

STUDENT SUMMER INTERNSHIP TECHNICAL REPORT

**Climate Change Vulnerability Assessment and  
Adaptation Plan for DOE Sites**

DOE-FIU SCIENCE & TECHNOLOGY  
WORKFORCE DEVELOPMENT PROGRAM

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## ABSTRACT

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During the summer of 2014, DOE Fellow, Yoel Rotterman, was given the opportunity to intern with the Office of Environmental Management (EM) at DOE Headquarters in downtown Washington D.C. under the mentorship of Mr. Albes Gaona, sustainability specialist at the Office of Deactivation and Decommissioning and Facility Engineering (D&D/FE) (EM-13). The Office's mission is to provide integration, planning and analysis for all EM D&D/FE including sustainability projects to ensure that these activities are completed efficiently and effectively, reducing significant risks and life cycle schedules and costs in the D&D program. The Office also provides technical direction and/or assistance to resolve difficult technical problems associated with D&D.

During the internship, Yoel had the opportunity to work on various topics. On his arrival, he attempted to continue conducting a Green and Sustainable Remediation (GSR) analysis of the M-1 Air Stripper of the Savannah River Site (SRS), in support of a project at FIU's Applied Research Center (ARC), and also to work on finding new technology applications for the surveillance and maintenance of the different DOE sites. Due to time and organizational inconveniences Yoel was not able to perform the GSR analysis. After taking a climate change workshop for a day and a half, he decided he was going to focus on a climate change vulnerability study for several DOE sites, taking as a reference several case studies and a workbook guide released by the Environmental Protection Agency (EPA).

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# 1. INTRODUCTION

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According to the Association of Climate Change Officers (ACCO), Climate change can be defined as the long-term change in meteorological and environmental conditions that alter the average weather patterns due to natural or human causes, or both. This concept has gained momentum in the past few years with the increase of global average air and water temperatures, rising sea levels, heavier flooding, melting of snow glaciers, longer drought periods, increased threats from wild-fires, and severe weather, which have been reflected in unprecedented and devastating natural disasters around the world.

President Obama released in 2013 the Executive Order (EO) 13653, *Preparing the United States for the Impacts of Climate Change*, to emphasize the importance for federal agencies to take action to enhance climate preparedness and resilience. The U.S. Department of Energy (DOE) provided the *DOE Climate Change Adaptation Plan* in 2014 to increase the resilience and mitigation actions across the Department, and to push for the implementation of climate change adaptation as part of its planning and operations.

The mission of the Office of Environmental Management (EM) is to manage the safe cleanup of environmental legacy contamination brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research. To assure the proper fulfillment of its mission and realizing the importance of climate change resilience, various DOE offices, including EM, hosted a seminar on June 22-23 that included speakers and workshops from various federal agencies such as the National Oceanic & Atmospheric Administration (NOAA) and private companies such as ACCO. The main purpose of this seminar was to teach the DOE-EM offices as well as the different DOE sites to be more capable of anticipating, preparing, responding, and recovering from multi-hazard threats with minimal damage to their social well-being, the economy, and the environment, with a risk-based vulnerability assessment and action plan.

## 2. EXECUTIVE SUMMARY

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This research work has been supported by the DOE-FIU Science & Technology Workforce Initiative, an innovative program developed by the US Department of Energy's Office of Environmental Management (DOE-EM) and Florida International University's Applied Research Center (FIU-ARC). During the summer of 2015, a DOE Fellow intern, Yoel Rotterman, spent 10 weeks doing a summer internship at DOE-EM, under the supervision and guidance of Albes Gaona, co-lead for the sustainability program at DOE-EM. The intern's project was initiated on June 1, 2015, and continued through August 7, 2015 with the objective of examining various projects focusing on sustainability, technology applications for surveillance and maintenance, and a climate change assessment, and also attending day to day meetings, conferences, and seminars held at DOE-HQ.

## 3. RESEARCH DESCRIPTION

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### 3.1 Climate Change Vulnerability Assessment

#### The Workshop

On June 23<sup>rd</sup>, various DOE offices, including the Office of Environmental Management (EM), hosted a one day and a half seminar focusing on climate change resilience and mitigation of the various DOE sites with the purpose of training the different offices and facilities to be more capable of anticipating, preparing, responding, and recovering from multi-hazard threats with minimal damage to their social well-being, the economy, and the environment, with a risk-based vulnerability assessment and a subsequent action plan.

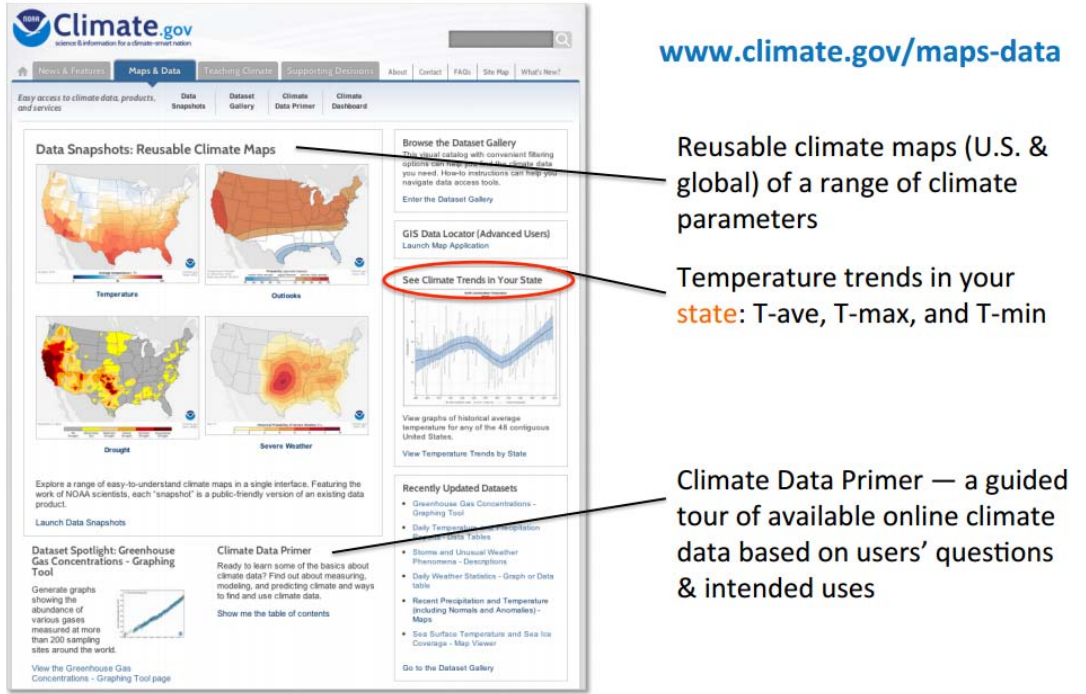
The first day of the seminar was a general introduction to understand the concepts of weather and climate science with the latest projections analyzed by the National Oceanic and Atmospheric Administration (NOAA), including an overview of possible future climate scenarios and how to deal with climate change, and a workshop on how to engage and effectively communicate climate change issues inside one's office.

One effective tool presented at the workshop was the five-step-resilience-toolkit, which prompts the organization doing the planning on how to do a detailed analysis of the process step by step, including:

1. Identifying the problem
  - Who should participate in the planning process; what are the most urgent climate-stressors; what are the boundaries of the problem; what will be the decision-making criteria.
2. Determining vulnerabilities
  - What is the exposure to the stressors; what is the organization's sensitivity; what is the adaptive capacity; assess the vulnerabilities.
3. Investigating options
  - What options are acceptable; what goals guide the objectives; identify options that could reduce vulnerabilities.
4. Evaluating risks and costs
  - Take into account hazards, assets, risks, potential losses, costs, feasibility, and benefits.
5. Taking action
  - Measure the effectiveness of each step and iterate as needed.

The second day was divided into four main subjects: (1) understanding climate variability, extreme events, and long-term climate change, (2) identifying climate hazards and how to adequately conduct vulnerability assessments, (3) leveraging climate data and tools, and (4) developing an adaptation plan for one's organization. A good source to find information on the tools and climate data is Climate.gov (Figure 1).





**Figure 1. Climate.gov/maps-data.**

Before the last section of the workshop, a case study of Los Alamos National Laboratory (LANL) was presented. LANL is a facility located in Northern New Mexico. Throughout the years LANL has been through several megafires, including Cerro Grande (May 2000) and Las Conchas (June-August 2011) (Figure 2). The impact the fires had on LANL was significant, including more than \$311 million in direct infrastructural damages and \$89.1 million in labor/productivity losses for the Cerro Grande fire after being closed for 11 days. Similarly for the Las Conchas fire, losses of \$15.7 million in direct costs and \$56.7 million in labor/productivity were recorded. These numbers could have been much larger without the efforts taken prior to the climate-related environmental events.

After the last fire in 2011, LANL started a long term strategy for environmental stewardship and sustainability by developing infrastructure to address full impacts, improve emergency planning and integrate tools such as geographic information systems (GIS), to be more resilient.



**Figure 2. Las Conchas fire.**

### Vulnerability Assessment and Action Plan Template

After the climate change workshop, a number of documents focusing on how to address the climate change threats to the mission of the Office of Environmental Management (EM) were synthesized in an attempt to establish a template that can be used across the DOE complex. Firstly, an analysis of the regulatory basis when building a radioactive waste disposal facility was conducted with reference to a case study from Oak Ridge National Laboratory (ORNL) in order to understand how a climate change vulnerability assessment could be implemented from a regulatory standpoint.

The main document that provided crucial information on the specific steps required by each facility to complete a proficient assessment of climate change risks was “*Being Prepared for Climate Change, A Workbook for Developing Risk-Based Adaptation Plans*,” by the Environmental Protection Agency (EPA). This document described five steps for conducting a vulnerability assessment, and five additional steps on how to move on to the action plan. It provided the objective of each step, the process to achieve the specific portion, and how to get started.

An example of how the Workbook interacts with the user is shown in Figure 3, where instructions are provided on how to evaluate each risk and compare them using a consequence/probability matrix.

Likelihood (probability) of occurrence	High	1. Warmer water may stress immobile biota 2. Warmer water may lead to changes in drinking water treatment processes n. _____	1. Warmer water may hold less dissolved oxygen 2. Sea level rise may cause bulkheads, sea walls and revetments to become more widely adopted n. _____	1. Shoreline erosion from sea level rise may lead to loss of beaches, wetlands and salt marshes 2. Combined sewer overflows may increase from more intense precipitation n. _____
	Medium	1. Increased wildfires from warmer summers may lead to soil erosion 2. Warmer winters may lead species that once migrated through to stop and stay n. _____	1. Parasites and bacteria may have greater abundance, survival or transmission due to warmer water 2. Warmer summers may drive greater water demand n. _____	1. More frequent drought may diminish freshwater flow in streams 2. More intense precipitation may cause more flooding n. _____
	Low	1. Warmer water may lead open seasons and fish to be misaligned 2. Warmer winters may lead to more freeze/thaw cycles that impact water infrastructure n. _____	1. Warmer water may lead jellyfish to be more common 2. Ocean acidification may cause the recreational shellfish harvest to be lost n. _____	1. Contaminated sites may flood from sea level rise 2. Warmer water may promote invasive species n. _____
		Low	Medium	High
Consequence of impact				

Figure 3. Example of the consequence/probability matrix.

Another reference that was very useful was the *Climate Change Adaptation Implementation Plan*, from the Office of Solid Waste and Emergency Response (OSWER). The mission of OSWER is to protect human health and the environment, and preserve the land resources. This document is intended to identify climate change impacts to OSWER’s programs and for integrating consideration of climate change impacts into the DOE-EM’s work, and therefore provided very useful information for this internship.

Figure 4 presents different vulnerabilities that could be present depending on factors such as the preservation of land, restoration of land, emergency response, and other materials.

Preserving Land	Proper Management of Hazardous and Non-Hazardous Wastes	Design and placement of RCRA Treatment, Storage and Disposal facilities, non-hazardous Subtitle D landfills, Superfund remedies and municipal recycling facilities may need to change to accommodate climate change impacts.
		Hazardous waste permitting requirements may need to be updated to reflect climate change impacts.
		Current waste management capacity may be insufficient to handle surges in necessary treatment and disposal of hazardous and municipal wastes, as well as mixed wastes generated from climate events.
		Levels of necessary financial assurance at RCRA and CERCLA facilities may need to adjust for increased risks/liabilities at specific facilities that may be directly affected by climate change impacts.
	Reducing Chemical Risks and Releases	Remediation and containment strategies and materials used in construction may need to be strengthened to reflect changing climate conditions.
		Current equipment, scientific monitoring and sampling protocols on sites may no longer be effective and therefore may require adjustments due to climate change impacts.
		Current assumptions regarding protectiveness of remediation and containment methods may not reflect changing climate impacts.
		Spill Prevention Plans may need to be updated due to the significant increases in the incidence of flooding and storm events.
Restoring Land	Site characterization and design of cleanups may not reflect changing climate conditions.	
	Risk factors and rankings for risk-based cleanup strategies may need to be reassessed based on changing climate conditions.	
	Changing climate conditions may impact continued remedy effectiveness.	
	Remedies that are "complete" or are long-term actions may no longer be protective and resilient as climate conditions change at site.	
	Increased contaminant migration may lead to boundary changes at current sites or creation of new sites.	
	Changes in climate conditions may alter assumptions about contaminant form/volatility.	
	Current scientific monitoring and sampling protocols on sites may no longer be effective.	
	Safety procedures on sites may not reflect likelihood or intensity of surrounding conditions.	
	Availability of utilities and transportation infrastructure may be limited as a result of increased impacts to those systems.	
	Current assumptions regarding protectiveness of remediation and containment methods may not reflect changing climate impacts.	
Emergency Response	Periodic evaluations of implemented remedies may not incorporate all climate change impacts, including changes in frequency and intensity that may impact remedy effectiveness.	
	Use of natural resources impacted by sites may change as a result of increased need, resource scarcity, or compromised resources.	
	Current levels of administrative, enforcement, and emergency response staff may be insufficient to cover needs if number of extreme events increase.	
	Sufficient capability and capacity for conducting necessary lab analysis following significant weather events may not be available.	
	Current waste management capacity, including interim capacity, may be insufficient to handle surges in necessary treatment and disposal of hazardous and municipal wastes, as well as mixed wastes generated from climate events.	
Tools, Data, Training and Outreach	Training needs (both current and future) are likely to increase in order to meet the increase demand for response actions.	
	Existing emergency planning currently required or employed by OSWER may not sufficiently consider elevated risks from multiple climate impacts.	
	Outreach and educational materials may need to be developed for owners and operators with facilities in areas of changing environmental conditions.	
	Revised training protocols and SOPs that take into account climate change impacts and what to look for may need to be developed.	
	Reliable data sources to use in site-specific analyses may need to be identified	
	Models, decision tools, site environmental data and information feeds may need to be updated to reflect changing climate conditions	

Figure 4. OSWER list of vulnerabilities.

Towards the end of this internship, an abstract related to the climate change vulnerability assessment conducted was submitted in the professional track of the Waste Management Symposium 2016 to be held in Phoenix, Arizona. The paper entitled “*DOE Climate Change Vulnerability and Adaptation Planning*”, (Abstract can be found in Appendix A) is intended to depict the importance for DOE-EM to assess climate change vulnerability and implement planning procedures.

### 3.2 Green and Sustainable Remediation

The main purpose of Green and Sustainable Remediation (GSR) is to achieve environmental cleanup in the safest and cleanest way possible, aiming for net environmental, social, and economic benefits.

The student intern, Yoel, participated in a GSR webinar on the second day of his internship, which addressed commonly, asked questions such as what is GSR, what is its history and main components, who is doing it, why to do it, and how to implement GSR at the various DOE sites.

According to the Executive Order (EO) 13514 and EPA’s Greener Cleanup Elements, there are five basic metrics that include five categories to perform a sustainable remediation evaluation. (Figure 5)

<b>1. Minimize Total Energy Use and Maximizes Use of Renewable Energy</b>	
	Minimize energy consumption (e.g. use energy efficient equipment)
	Power cleanup equipment through onsite renewable energy sources
	Purchase commercial energy from renewable resources
<b>2. Minimize Air Pollutants and Greenhouse Gas Emissions</b>	
	Minimize the generation of greenhouse gases
	Minimize generation and transport of airborne contaminants and dust
	Use heavy equipment efficiently (e.g. diesel emission reduction plan)
	Maximize use of machinery equipped with advanced emission controls
	Use cleaner fuels to power machinery and auxiliary equipment
	Sequester carbon onsite (e.g., soil amendments, revegetate)
<b>3. Minimize Water Use and Impacts to Water Resources</b>	
	Minimize water use and depletion of natural water resources
	Capture, reclaim and store water for reuse (e.g. recharge aquifer, drinking water irrigation)
	Minimize water demand for revegetation (e.g. native species)
	Employ best management practices for stormwater
<b>4. Reduce, Reuse and Recycle Material and Waste</b>	
	Minimize consumption of virgin materials
	Minimize waste generation
	Use recycled products and local materials
	Beneficially reuse waste materials (e.g., concrete made with coal combustion products replacing a portion of the Portland cement)
	Segregate and reuse or recycle materials, products, and infrastructure (e.g. soil, construction and demolition debris, buildings)
<b>5. Protect Land and Ecosystems</b>	
	Minimize areas requiring activity or use limitations (e.g., destroy or remove contaminant sources)
	Minimize unnecessary soil and habitat disturbance or destruction
	Minimize noise and lighting disturbance

**Figure 5. Greener Cleanup Elements (Metrics).**

Yoel was able to improve his knowledge of GSR and its impact on DOE-EM during the time he spent at DOE-HQ.

### **3.3 Technology Applications for Surveillance and Maintenance**

During his internship, Yoel was able to evaluate different technologies that could be beneficial for the surveillance and maintenance operations at the different DOE sites across the United States. One technology evaluated that could be used in the area of surveillance and maintenance, was the Unmanned Aerial Vehicle (UAV) and drones to reduce risks when managing hazards,

operating critical equipment, monitoring radiological conditions from various facilities, and increasing security.

## 4. OTHER ACTIVITIES

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### 4.1 Vitreous State Laboratory Tour

Yoel had the opportunity to visit the Vitreous State Laboratory (VSL) situated at the Catholic University in Washington D.C. After an elaborate explanation of the process of melting glass with radioactive high level waste and the operation of the melters used in the process, he was able to tour the facility which possesses various scales of melters, and a laboratory simulating one of the DOE sites.

### 4.2 Day to Day Meetings

During his visit, Yoel was able to attend several meetings that are a key component in the daily activities at DOE-HQ. He was able to experience how different offices work together to achieve greatest resilience inside the Department. These meetings included EM-10 staff meetings, a meeting with Oak Ridge advisory board members with whom Yoel was working on a case study from their facility, and a meeting with the Climate Adaptation Collaborative that was created to centralize training, policy, implementations, studies, and lessons learned from DOE Headquarters to the field sites pertaining to climate change.

### 4.3 Internal Workshops

DOE-HQ hosted several workshops tailored for the summer interns to get the greatest benefit from their internship experiences. Yoel participated in a number of these workshops including a networking workshop; a financial literacy workshop; resume writing; an information session on the different programs that are offered across the various DOE offices to broaden the portfolio of available opportunities; and a federal employment information session hosting several offices from inside DOE-EM as well.

### 4.4 Visit to the Savannah River Site

Yoel Rotterman traveled to the Savannah River Site (SRS) from August 12 to August 14 with the purpose of touring the site and gathering relevant information to support a GSR analysis of the M-1 Air Stripper. The information collected would serve as a baseline to analyze the performance of the current air stripping system, which would allow the development of optimization recommendations, as well as an evaluation of natural attenuation as a sustainable solution for some regions in the vadose zone.

The complete report can be found in Appendix B

## 5. CONCLUSION

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The Office of Environmental Management plays a very important role inside the DOE, and has a crucial mission to ensure the safe cleanup of the legacy of environmental contamination brought about by fifty-years of nuclear energy research and nuclear weapons development.

By focusing on climate change and how it may affect DOE's ability to fulfill its mission, Yoel was able to gain experience with different offices inside the DOE and realize how complex and broad the structure of the Department is, and what it really takes to combine the expertise from the different offices to achieve one goal.



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## APPENDIX A

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### DOE Climate Change Vulnerability and Adaptation Planning

Executive Order (EO) 13653, *Preparing the United States for the Impacts of Climate Change*, was issued in 2013. The President emphasized the importance for federal agencies to take action to enhance climate preparedness and resilience. The U.S. Department of Energy (DOE) released the *DOE Climate Change Adaptation Plan* in 2014 to build resilience and mitigation across the Department, and to assure inclusion of climate change adaptation as part of its planning and operations. As part of the EO implementation, DOE established the Climate Adaptation Collaborative across the programmatic offices to centralize training, policy, implementations, studies, and lessons learned from the Headquarters to the Field sites.

DOE's Office of Environmental Management (EM) has an important mission to manage safe cleanup of environmental legacy contamination brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research. Specifically, EM manages remediation of soil and groundwater, deactivation and decommissioning of facilities, and disposal of hazardous and radioactive waste.

As part of their Fifth Assessment Report in 2014, the Intergovernmental Panel on Climate Change (IPCC) observed that recent climate changes have had extensive impacts on human and natural systems. A summary of observational trends includes: the increase of global average air and ocean temperatures, rising of average sea level, heavier flooding, melting of snow glaciers, longer drought periods, increase threats from wild fires, and severe weather. Three case studies are discussed in this paper that demonstrate why it is important for DOE EM to assess climate change vulnerability and implement planning procedures.

1. Los Alamos National Laboratory in New Mexico invested over \$0.5 billion in response to extreme drought, fire, rainfall, and flooding management events over a period of about 20 years. These events prompted a change in management strategy to a proactive plan for the site to mitigate climate change impacts. Of interest is proactive radioactive waste management to assure that operational areas and containers are not at risk to future fires and flooding.
2. The majority of DOE's cleanup program is regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and the DOE Orders. With the eminent vulnerability that climate change presents to contaminated sites, the U.S. Environmental Protection Agency (EPA) now requires a climate change vulnerability assessment and adaptation plan for all regulated cleanup programs to prioritize its adaptation efforts. One example is the American Cyanamid Superfund Site in New Jersey. After Hurricane Irene hit the coast of New Jersey in 2011, three major berms within the 100-year floodplain containing contaminated solvents flooded, causing major damages to the facility. Post-flood modifications included relocation of office

trailers, transfer of waste and equipment outside the floodplain, implementation of a berm inspection program, and evaluation of infrastructure design. Where climate change poses a potential threat to DOE's remedial systems under CERCLA, impacts will be assessed in five-year reviews.

3. Hazardous and radioactive waste disposal facilities for which DOE has self-regulatory authority under DOE Order 435.1, are subject to a 1000-year regulatory period of analysis. For radioactive waste disposal facilities in low-lying areas in proximity to groundwater, climate change vulnerability and assessment is prudent for operational management. In the past 20 years, some facilities have measured increases in annual precipitation, higher-magnitude flooding events, and rising groundwater levels. These responses to recent climate change will be assessed through annual maintenance, monitoring plans, as well as updates to the facility's performance assessment. Predictive data from [www.climate.gov](http://www.climate.gov), supported by the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA), will be used to update performance assessment models.

## APPENDIX B

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### **Yoel Rotterman (DOE Fellow) SRS Visit, August 12 – 14, 2015**

The Cooperative Agreement between the Department of Energy (DOE) Office of Environmental Management (EM) and the Applied Research Center (ARC) at Florida International University (FIU), “Environmental Remediation Technologies (EM-12)” focuses its research in the area of soil and groundwater remediation and treatment technologies and is currently working with Savannah River National Laboratory (SRNL) to apply these approaches to the similar challenging environmental problems at the Savannah River Site (SRS). One task (Task 3) under this project involves the analysis of baseline, optimization studies and development of a system improvement plan for the groundwater remediation system at the A/M Area of SRS.

The main objective of this task in 2015 is to collect and analyze engineering design, construction and performance data for the M-1 Air Stripper (in August and September) to produce a Green and Sustainable Remediation (GSR) analysis of the air stripper by December.

#### **Purpose of the Visit:**

Yoel Rotterman traveled to the Savannah River Site (SRS) with the purpose of touring the site and gathering relevant information to support a GSR analysis of the M-1 Air Stripper. The information collected would serve as a baseline to analyze the performance of the current air stripping system, which would allow the development of optimization recommendations, as well as an evaluation of natural attenuation as a sustainable solution for some regions in the vadose zone.

#### **Site Visit Agenda:**

- SRNL (Ralph Nichols) provided the original idea for Task 3, which include analysis of:
  1. Baseline activity to explain where the project is now and to compare it to when the project began operations in the mid-1980’s.
  2. Performance of the air stripper and the pumping system concerning electricity saved over a long timeframe, greenhouse gas emissions with various options, possible water line-pressure reduction to save electrical energy, and analysis of the groundwater pumping system and the volume flow rate of the air.
- SRNL described the organizational structure at SRS. A separate contractor is in charge of the operations and maintenance (O&M) of the different legacy facilities with environmental cleanup activities (the M-1 Air Stripper remediation system being one of those). The Area Completion Project (ACP) ) is the overarching remediation program for the groundwater that would need to support FIU in obtaining critical

system and performance information for the proposed GSR analysis . SRNL is willing to help FIU in obtaining the documents from ACP.

- Some level of funding might be required for the ACP contractor to engage with FIU and SRNL to ensure timely assembly of the critical information for this GSR.

Several background documents on the air stripper were provided during this trip, including:

- **Effectiveness of the M-Area Ground-water Remedial Action Program, Sept. 1985-86**

This document introduces the project objectives and gives a background of the site, the performance of the different remediation systems, the air stripper, and well network. It also gives information on the hydrology and its effects, the effectiveness of the remedial program, and recommendations.

It serves as a starting point for FIU's GSR analysis.

- **Air Stripper and Recovery Well Network for removing VOC's from Water**

This document provides an introduction of the Savannah River Site, and the Groundwater Assessment Program - it evaluates the air stripper as the chosen remedial action alternative- later, it describes the air stripper technology, the program strategy, the design criteria and system description, operation and performance.

It is also important information for FIU's GSR analysis.

- **Development of Chemical Reduction and Air Stripping Processes to Remove mercury from Wastewater**

The paper evaluates the removal of mercury from wastewater using chemical reduction and air stripping with a full-scale treatment system at the Savannah River Site, with the objective of reducing mercury exposure to the general population from fish consumption.

This paper provides three good sources of information: 1) Kavanaugh and Trussell 1980, 2) Treybal 1980, and 3) Montgomery. It also provides the concentration of mercury in the inlet groundwater (250 ng/L), the nominal wastewater, flow to the air stripper (1,609 L/min, or 425 gpm), the internal volume of the countercurrent air stripper (23.280 L, or 6,150 gpm), and the dimensions of the upper and lower beds of the stripper (5.8-m, and 5.2-m, respectively)

During the visit FIU was able to obtain some additional information that will be useful in its GSR analysis, although the information was relayed verbally and the original data source(s) is unknown. These data includes:

- RWM Wells are 125 ft deep, and are now pumping at a rate of 420 gal/min.
- On average it rains 45 inches annually, and 15 inches goes into the ground.
- Inlet water concentrations range from 2-3 ppm. Outlet water concentrations are less than 0.5 ppm
- Concentration of mercury: 250 ng/liter
- Water pumps 450 gal/min
  - o (On the first week of October, most likely, SRNL will be able to know how much power the pumps are using by doing measurements on voltage, current, etc.)
- Motor of the air blower: GCAS-MO-200-2-60 / 60 HP / 480 V / 3PH

A meeting in September involving experts from SRNL and the site remediation contractor (Savannah River National Solutions) was discussed between SRNL and DOE. Details on the meeting are still pending.

Yoel was able to tour the air stripping system with Ralph Nichols and Dennis Jackson from SRNL.

### **Conclusions:**

- Yoel visited SRS and was directed by Ralph Nichols from SRNL to identify the data/documents required for the GSR analysis. However, it was determined that a portion of the data required for analysis of the design, construction, operations & performance information is held by the remediation contractor funded under ACP.
- All parties (DOE-HQ, FIU, SRNL, and ACP contractor) need to be engaged for this GSR to achieve its goals and deliverables.
- The readily available engineering data is insufficient to conduct a proper academic GSR analysis.
- Yoel will work with his mentor (Dave Roelant) and Sr. mechanical engineer (Amer Awwad) at FIU ARC to perform this GSR analysis. FIU ARC will work very closely with SRNL for this analysis.