SUMMARY: MANAGEMENT OF SUBSURFACE REDUCTIVE DISSOLUTION UNDERNEATH LANDFILLS

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High concentrations of iron have recently been observed in groundwater and soils around municipal solid waste landfills in Florida. The levels have been attributed to reductive dissolution from native iron in the soil perhaps caused by a shadowing effect of the landfill liner, which inhibits the reaeration of the shallow aquifer beneath the landfill. In this study, the research team will evaluate the validity of this hypothesis, develop a list of engineering management alternatives for controlling the release of iron in-situ, and conduct laboratory experiments on management methods for dealing with this issue.

Recently elevated concentrations of iron have been observed in groundwater monitoring wells down gradient of lined landfills in Florida. The source of this iron contamination has not been verified yet, but is potentially associated with the presence of the landfill by either one or both of the following mechanisms: 1) the source of the iron is direct release of iron from the municipal solid waste leachate, or 2) the source is from naturally-occurring iron mobilized from the soil due to changes in soil chemistry or local hydrology. After the source is determined, the immediate question is if iron is being mobilized, is this a sign that other, potentially more toxic metals, like arsenic, are also being transported downstream too? If this is the case, then how do we control these releases?

Once the source of the elevated iron is determined, the next step will be to determine if co-liberation of toxic metals is also occurring, and if so, to come up with an effective strategy to remediate the problem. The research team will focus on identifying viable engineering alternatives that will minimize the potential disturbance to the system, limit treatment costs, and produce the most effective results. The goal of this research is: 1) to investigate the key parameters governing reductive dissolution of iron; 2) to develop a list of engineering management alternatives for controlling the release of iron in-situ; and 3) to conduct laboratory experiments on methods for iron and co-contaminant removal from groundwater at landfill impacted sites.

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PROGRESS REPORT
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Project Title: Management of subsurface reductive dissolution underneath landfills
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Progress to Date:

- **Task 1**. **Develop a list of engineering alternatives for managing elevated iron levels**. The graduate research team of Richard Reichenbach, Frans Badenhorst, and André McBarnette has started the literature review of in-situ management methods for iron mitigation. We expect preliminary results in late January 2011.

- **Task 2. Conduct laboratory experiments on selected treatment technologies for managing iron dissolution**. We have conducted preliminary experiments to develop the aquarium testing unit set-up (Figure 1 and Figures 7 and 8). We have also received the custom reactor coil (Figure 2) for plug flow configuration of the pilot unit for testing. The existing PIMA and photocatalytic processes (Figures 3 and 4) are being modified for soil treatment. We are also very excited to report that we have received additional funding support from the FAU College of Engineering and Computer Science to purchase an advanced oxidation pilot plant unit for testing photocatalytic oxidation and ultraviolet radiation processes (Figures 5 and 6). This unit arrived in November 2010 and has been flow tested already. We are in the process of meeting with Waste Management officials to obtain samples of soil, leachate, and groundwater for preliminary testing. This meeting is scheduled for December 20, 2010.


Figure 1. Aquarium testing set-up

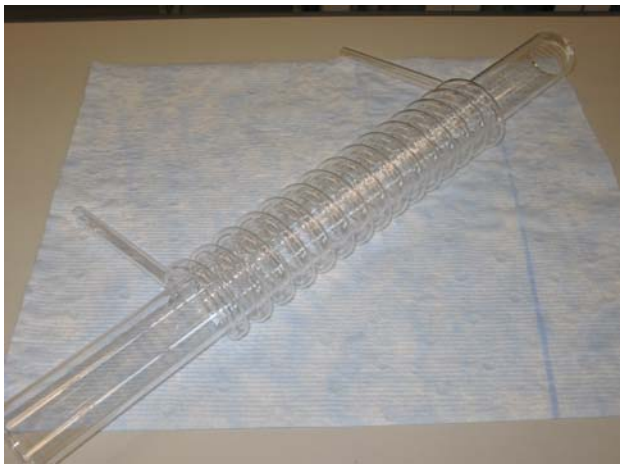
Figure 2. Custom quartz rector coil

Figure 3. UV reactor set-up

Figure 4. UV reactor safety cabinet

Figure 5. Falling film reactor

Figure 6. Pump and treat pilot plant

Figure 7. Aquarium testing unit

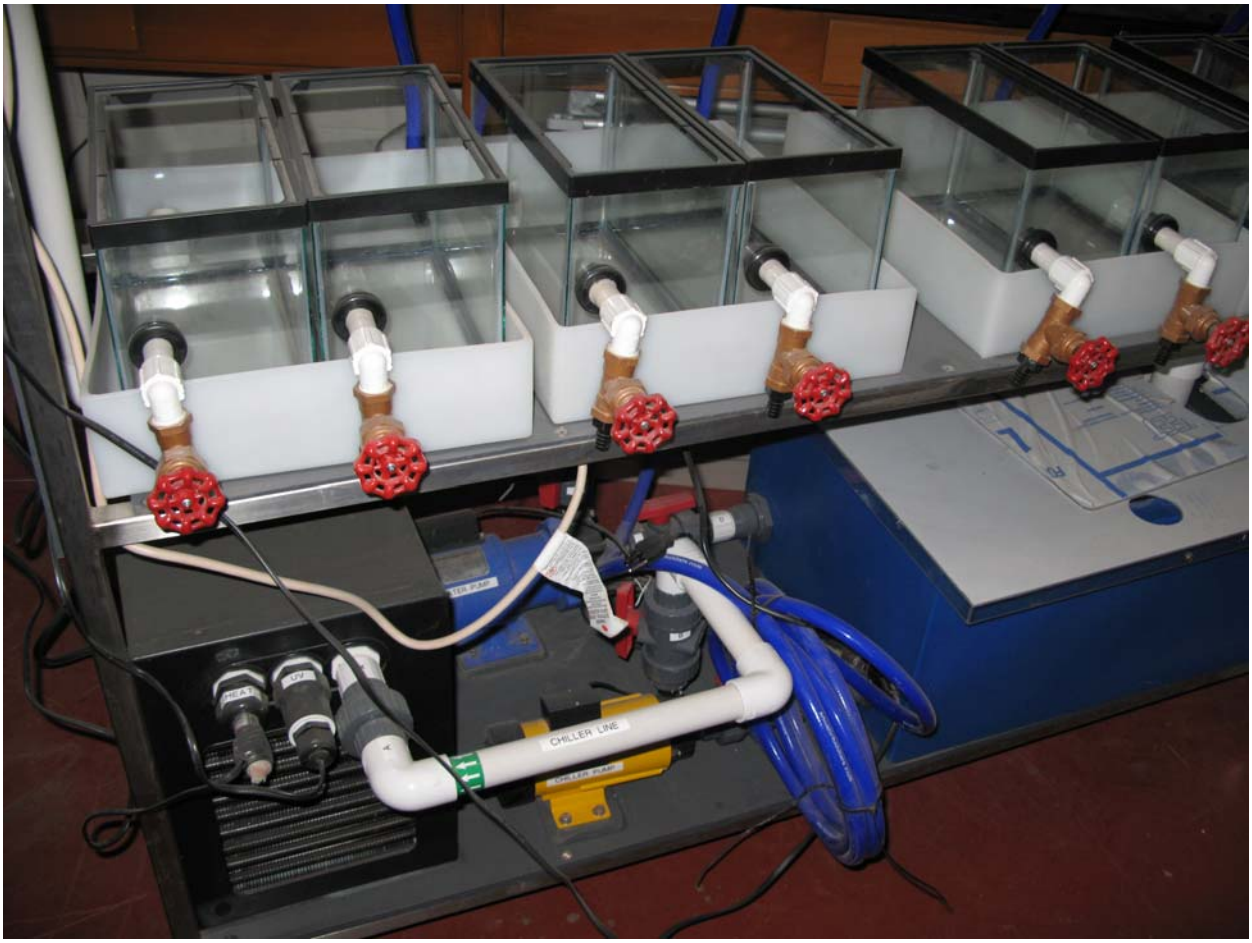

Figure 8. Close up of aquarium testing unit.

Research planned for the upcoming months:

- Complete the preliminary literature review
- Begin aquarium-scale testing with the new reactor coil and plug flow configuration.
- Start actual leachate tests with aquarium-scale unit.
- Prepare for pilot tests and design experiments to test the new unit.