QUARTERLY PROGRESS REPORT

September 1 – November 30, 2010

PROJECT TITLE: *Sequential MBR-UV Treatment of Landfill Leachate*

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COMPLETION DATE: 8/31/2011 **PHONE NUMBER:** 850.410.6119

PROJECT WEBSITE ADDRESS (URL):
http://www.eng.fsu.edu/~wattsmi/UV_MBR/index.html

SCOPE OF WORK: The vast quantity of pharmaceuticals, personal-care products, and endocrine-disrupting compounds (EDCs) stored in municipal landfills poses a significant challenge to leachate-water quality. Advanced leachate treatment, utilizing combinations of biological, chemical, and physical water treatments, can be designed to protect groundwaters influenced by landfill-leachate, or provide reclaimed water for non-potable or agricultural purposes. The versatility and multiple barriers in UV treatment make it an attractive option for landfill leachate treatment. However, the rich concentration of leachate constituents which scatter or absorb light must be addressed with pre-treatment. A novel membrane bioreactor (MBR) system at USF, involving anaerobic biological process and ultrafiltration membranes, has been tested for removal of trace organic compounds and xenobiotic contaminants (17β-estradiol, a prevalent female hormone) from landfill leachate. This work seeks to apply state-of-the-art, germicidal-UV-light technology to assist MBR in removal of trace organic compounds.

CURRENT PROJECT PERIOD: An initial survey of local (Leon County, FL) landfill-leachates uncovered the major technical challenges to applications of UV-Advanced Oxidation. High UV_{254}-absorbance (>1 cm^{-1}), and dissolved organic carbon (>500 ppm as C) will impede light penetration and subsequent formation of oxidizing free radicals. At the suggestion of the TAG committee, Ozone-Advanced-Oxidation was tested as a pre-treatment for anaerobic MBR.

Leachate samples were collected for the Leon County Sanitary Landfill. The site is located in 7550 Apalachee Parkway, Tallahassee, FL. A TELEDYNE TEKMAR Phoenix 8000 UV persulfate TOC analyzer was used for measurements of total organic carbon in this experiment. Ozone used for these experiments was generated using an AZCOZON Industries Ozone generator model RMU16-04.

As was discussed in the previous quarterly report (Quarterly Report #4), a steady decrease in leachate TOC was observed with increasing O_3 dose and still further with the addition of 5 ppm H_2O_2. This TOC mineralization corresponded with an increase in the fraction of biodegradable organic carbon in samples treated with ozone or ‘peroxone’.

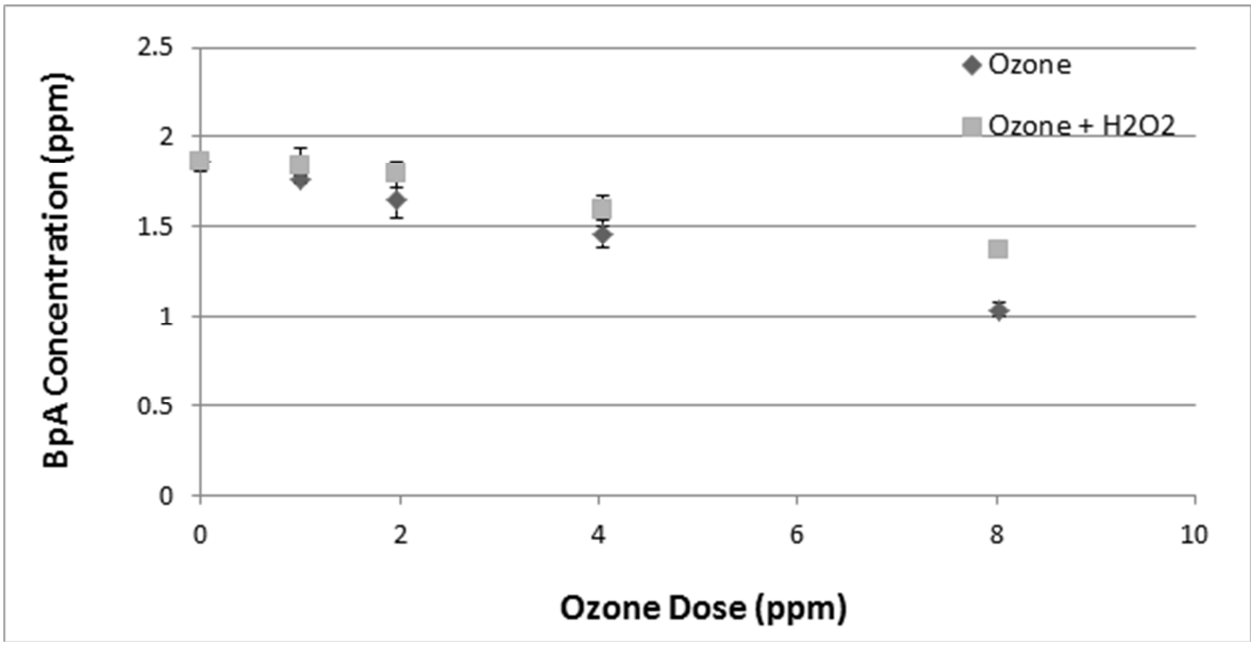

Figure 1 – Degradation of bisphenol-a (BpA) in Leon County leachate with increasing ozone or 'peroxone' dose.

It was observations of organic micropollutant degradation that elucidated advantages of one oxidation pre-treatment over the other. At an ozone dose of 8 mg/L in Leon County leachate (2 min of contact time), a significantly lower bisphenol-a concentration was measured in leachate treated with ozone alone, rather than ozone plus peroxide (Figure 1). This can be explained by the relative selectivity of the O_3 oxidant as compared to the free radical, ·OH, produced by the 'peroxone' process. The excess scavenging of ·OH in the leachate water matrix limited the rate of bispenol-a disappearance.

NEXT PROJECT PERIOD: The project team will track the degradation of 3 xenobiotic estrogens through ozone pre-treatment, and anaerobic biological treatment.

TAG: Dr. Jeff Bandy (*Carollo Engineers*), Dr. Gang Chen (FSU), Dr. Tarek Abichou (FSU), Hooshang Boostani (Hillsborough County), Allan Choate (Polk County), and Dr. Erik Rosenfeldt (UMass-Amherst). *Next meeting:* to be scheduled in *mid*-July 2010.