STUDENT SUMMER INTERNSHIP TECHNICAL REPORT

Summer Learning Experience

DOE-FIU SCIENCE & TECHNOLOGY
WORKFORCE DEVELOPMENT PROGRAM

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EXECUTIVE SUMMARY

This internship has been supported by the DOE-FIU Science & Technology Workforce Initiative, an innovative program developed for the U.S. Department of Energy's Office of Legacy Management (DOE-LM) by Florida International University's Applied Research Center (FIU-ARC). During the summer of 2021, DOE Fellow intern, Olivia Bustillo, spent 8 weeks performing a summer internship based out of DOE-LM's Grand Junction, CO office under the supervision and guidance of Ms. Jalena Dayvault. The internship was initiated on June 30, 2021 and continued through July 24, 2021 with the objective of gaining a better understanding of the mission of the DOE Office of Legacy Management (LM) and how Bustillo's research at FIU will support the goals within LM.

1. INTRODUCTION

During the summer of 2021, Department of Energy's (DOE) Office of Legacy Management (LM) Fellow, Olivia Bustillo, had the opportunity to participate in developing a plan for a unique summer learning experience as part of the first internship with the Office of Legacy Management through FIU's workforce development program. The plan included several different activities that would expose Bustillo to a variety of work being conducted by LM that relate to her interests, as well as allow her to learn more about how her research at FIU supports the goals within LM. Events included sampling activities, site inspections, laboratory work, and stakeholder meetings. These events will aid her future research as she begins a Master's program and continues her Fellowship at FIU. The various sampling activities, site inspections, and stakeholder meetings occurred at a variety of locations throughout Colorado as well as one site in Wyoming. The Fellow was stationed in Grand Junction Colorado and performed site visits as necessary. When not in the field, work was completed either in the office or remotely.

The research that the Fellow conducts at FIU is related to the Old Rifle site in Colorado. The site is investigating how to remediate the groundwater, which is contaminated with uranium (U). FIU, in collaboration with DOE-LM, is investigating the use of apatite injection for sequestering U in groundwater. Specifically, FIU will study the mechanism of U removal from groundwater using apatite as well as the environmental factors that influence the stability of that removal. The data obtained will help fill the knowledge gaps on the mechanisms involved in the removal of U, the stability of the removal and assist DOE-LM remediate uranium in the site where uranium is present.

2. INTERNSHIP DESCRIPTION

2.1 Groundwater and Surface Water Sampling

Olivia Bustillo participated in several groundwater and surface water sampling activities throughout the summer. The sampled sites included Old Rifle, Rocky Flats, Durango, and Riverton. The sampling activities taught her the entire process, including the sampling method and how the data is analyzed, managed, and utilized to support LM. While participating in these events, Bustillo also assisted the sampling team in collecting field measurements.

Groundwater and surface water sampling each entail different procedures. In addition, each site has specific characteristics that require difference approaches, taking into account various factors such as sampling location, analytes of interest, pump type, sample collection and preservation methods. Also, the history of the site must always be considered when defining these parameters. For example, when choosing a sampling location, the history of the site must be considered to ensure that the most pertinent areas are being monitored. The analytes of interest vary depending on the site needs, which will affect the collection and preservation methods. Sites may have wells within the boundaries that are categorized differently, which results in alternate collection procedures at wells within the same area.

Figure 1. Groundwater (left) and surface water (right) sampling activities in Durango.

Some sites have also employed telemetry systems to collect samples, which also changes the collection process. Bustillo worked with the telemetry systems located at the Rocky Flats site. These systems were used to collect surface water samples, but unlike samples that are gathered manually and typically not very frequently, the telemetry system allows the samples to be gathered into large carboys based on flow rate. This allows the data to provide a clearer and more accurate description of the behavior of the site at each sampling point.

Figure 2. The telemetry system (left) and surface water sampling activities (right) at Rocky Flats.

While working with the sampling teams, Bustillo was able to recognize that sampling is of high importance within LM. The data obtained from sampling gives vital information about the site, such as whether action needs to be taken if conditions change at the site. LM utilizes sampling to monitor sites to assist in identifying and addressing potential site issues. Ensuring data of high quality and having defendable data is required due to the nature of the work, which all starts in the field with gathering samples. To maintain the quality of the samples, specific procedures must be followed in the field. Therefore, the sampling team is required to be well-trained in these procedures to conduct them properly. To ensure there is no cross-contamination between wells, there is dedicated equipment at the sites, if site conditions allow it.

Figure 3. The Fellow participating in groundwater sampling at Rocky Flats.

2.2 Site Inspections

Bustillo had the opportunity to attend site inspections at the Naturita and Durango sites. Participating in these events helped the Fellow understand why site inspections are necessary, the way they are conducted, and how the information assists LM in reaching their various goals. Going to a variety of sites provided an opportunity for Bustillo to recognize the unique design, challenges, and points of interest of each site that those conducting the site inspections must be aware of. There were many people with different roles coming together to collaborate towards a common goal for

the site inspections. This included a representative from the state of Colorado, site managers and site leaders from LM and LM's strategic partner. Site leaders may invite other people such as engineers or certain specialists depending on the conditions and concerns at the site, if any. At several of the inspections, pedologist Morgan Williams joined the team to use his knowledge in soil science to gather information and changes regarding erosion where needed. His work was a part of an ongoing Erosion Risk Project from the Applied Studies and Technology Program within DOE. Overall, the Fellow learned that site inspections are required to ensure that the sites remain protective of human health and the environment. There are many aspects that are considered during inspections such as vegetation, soil, and the influence of animals around the site. Site history also plays a key role during site inspections, and it is the responsibility of the site leader and manager to be aware of any past issues.

Figure 4. Site inspections at Naturita and Durango.

2.3 Environmental Sciences Laboratory

Bustillo spent a portion of the internship in the Environmental Sciences Laboratory at the Grand Junction office working with Peter Steves, the lab manager. In the lab, Bustillo was able to aid Steves in processing and analyzing water samples from the Riverton, Wyoming site. This was a unique opportunity since the process of maintaining data quality and integrity was followed from the field to the lab. This does not solely include following the correct procedures in the field to ensure high data quality, but continuing to hold high standards of work when in the lab. When performing lab work, it is essential to pay close attention to detail and work in an organized manner so that there is confidence in the results that are obtained. However, there are many factors that affect the data quality, such as calibrating equipment so that it functions properly or preparing standards to create an accurate calibration curve.

When analyzing the samples, Bustillo was introduced to two new instruments, the ion chromatography system and the kinetic phosphorescence analyzer. Steves trained her on what each instrument does, how it operates, and how the software is utilized to interpret the data. Once trained, she was able to prepare and run samples on both instruments while also gaining experience working with the software for each. The samples she ran were obtained from the Riverton site in Wyoming where they were conducting a tracer test to determine the direction and size of a plume. The kinetic phosphorescence analyzer was used to analyze the samples for uranium, while the ion chromatography measured the concentrations of select anions. Both instruments introduced a new method of analysis to the Fellow and allowed her to expand her knowledge of laboratory technology. Steves also taught the Fellow how to assemble and run a column test, which allowed her to familiarize herself with the process before returning to FIU, where she will eventually conduct column tests in her research.

While in the lab, Bustillo had the opportunity to learn about the importance of being able to provide minor maintenance repair to analytical equipment. Having the knowledge and ability to do this can be a simple and more efficient method of maintaining equipment in the lab, as long as it is feasible.

Figure 5. (a) Olivia Bustillo (left) and Peter Steves (right) in the lab (Individuals Following CDC Guidelines); (b) Ion Chromatography system.

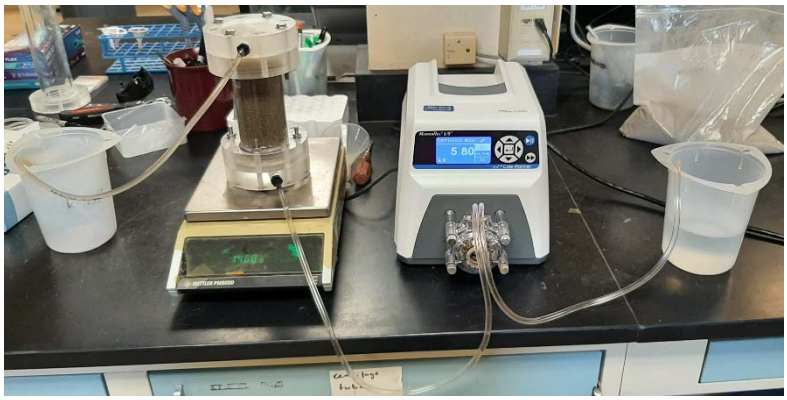

Figure 6. Assembled column test.

2.4 Stakeholder Interactions

One topic that is always discussed but never witnessed in the laboratory is stakeholder interactions. This summer, Bustillo was able to witness stakeholder interactions and their importance firsthand. She saw DOE interactions with the local communities, tribal communities, and other agencies such as the Nuclear Regulatory Commission (NRC). DOE collaborates with their many stakeholders to ensure long-term stewardship and management of their sites for future protection of human health and the environment. The continuous clear communication and transparency they provide with stakeholders and interested parties is vital to gain trust and support. This was witnessed firsthand in an NRC meeting the Fellow attended. In this meeting, the organized manner in which all parties shared information and discussed their needs and viewpoints was apparent.

As a key part of DOE operations, the methods used to best communicate with surrounding communities is constantly growing and developing. Bustillo attended a cultural conversations presentation by Lesly Cusick, Community and Stakeholder Engagement Specialist at RSI, where she talked about the importance of learning about the community in which a project is taking place and the importance of engaging with them. One of her main points was that when entering a community of need as a government agency, it is vital to listen to the community needs as opposed to telling them what they need. The presentation exposed another responsibility DOE undertakes outside of research itself.

Olivia had an opportunity to accompany Bill Frasier, DOE-LM Site Manager, to the Riverton site in Wyoming. The purpose of this trip was to establish and maintain stakeholder relations by meeting with stakeholders and discussing the site. The stakeholders included the local tribal community as well as the local church. This provided Olivia with firsthand experience meeting and effectively communicating with stakeholders. Throughout the various meetings, Bustillo met with different offices within the local tribal community, such as the engineering and financial offices. There was also a meeting with the local church officials, which was the first meeting DOE had with this stakeholder. This visit was necessary to discuss the potential of a future project at the site, which aims to provide assistance for the local tribal community if certain funding is awarded to DOE. The church was informed of the history of the site, the ongoing activities, as well as this potential new project since some of their land falls within the institutional controls at the site.

3.5 Site Leader Responsibilities

One of the advantages of working in a variety of roles was the ability to gain an understanding of the numerous responsibilities a site leader undertakes with each site. Their ultimate goal is to ensure the safety of human health and the environment, but in order to do this they must balance many factors when taking responsibility for a site. While knowing the interests of the stakeholders and complying with applicable laws and regulations, they must address site needs, identify potential problems, and provide innovative solutions that lead their team to accomplish their goals, keeping in mind to maintain long-term protectiveness and reduce long-term costs when taking any action. To achieve this, the site leader must be thoroughly involved in their site and understand the history. A site leader may attend sampling activities to better understand the behavior of the site. It is also their responsibility to ensure the safety and health of the sampling team, so a site leader

may choose to check on their wellbeing during the event. Site leaders always attend site inspections, which helps them stay up to date on the condition of their site.

3. CONCLUSION

Throughout the summer of 2021, Bustillo had many opportunities to expand her knowledge about DOE LM's mission and the field of environmental engineering as a whole. A part of LM's mission is to sustainably manage and optimize the use of land and assets, which the Fellow got to witness firsthand. Land is taken and developed so often, it was refreshing to be a part of the work being done to restore and conserve sites as well as make them available for beneficial use. Three of the sites visited are great examples of a successful execution of this mission; Old Rifle, Rocky Flats, and Durango. The Old Rifle site has managed to engage the community with a Remote Control Park where people can gather and race cars together. A large portion of Rocky Flats is now a National Wildlife Refuge which provides not only a great example of ecological revitalization, but a restored habitat for the threatened Preble's jumping mouse. The refuge is available for public use and there are more trails being developed to provide more accessibility. Finally, the Durango site now serves as a dog park that has become extremely popular within the surrounding community.

The internship also provided support to the Fellows' research at FIU. Bustillo was able to make connections with scientists that were directly involved, and still are, with the research regarding the use of hydroxyapatite as a remediation technology for uranium in groundwater. This included a "Drivers of and Solutions to" discussion on the uranium plume persistence at the Old Rifle site held by Kenneth Williams, Senior Scientist at Lawrence Berkeley National Laboratory. This discussion provided a comprehensive review of the project at the site, the challenges they have encountered since the beginning, what the current status of the site is, as well as how the remediation technology is performing. Since the research that Bustillo is involved in is based on the studies done at the Old Rifle site, this allowed her to enrich her knowledge about the hydroxyapatite technology. The presentation also provided more information about the challenges associated and the applicability of the hydroxyapatite technology at other sites. When meeting with Williams she was able to inquire further about the hydroxyapatite pilot test to gain information from the perspective of one of the primary scientists involved. Mark Kautsky, UMTRCA (Uranium Mill Tailings Radiation Control Act) Program Manager for DOE-LM, had also shared an evaluation done regarding the use of (HA) at the Shiprock, New Mexico site that gave a new insight to the Fellow regarding the technology and some of its limitations. In June, the Fellow was able to present her project to a group at the Moab site since they are interested in using the hydroxyapatite technology to remediate uranium. This allowed Bustillo to make connections with scientists with whom she can share and exchange ideas that could help further her research.

Overall, this was a very enriching experience for Bustillo as she was able to take ownership of her experience to create a meaningful internship. She was successful in learning about the various responsibilities within LM and what their mission is truly about. Along with this, she was able to expand and refine her knowledge as a scientist and a professional.