

Thesis Project Portfolio

Un-fantastic Plastics: An end-of-life analysis of the University of Virginia's Solid Waste Management System

(Technical Report)

The Rise of Composting at UVA—Challenges and Opportunities

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Madeleine Alwine

Spring, 2022

Department of Engineering Systems and the Environment

Table of Contents

Sociotechnical Synthesis

Un-fantastic Plastics: An end-of-life analysis of the University of Virginia's Solid Waste Management System

The Rise of Composting at UVA—Challenges and Opportunities

Prospectus

Sociotechnical Synthesis

Excessive production of plastic waste is a threat to ecological and human health and is a major Solid Waste Management (SWM) challenge. This issue has led to an increased focus on composting as a sustainable alternative. In Virginia, this took the form of an executive order issued by Governor Northam banning single-use plastics in government facilities. As a public university, UVA must adapt its waste management strategy to comply with this executive order by increasing the amount of compostable materials in the waste stream. The technical work of this project seeks to create a model that analyzes the SWM of the university with respect to various priorities of the university such as landfilled mass, GWP, energy, and monetary cost. Although it is important to explore these technology-based parameters, human waste-sorting behavior plays a major role in determining the success of sustainable waste management efforts. The STS component of the work seeks to use Michael Harrison's Interactive Sociotechnical Analysis (ISTA) framework to explore the externalities created when composting is introduced on a large scale into a system with imperfect sorting, excessive plastic waste, and inequitable facility siting practices.

My work on this topic seeks to answer the question: What is the degree of compost contamination at the University of Virginia, and what strategies could be used to limit contamination? In order to answer this question, I used data from waste audits of compost bins around UVA grounds. A waste audit seeks to analyze the contents of a waste stream by sorting the waste into categories and weighing it. This method helps to determine the nature and amount of contamination in UVA's compost bins. Once this was completed, I conducted a literature review of waste contamination reduction strategies and analyzed them for applicability to UVA. The results of the analysis suggest that compost collected on grounds at UVA contains

significant amounts of contamination and will require an intervention in order to improve waste sorting before expanding composting across the university. As composting grows as a form of waste management, it is important to be aware of the severe hazards created by improper sorting and work to minimize the presence of improper materials in the compost waste stream. The results of both the technical analysis and the STS research can be used to make recommendations to UVA Facilities Management in order to mitigate the university's environmental impact and reduce the hazards resulting from compost contamination at UVA and in the surrounding Charlottesville community.