

Thesis Project Portfolio

Jackson Cleaners Environmental Remediation

(Technical Report)

An Actor-Network Theory Analysis of the OceanGate Submersible Implosion

(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

Brianna Wright

Spring, 2024

Department of Civil and Environmental Engineering

Table of Contents

Sociotechnical Synthesis

Jackson Cleaners Environmental Remediation

An Actor-Network Theory Analysis of the OceanGate Submersible Implosion

Prospectus

Sociotechnical Synthesis

My technical work and my STS research are connected in multiple ways including engineering failures, the multiple actors playing in that failure, and the future of engineering regarding both concepts. Engineering failures consist of what happens when something engineers have built, designed, or analyzed does not end up working to the ability it was designed to or causes destruction. While engineering failures were seen in both my technical work as well as my STS paper, they differed in different ways regarding outcome and future steps when considering fixing the failure. My technical work focuses primarily on the fixation of the engineering failure, whereas my research explores the reasoning behind the engineering failure and the actors that contributed to it. So, while my technical work and my STS research approach differ in many ways, both projects have the common core of engineering failures, the multiple actors playing in that failure, and the future of engineering regarding both concepts.

My technical work attempts to resolve the engineering failure through developing multiple remediation techniques for the site. This site is located in Ypsilanti, Michigan, which is a small, average-income city. My capstone team developed remediation techniques for the soil and groundwater at and surrounding a small dry cleaning business located directly adjacent to the Huron River, called Jacksons Cleaners. This dry cleaning business released tetrachloroethylene known as PCE and its daughter products, trichloroethylene (TCE), 1,2-Dichloroethane (DCE), and Vinyl chloride (VC) into the surrounding community and eventually spread into the Huron River. The goal of my team and I developing remediation techniques was to resolve the issue of toxins being released since it has resulted in multiple effects on human health varying from dizziness and throat irritation, to respiratory diseases.

My STS research also explores a form of engineering failure, but from a different angle. My research focuses on the multiple actors that contributed to the engineering failure and implosion of the OceanGate submersible that left the loss of all five passengers lives. This focus of the engineering failure was through the ethical framework, actor network theory (ANT) developed by Michel Callon, Bruno Latour, and John Law. Throughout my research on the submersible, I identify all actors that contributed to the engineering failure of the implosion while claiming that there is not one singular party responsible for the incident, rather it is multiple actors responsible for the outcome of this engineering design. While the goal of my technical work was to develop solutions for the cause of the failure for Jacksons Cleaners, my goal for the STS research was to identify the causes of the failure for OceanGate implosion as a first step in order to correct and improve future engineering designs.

Working on these two projects simultaneously allowed me to gain different perspectives and guidance for each project. My technical work gave me a better understanding of how engineers learn from failures and develop more designs that not only help fix the failures, but also prevent future failures. This point of view helped my research paper in ways of understanding next steps beyond failure. Similarly, the research I conducted for the STS paper gave me a greater understanding of the multiple moving parts of an engineering failure and how so many factors can come into play when it comes to identifying what causes certain failures and how one can prevent them in the future. This understanding increased my motivation to develop more intricate remediation techniques for my team's technical project. In summary, working on both the technical project and the research paper this past year helped me develop as an engineer as a whole by viewing problems at different angles.