

Application Form
2006-07 TWRI Mills Scholarship Program

1. Name of Student and TAMU Student ID Number.

Meredith Langille

2. Name and Contact Information for Faculty Advisor or Committee Chair.

Timothy Kramer
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3. Description of the student's proposed research, emphasizing how it will address a water resources-related concern (one page or less).

Perchlorate ion (ClO_4^-) can disrupt the ability of the thyroid gland to metabolize iodide ions and interferes with the production of thyroid hormones, which are critical for fetuses and infants in developing a mature brain. Its contamination is a nationwide problem, including Texas, and threatens public health via contaminated drinking water and food. However, conventional treatment processes cannot effectively remove perchlorate ion. Perchlorate ion is inert to common reductants including the transition elements due to its high activation energy barrier and unique electron transfer process called *bridged electron transfer*. Therefore, successful perchlorate removal and destruction will be highly dependent on whether the reductant has the capability to surmount the energy barrier and develop a bridge complex with the perchlorate ion to transfer electrons.

A new method consisting of a combination of granular activated carbon and electrochemical processes is being investigated to improve perchlorate ion removal from contaminated water. The new process will not just remove perchlorate by transferring it to another media, but destruct perchlorate ion into innocuous chloride ion, oxygen and water. The electrochemical reactor will be packed with granular activated carbon. Each granule of activated carbon will thus be working as a small electrode. The hypothesis guiding this proposed project is that individual processes, activated carbon or electrochemical alone is not an effective method for the removal of perchlorate. However, a combination of these two processes will complement the limitations of the two processes and lead to better performance. The electrical potential will provide energy to surmount the activation energy barrier associated with the reduction of perchlorate ion. The catalytic reaction of the activated carbon will prompt the formation of the bridge complex between the activated carbon and the perchlorate ion. Preliminary experiments have shown a great increase in perchlorate removal between non-electrical and electrically activated carbon based cells. Additional investigations are required to understand the removal/reduction mechanism of perchlorate using the proposed process.

The goal of my project will be to continue the existing research with two specific objectives. The first task will investigate the synergism between the combinations of the activated carbon with the electrochemical process. The activated carbon will be modified by acid, base, and hydrogen peroxide to increase its catalytic capability. The second task will optimize the selected system from Task 2 using perchlorate contaminated water. A

series of batch tests will be conducted to investigate the effects of pH, electrical potential, anion competition, and background organics. Continuous operations will be conducted to determine whether efficient perchlorate removal will be sustainable for long periods of operation. O&M cost of the proposed process would be much less than conventional activated carbon since main O&M cost is caused by the replacement of activated carbon. Although O&M cost of the proposed process would not have an advantage over ion exchange, the proposed process would have the advantage over ion exchange for costs associated with disposal of highly concentrated waste and its environmental problems

4. Proposed use of funds resulting from this Scholarship (for example, to pay tuition, conduct research, etc.). One to two paragraphs or less.

Resulting funds from this Scholarship will allow me to help pay for a portion of tuition for the fall semester. As a Graduate student, finances are stretched to their limits. Any money that can be used to pay for tuition is well received.

5. Intended career path the student anticipates pursuing. (One to two paragraphs or less).

I am looking to complete my Masters of Science Degree in Civil Engineering in December. Upon completion, I plan to return to the Northeast to work for a few years to obtain experience in Environmental Engineering, using my knowledge to aid in the remediation of contaminated sites. During those years I will look into applying for fellowships that could aid in my eventual pursuit of a Doctorate Degree. My ultimate goal is to obtain a Doctorate in Environmental Engineering. I wish to use that knowledge to aid in cutting edge research on removal of contaminants such as petroleum products from the environment.