

Technical Advisory Group Meeting

“Management of Subsurface Reductive Dissolution Underneath Landfills”

“Onsite Treatment of Leachate Using Energized Processes”

By D.E. Meeroff (Florida Atlantic University)

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

DATE: **Friday, February 17, 2012**
TIME: **10:45 am**
WHERE: **Florida Atlantic University Boca Raton Campus**
 CM Building (22), Room 130 (Studio 1)
 777 Glades Road, Boca Raton, Florida 33431

Sign-In Sheet

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Name: Matt Dial
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Phone:

Others in attendance: Jim Golden, Ahmed Albasri, Frank Youngman, Fred Bloetscher, Daniel Meeroff.

Minutes

1. Opening address by Dr. Meeroff followed by introduction of the group members and participants both through GoToMeeting and live (11:03 am)
2. Introduction to Landfill Technology Research by Dr. Meeroff
 - Dr. Meeroff presented the agenda of the meeting, the objectives of the research, and provided an overview of current and past research projects funded by the Hinkley Center for Solid and Hazardous Waste Management. He also presented the newly published journal article “*Application of photochemical technologies for treatment of landfill leachate*” by Daniel E. Meeroff, Frederick Bloetscher, D.V. Reddy, Francois Gasnier, Swapnil Jain, André McBarnette, and Hatsuko Hamaguchi published in the *Journal of Hazardous Materials*. Finally, Dr. Meeroff showed the TAG members the project website (<http://labees.civil.fau.edu/leachate.html>)
3. “Reducing The Iron Pollution In Landfill Soils By Using Aeration Wells” by Ahmed Albasri
 - Mr. Albasri presented his preliminary results of laboratory scale aquarium experiments designed to test the feasibility of using groundwater circulation wells to remove iron from the subsurface in-situ. He discussed possible treatment approaches for iron removal, how the groundwater circulation well process works, methods for testing, and preliminary results using Boca Raton soils spiked with iron. Then he presented the upcoming experiments with Polk County soils. He finished with a set of questions for the TAG members:
 - Do you have any knowledge of design equations that govern groundwater circulation well (GCW) systems or sparging wells?
 - Do you have any suggestions for an appropriate test method to speciate the forms of iron, Fe(II) and Fe(III), in groundwater and soils?
 - Where else is iron reductive dissolution a problem?
 - What are the costs associated with remediation of iron dissolution?
4. “Onsite Treatment of Leachate Using Energized Processes” by Frank Youngman

- Mr. Youngman presented his work on scale up of the photocatalytic oxidation process to pilot scale using a falling film reactor design. He discussed how photocatalytic processes became a strong candidate for on-site pretreatment of leachate based on previous work conducted by FAU. He discussed how the process works, and then presented the leachate sampling locations and previous results for COD, ammonia, and alkalinity. He discussed the FAU solution for temperature control for kinetics experiments, and then he showed his novel solution to the particle plugging problem when the photocatalyst sits too long in the impeller chamber of the pump. Then he presented the results of his first experiments on COD, ammonia, color, and alkalinity. At the current TiO_2 dosage (4 g/L), he estimated that it would take approximately 190 hours to achieve the 800 mg/L COD target for sewer disposal; 36 hours for 90% removal of ammonia and alkalinity, and 140 hours from 90% color removal. He recommended increasing the TiO_2 dosage incrementally to improve efficiency. He also plans to see if any removal occurs after all the alkalinity is destroyed in the sample (he is currently at 87% removed after 36 hours). Additional planned experiments are to optimize the catalyst dosage, understand the alkalinity dependence, learn more about the reaction order kinetics, develop a protocol for catalyst recovery, measure the catalyst turnover number, which is related to the longevity of the catalyst, perform tests on additional parameters like arsenic, and perform a preliminary cost analysis. He finished with a set of questions for the TAG members:

- Are there other contaminants of concern that we are not testing?
And what are the treatment targets for those?
- How much does your leachate management cost?
- Will this process be cost competitive?
- How much leachate is produced at your landfills?
- Do you want us to test your leachate?

5. Discussion of TAG Input Needs (Open Forum)

- Tim Vinson asked why the iron assay was not working. Mr. Albasri and Dr. Meeroff explained the problems with the phenanthroline method. The test is supposed to convert the iron to a ferrous chelate that changes color in the orange-red region. However, there seems to be a strong instability with the method in the presence of soluble ferric chelates or amorphous ferric hydroxides and oxyhydroxides. This effect was confirmed in discussions with other certified labs in the area. Sam Levin suggested that the iron(III) could be removed since it is insoluble. However, the samples

- were filtered and no beneficial effect was noted, which led to the supposition that we have some slightly soluble forms of ferric chelates in the matrix that are interfering with the color change reaction. John Schert suggested that the research team contact Tim Townsend of the University of Florida to find out how they deal with iron speciation issues. Dr. Meeroff promised to contact Dr. Townsend.
- Damaris Lugo asked what Polk County is doing to remediate the iron levels. Matt Dial of Polk County answered that they are working closely with FDEP in monitoring and characterizing the situation as a case study to help FDEP in developing an action plan to deal with elevated levels of iron near landfills.
 - Amede Dimonnay commented that most landfills in the southeast Florida region are considering injection wells for leachate disposal due to its low cost. Mr. Youngman and Dr. Meeroff responded that injection wells are attractive at present if you have the right geology, but in the near future, regulations are on the horizon to require reuse level treatment prior to discharge. This will cause all injection well operations to need to install pre-treatment systems or abandon the wells. So as long as the photocatalysis process can be cost-competitive, it still will remain an excellent option. Sam Levin added that the costs for leachate management statewide run about 7-15 cents per gallon or around \$3-\$15 per thousand gallons. The CDSL landfill is currently on the order of \$3.65-\$8.33 per thousand gallons. Damaris Lugo added that the CDSL facility entered into a mutually beneficial agreement with Broward County Water and Wastewater Services to accept wastewater treatment sludge in exchange for accepting the leachate at a reduced cost. The preliminary cost estimate for photocatalysis is on the order of \$2 per thousand gallons. Questions were raised as to the cost of chemicals. Dr. Meeroff stressed that the process is catalytic, so theoretically this is a one-time cost. The cost of one 22-lb bag of photocatalyst is on the order of \$500.
 - Tim Vinson asked how the color parameter of leachate was measured. Dr. Meeroff and Mr. Youngman replied with an explanation of the color comparison wheel test and how it works.
 - Sam Levin gave Mr. Youngman a rule of thumb about leachate production with a 40,000 gallon per acre per month generation rate. He mentioned that closed landfills produce a lot less.
 - The issue of additional parameters of interest produced the following candidates: chlorides, sodium, ammonia (which is already being analyzed), and arsenic. Sam Levin mentioned that the removal of ammonia alone in a recirculating bioreactor landfill could enhance the

biodegradation rate of other pollutants inside the landfill in a self-treatment approach.

- Damaris Lugo volunteered to ask the landfill facility in southwest Broward County on US27 and Sheridan Street (which accepts a great deal of C&D waste) to provide leachate samples for comparison purposes.
- The issue of catalyst reuse was brought up by several participants. Dr. Meeroff replied that in earlier tests, it was found that the catalyst performed the same for up to several batches without loss in treatment efficiency, but in those tests, the catalyst was pretreated by incineration at 550 degrees Celsius to remove any adsorbed organics on the catalyst surface. In this latest round of testing, Mr. Youngman will be conducting an experiment on capturing the catalysts and reusing them once he can determine the optimum dose, so stay tuned for the answer.

6. Adjourn, thank you for participating (12:38 pm)