STUDENT SUMMER INTERNSHIP TECHNICAL REPORT

The Technology Development Office

DOE-FIU SCIENCE & TECHNOLOGY WORKFORCE DEVELOPMENT PROGRAM

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ABSTRACT

The Technology Development Office (EM-3.2) was established to provide leadership to mission strategies, policy changes, and guidance for technology development in order to support EM's mission. The office supports the use of state-of-the-art technologies to reduce costs, accelerate schedules, and mitigate vulnerabilities. In addition, the office supports technology readiness assessments and assists field offices with implementing technology development concepts. It also coordinates technology development activities by DOE's national laboratories and technology centers, to include the use of EM resources by researchers and developers for promising technologies related to the EM mission.

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1. INTRODUCTION

Established in 1989, the Department of Energy's Office of Environmental Management (DOE-EM) has worked for over 25 years to achieve the successful cleanup of the nuclear weapons proliferation radioactive waste management legacy left from the Cold War era: which includes (1) testing and proving grounds, infrastructure needed for the development of thermonuclear devices under the Manhattan Project; (2) the industrial and military infrastructure that was built across the U.S. to support the nuclear arms race during the cold War; and (3) a network of government-sponsored research facilities for the peaceful applications of nuclear science and technology (U.S. Department of Energy, 2016). Among the efforts included within EM's broad mission statement is the storage and security of nuclear materials, the remediation of groundwater and soil, and the deactivation and decommissioning of nuclear facilities. During the early years DOE (formerly known as the Atomic Energy Commission) cleanup program, there was limited availability of cleanup technologies and associated tools, especially for the disposal of radioactive contamination. As such, the Doe was driven to invest heavily into technology innovation which was the direct result of the creativity of cleanup contractors in their efforts to reduce cost and accelerate schedules. This early investment in science and technology directly contributed to the cleanup successes of the last 25 years.

For my internship, I was sent to the Department of Energy Headquarters (DOE-HQ) in Washington D.C. to assist in the ongoing work being done within The Technology Development Office (EM-3.2). The mission of the Technology Development Office (TDO) is to provide leadership and develop mission strategies, policy, and guidance for technology development to support EM's mission. The office supports and implements the use of state-of-the-art technology to reduce costs, accelerate schedules, and mitigate vulnerabilities by leveraging the expertise and capabilities of national laboratories and technology centers. EM will also engage nontraditional suppliers, commercial markets and emerging industries to leverage state-of-the-art and user-driven solutions (U.S. Department of Energy, 2016). The office also as the overriding responsibility to support field offices by enabling the effective execution of its mission. In addition to integrating best practices across the DOE complex, the office manages EM's technology-based international, interagency, and academic interfaces to identify advancing technologies, solutions, materials, and processes. It also fosters the transfer of commercially available technology and newly developed entrepreneurial technology to support cleanup efforts. Among the many key program elements implemented by DOE-EM, is the Science and Technology workforce Development Program, which has granted myself and several other students the opportunity to partake and contribute to the pool of knowledge into the field of nuclear waste cleanup and management. The program is designed to create a "pipeline" of minority engineers to enter the DOE workforce in technical areas of need.

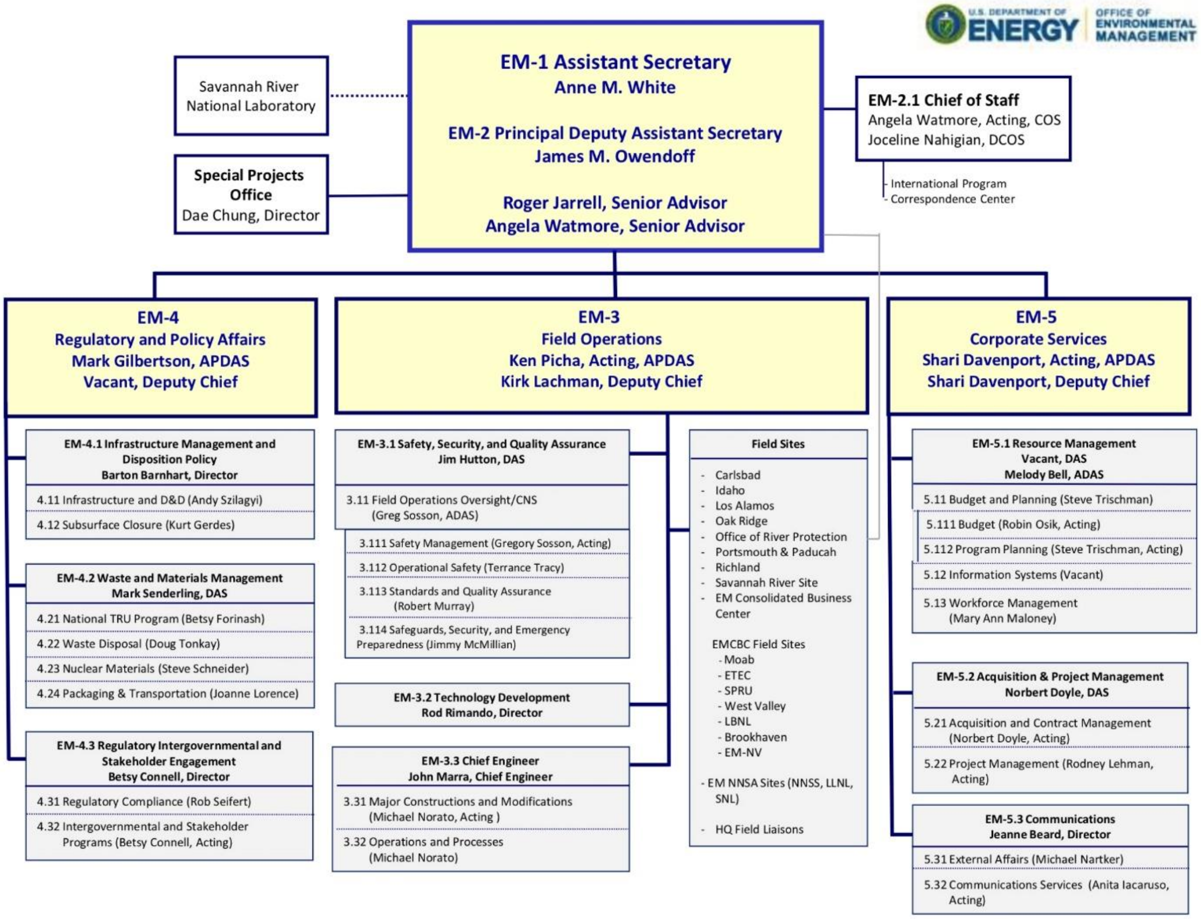

Figure 1. DOE-EM organization chart.

2. EXECUTIVE SUMMARY

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 Environmental Management (DOE-EM) and Florida International University's Applied Research Center (FIU-ARC). During the summer of 2018, DOE Fellow intern Joshua Nuñez spent 10 weeks doing a summer internship at DOE Headquarters in Washington D.C. under the supervision and guidance of Rodrigo Rimando and Jean P. Pabón. The intern's project was initiated on June 4, 2018 and continued through August 10, 2018 with the objective of aiding the EM's Technology Development Office.

3. INTERNSHIP DESCRIPTION

During the 10-week long internship at DOE-HQ, my mentor (and TDO office director), Mr. Rimando, assigned to me a series of daily and weekly tasks and project deliverables. The daily/weekly updates included:

- Providing brief updates on assigned tasks
- Identify issues and follow-up actions
- Prepare summaries of biweekly TDO staff meetings
- Write up brief activity reports

For the project deliverables, they included the following topics:

- Briefings on the Pipe Crawling Activity Measurement System (PCAMS); which included RadPiper, data management, and support equipment
- Briefings on fixative testing
- White paper on Job killers (manufacturing) vs. Job Enhancers/Enablers (non-manufacturing)
- Reflections briefing of the internship experience

3.1 Briefing on Pipe Crawling Activity Measurement System (PCAMS)

The PCAMS RadPiper is a robotics pipe measurement technology coupled with an automated analysis and reporting system to accelerate the quantification of uranium (U-235) in pipeline deposits. The robot precisely models the geometry of the deposits on the pipe walls to aid in calculations of U-235. RadPiper is battery-powered and tetherless and self-steers using two tracks. RadPiper also safeguards against end-of-pipe conditions and obstacles in the pipe making it fully autonomous upon launch.

The robot’s overall mission is to assist in the deactivation and decommissioning of facilities that were once used for nuclear weapons production. DOE officials estimate the robot could tens of millions of dollars in completing the characterization of uranium deposits at the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio, and perhaps another $50 million at a similar uranium enrichment plant in Paducah, Kentucky. The Portsmouth Gaseous Diffusion Plant began its operations in 1954 and produced enriched uranium that was used in the production of nuclear weapons. With 10.6 million square feet of floor space, it is the DOE’s largest facility under roof, with three buildings containing enrichment process equipment that relatively equals the size of 158 football fields.

Figure 2. PORTS Group Photo with RadPiper technology.

3.2 Briefings on Fixative Testing

Alongside part of the TDO's mission to manage EM's technology-based academic interfaces to identify advancing technologies, solutions, materials and processes, I was tasked with providing a briefing on FIU's role for the fixative materials being tested for deployment at the Savannah River Site (SRS). Part of FIU's contribution to technology development is to improve the operational performance of fixatives to mitigate the release of radioisotopes during fire and/or extreme heat conditions. Parts of FIU's experimental design included, but was not limited to, incremental temperature increases using a muffle furnace, and exposure to a direct flame.

Figure 3. Fixative research presentation during SRS visit.

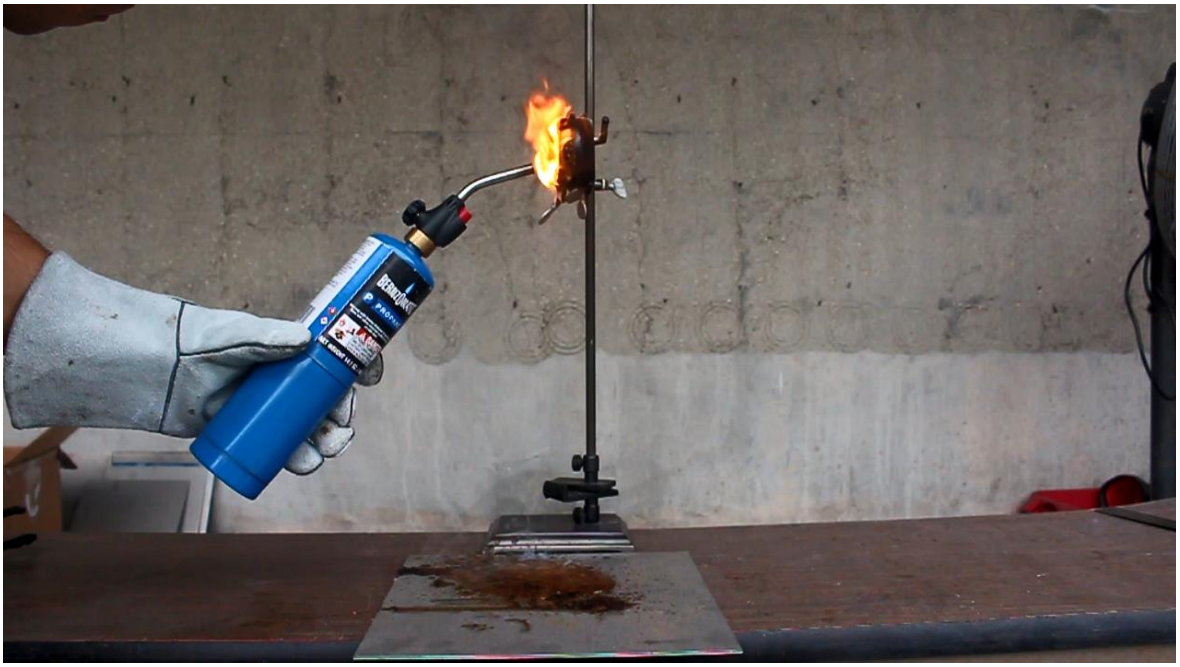

Figure 4. Fixative technology testing with a direct flame.

3.3 White Paper on Job Killers (manufacturing) vs. Job Enhancers/Enablers (non-manufacturing)

Throughout my internship, I was also tasked with conducting a literature review on the impact of robots/robotics on the workforce, specifically whether robots are 'job killers' or 'job enhancers' in both manufacturing and non-manufacturing applications. When "robot" comes to mind, the first thing most people think of are human-like mechanical systems that are fully functional on their own. Robotics is the automation of mechanical systems to the point of getting rid of human interference. Mechatronic systems still need human input, while robotic systems can perform tasks without it. All robotic systems are mechatronic systems, however not all mechatronic systems are robotic systems. Mechatronic systems are technologies that combine mechanical and electrical engineering.

My research conducted showed that the introduction of robots into the workforce would have an overall positive impact, as it would create more jobs that it would otherwise take away by replacing people. As production becomes more capital intensive, the labor cost advantages of traditional low-cost locations will shrink, making it attractive for manufacturers to bring previously offshore jobs back home. The increased use of robotics and computerization will have a significant reduction in the number of assembly and productions jobs by approximately 610,000. However, this decline will be more than offset by the creation of approximately 960,000 new jobs.

One of the key concerns that we have when we think of robots in the workplace is safety for the employees. Typically, industrial robots in the industry are used to perform unsafe, hazardous, redundant, and unpleasant tasks. Although robots are sometimes viewed as replacements, they are supplements to the human workforce. The accuracy and repeatability of their functions are crucial to the efficiency of a workplace. Robotic systems enhance the safety of the work environment, and new jobs are created from their implementation. While menial tasks are being taken over by robotic systems, jobs are created for operators and overseers of these systems.

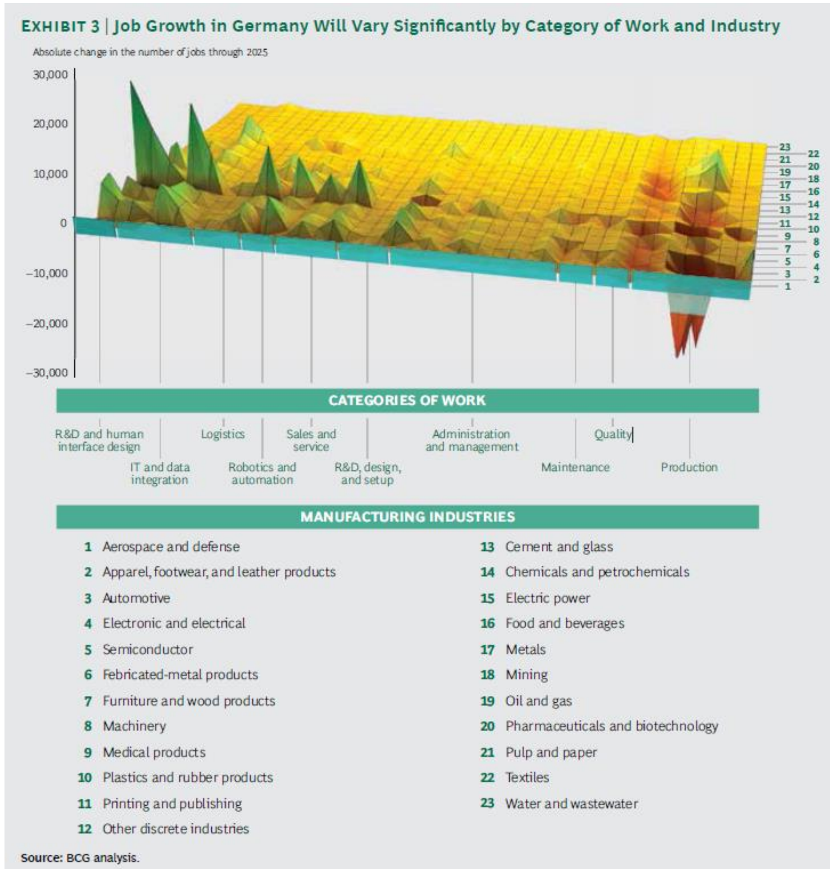

Figure 5. Job growth in Germany.

4. CONCLUSION

During my 10-week long summer internship, I gained significant experience and knowledge of the challenges that DOE-EM faces concerning clean-up issues from the managerial perspective by attending higher level DOE management meetings and events. I was granted the opportunity to visit several sites that are undergoing clean-up activities, such as the Portsmouth Gaseous Diffusion Plant in Ohio and the Savannah River Site in South Carolina, which allowed me to gain firsthand knowledge of the technologies currently under development.

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