

STUDENT SUMMER INTERNSHIP TECHNICAL REPORT

Automating Surplus Plutonium Disposition: Research and Design of the Blend Can Loading System

DOE-FIU SCIENCE & TECHNOLOGY
WORKFORCE DEVELOPMENT PROGRAM

Date submitted:

December 16, 2022

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Submitted to:

U.S. Department of Energy
Office of Environmental Management
Under Cooperative Agreement # DE-EM0005213



Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

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EXECUTIVE SUMMARY

This research work has been supported by the DOE-FIU Science & Technology Workforce Development Initiative, an innovative program developed by the U.S. Department of Energy's Office of Environmental Management (DOE-EM) and Florida International University's Applied Research Center (FIU-ARC). During the spring of 2022, a DOE Fellow intern, Desmond Sinnott, spent 10 weeks doing a summer internship at SRNL/Aiken County, SC under the supervision and guidance of Mr. Joe Kinney, Advanced Engineering. The intern's project was initiated on June 1st, 2022 and continued through August 12th, 2022 with the objective of (Learn/Assist with Research and Development).

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1. INTRODUCTION

The U.S. Department of Energy's Savannah River National Laboratory (SRNL) is a multidisciplinary research and development center that focuses on solving major challenges such as nuclear waste disposal and national security (SRS Overview, July 2022). It is located at the Savannah River Site (SRS) in Aiken, South Carolina, which was originally constructed to support the development of nuclear weapons for the cold war arms race in the early 1950's. In 1989, the Department of Energy's Office of Environmental Management was created with a mission focused on the cleanup of contaminated nuclear weapons manufacturing and testing sites across the United States. This very complex mission requires highly skilled and knowledgeable scientists and engineers to produce innovative and advanced processes.

This 10-week internship was an extension of the DOE Fellow's workforce development program at Florida International University (FIU). During this internship, DOE Fellow Desmond Sinnott had the opportunity to work in the Advanced Engineering Department at SRNL with a team of engineers under the mentorship of senior fellow engineer Mr. Daniel Krementz and former DOE Fellow Tristan Simoes-Ponce. The primary focus of this internship was to understand and assist with the Surplus Plutonium Disposition Project (SPD), more specifically, the Blend Can Loading System (BCLS). The purpose of the SPD Project is to expand Plutonium Oxide (PuO_2) down blending capabilities from the current manual processes. Desmond was responsible to learn about these projects and systems while helping with additional testing and development of BCLS user and maintenance manuals for operators.

The BCLS (Figure 1) is an automated system within the SPD Glove Box that is used to transfer PuO_2 from a convenience can, through a sieve, into a vibratory feeder. The system then dispenses the desired mass of PuO_2 into a blend can loaded with adulterant. This blend can is then transferred to a mixer downstream from the BCLS. Below is a CAD Rendering of the BCLS using CREO Parametric software. Components and subassemblies that experience wear during operation and that require specific maintenance protocol for replacement are labeled in the figure.

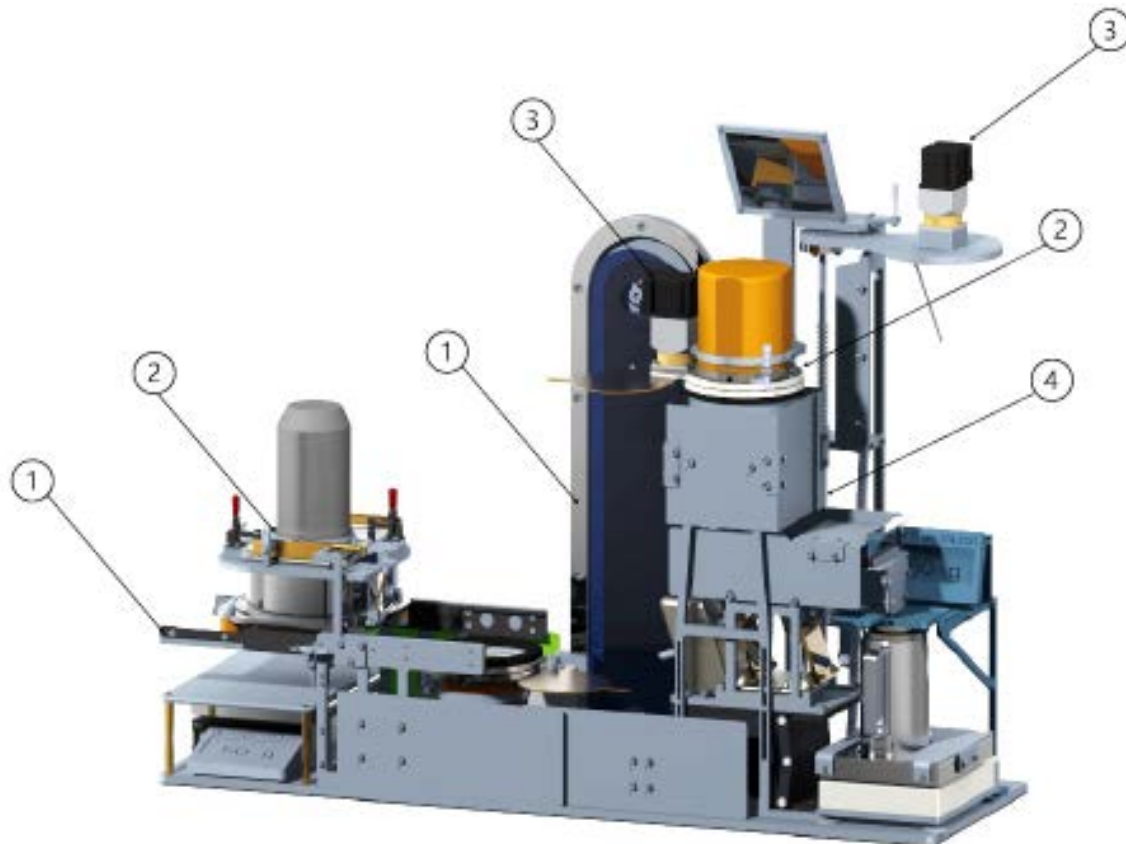


Figure 1. Blend Can Loading System Rendering; (1) Emptying Assist Device (EAD) and Sieve Rails, (2) Convenience Can and Intermediate Can Valves, (3) Smart Motors and Gear Boxes, (4) Vibratory Feeder

2. RESEARCH DESCRIPTION

The internship work ranged from assisting with simple tasks such as scanning technical engineering drawings onto a computer, to testing of full-scale project equipment. In addition, the DOE Fellow was able to assist with BCLS design modeling using CREO Parametric, the CAD software primary used at SRNL and learned the importance of relationships and communication between design engineers and manufacturers. At SRNL, much of the manufacturing is done in-house. Hence, being able to efficiently communicate with the team of engineers and with the manufacturers is critical.

The DOE Fellow supported SRNL's development of technology for the SPD Project. The SPD Project is designed to expand and continue the down-blending process of 34 Metric Tons of weapons-grade Plutonium. This project will assist the DOE in their mission to dilute and dispose this material, while reducing operator exposure and improving process capabilities. The BCLS is a critical part of this project that automates the down blending process, no longer requiring operators to dilute these materials by hand. The BCLS system had reached a Technology Readiness Level of 7 (TRL-7) by summer 2022, hence most of work this summer was regarding documentation. Documentation is a vital part of project success, whether by recording data, keeping notes, recording or capturing processes during the design and testing phase of the project.

The BCLS required endurance testing to ensure it could process the required quantity of material (328 convenience cans or 8,792 blend cans per 2 years of operation). Through these tests, recommendations for replacement were determined. Specific components and subassemblies experience wear during operation and require a specific maintenance protocol for replacement. Approximately 4 weeks were spent developing a maintenance manual for BCLS operators. This manual was very extensive and required a team of design engineers to disassemble and assemble all of the components of BCLS in order to properly document and explain plainly these steps and processes so that any operator could perform these steps without difficulty. The BCLS maintenance manual provides valuable recommendation for the user to keep the system operational for its intended life. This experience proved to be very useful in helping DOE Fellow understand the BCLS design and function.

3. CONCLUSION

The main objective of this internship was to further enhance DOE Fellow's knowledge in engineering, grow as a professional, and contribute to the important work being done at SRNL. During the short time in the Advanced Engineering department, Desmond was exposed to many different projects and was able to tour and learn about the past, present, and future work of the DOE at the Savannah River Site. The lessons learned through mentors, and tasks were of great benefit to Desmond as an engineer. A good amount of technical knowledge was also gained through practicing with new CAD software. Many days of hands-on work provided me with know-how and practical skills in new areas of application. Desmond's experience overall at SRNL was very beneficial in terms of skill development but even more so in professional development. It is difficult to simulate a real work environment while still in school. This internship gave DOE Fellow confidence to apply to professional challenges that are ahead of him.

4. REFERENCES

- [1] SRS Overview. July 2022. Srs.gov.
https://www.srs.gov/general/news/factsheets/srs_overview.pdf