QUARTERLY PROGRESS REPORT 2

Title: Equivalency of Double Liner System for Florida Coal Ash Landfills

Project Duration: October 1st, 2020 – September 30th, 2021
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PROJECT WEB SITE:

http://eng-web1.eng.famu.fsu.edu/~abichou/equivalency.html

Present Goals:

We **first** reviewed the process used by EPA to calculate leakage flow rates through the federal proposed composite liner system and through the Florida Class-I landfill double liner system. **Second**, we reviewed all previous documentations (FDEP reports, published journal and conference papers) used by the State of Florida to successfully obtain approval for their double liner system as Florida's Subtitle D alternative. **Third**, we started using the findings of first two tasks to recalculate theoretical leakage flow rates through Florida and EPA liner systems to assess if any errors were committed, by not actually comparing the two liner systems, but comparing only theoretical leakage rates through parts of each liner system. **Finally**, we are collecting actual leachate flow rates into the leak detection system (LDS) at Florida's active and closed double-lined Subtitle D landfills to update the performance and see if liner leakage rate equations should be updated.

Next, we will showcase some of the work accomplished during this reporting on Quarter 2:

Data Collection:

To compare the design leakage to the actual leakage real-time date has been obtained from several double lined landfills in Florida. Some of the data was obtained directly from the landfills whereas the remaining data has been acquired from the FDEP Oculus database. The data obtained from the landfills was the amount of leachate collected in through the LCS and LDS, Rainfall Data, Lining profile and areas of all the cells associated with a particular data. The Landfills for which data has been obtained:

Landfill	District	County	Remarks
Test Site A	SW	Hernando	Data Processing in Progress
Test Site B	SED	Palm Beach	Data Processing in Progress
Test Site C	SW	Orange	Data Processing in Progress
Test Site D	SD	Hillsborough	Data Processing in Progress
Test Site E	CD	Sarasota	Data Processing in Progress
Test Site F	CD	Volusia	Data Processing in Progress

Table. 2 Landfills with Data given by the landfill Authorities.

In addition to the 6 landfills mentioned above we obtained data for 8 landfills from the OCULUS database for which data was extremely hard to find and process. The permit documents had to be scavenged to find the leachate data in some cases. More data was obtained from 1995 FDEP study. List of the present landfills in addition to the ones mentioned earlier are listed below.

Landfill	District	Source	Data Status
Test Site G	SWD	Oculus Database	Data Processing Complete
Test Site H	NED	Oculus Database	Data Processing Complete
Test Site I	NED	Oculus Database	Data Processing in Progress
Test Site J	NED	Oculus Database	Data Processing in Progress
Test Site K	SED	1995 FDEP Study	Data Processing Complete
Test Site L	SED	1995 FDEP Study	Data Processing Complete
Test Site M	CD	1995 FDEP Study	Data Processing in Progress
Test Site N	SED	1995 FDEP Study	Data Processing Complete
Test Site O	SWD	Oculus Database	Data Processing Complete
Test Site P	SWD	Oculus Database	Data Processing in Progress
Test Site Q	NED	Oculus Database	Data Processing in Progress
Test Site R	SWD	Oculus Database	Data Processing in Progress

Example Data:

Design Leakage through the liners has been calculated using the equations in the earlier section. The design leakage is calculated for RCRA Subtitle D standard, double liner system of Test Site B. For this site there are 16 cells and data for cell 8 is presented below.
The design leakage through RCRA Subtitle D is as follows:

Variable	Value	Units
Area of Hole	1	cm^2
Leachate Head above primary Liner	0.3	m
Hydraulic Conductivity of Soil beneath Liner	$1x10^{-9}$	m/sec
Assuming Medium Contact, β	0.68	
Thickness of Soil	0.61	m
Leakage through Composite Liner	0.9439	gpad

Table. 2 Leakage calculation for RCRA-D.

The Liner system for Cell-8 is as follows (Top to Bottom) (**Fig. 1** showing liner system):

- 2 feet protective sand layer
- 8 oz/sy geotextile
- 250 mil geonet
- 60 mil HDPE geomembrane
- 2@250 mil geonet
- 60 mil Geomembrane
- GCL
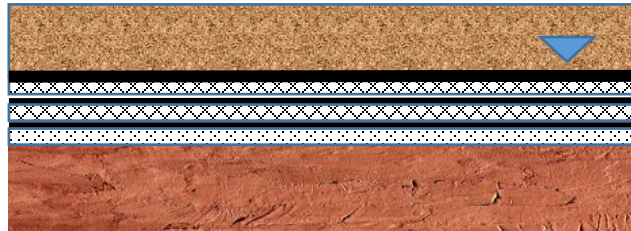
Design Leakage through the primary liner is calculated for all the cells using equations (1) and (2). From this the depth of leachate (3) in the LDS is calculated by calculated the width of wetted area (4). The design leakage into the ground is calculated using equation (5).

The Actual leakages through RCRA-D, and Each cell are plotted to compare with the design leakages. And one such plot is presented below:
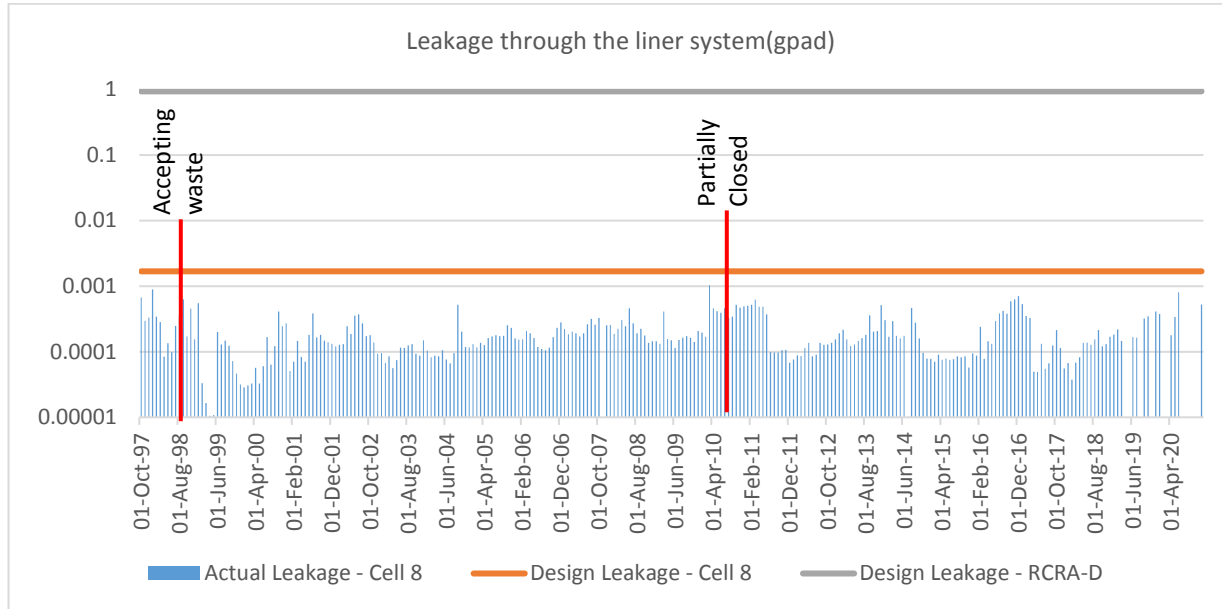
Fig. 2 Preliminary LDS data collected from one cell at a participating landfill.

It can be seen from the graph that the Actual leakage from the Liner system is lower than the Actual leakage and which in turn is much lower than the leakage through RCRA-D.

TAG meeting- April 16th:

We completed our first TAG meeting on April 16th, the members of the TAG were impressed by the efforts we are putting in to obtain data and make the project as comprehensive as possible. We received insights from the TAG team of how to obtain more data from different sources and how we can make the project more far-reaching. Some members came forward to obtain data by themselves and send it to us. Overall, the TAG meeting was a success.

Metrics:

1. List of graduate student or postdoctoral researchers **funded** by **THIS** Hinkley Center project

Last name, first name	Department	Professor	Institution
Prashanth Reddy Biyyani	Civil & Environmental Engineering	Dr. Tarek Abichou	FAMU-FSU College of Engineering

2. List undergraduate researchers working on **THIS** Hinkley Center project
   Present Undergraduate Researchers (None)

3. List research publications resulting from **THIS** Hinkley Center project (use format for publications as outlined in Section 1.13 of this Report Guide).
   NOT YET

4. List research presentations (as outlined in 1.13.6 of this Report Guide) resulting from **THIS** Hinkley Center project.
    TAG Meeting presentation
5. List who has referenced or cited your publications from this project?
   NO

6. How have the research results from **THIS** Hinkley Center project been leveraged to secure additional research funding? **NO**

7. How have the results from **THIS** Hinkley Center funded project been used (**will be used**) by FDEP or other stakeholders? (1 paragraph maximum).

TAG members:

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