at selected points, rate of mercury absorption at various locations, concentrations of total mercury at the key stations (EFK 6, EFK 14, EFK 18), total mercury load at the key stations, flux exchange between subsurface and surface. The simulations will be used to determine the model uncertainty in terms of stochastic variations of input parameters.

Task 2: TMDL Analysis for the entire EFPC

Task 2 Overview

The numerical model of the EFPC will simulate fate and transport of mercury and VOC plumes within the EFPC watershed, and will assist in analyzing the TMDL requirements for surface water and groundwater within the EFPC watershed. The main objectives of this task are to:

- Develop a TMDL methodology for analysis of flow and load duration exceedance probabilities for key monitoring stations along Bear Creek and the EFPC from numerical simulations and observed data; and

- Provide analysis of the relative contribution of point and non-point sources to mercury pollution in the watershed including the contributions from the floodplain of the two watershed creeks (EFPC and Bear Creek), the remobilization of stream sediments during stormwater events, the groundwater exchange with the creeks, and the transport within the creeks.

Task 2 Quarterly Progress

Subtask 1: Update the database

Field and laboratory data pertaining to water quantity (surface and groundwater levels, and water flow) and water quality (i.e. temporal and spatial distribution of pollutant sources in soil, water, and sediments, bioassessment) were extracted from the OREIS database. Excel spreadsheets were developed and the data categorized based on media type (i.e. soil, surface water, sediment, and groundwater). Previously submitted reports were then updated with the newly extracted data for 2010 and 2011 (Appendix C of Mercury Remediation Strategy (MRS) previously submitted to DOE). The data was analyzed to identify any data gaps and additional data needs and monitoring recommendations. Spatial analysis was performed to identify spatial variations of mercury in EFPC water, in shallow and deep soil layers, and in stream bank and streambed sediments. Temporal analysis was performed to evaluate the timing of impairment and potential source loading or other conditions contributing to impairment. Specifically, the effect of rainfall and runoff flow was investigated on the concentration of mercury in the creek. The effect of rainfall/runoff and high flow conditions were investigated on the sediment transport, and thereby, mercury transport in the creek.

Subtask 2: Review and analysis of TMDL requirements (TMDL literature review)

A comprehensive review was performed on TMDL requirements for EFPC established by EPA and TDEC. A report was developed which includes water quality criteria and TMDL target, water quality assessment and deviation from the TMDL target, water quality data analysis, and source identification.

Water quality data analysis has been completed including graphical presentations of temporal and spatial variations of data points, seasonal analysis of data points, remove data outliers and anomalies using methods suggested by EPA.

Subtask 3: TMDL analysis of UEFPC

Target mercury concentration for the EFPC was determined based on TDEC regulations for surface waters. The target concentration was determined to be 51 ppt for recreational use. Based on this target concentration, a "Loading Capacity" duration curve was developed.

The flow and concentration timeseries associated with NPDES outfalls were revisited. Load and flow duration curves were graphed for the outfalls and compared with simulation results. Flow duration curves were developed for two key stations along EFPC (EFK 23.4 and EFK 6.3). Flow duration intervals and zones were determined to study the effect of flow conditions on the distribution of impairments. Impairments observed in the low flow zones (dry seasons) were indicated as the influence of point sources (outfalls), while sediments (non-point sources) were determined to be effective during high flow conditions (wet seasons).

Load duration curves were developed for key stations. A series of numerical simulations were performed to determine the percentages of the load associated with outfalls, sediments, and overland flow (load allocation analysis). Based on the numerical simulation results, waste load allocations (WLAs) were developed for continuous point source discharges using the duration curves. In the case of sediments, specific simulations were performed only with contaminant sources inside the sediments to determine the contribution of sediments to the total load observed in the creek. Load duration curves and load percentiles were developed for each source (i.e., outfalls, sediments and overland wash-off).

A report was drafted on TMDL target definition, development of flow and load duration curves and load allocation analysis.

Several scientific papers have been drafted and submitted to journals and conference proceedings based on this project work, including the following:

- A peer reviewed article entitled "Simulation of Flow and Mercury Transport in Upper East Fork Poplar Creek, Oak Ridge, TN", which was approved for publication in the Remediation Journal in January 2012.
- A paper entitled "Transport of Volatile Organic Compounds in West Plant Area, Oak Ridge, TN", which was submitted to the Waste Management Symposium 2012.
- A paper entitled "Migration of Plume of Organic Compounds in a Highly Fractured Subsurface Domain", which was submitted to the Ground Water Journal.

Task 3: Parameterization of Major Transport Processes of Mercury Species

Task 3 Overview

The overall objective of this task is to provide laboratory measurements for critical mercury transport, transformation, and exchange processes (i.e., methylation/demethylation, and dissolution) to be used in the numerical model. The laboratory experimental work will provide insight on parameters relevant to the Oak Ridge Reservation (ORR) and which are required in the numerical model, such as dissolution rate of mercury and the proportion of mercury species available for methylation/demethylation in sediments. In addition, experimental work will be conducted to analyze the effect of significant environmental factors (pH, Eh, sunlight) on the major transport and transformation processes of Hg.

Under this task we will systematically investigate the stability, bioavailability, and mobility of the aged mercury species in soils and sediments. The proportion of Hg species available for methylation and demethylation in sediments will be estimated by using isotope addition techniques. In addition, the dissolution of cinnabar and Hg bead, which have often been observed at this site and are thought to be recalcitrant mercury species, will be investigated by using both experimental and theoretical calculation methods. Three factors, oxidation-reduction, pH, and complexation with organic ligands (e.g., low molecular weight thiols such as cysteine and glutathione and large molecular NOM), will be particularly investigated for their role in mobilizing the aged mercury species. These studies will provide a better understanding of the bioavailability and dissolution of aged Hg species in soils and sediments.

Task 3 Quarterly Progress

- Conducting ongoing experiments to investigate the role of pH, Eh, and thiol-containing compounds in the dissolution of cinnabar.
- A model based on chemical thermodynamics is being developed to calculate the dissolution of cinnabar under different pH and Eh conditions and thiol concentrations.
- Conducted experiments to estimate the difference of newly input and ambient Hg species in methylation/demethylation efficiency. This parameter was then used to improve the calculation of the net MeHg production or reduction flux in aquatic ecosystems. A paper associated with the aforementioned studies has been submitted to the Environmental Science and Technology and is currently under review.

Task 4: Geodatabase Development for Hydrological Modeling Support

Task 4 Overview

The main objective of this task is to create a geodatabase to support hydrological model development and simulation of contaminant fate and transport at Oak Ridge Reservation (ORR), TN. The geodatabase will serve as a centralized data management system which facilitates storage, editing, and versioning of model parameters. A working prototype was developed by FIU ARC during FY 2010. As FIU ARC continues to conduct model simulations to support the D&D remediation activity at ORR, there will be an ongoing need for the update of the geodatabase and the utilization of the integrated GIS-hydrological modeling system developed.

The two objectives for this task for FY 2011 are:

- Configuration of the database to provide remote access to input and output files.
- Import of simulation input and output files for the Y-12 NSC, WOC and EFPC models into the geodatabase along with versioning.

Task 4 Quarterly Progress

- Conducting ongoing customization of geodatabases to facilitate import/export of model data.
- Conducting ongoing import/export of spatial data into geodatabases and execution of geoprocessing tasks as necessary for model simulations.

Task 5: Student Support for Modeling of Groundwater Flow and Transport at Moab Site

Task 5 Overview

FIU, in collaboration with DOE's Moab site project director, will use an existing groundwater numerical model to evaluate the tailings pore-water seepage in order to assist in effective dewatering of the tailings pile and to optimize the groundwater extraction well field as part of the DOE Uranium Mill Tailings Remedial Action (UMTRA) for the Moab site.

The two main objectives of Task 5 are to:

1. Use an existing groundwater numerical model to simulate the fate and transport of contaminants including uranium and ammonia in the subsurface at the Moab, Utah site.
2. Perform numerical simulations of remedial scenarios proposed by DOE including pumping of contaminated groundwater from the shallow plume to an evaporation pond on top of the tailings pile, and injecting the diverted Colorado River water into the alluvial aquifer in order to predict the outcome of each remedial action and to investigate the effectiveness of each scenario. Numerical simulation of remedial actions assists DOE in deciding their effectiveness.

Task 5 Quarterly Progress

- The student's summer internship report for the "Preliminary Studies of Nitrogen Concentration in Wells at the Moab Site" was completed and submitted in October 2011. This document is also reported as part of the milestone 2011-P5-M3 under Project 5.
- An analysis of groundwater quality data adjacent to the Colorado River for calculating the flux of contamination into the river was also conducted.
- New geostatistically interpolated plumes and groundwater elevation contours were created and will be used as input for the Moab groundwater model.
- Participated in a 2-day modeling webinar – "Using Groundwater Vistas", which was conducted by the subcontractor who developed the existing groundwater model. This model is to be used for some of the planned modeling work.
- Conducted numerical simulations with the existing model using updated groundwater quality data.
- The Moab groundwater model report was updated with model configuration data and results obtained from simulations using the existing model.

Milestones and Deliverables

The milestones and deliverables for Project 3 are shown on the following table. Milestone 2011-P3-M5 (Task 1 progress report on the EFPC model update, calibration and uncertainty analysis) has been drafted and submitted for internal review. Milestone 2011-P3-M4 [a report on project coordination with the applied field research center (ORNL) & ASCEM], which was re-forecasted for November 18, 2011, has been submitted following a site visit on Nov. 2, 2011. Milestone 2011-P3-M6, Task 5 Progress Report on "Student Support for Modeling of Groundwater Flow and Transport at the site of Moab, Utah," has been re-forecasted for Feb 18, 2012, as additional data was received from the site that needs to be incorporated into the model. This data is currently being reviewed and updated in the model.

Work Plan for Next Quarter

- Prepare Task 2 progress report on "Simulation of TMDL for the Entire EFPC."
- Prepare Task 4 progress report on "Geodatabase development for hydrological modeling support."

- Finalize Moab model and its configuration according to ASCEM specifications and prepare Task 5 progress report on "Student support for modeling of groundwater flow and transport at Moab, UT site."
- Present a project overview to DOE HQ and project accomplishments.

Milestones and Deliverables for Project 3

Task	Milestone/ Deliverable	Description	Due Date	Status
Task 1: EFPC Model Update, Calibration, Uncertainty Analysis	2011-P3-M5	Task 1 progress rpt on "EFPC model update, calibration, uncertainty analysis"	11/17/2011	Complete
Task 2: Simulation of TMDL for the Entire EFPC	2011-P3-M7	Task 2 progress rpt on "Simulation of TMDL for entire EFPC"	2/1/2012	On target
Task 3: Laboratory experiments for methylation/ demethylation and transport parameters of mercury	2011-P3-M1	Task Plan for Prof. Cai (after visit & coordination with ORNL)	8/1/2011	Complete
	2011-P3-M11	Task 3 technical report entitled, "Parameterization of major transport processes of mercury species"	5/17/2012	On target
Task 4: Geodatabase Development for Hydrological Modeling Support	2011-P3-M9	Task 4 progress on "Geodatabase development for hydrological modeling support"	3/1/2012	On target
Task 5: Student Support for Modeling of Groundwater Flow and Transport at the site of Moab, Utah	2011-P3-M3	Student summer internship at Moab Site	9/23/2011	Complete
	2011-P3-M6	Task 5 progress report on "Student support for modeling of groundwater flow and transport at Moab, UT site"	12/1/2011 Re-forecasted to 2/18/2012	Re-forecasted
	2011-P3-M10	Finalize model and its configuration according to ASCEM specifications (after visit to Moab Site)	03/17/2012	On target
Project-wide	2011-P3-M2	Submit 2 abstracts to Waste Management Symposium 2012	8/19/2011	Complete
	2011-P3-M4	Rpt on project coordination w/ applied field research center (ORNL) & ASCEM (after site visit)	9/28/2011 Re-forecasted to 11/18/2011	Completed 11/18/2011
	2011-P3-M8	Presentation overview to DOE HQ of the project and accomplishments	2/17/2012	On target
	2011-P3-M12	Submit publications to relevant journals	5/17/2012	On target
	Deliverable	Draft Technical Task Plan	08/12/11	Complete
	Deliverable	Quarterly Status and Progress Summary Reports	Quarterly	On target
	Deliverable	Year End Report	06/15/2012	On target

Project 4
Waste and D&D Engineering & Technology Development

Project Manager: Dr. Leonel E. Lagos

Project Description

This project focuses on delivering solutions under the decontamination and decommissioning (D&D) and waste areas in support of DOE HQ EM and includes support of the Office of Innovation and Technology Development R&D Plan. This work is also relevant to D&D activities being carried out at other DOE sites such as Oak Ridge, Savannah River, Hanford, Idaho and Portsmouth or international efforts being conducted by EM-30 with the Nuclear Decommissioning Authority (NDA) in England and the International Atomic Energy Agency (IAEA). Efforts on this project include the following tasks:

- Task 1: Waste Information Management System (WIMS)
- Task 2: D&D Support to DOE EM for Technology Innovation, Development, Evaluation and Deployment
- Task 3: D&D Knowledge Management Information Tool (KM-IT)
- Task 4: IT Support to EM and DOE Sites

Task 1: Waste Information Management System (WIMS)

Task 1 Overview

This task provides direct support to DOE EM for the management, development, and maintenance of a Waste Information Management System (WIMS). WIMS was developed to receive and organize the DOE waste forecast data from across the DOE complex and to automatically generate waste forecast data tables, disposition maps, GIS maps, transportation details, and other custom reports. WIMS is successfully deployed and can be accessed from the web address http://www.emwims.org. The waste forecast information is updated at least annually. WIMS has been designed to be extremely flexible for future additions and is being enhanced on a regular basis.

Task 1 Quarterly Progress

- New waste forecast data is imported into WIMS on an annual basis. The 2011 waste forecast dataset was imported into WIMS and made available to the public on the WIMS website on April 19, 2011.
- Performed database management, application maintenance, and performance tuning to WIMS in order to ensure a consistent high level of database and website performance.
- Submitted draft and final paper on WIMS to the Waste Management 2012 Symposium.

Task 2: D&D Support to DOE EM for Technology Innovation, Development, Evaluation and Deployment

Task 2 Overview

This task provides direct support to DOE EM for D&D technology innovation, development, evaluation and deployment. The objective of Task 2 is to use an integrated systems approach to develop a suite of D&D technologies (D&D Toolbox) that can be readily used across the DOE complex to reduce technical risks, improve safety, and limit uncertainty within D&D operations. FIU directly supports DOE-EM's Office of Innovation and Technology Development and affiliated DOE sites, national laboratories, and institutions contributing to the development of innovation in D&D. This task will also collaborate with DOE-EM's international partnerships and agreements by providing D&D expertise, knowledge and support when requested to do so by DOE EM. The technical approach for this task is to identify and demonstrate new technologies, methodologies, and approaches to support EM's collaborative international activities.

Task 2 Quarterly Progress

- Prepared a scope of work for the technology vendor for a feasibility study for the removal of strippable coatings using a remote controlled platform. Held conference call with technology vendor to discuss scope, schedule, and deliverables. Began process for FIU purchase order request for this work.
- In an effort to aid the various *in situ* decommissioning projects at SRS, a meso-scale concrete test bed has been designed and is being installed at FIU-ARC in order to test various sensors imbedded in grout. This experiment consists of using various sensors including Electrical Resistivity Tomography, Advanced Tensiometers, Piezoelectric Sensors, and Fiber Optic Sensors (ERT, AT, PES, FOS) to measure various parameters including strain, crack detention, corrosion, fluid mobility, moisture, as well as a variety of others. Principal Investigators (PIs) from Idaho National Laboratory (INL), Mississippi State University (MSU), University of Houston (UH), and University of South Carolina (USC) will be providing the sensors as well as testing them. The main purpose is to recognize the limitations of these sensors for their future use in monitoring closed nuclear facilities.
- Sensor frames and sensor racks were completed by FIU staff and students. In addition, PIs from all four institutions came to FIU facilities in Miami to install their sensors onto the FIU designed and constructed racks. DOE Fellows and graduate students as well as FIU staff provided support to the various PIs during the installation of the sensors. Over 250 remote sensors were place on 9 panel racks.
- FIU supported development of lessons learned and best practices for DOE's EFCOG group. FIU worked closely with EFCOG's D&D Working Group and site representatives to draft and develop 4 best practices and lessons learned documents:
    - A draft lessons learned was completed on the unanticipated high dose during the removal of wire flux monitor cabling from the HWCTR reactor vessel and sent to the site point of contact for review on 11/10/11.

- A lesson learned on the closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site was drafted and sent to the site point of contact for review on 11/10/11. Site comments were received and incorporated and the document was then sent to EFCOG for review on 12/5/11.
- A best practice on the historical hazard identification process for D&D was reviewed for a second time by the site point of contact and subsequently sent to EFCOG for their review. EFCOG comments were subsequently incorporated into the document and it was sent to DOE HQ for their review on 12/1/11. FIU received comments from DOE HQ and is working with the site representative on incorporating the comments.
- A best practice on the 185-3K Cooling Tower Demolition was sent to DOE HQ for review on 12/2/11. FIU received comments from DOE HQ and the site point of contact is working to get the prime contractor's input and approval at SRS.

Construction of Sensor Frames and Sensor Racks

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

Preparation of the Test Site

- FIU participated in bi-weekly conference calls with the ISDSN working team. Conference calls are led by SRNL with participation of team members: INL, Mississippi State University (MSU), University of Houston (UH), and University of South Carolina (USC), and Florida International University (FIU).

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

Task 3 Overview

The D&D Knowledge Management Information Tool (KM-IT) is a web-based system developed to maintain and preserve the D&D knowledge base. The system was developed by Florida International University's Applied Research Center (FIU-ARC) with the support of the D&D community, including DOE-EM (EM44 & EM72), the ALARA centers at Hanford and Savannah River, and with the active collaboration and support of the DOE's Energy Facility

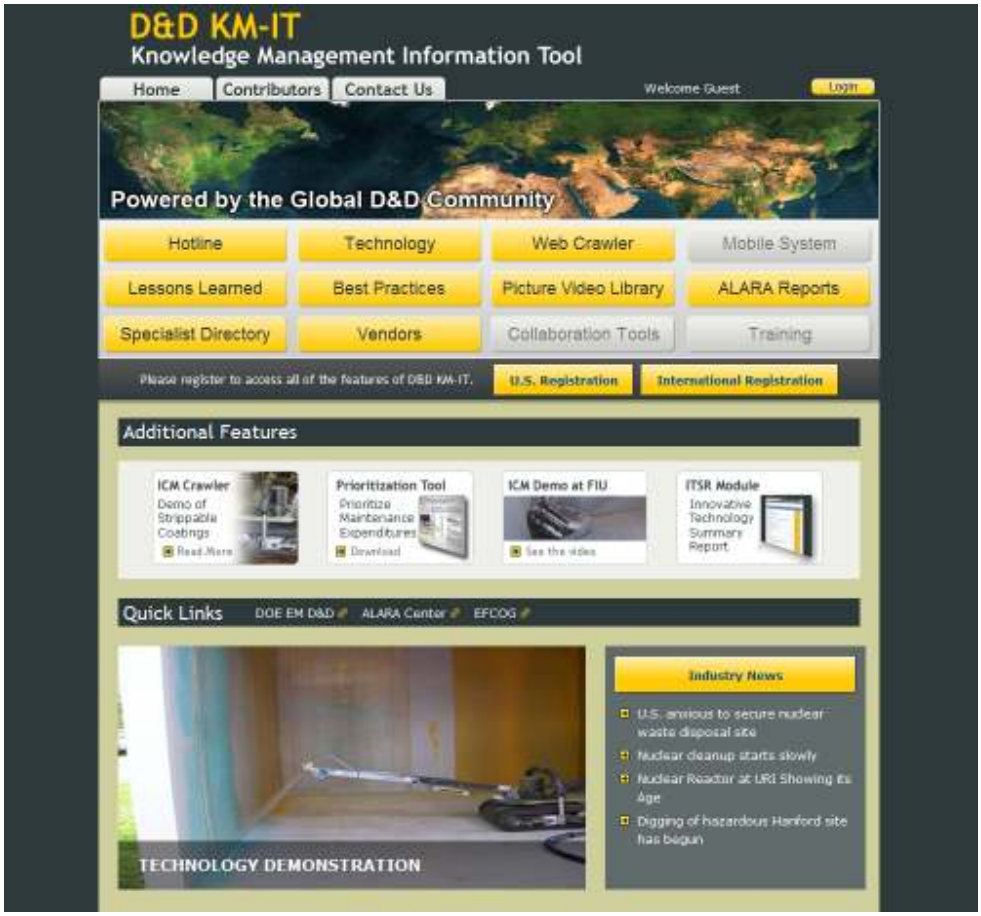
Contractors Group (EFCOG). The D&D KM-IT is a D&D community driven system tailored to serve the technical issues faced by the D&D workforce across the DOE Complex. D&D KM-IT can be accessed from web address http://www.dndkm.org.

Task 3 Quarterly Progress

- Held bi-weekly teleconferences with DOE on project task status and action items.
- Completed the design and development of the Collaboration Tools module and integrated it with D&D KM-IT. This module was deployed on the staging server for DOE review. This completed milestone 2011-P4-M3.2. The features of the collaboration tools include the following:
    - **News** – to inform the users of news about the people, conferences, and papers and other events that affect the D&D community.
    - **Announcements** – collected from contributions by the D&D community, pulled from news reporting elements (e.g. industrial journals) or any other reliable source and will include information on new projects, schedules and software upgrades that affect the D&D community as well as D&D related discussions, professional training opportunities and D&D project management.
    - **Discussion Board** – an online discussion site to host discussions among the members of the D&D community and where people can exchange valuable information about D&D related topics.
    - **Calendar** – to provide dates of major D&D community events, create invitations and keep reminders for a particular date. D&D community members have the ability to post their events through this module.
    - **Wikis –** a wiki is an informational web page that can be modified by D&D community users to add material and clarify information, permitting communication and collaboration within the D&D community.
    - **Blogs** – a blog uses a conversational style of writing and provides timely news and commentary on specific areas of interest. This feature will allow the D&D community to maintain their D&D related blog on the D&D KM-IT.
    - **Links** to D&D related websites.
    - **Frequently Asked Questions** related to D&D.
    - **Help** for various features of the Collaboration Tools.
- The new vendor module was launched and made live on the public website on December 16, 2011. The vendor module provides a directory of commercial D&D vendors. Vendor management captures all the vendor related information, including vendor name, address, phone, fax, email, website and areas of expertise. While not a comprehensive directory of all the D&D vendors in the marketplace, the new module will provide an excellent starting point for researching the vendors who provide D&D products and services.
- Completed the updating of existing vendor information for the Vendor Module, adding new vendor descriptions as well as areas of expertise for each vendor. Worked on identifying additional D&D vendors from the Waste Management Symposia 2011.

Added relevant D&D vendors to the Vendor module of the D&D KM-IT, including vendor names, description, contact information, and areas of expertise. Also continued adding technologies to the Technology Module from the Hanford ALARA newsletters.

- A new look for the D&D KM-IT website was launched in December. The website is sporting a new look with even more user interaction; the result is a fresher appearance and more intuitive navigation.



New website appearance for D&D KM-IT.

- Completed monthly analysis of website analytics and prepared a report on the results.
- Search Engine Optimization process continues to be deployed on the D&D KM-IT web application.
- Drafted a charter, including potential members, for forming a D&D KM-IT user group to assist in reviewing the current features/enhancements of the D&D KM-IT system to improve the user experience.
- Established the development and the deployment architecture for the vendor and specialist directory mobile applications. Worked on the component development for the vendor module for mobile application development.

- Developed a white paper titled, "Leveraging Wikipedia and Wiki-Based Technologies," on the use of internet resources (e.g. Wikipedia) and how they are of value to the D&D KM-IT site. This paper was sent to DOE for review and discussion.
- Submitted draft and final paper on D&D KM-IT to the Waste Management 2012 Symposium.

Task 4: IT Support to EM and DOE Sites

Task 4 Overview

DOE EM expressed a need for enhancing the DOE EM website and developing a system of knowledge management, similar to our current Knowledge Management Information Tool (KM-IT) being developed for EM-44, to allow sharing of DOE EM information among the DOE community. To address this need, FIU-ARC subsequently received additional funding toward the end of FIU's FY10; due to the late arrival of this additional funding, DOE and FIU agreed to treat this funding as carryover funding with the expectation that the scope of work delineated in the proposal document would be carried out during FIU's FY11 period of performance. FIU-ARC proposed 3 subtasks as described in the Task 4 section of this document. A fourth subtask, separate from the additional $500K scope was added to provide support to SRS with data acquisition through wireless sensors and access through the D&D KM-IT system.

Task 4 Quarterly Progress

- Further activities on the DOE EM Website and Knowledge Base for Environmental Management are currently being maintained in standby pending further input from EM.
- For the ISDSN IT subtask, users from all of the participating universities and national labs (Mississippi State University, University of Houston, University of South Carolina, Idaho National Lab and Savannah River National Lab) were assigned the security credentials to login to the work station and were asked to register with the D&D KM-IT system to get access to the Sensor Remote Accessing System (SRAS). Connectivity and accessibility of the work station and to the assigned folders was established. Client software was configured on the local machine for re-moting into the workstation. SRAS uses the security framework of KM-IT for authentication and authorization before granting access to sensor data. In addition, application and web server administration of SRAS was performed on a regular basis to maintain the system.

Milestones and Deliverables

The milestones and deliverables for Project 4 are shown on the following table. Milestone 2011-P4-M3.2, deployment of Collaboration Tools to DOE for review/testing, was completed and placed on the staging server on October 31, 2011. The project is on schedule to meet all remaining milestones and deliverables with the exception of two deliverables associated with Task 4, since further activities on the DOE EM Website and Knowledge Base for Environmental Management are currently being maintained in standby pending further input from EM-72.

Work Plan for Next Quarter

- Perform database management, application maintenance, and performance tuning to WIMS (Task 1).
- Present WIMS to the Waste Management 2012 Symposium (Task 1).
- Integrate new waste forecast data into WIMS, if a new dataset is received from DOE (Task 1).
- Continue feasibility study for remote removal of strippable coatings and decon gels (Task 2).
- Continue work with university PIs and SRNL and INL in the development of a test site and testing of remote sensors at FIU for in situ decommissioning (Task 2).
- Complete installation of the meso-scale concrete test bed for the ISDSN subtask (Task 2).
- Deploy mobile application for vendor and specialist modules to DOE for review/testing (Task 3).
- Incorporate DOE review comments and input on Collaboration Tools module to DOE for review/testing (Task 3).
- Present D&D KM-IT to the Waste Management 2012 Symposium (Task 3).
- Draft DOE EM website analysis report (Task 4) – on standby pending input from EM-72.
- Deploy a workstation near the test site in the trailer where the data acquisition systems are housed. Connect workstation to all 4 data acquisition systems. The integration application deployed on the workstation will move the acquired data files from the data acquisition systems to a centralized SRAS server and will be made available to the stakeholders (Task 4).

Milestones and Deliverables for Project 4

Task	Milestone/ Deliverable	Description	Due Date	Status
Task 1: Waste Information Management System (WIMS)	2011-P4-M1.1	Import 2011 data set for waste forecast and transportation data	Within 60 days after receipt of data from DOE	Complete
Task 2: D&D Support to DOE EM for Technology Innovation, Development, Evaluation, and Deployment	2011-P4-M2.1	Complete In-Situ Decommissioning Experiments	04/30/12	On target
	Deliverable	Draft technical report for review of mercury D&D issues at Oak Ridge	One month after receiving documents	On target
	Deliverable	Draft Tech Fact Sheet for in-situ decommissioning experiments	One month after experiments are completed	On target
	Deliverable	Draft Feasibility Report for remote removal of strippable coatings	4/20/2012	On target
Task 3: D&D Knowledge Management Tool (D&D KM-IT)	2011-P4-M3.1	Deployment of Vendor Management module to DOE for review/testing	7/31/2011	Complete
	2011-P4-M3.2	Deployment of Collaboration Tools to DOE for review/testing	10/31/2011	Complete
	2011-P4-M3.3	Deployment of mobile application for vendor and specialist modules to DOE for review/testing	1/31/2012	On target
	2011-P4-M3.4	Deployment of training module to DOE for review/testing	4/30/2012	On target
	2011-P4-M3.5	D&D KM-IT data mining	5/17/2012	On target
	Deliverable	Draft report of internal C&A audit findings and responses	30-days after internal audit	On target
	Deliverable	Draft report of external C&A audit findings and responses	30-days after external audit	On target
	Deliverable	Draft Tech Fact Sheet for new modules or capabilities of D&D KM-IT	30-days after deployment of new module or capability	On target
Task 4: IT Support to EM and DOE Sites	2011-P4-M4.1	Draft static prototype for EM knowledge base to DOE for review	8/31/2011	Complete
	Deliverable	Draft DOE EM website analysis report	11/28/2011	On hold
	Deliverable	Draft knowledge base requirements document for EM	2/28/2012	On hold
Project-wide	Deliverable	Draft Project Technical Plan	6/17/2011	Complete
	Deliverable	Draft Year End Report	06/18/2012	On target
	Deliverable	Quarterly status and progress summary reports	Quarterly	On target

Project 5
DOE-FIU Science & Technology Workforce Development Initiative

Project Manager: Dr. Leonel E. Lagos

Project Description

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. 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.

Project Overview

The main objective of the program is to provide interested students with a unique opportunity to integrate course work, Department of Energy (DOE) field work, and applied research work at ARC into a well structured academic program. Students completing this research program would complete the M.S. or Ph.D. degree and immediately be available for transitioning into the DOE EM's workforce via federal programs such as the Student Career Experience Program (SCEP) or by getting directly hired by DOE contractors.

Quarterly Progress

- Ten (10) DOE Fellows Technical Summer Internship reports were completed and delivered to DOE (milestone 2011-P5-M3).
- Completed Fall 2011 recruitment process to attract and select new DOE Fellows (Fall 2011). The DOE Fellows Selection Committee reviewed application packages and interviewed candidates. Eleven (11) new DOE Fellows were selected to be the Class of 2011 (milestone 2011-P5-M4).
- Coordinated and hosted the DOE Fellows Poster Exhibition & Competition. DOE Fellows prepared 15 posters that were showcased at this annual event on October 25, 2011. The poster exhibition showcased the research accomplishments of DOE Fellows 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.

DOE Fellows Poster Exhibition and Competition – October 25, 2011

- Continued to work with DOE sites and HQ to fully engage DOE Fellows with research outside ARC.
- Conducted DOE Fellows weekly meeting and summer internship student presentations:
  - Sheidyn Ng presented her summer internship work conducted with DOE HQ EM-20 under the supervision of Mr. Kenneth Picha.
  - Heidi Henderson presented her summer internship work conducted with DOE HQ EM-30 under the supervision of Ms. Ana Han.
  - Mario Vargas presented his summer internship work conducted with Lawrence Livermore National Laboratory under the supervision of Mr. Alan Goldner.
  - Jose Matos presented his summer internship work conducted with the Washington River Protection Solutions under the supervision of Mr. Ruben Mendoza.
  - Janty Ghazi presented his summer internship work conducted with the Washington River Protection Solutions under the supervision of Mr. Rob Gurnick.
  - Givens Cherilus presented his summer internship work conducted with the Savannah River National Laboratory under the supervision of Mr. Alex Cozzi and Ms. Marissa Reigel.

DOE Fellow Weekly Meeting Presentations

DOE Fellow Intern	Site/Office/Lab	Presentation Date
Rinaldo Gonzalez	Pacific Northwest Nat. Lab	08/31/11
Amaury Betancourt	Savannah River National Lab	09/07/11
William Mendez	Savannah River Site	09/14/11
Alex Henao	Moab Site	09/21/11
Sheidyn Ng	DOE-HQ EM20	10/05/11
Heidi Henderson	DOE-HQ EM30	10/05/11
Mario Vargas	Lawrence Livermore Nat. Lab	10/26/11
Jose Matos	Washington River Protection Solutions	10/19/11
Lilian Marrero	Soil & Groundwater modeling for DOE-EM	11/09/11
Givens Cherilus	Savannah River Site	11/30/11
Janty Ghazi	Washington River Protection Solutions	12/07/11

- DOE Fellows continued to assist EFCOG in developing Lessons Learned and Best Practices documents.
  - A draft lessons learned was completed on the unanticipated high dose during the removal of wire flux monitor cabling from the HWCTR reactor vessel and sent to the site point of contact for review on 11/10/11.
  - A lesson learned on the closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site was drafted and sent to the site point of contact for review on 11/10/11. Site comments were received and incorporated and the document was then sent to EFCOG for review on 12/5/11.
  - A best practice on the historical hazard identification process for D&D was reviewed for a second time by the site point of contact and subsequently sent to EFCOG for their review. EFCOG comments were subsequently incorporated into the document and it was sent to DOE HQ for their review on 12/1/11. FIU received comments from DOE HQ and is working with the site representative on incorporating the comments.
  - A best practice on the 185-3K Cooling Tower Demolition was sent to DOE HQ for review on 12/2/11. FIU received comments from DOE HQ and the site point of contact is working to get the prime contractor's input and approval at SRS.

- On November 16, 2011, FIU's Applied Research Center (ARC) conducted the fifth (5th) DOE Fellows Induction Ceremony during which 11 new FIU minority students were inducted as DOE Fellows:
    - Claudia Cardona (Graduate, Environmental Engineering)
    - Nel Ciurdar (Undergrad, Electrical Engineering)
    - Eric Inclan (Graduate, Mechanical Engineering)
    - Lilian Marrero (Graduate, Civil Engineering)
    - Joshua Midence (Undergraduate, Civil Engineering)
    - Carol Moreno-Pastor (Undergrad, Biomedical Engineering)
    - Jaime Mudrich (Graduate, Mechanical Engineering)
    - Ximena Prugue (Undergraduate, Mechanical Engineering)
    - Paola Sepulveda (Undergraduate, Biomedical Engineering)
    - Frank Silva (Undergraduate, Electrical Engineering)
    - Bryant Thompson (Undergraduate, Biomedical Engineering)

- This year, Ms. Tracy Mustin (Acting Principal Assistant Secretary for Environmental Management) was one of the keynote speakers for the ceremony. Ms. Mustin welcomed the FIU students to the DOE Fellows program and encouraged them to continue to hone their communication skills as well as their technical skills. Ms. Mustin emphasized the needed ability to articulate their research aims, results and significance.
- Other distinguished guests included Dr. Jeff Griffin (Associate Director for Environmental Management, Savannah River National Laboratory) and Dr. Ines Triay (Former Assistant Secretary for DOE Office of EM). FIU was represented by Dr. Andres Gil (Vice President for Research), Dr. John Proni (ARC Executive Director), and Dr. Leonel E. Lagos (DOE Fellows Program Director), as well as FIU faculty, staff, and students. Ms. Mustin and Dr. Griffin had the opportunity to participate in morning tours of the ARC research laboratories and listen to DOE Fellows presenting their research work. In addition, the distinguished guests and FIU faculty had the opportunity to interact with the DOE Fellows during a poster exhibition following the induction ceremony.

DOE Fellows Induction Ceremony – November 16, 2011

The DOE-FIU Science and Technology Workforce Development Program is pleased to announce that the "pipeline" is working! During the Fall 2011 semester, eleven (11) DOE Fellows in science, technology, engineering, and math (STEM) disciplines were hired by DOE, DOE national laboratories and private industry. The following DOE Fellows were hired:

- Edgard Espinosa (DOE EM – Washington, DC)
- Charles Castello (Oak Ridge National Laboratory - Oak Ridge, Tennessee)
- Rinaldo Gonzalez (Pacific Northwest National Laboratory – Richland, Washington)
- Denny Carvajal (Mount Sinai Medical Center - Miami, Florida)
- Amaury Betancourt (Florida Department of Environmental Protection – Tampa, Florida)
- William Mendez (Boeing Company – Seattle, Washington)
- Mario Vargas (Boeing Company – Seattle, Washington)
- Merlin Ngachin (Waste Control Specialists – Andrews, Texas)
- Givens Cherilus (Florida Power & Light, Miami, Florida)
- Shina Rana (Florida Power & Light, Miami, Florida)
- Alex Henao (Internal Revenue Service - Louisville, Kentucky)

Additional information can be obtained at
http://www.arc.fiu.edu/Intern/eventsNews_DOEFellowsHiredin2011.asp

Milestones and Deliverables

The milestones and deliverables for Project 5 are shown on the following table. The milestones completed during this quarter include the selection of new DOE Fellows for Fall 2011 (2011-P5-M4), the completion of the DOE Fellows' summer internship reports (2011-P5-M3), and the conduction of the DOE Fellow Induction Ceremony (2011-P5-M5), which took place on November 16, 2011. The project is on target for the completion of the remaining deliverables.

Work Plan for Next Quarter

- Begin Spring 2012 campaign to recruit DOE Fellows into the program.
- Begin coordination of internship placements for summer 2012 at DOE sites, national laboratories, DOE-HQ, and DOE contractors.
- Submit DOE Fellow research abstracts to Waste Management 2012 Symposia for student poster exhibition and work with DOE Fellows to develop posters.
- Submit DOE Fellow professional papers to WM2012 for professional oral and poster presentations and work with DOE Fellows to develop oral presentations and professional posters.
- Coordinate travel for DOE Fellows to attend Waste Management 2012 Symposia.
- Coordinate student participation at the Waste Management 2012 Symposia.
- Participate in Waste Management 2012 Symposia
- Submit abstract to ANS's DD&R conference scheduled for June 2012.
- Conduct DOE Fellows Lecture Series. Dr. Soon Heung Chang (President of Korean Nuclear Society, Dean at KUSTAR/KAIST Institute, and Vice President at the Korea Advanced Institute for Science and Technology) has been invited to visit FIU and talk to our DOE Fellows. The event has been scheduled for February 10, 2012.

Milestones and Deliverables for Project 5

Task	Milestone/ Deliverable	Description	Due Date	Status
Task 4: Selection of DOE Fellows	2011-P5-M1	Selection of new DOE Fellows - Spring 2011	06/30/11	Complete
	2011-P5-M4	Selection of new DOE Fellows – Fall 2011	10/31/11	Complete
	Deliverable	List of identified/recruited DOE Fellow (Class of 2011)	10/31/11	Complete
Task 6: Summer Internship Program (SIP)	Deliverable	List of 2011 Student Summer Interns and their research assignment	06/06/11	Complete
	2011-P5-M2	DOE Fellows Complete Summer Internships	08/31/11	Complete
	2011-P5-M3	Summer Internships Reports Completed	10/03/11	Complete
	Deliverable	Deliver Summer 2011 Interns reports to DOE	10/14/11	Complete
Task 8: Program Presentations/ Communication/ Conferences	2011-P5-M5	Conduct Induction Ceremony – Class of 2011	11/30/11	Complete
Program-wide	Deliverable	Draft Technical Task Plan	06/17/11	Complete
	Deliverable	Quarterly Status and Progress Summary Reports	Quarterly	On target
	Deliverable	Draft Year End Report	06/17/12	On target
	Deliverable	Update Technical Fact Sheet	30 days after end of project	On target