

## **Technical Advisory Group Meeting**

“Sustainable Management of Pollutants Underneath Landfills”

“Onsite Treatment of Leachate Using Energized Processes”

“Critical Examination of Leachate Clogging”

By D.E. Meeroff (Florida Atlantic University)

Funded by the Hinkley Center for Solid and Hazardous Waste Management (HCSHWM)

**DATE:** Friday, March 15, 2013  
**TIME:** 1:00 pm  
**WHERE:** Florida Atlantic University Boca Raton Campus  
Computer Center Building  
CM Building (22), Room 130 (Studio 1)  
777 Glades Road, Boca Raton, Florida 33431

**Attendance:**

**Dan Meeroff (FAU), Tim Vinson (Hinkley Center), Cleevens Geurrier (FAU), Christine Lyons (FAU), Khaled Sobhan (FAU), Ahmed Albasri (FAU), Frank Youngman (FAU), Kevin Kohn (University of Florida), Art Torvela (FDEP), Amede Dimonnay (FDEP)**

1. Opening address by Dr. Meeroff followed by introduction of the group members and participants both through GoToMeeting and live (1:03 pm)
  
2. Introduction to Landfill Technology Research by Dr. Meeroff  
Dr. Meeroff presented the agenda of the meeting, the objectives of the research, and introduced the speakers. Dr. Meeroff showed the TAG members the project website (<http://labees.civil.fau.edu/leachate.html>).
  
3. Pilot Studies of Photocatalytic Oxidation of Leachate by Frank Youngman  
Frank began discussing the background of his research. He explained how the photocatalytic oxidation treatment mechanism works. Then he went over the methodology of the pilot scale experiments. He reported on the progress of catalyst optimization, process removal efficiency and kinetics of COD, ammonia, and color, and he described ongoing catalyst recovery experiments. He presented a preliminary cost analysis of the process based on his findings to date, and then provided recommendations for modifying the process to achieve better removal efficiencies. Tim Vinson asked Frank to compare the UV dose to previous work to clarify the differences. Tim Vinson also asked if it was possible to shift the amount of

light while keeping a constant level of  $\text{TiO}_2$  in order to use less catalyst. He also stated that the reaction kinetics make the photocatalyst act like a reactant not a catalyst. He asked if the catalyst is available in bigger particle sizes to facilitate the separation of the catalyst at the end of the run. Tim Vinson also asked about the fate of the ammonia if the system is not closed. Perhaps the ammonia is boiling off due to the elevated temperature in the unit. It was suggested to trap the gases and test for ammonia in the offgas. Frank and Dr. Meeroff responded by explaining the pH effect for ammonia removal such that loss of gaseous ammonia would not be favored at these pH values and temperatures, but no direct measurements of gaseous ammonia in the treatment offgas have been taken. Frank thought that it would be interesting to see if the dose of catalyst could be lowered to below 2 g/L while increasing the UV radiation above  $0.3 \text{ mW/cm}^2$ , which is the current upper limit of the pilot treatment unit. Frank also responded to a question about scale up issues with regards to determining the catalyst dose and UV operating conditions. Since the demonstration testing has not reached the sewer disposal target for COD and ammonia, Frank responded that modifications to the unit must be made with respect to increasing the UV dose and increasing the time in the reaction zone. Art Torvela mentioned that landfill leachate treatment processes should be tested against total recoverable petroleum hydrocarbons (TRPH) and chlorinated solvents. He mentioned the target limits for TRPH is 90 ppb and for Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) it is 200 ppb and for benzene it is 1 ppb. He also mentioned a  $\text{CS}_2$  treatment process that has been proposed. Dr. Meeroff observed that as the amount of leachate generated increases the economics for photocatalytic oxidation become more favorable. At the same time, if the amount of leachate increases, the costs for sewage disposal and exceedance surcharges go up, which also favors photocatalytic oxidation. The key will be to reduce the reaction time required to meet the 800 mg/L COD level because the ammonia will already be gone in half the time it takes for the COD to be removed.

#### 4. Laboratory Studies of Groundwater Circulation Well Technology by Ahmed Albasri

Ahmed began by discussing the background on his research. He explained how the groundwater circulation well treatment process is intended to work. He was asked by Dr. Sobhan about the iron levels found in elevated monitoring wells. Ahmed responded that elevated levels were recorded in the 40 – 85 mg/L range compared to the groundwater cleanup target of 3 mg/L. Then he went over the methodology of the aquarium experiments. Dr. Sobhan asked about the scale issue using aquarium tests. Ahmed explained that the purpose of aquarium tests is to determine the parameters for scale-up with regard to air flow rates, depth, well spacing, radius of

influence, etc. He reported rapid removal of iron in the early stages of the process, but iron speciation has still not been measured. Ahmed explained his steady state aquarium loading experiments and presented his results for two of the experiments involving Polk County soils. For one of the experiments, the results showed similar rapid removal of iron within the first hour of treatment. But for the second aquarium, the results were inconclusive because the initial concentration was so low (about 10 mg/L vs. 65 mg/L for the first experiment). Ahmed explained that he will continue loading until a higher steady state concentration is reached and then additional replicates can be tested. Tim Vinson mentioned a UF dissertation that described how measuring Fe(II) and Fe(III) is possible in a study focused on Escambia County. Tim also mentioned that he has seen data regarding pump and treat costs for a similar sized situation that were on the order of \$ 1 million per year. Art Torvela told Ahmed that he has personally seen reports with existing empirical sparging well design equations and offered to share those with him. He also mentioned that Ahmed should investigate a former Delray dump with an iron hotspot because he has data that he is willing to share and that the cost for an impermeable reactive barrier technology for this case cost on the order of \$2 million.

#### 5. Leachate clogging experiments by Christine Lyons

Christine introduced the joint project with the Hinkley Center, UF, and FAU regarding the examination of leachate clogging issues at the Solid Waste Authority of Palm Beach County. She presented her water quality data from several sampling events, showed a brief video of her sodium hydroxide experiments to create precipitants in the leachate, and previewed the upcoming demonstration site project to test potential mechanisms. She mentioned the ongoing leachate collection system rehab projects which involve 4000 psi jetting and showed the results. Jetting with 10,000 psi and also chemical jetting is planned for the future. Other landfills in the southeast were identified by Art Torvela as Miami and Monarch Hill that possibly suffer from leachate clogging too. Kevin Kohn talked about potential mechanisms. He said that leachate is highly saturated with methane and carbon dioxide and when the carbon dioxide degasses, the pH jumps up and precipitation of calcium carbonate is favored. So he described his recent experiment where he collected degassed leachate/condensate from a landfill gas well at the SWA on March 13, 2013. He monitored the pH in the degassed leachate and after exposure to air, he continued to monitor the pH and noticed a slight increase. He tried out his methodology at the New River Landfill closer to home first before trying the experiment at the SWA. In general, the pH increased from 7.6 to 8.1 after exposure to air. He also mentioned ideas about the demonstration project at the SWA which will involve continuous pumping vs. settling or intermittent pumping. It was

mentioned that permitting is now handled at the Tallahassee level instead of the local level, so it was suggested to contact Richard Tedder or Joe Lurix to determine who is handling the SWA case.

6. Adjourn (3pm), thank you for participating!

For more information, contact Dr. Daniel E. Meeroff at:  
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