

Technical Awareness Group Meeting

Theme: Beneficial Use of Waste Materials

April 27, 2016

Florida Department of Transportation
State Materials Office
5007 NE 39th Avenue
Gainesville, Florida

Students and Faculty from the
Engineering School for Sustainable Infrastructure and
Environment
University of Florida

Hinkley Center Projects

- Application of New Leaching Protocols for Assessing Beneficial Use of Solid Wastes in Florida
- Use of Solid Wastes in Asphalt and Concrete in Florida



Agenda

- Welcome, introductions, and objectives
- Beneficial use basics

Leaching

- Methods
- Using leaching data in beneficial use decision making
- Specific research investigations
- Project summary and needs assessment

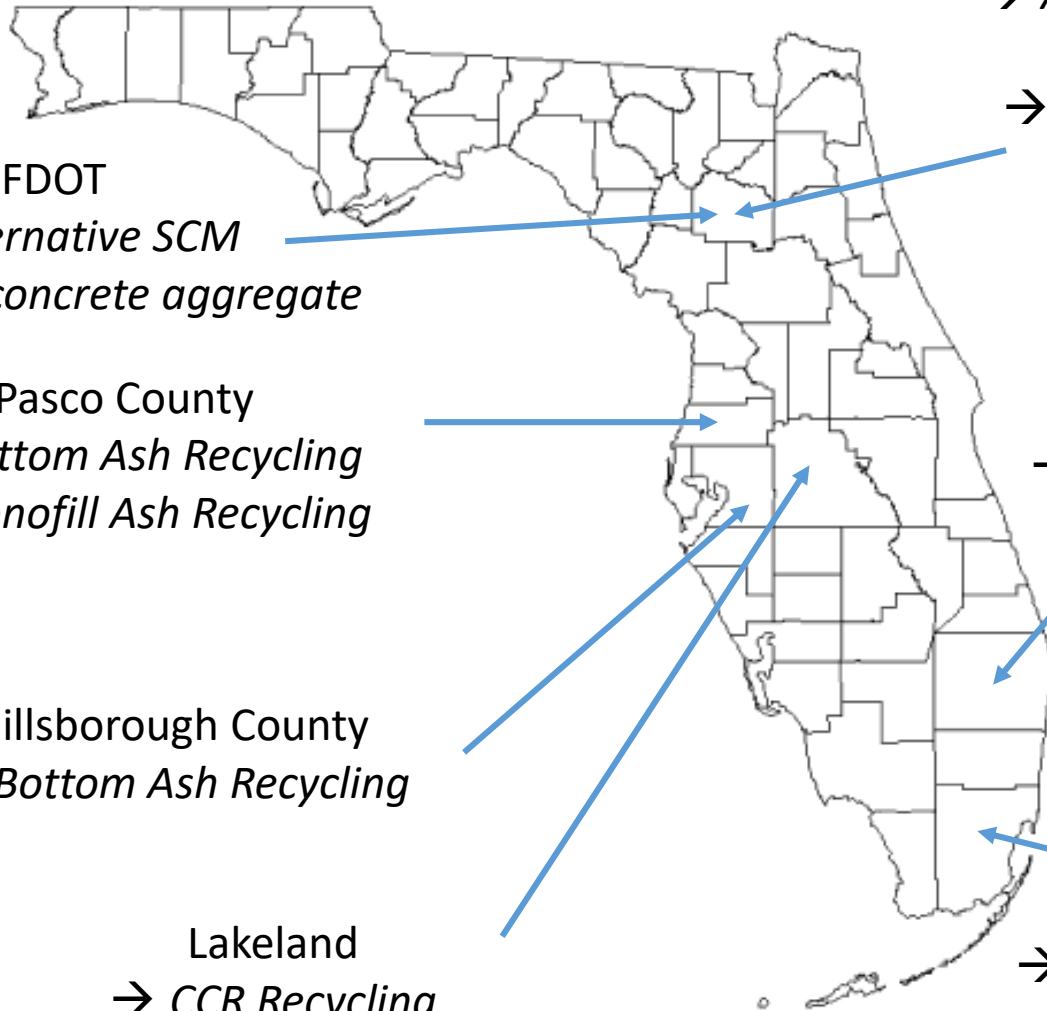
Characterizing the benefit → wastes as:

- Supplemental cementitious material
 - Cement kiln feed
 - Concrete aggregate
 - Asphalt pavement aggregate
 - Structural fill/road base
- Project summary, next steps, and discussion

Beneficial Use

- This term is often used to apply to a number of different types of non-hazardous solid waste (outside the typical waste components in MSW) that are recycled as substitutes for raw materials.

Current UF Efforts in Beneficial Use



FDOT

→ *Alternative SCM*

→ *Recycled concrete aggregate*

Pasco County

→ *Bottom Ash Recycling*

→ *Monofill Ash Recycling*

Hillsborough County

→ *Bottom Ash Recycling*

Lakeland

→ *CCR Recycling*

Hinkley Center

→ *Application of LEAF for Beneficial Use*

→ *Issues Regarding Ash in Concrete*

Palm Beach County

→ *Bottom Ash Recycling as Aggregate*

Miami-Dade County

→ *Bottom Ash Recycling as Cement Kiln Feed*

Application of New Leaching Protocols for Assessing Beneficial Use of Solid Wastes in Florida

- Literature review
- Florida beneficial use leaching assessment
- LEAF testing
- Guidance document



Use of Solid Wastes in Asphalt and Concrete in Florida

- Literature review and needs assessment
- Statewide assessment of bottom ash gradation
- Concrete performance research
- Leach testing



Morning Agenda

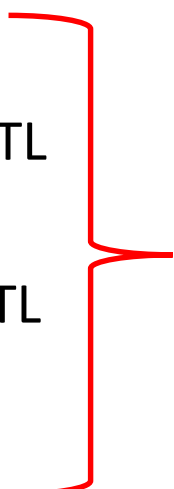
- Beneficial use basics
- Leaching protocol review
- Using leaching data to make beneficial use decisions
- Selecting appropriate partition coefficients
- Evaluating risk from blended uses
- Project summary and needs assessment

Project Summary and Needs Assessment

- The new suite of leaching tests provide an expanded set of tools for use in beneficial use decision-making.
- Leaching tests are just one component – fate and transport modeling and risk assessment are major components, and the assumptions that go into these may have more impact on the final outcome than the leaching test itself.
- Let's look back and see how we have used leaching tests in beneficial use decision-making in the past.

Past Florida Assessment

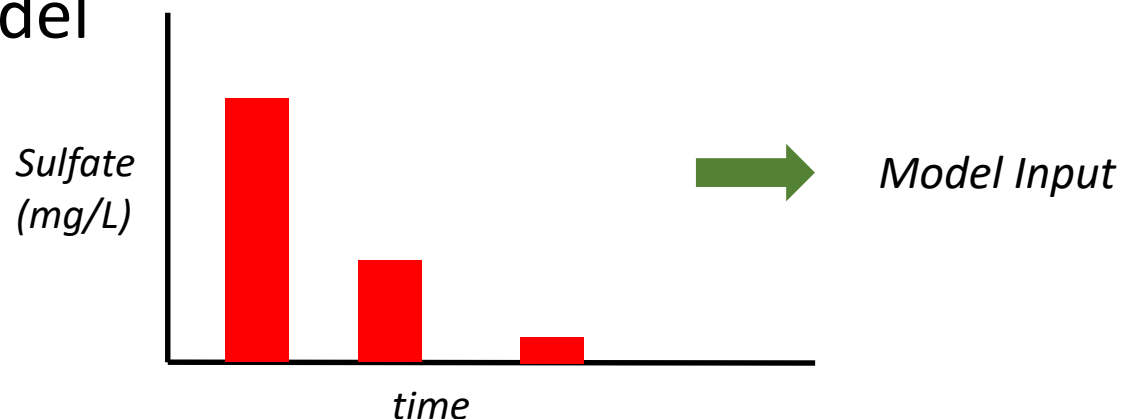
Approach: Compare SPLP results to GCTL

- Street sweepings, catch basin sediments, pond sediments
 - Metal concentrations < GCTL
 - Lime sludge
 - Metal concentrations < GCTL
 - Alum sludge
 - Al, Pb, Mn > GCTL
 - Ferric sludge
 - Al, Fe, Mn > GCTL
 - C&D wood
 - As > GCTL
- 
- 1314 or 1316 could be used to get a more realistic Co input for fate and transport model
 - If waste is blended with soil, hybrid approaches could be used to assess potential leachability

Past Florida Assessment

Approach: Compare SPLP results to GCTL

- Recovered Screened Material (RSM)
 - All metals (95%UCL) below GCTL
 - Sulfate 4-6 times the GCTL
- 1316 (or 1314) would allow us to evaluate the decrease in sulfate leaching over time, and this could be factored into a pollutant fate and transport model



Past Florida Assessment

Approach: Compare SPLP results to GCTL

- Wood Ash
 - Mid 2000's
 - SPLP Pb = 52 ug/L
 - SPLP As = <5 ug/L
 - 2015
 - SPLP Pb = 240 ug/L
 - SPLP As = <4 ug/L



How can we use new leaching protocols to make better decisions?

Past Florida Assessment

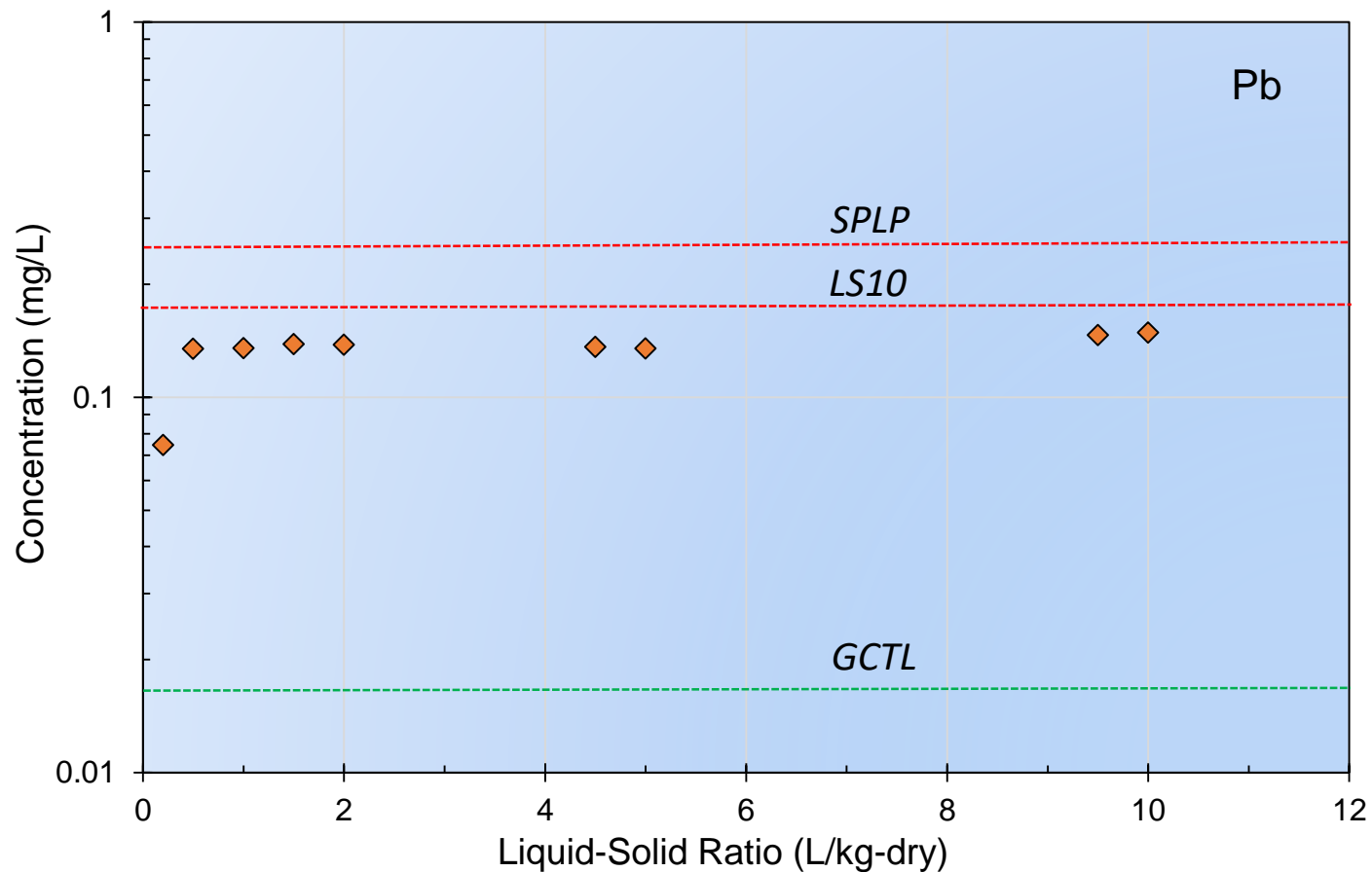
Wood Ash

- For a single point screening assay, does using LEAF LS10 differ from SPLP?
 - SPLP Pb = 240 ug/L
 - SPLP As = <4 ug/L
 - LS10 Pb = 172 ug/L
 - LS10 As = 5.4 ug/L

Past Florida Assessment

Wood Ash

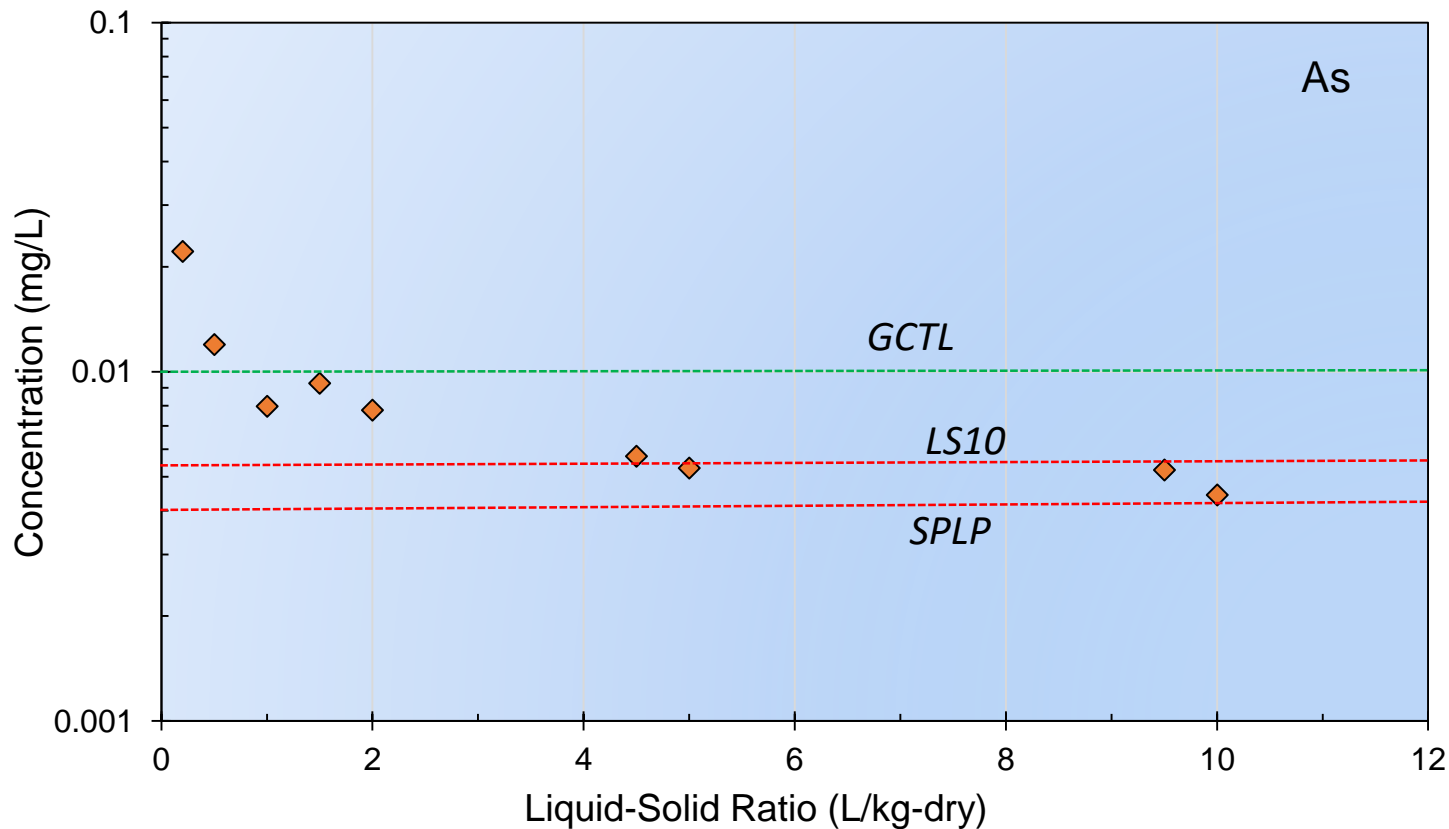
Use the column test (1314) to give us a better estimate of C_o ?



Past Florida Assessment

Wood Ash

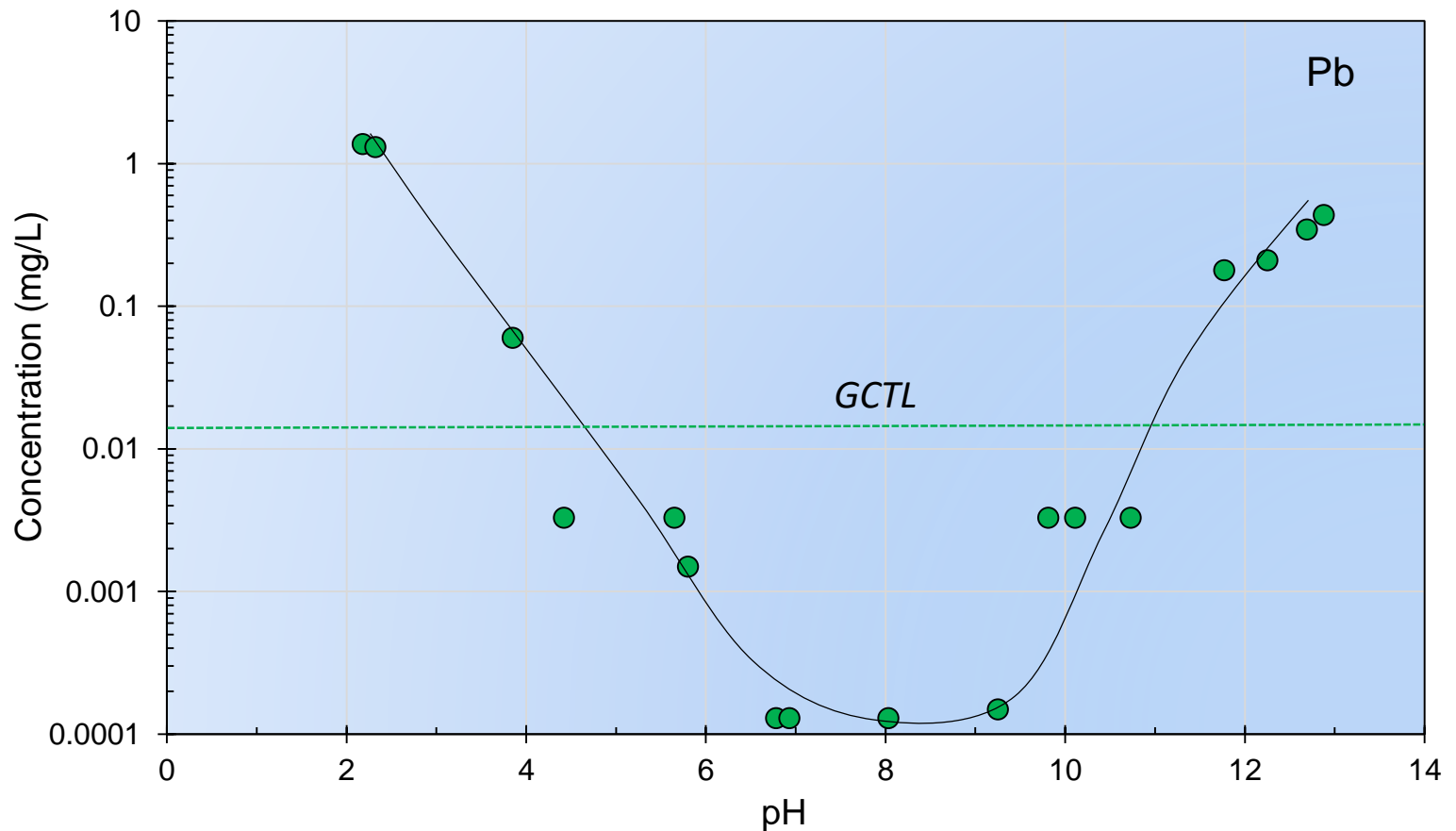
Use the column test (1314) to give us a better estimate of C_0 ?



Past Florida Assessment

Wood Ash

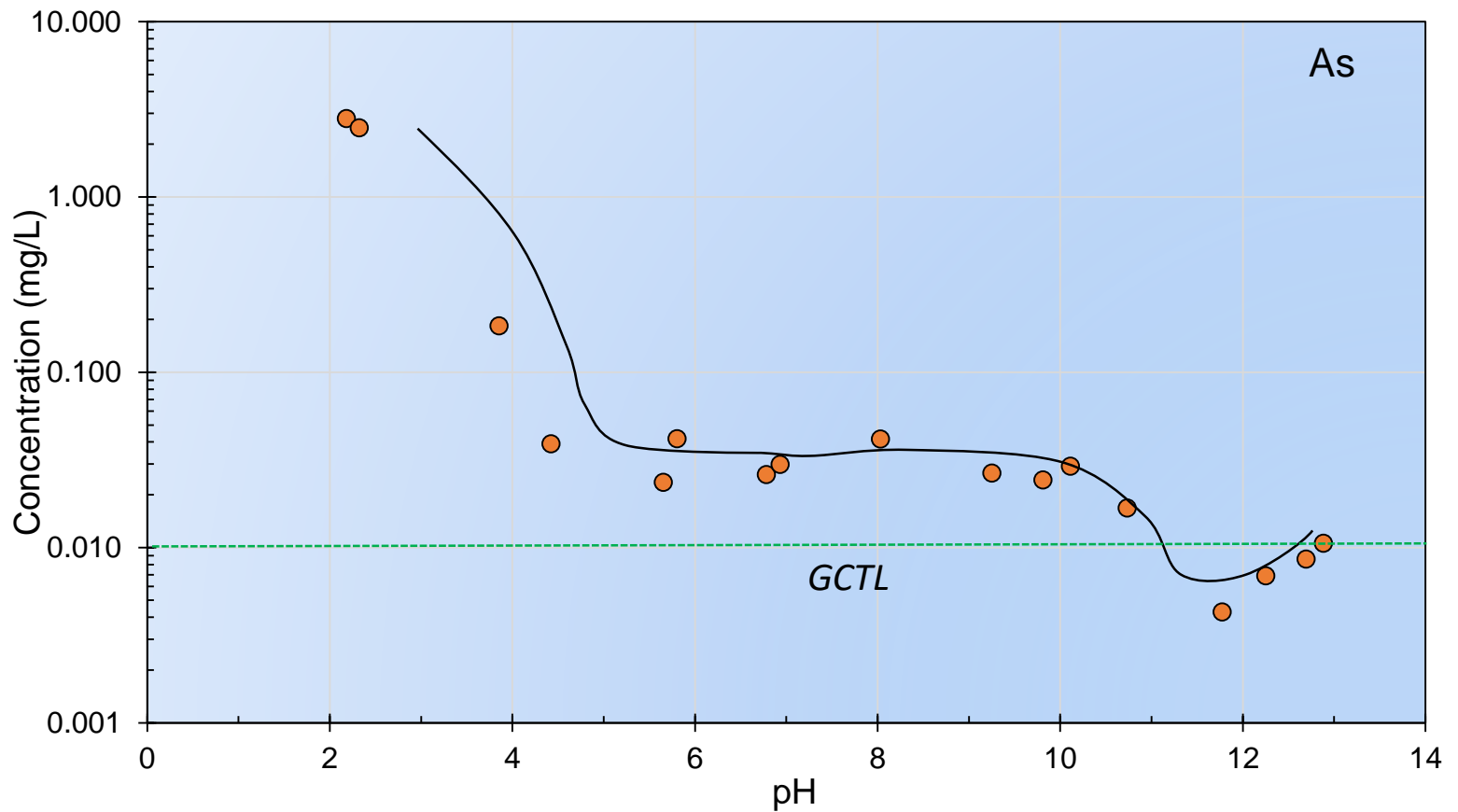
Use the pH stat (313) test to give us a better understanding of C_o ?



Past Florida Assessment

Wood Ash

Use the pH stat (1313) test to give us a better understanding of C_0 ?



Lessons Learned?

- The use of the new leaching procedures sheds light on why some elements behave the way they do, and allow a more finessed risk assessment to be conducted. But for the majority of wastes and scenarios encountered in Florida, the use of LEAF data as an input to pollutant fate and transport models does not alter risk assessment outcomes dramatically compared to using SPLP. The other assumptions in the process (e.g., infiltration rate, K_d , dilution) have a greater effect.

Needs Assessment

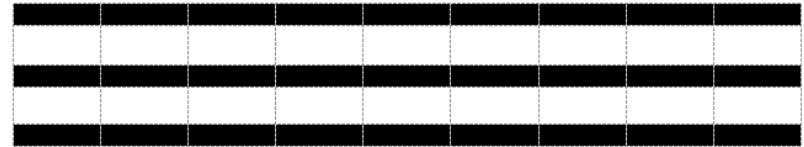
- More field testing and validation are required.
- A better understanding of actual liquids infiltration through roads or similar structures is needed.

We are far from wrapping up research on this subject, but are wrapping up this specific project.

Final Deliverables

- Project report
- Guidance document

- Need TAG members to review



**Application of New Leaching Protocols for
Assessing Beneficial Use of Solid Wastes in Florida**

April 2016

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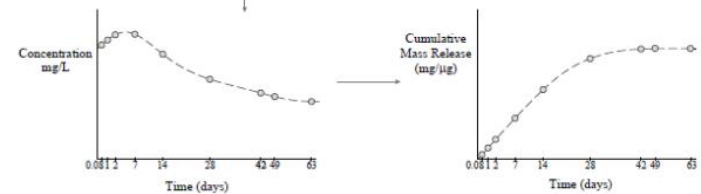
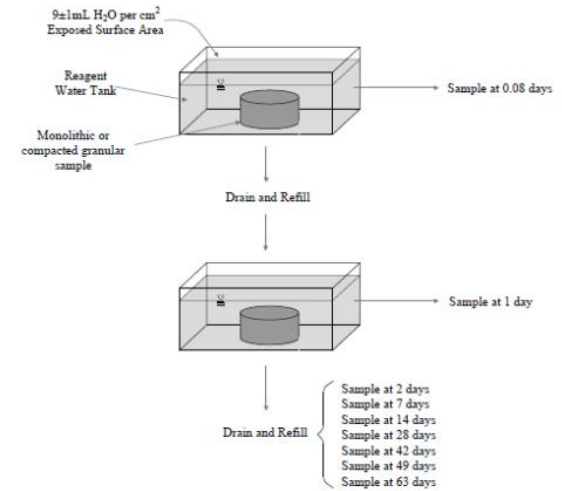


Application of Leaching Tests for Beneficial Use Decision-Making

Prepared by: University of Florida



Procedure for Method 1315



How to present the data for method 1315?

Mass released during a leaching interval (mg/m²)

$$M_t = \frac{C_i \times V_i}{A}$$

Where C_i is the element concentration in the eluent in that interval (mg/L), V_i is the eluate volume in the interval (L), and A is the surface area exposed to eluent (m²)

Mean interval flux during a leaching interval (mg/m²s)

$$F_i = \frac{M_t}{t_i - t_{i-1}}$$

Where t_i is the cumulative time at the end of the current leaching interval (s), and t_{i-1} is the cumulative time at the end of the previous interval (s)

In Method 1315, the release of constituents from monolithic or compacted granular materials is evaluated. The specimen is placed in a leaching bath for set time intervals, after which the leachate is removed and processed for analysis and the bath is refilled with DI water for the subsequent leaching interval.



UF UNIVERSITY of FLORIDA



Lunch

Courtesy of Jones Edmunds

Afternoon Agenda

- Determining if beneficial use is beneficial
- Wastes as:
 - Supplementary cementitious material
 - Cement kiln feed
 - Concrete aggregate
 - Asphalt pavement aggregate
 - Structural fill/base course
- Project summary, next steps and discussion
- Adjourn

Next Steps

- Work continues on a variety of projects related to beneficial use
- Example of specific tests:
 - Characterizing the impact of aluminum on concrete performance and leachability
 - Characterizing the leachability of aluminum as a function of cracking
 - Flow through evaluation of leaching from asphalt amended with waste materials
 - Better simulation of pavement hydraulics
- Another TAG meeting in the Fall semester