# QUARTERLY PROGRESS REPORT

September 2015 – November 2015

**PROJECT TITLE: Development and Evaluation of Contaminant Removal Technologies for Landfill Gas Processing**

**PRINCIPAL INVESTIGATOR(S):**
John N. Kuhn
Department of Chemical & Biomedical Engineering
University of South Florida
Email: jnkuhn@usf.edu
Phone: (813) 974 - 6498

Babu Joseph
Department of Chemical & Biomedical Engineering
University of South Florida
Email: bjoseph@usf.edu
Phone: (813) 974 - 0692

**PROJECT WEBSITE:** http://www.eng.usf.edu/~jnkuhn/Hinkley2015.html

**Work accomplished during this reporting period:**

For the period outlined in this first report, extensive background research has been done to narrow down the choices for siloxanes and the impregnation amounts. Since each landfill will have a different amount of siloxanes and compositions, a choice was made that took into account several factors. The siloxanes were narrowed down to two molecules, L2 and D4. L2 is a linear molecule with 2 silica atoms and it is the simplest siloxane found, whereas D4 is a cyclic molecule containing 4 silica atoms and with a slightly more challenging chemistry. Once the chemicals have been ordered, the synthesis process immediately followed.

For the synthesis, the catalyst support was synthesized through the co-precipitation method. It consisted of Cerium oxide and zirconium oxide in a 0.6:0.4 weight percent respectively. Nickel, magnesium and platinum were all then deposited onto the support using wetness impregnation method. Nickel was deposited in a 1.34 weight percent while magnesium was deposited in a 1.00 weight percent and finally platinum in 0.16 weight percent.

The siloxane amounts that were chosen to poison the catalyst were based on a control of a clean sample (0 days), a lower limit (2.5 days), a middle limit (1 month) and finally a high limit (6 months).

The challenge faced at this stage in the experimental process is how to dissolve and load the siloxanes onto the catalyst and whether the full effect of the siloxanes will be realized.

The approach used to solve this challenge will include trying to use different methods to load

the siloxanes onto the catalyst.

In addition, we have initiated process simulations for the removal of siloxanes. A student team has also been grouped to design a reactive adsorbent bed for the removal of siloxanes via decomposition.

*Future Tasks:* The future direction would be to load the siloxanes onto the catalyst using different methods and characterize them to determine the best method to use for the remaining portion of the study. Then, it is essential to characterize the materials. The catalyst will be characterized using several different techniques such as temperature programmed reduction (TPR), x-ray diffraction (XRD), and identifying the surface area using BET. Those characterization techniques will help to show the reducibility of the catalyst, the crystal structure and the surface area of the catalyst and the effect of the siloxanes on the catalyst if any.

**TAG Meetings:**
A TAG meeting was not held during this reporting period.

**Metrics:**

1. List research publications resulting from **THIS** Hinkley Center project.

   None

2. List research presentations resulting from (or about) **THIS** Hinkley Center project.

   A poster at the USF COE Research Day (see bottom picture).

3. List who has referenced or cited your publications from this project.

   None

4. How have the research results from **THIS** Hinkley Center project been leveraged to secure additional research funding? What additional sources of funding are you seeking or have you sought?

   None

5. What new collaborations were initiated based on **THIS** Hinkley Center project?

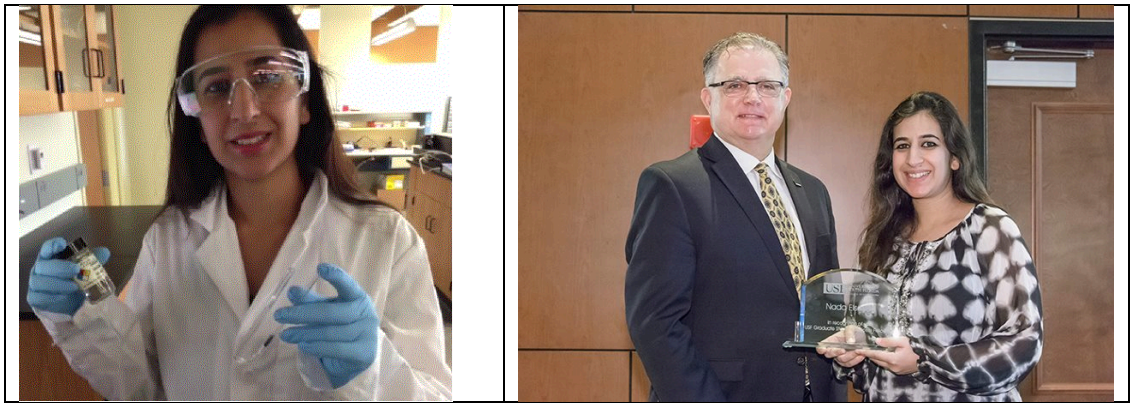
   This project has increased collaboration with Sarina Ergas and Jane Zhang for which the research is also related to their Hinkley research projects.

6. How have the results from **THIS** Hinkley Center funded project been used (not will be used) by the FDEP or other stakeholders?

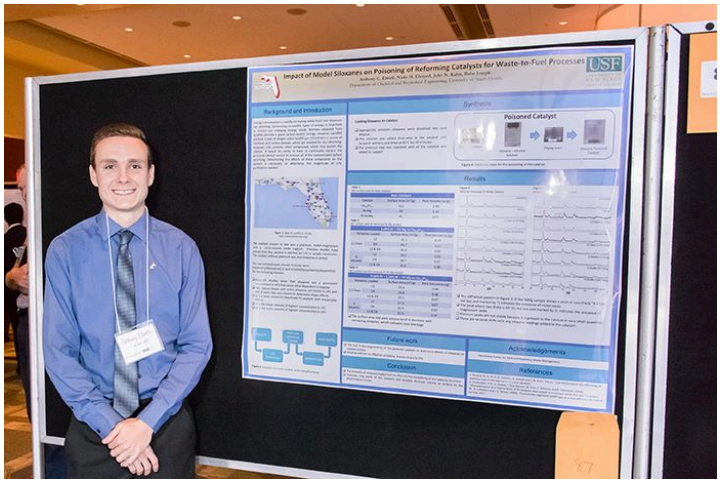
None

**Pictures:**

The primary student researcher on this project is Nada Elsayed. Anthony Elwell is an undergraduate researcher also assisting with this research.



Nada Elsayed is seen in the pictures above. On the right, she is with the USF COE Dean (Robert Bishop) during the award of a plaque for her USF GSS fellowship.




Tony is a junior Chemical Engineering student working on this project. He recently presented a poster on this project.