Personal Introduction to Honors Thesis

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Honors Chemical Engineering

Removal of Fluoride from Mine Water via Adsorption for Land-Applied Soil Amendment

As a part of Moo Pig Sooie, I worked on the overall development of our proposal for a secondary system to remove fluorine from mine water discharge. My specific role on the team was Purchasing Coordinator, which required me to function as the liaison between my team members and the appropriate University of Arkansas staff to purchase and obtain the tools needed for our laboratory experience. Initially, I was in charge of ordering our first chemicals, sodium fluoride and calcium sulfate, known as gypsum. I also got my team the laboratory equipment needed that was not already available in one of the chemical engineering department's labs, such as rice hulls, bone char, multiple kinds of activated alumina, our own disposable pipettes, weighing boats, and material scoops, as well as a scale that was able to function at the milligram level as needed by our sodium fluoride content in the synthetic water. After these initial purchases, I was in charge of keeping the chemicals and adsorbents stocked as well as ordering any additional equipment we deemed necessary as our experiments progressed, such as syringes to better filter our batch scale samples and 30-gallon drums for our bench scale experiments.

Another responsibility I had as the Purchasing Coordinator for Moo Pig Sooie was to set up our relationship with the Water Quality Lab and facilitate the testing of our samples, sometimes up to one hundred delivered in a day. We understood that this was a large burden on the Water Quality Lab and its staff, so I strived to maintain a cooperative relationship that would

allow them to complete their work in detail while also relaying the data to my team members in a timely manner as they relied on me heavily to deliver the results in order to compute the models and interpret our data. This role was crucial because if the data were received too late, decisions could have been made that would have been found to be inappropriate had the values been seen sooner. One example of this was when we tested our bio chars, rice hull and orange peel, as normal batch tests. They were placed into a beaker with one liter of our synthetic water, stirred with an impeller and baffles, and samples were taken in different time intervals, running for up to four hours. We continued to test different masses of these adsorbents, as was done with bone char and activated alumina, until the data came back showing us that they increased the fluorine concentration in the water. Had we known this before, we would have begun the tests with only the pyrolyzed chars in deionized water, which also showed to increase the fluorine concentration in the water. This would have preventing the extra unnecessary testing of different masses of the adsorbents and would have allowed us to focus our time and resources elsewhere into a more promising solution.

Finally, as a member of Moo Pig Sooie, I had the responsibility of helping with both research and laboratory experiments to progress our work on the task laid out. I spent many hours in the lab along with my team members, running the batch tests that often lasted four hours, pyrolyzing our chars, bench testing our column at different flow rates, and producing synthetic water and more realistic mine water at the correct pH. I learned a great deal in this laboratory setting from the experiences I had and from my advisors and peers. We worked beginning to end on the design of a secondary fluorine removal system for mine water discharge, encompassing economics, full scale design, and health and environmental regulations.