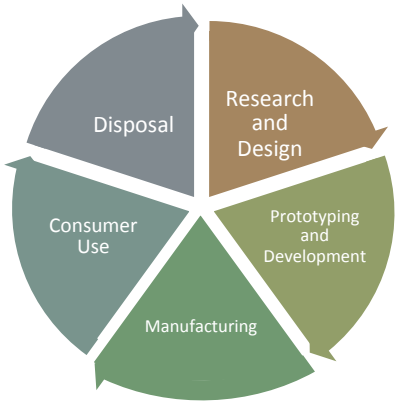
NDnano Undergraduate Research Fellowship (NURF)
2012 Project Summary

Student Name: Sean McGee
Faculty Mentor: Profs. Kathleen Eggleson and Marya Lieberman
Project Title: Ethical, Societal, and Health Implications of Complex Engineered Nanomaterials—A Life Cycle Approach

Historically, the environmental impacts of products under development have only been briefly considered prior to use (ex. vinyl chloride in hairspray and asbestos). The devastating consequences of past errors have led to a search for sustainable approaches that address potential environmental and health impacts concurrently with research and development. Life cycle analysis (LCA) considers the potential side-effects of a product "from cradle to grave" in the early developmental stages and therefore is critical for mitigating similar health and environmental issues before they occur.



This project focused on a developing technology in the lab of Dr. Marya Lieberman: the Paper Analytical Device (PAD). The particular PAD I worked with is a simple, cost-effective field test for the detection of iodine in human urine, the presence of which is a strong indicator of good thyroid health. While there is a great human benefit from the use of these PADs – namely the detection and mitigation of potential health problems caused by iodine deficiency – this PAD contains high levels of ionic arsenic, both As(III) and As(V), both of which are severely toxic and hazardous to the environment. As a result I focused my study on the proper disposal of the arsenic PAD in order to prevent the contamination of its immediate environment after use. All my work was carried out at the University of Notre Dame.

My project consisted of two major parts:

1. Literature review: the initial stages of my project focused primarily on a broad sweep of current technologies used in the detoxification of arsenic.
2. Inductively Coupled Plasma (ICP): ICP tests the relative concentrations of various elements in a solution by vaporizing a sample, igniting it into a plasma, and measuring the optical emissions of the sample's electrons at various wavelengths. ICP allowed us to quantify how much arsenic was being leached out of the PADs into the local environment as well as see how much of an effect the various treatments were having on the arsenic concentration.

ICP-OES machine

The preliminary results of this project bode well for the potential treatments designed for the detoxification of the arsenic PADs. Research is ongoing in the Lieberman lab and we hope the findings of this project will soon be published.

Presentation: A poster titled “Green Design for to Prevent Arsenic from PADs Post-Disposal” was delivered by Sean McGee to COS-JAM at the University of Notre Dame on August 3, 2012.