Thesis Project Portfolio

Design of a Processing Plant for Direct Lithium Extraction from Geothermal Brine in the Salton Sea Region

An Actor Network Theory Analysis of Moral Responsibility for PFOA Contamination

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Socio-Technical Synthesis: Networks for Lithium Extraction and Teflon Production

My technical work and my STS research are connected primarily through the building of actor networks and exploring the implications of constructed systems. An actor network is a combination of human and non-human actors working towards a common goal. In my technical project, my team and I constructed a network designed to produce battery grade lithium hydroxide monohydrate. To gain insight into unethical practices to avoid in network building, my STS research examines the network that DuPont built for continued Teflon production despite health and environmental repercussions. Although there are stark contrasts in the technologies, both highlight an interconnected network with the goal of producing a highly lucrative chemical with limited available safety data concerning the production process.

My technical work explores direct lithium extraction from geothermal brines by scaling up laboratory data for a lithium selective sorbent. My capstone team designed a full scale processing plant to extract lithium ions in extremely dilute concentrations from geothermal brine that is readily available from an existing geothermal power plant. After the brine is pumped to the surface and flashed, it is sent through a lithium selective sorbent prior to electrodialysis and crystallization units to produce battery grade lithium hydroxide monohydrate. In the detailed design, it is vital to understand how experimental data, regulations, economics, and expected personnel affect the system and overall process viability. In addition to determining feasibility, this project aims to identify gaps in understanding and data collection to provide guidance for future research.

My STS research examines how DuPont created a network that enabled continued Teflon production despite polluting the local community with harmful and toxic perfluorooctanoic acid in the process. Through Actor Network Theory alongside criteria for moral responsibility, the

role of DuPont, regulatory bodies, and the local community are investigated to understand each actor's function in the network and ultimately who is morally responsible for the environmental and health disaster that entailed. By ensuring financial dependence and loyalty of regulatory bodies and the community, I explore how DuPont formed and maintained a network towards the goal of Teflon production as well as why DuPont alone fulfills all criteria for responsibility and should be held accountable. The goal of my research is to better understand the role of networks in corporate responsibility regarding the safety and wellbeing of customers, employees, and the broader community served.

Simultaneously working on these two projects added great value in terms of context and awareness in both research papers. My technical work increased my understanding of the complexity and interconnections involved in network building, which helped me to perceive how DuPont began their recruitment process. After completing my STS research, I was inclined to provide recommendations in my technical report for additional research and safety data to be collected prior to process implementation. This addition and improvement to the research paper resulted from learning how profitable returns led to covering up undesirable safety data when DuPont's experimentation was completed after full scale operation. In summary, working on both my STS research paper and my technical project together this past year has allowed me to better understand actor networks and responsibility to safety.