

Leach Testing to Support Separation of Bottom Ash and Fly Ash at the South Broward WTE Facility

July 2018

Prepared for:

Wheelabrator Technologies Inc.

Prepared by:

Timothy Townsend, PhD, PE (Professor and Principal Investigator)

Kyle Clavier, EI (Graduate Research Assistant)

Yalan Liu (Graduate Research Assistant)

Department of Environmental Engineering Sciences
Engineering School of Sustainable Infrastructure and Environment
University of Florida

Timothy G. Townsend, PhD, P.E.

FL Reg # 60283

Table 9: TCLP results for cadmium and lead from 14 daily bottom ash samples leached with extraction fluid #1. When calculating means and UCL, measurements below detection limit were set to the detection limit.

Sample	Sub Sample	18-Hour Extract pH	Leached Concentration (mg/L)		Sample	Sub Sample	18-Hour Extract pH	Leached Concentration (mg/L)	
Bottom Ash Fluid #1			Cadmium	Lead	Bottom Ash Fluid #1			Cadmium	Lead
BA 8.10 M F1	1	N/A	0.104	0.108	BA 8.15 M F1	1	N/A	BDL	BDL
	2	10.83	BDL	0.00770		2	10.18	BDL	0.00830
	Average	10.83	0.0526	0.0576		Average	10.18	0.001	0.00615
BA 8.10 E F1	1	N/A	BDL	0.00440	BA 8.15 E F1	1	N/A	BDL	BDL
	2	9.19	0.00200	0.0290		2	10.97	BDL	BDL
	Average	9.19	0.00150	0.0167		Average	10.97	0.001	0.00400
BA 8.11 M F1	1	N/A	BDL	0.0218	BA 8.16 M F1	1	N/A	BDL	BDL
	2	10.83	BDL	0.00630		2	10.91	BDL	BDL
	Average	10.83	0.001	0.0141		Average	10.91	0.001	0.00400
BA 8.11 E F1	1	N/A	BDL	BDL	BA 8.16 E F1	1	N/A	BDL	BDL
	2	10.5	BDL	BDL		2	9.84	BDL	BDL
	Average	10.5	0.001	0.00400		Average	9.84	0.001	0.00400
BA 8.12 M F1	1	N/A	BDL	BDL					
	2	10.07	BDL	BDL					
	Average	10.07	0.001	0.004					
BA 8.12 E F1	1	N/A	BDL	BDL					
	2	10.47	BDL	BDL					
	Average	10.47	0.001	0.004					
BA 8.13 M F1	1	N/A	BDL	0.00460					
	2	10.86	BDL	BDL					
	Average	10.86	0.001	0.0043					
BA 8.13 E F1	1	N/A	BDL	BDL					
	2	9.89	BDL	0.0123					
	Average	9.89	0.001	0.00815					
BA 8.14 M F1	1	N/A	BDL	BDL					
	2	9.49	BDL	0.00430					
	Average	9.49	0.001	0.00415					
BA 8.14 E F1	1	N/A	BDL	BDL	Total	Total Average		0.00471	0.00994
	2	10.28	BDL	BDL		Total Standard Deviation		0.0138	0.0143
	Average	10.28	0.001	0.00400		Total 95% UCL		0.0112	0.0167
						Total 90% UCL		0.00969	0.0151

Table 10: TCLP results for cadmium and lead from 14 daily bottom ash samples leached with extraction fluid #2. When calculating means and UCL, measurements below detection limit were set to the detection limit.

[illegible]

Table 11: TCLP results for cadmium and lead from 14 daily fly ash samples leached with extraction fluid #2. When calculating means and UCL, measurements below detection limit were set to the detection limit.

Sample	Sub Sample	18-Hour Extract pH	Leached Concentration (mg/L)		Sample	Sub Sample	18-Hour Extract pH	Leached Concentration (mg/L)	
Fly Ash Fluid #2			Cadmium	Lead	Fly Ash Fluid #2			Cadmium	Lead
FA 8.10 M F2	1	N/A	BDL	0.325	FA 8.15 M F2	1	N/A	BDL	0.0525
	2	11.41	BDL	0.283		2	11.18	BDL	0.0690
	Average	11.41	0.001	0.304		Average	11.18	0.001	0.0608
FA 8.10 E F2	1	N/A	BDL	BDL	FA 8.15 E F2	1	N/A	BDL	BDL
	2	10.48	0.00100	BDL		2	10.86	BDL	BDL
	Average	10.48	0.00100	0.004		Average	10.86	0.001	0.004
FA 8.11 M F2	1	N/A	BDL	0.289	FA 8.16 M F2	1	N/A	BDL	0.509
	2	11.45	BDL	0.237		2	11.63	BDL	0.664
	Average	11.45	0.001	0.263		Average	11.63	0.001	0.586
FA 8.11 E F2	1	N/A	BDL	BDL	FA 8.16 E F2	1	N/A	BDL	0.448
	2	10.81	BDL	BDL		2	11.81	BDL	0.443
	Average	10.81	0.001	0.004		Average	11.81	0.001	0.445
FA 8.12 M F2	1	N/A	BDL	1.38					
	2	11.61	BDL	1.30					
	Average	11.61	0.001	1.34					
FA 8.12 E F2	1	N/A	BDL	0.598					
	2	11.66	BDL	0.505					
	Average	11.66	0.001	0.551					
FA 8.13 M F2	1	N/A	BDL	1.23					
	2	11.87	BDL	1.02					
	Average	11.87	0.001	1.12					
FA 8.13 E F2	1	N/A	BDL	0.366					
	2	11.63	BDL	0.358					
	Average	11.63	0.001	0.362					
FA 8.14 M F2	1	N/A	BDL	1.00					
	2	11.75	BDL	0.907					
	Average	11.75	0.001	0.955					
FA 8.14 E F2	1	N/A	BDL	1.01	Total	Total Average		0.001	0.498
	2	11.70	BDL	0.938		Total Standard Deviation		0.000	0.446
	Average	11.70	0.001	0.971		Total 95% UCL		0.00100	0.709
						Total 90% UCL		0.00100	0.659

Table 12: TCLP results for cadmium and lead from 14 daily combined ash samples leached with extraction fluid #2. When calculating means and UCL, measurements below detection limit were set to the detection limit.

Sample	Sub Sample	18-Hour Extract pH	Leached Concentration (mg/L)		Sample	Sub Sample	18-Hour Extract pH	Leached Concentration (mg/L)	
Combined Ash Fluid #2			Cadmium	Lead	Combined Ash Fluid #2			Cadmium	Lead
CA 8.10 M F2	1	N/A	0.702	0.251	CA 8.15 M F2	1	N/A	0.647	0.354
	2	6.72	0.719	0.436		2	6.85	1.24	0.324
	Average	6.72	0.711	0.344		Average	6.85	0.944	0.339
CA 8.10 E F2	1	N/A	0.607	0.0788	CA 8.15 E F2	1	N/A	0.144	1.14
	2	6.53	0.715	0.197		2	5.68	0.161	1.65
	Average	6.53	0.661	0.138		Average	5.68	0.153	1.39
CA 8.11 M F2	1	N/A	0.136	0.0248	CA 8.16 M F2	1	N/A	BDL	0.00440
	2	7.75	0.165	0.0233		2	9.51	0.00400	BDL
	Average	7.75	0.150	0.0241		Average	9.51	0.00250	0.00420
CA 8.11 E F2	1	N/A	0.334	0.0654	CA 8.16 E F2	1	N/A	0.289	1.00
	2	6.93	0.750	0.105		2	5.91	0.215	1.91
	Average	6.93	0.542	0.0850		Average	5.91	0.252	1.46
CA 8.12 M F2	1	N/A	0.322	0.0632					
	2	6.90	0.505	1.02					
	Average	6.90	0.414	0.540					
CA 8.12 E F2	1	N/A	0.0100	BDL					
	2	7.48	0.496	0.0470					
	Average	7.48	0.253	0.0255					
CA 8.13 M F2	1	N/A	0.163	0.0420					
	2	7.35	0.428	0.0730					
	Average	7.35	0.296	0.0575					
CA 8.13 E F2	1	N/A	0.332	0.0586					
	2	7.17	0.565	0.0257					
	Average	7.17	0.449	0.0421					
CA 8.14 M F2	1	N/A	0.0214	BDL					
	2	7.94	0.131	0.0137					
	Average	7.94	0.0762	0.00885					
CA 8.14 E F2	1	N/A	0.193	4.52	Total	Total		0.367	0.778
	2	5.59	0.273	8.34		Total Average		0.268	1.70
	Average	5.59	0.233	6.43		Total Standard Deviation		0.494	1.58
				Total 95% UCL			0.464	1.39	
				Total 90% UCL					

6.0 Recommendations

UF researchers performed extensive testing of bottom, fly, and combined ash streams from the Wheelabrator South Broward facility to support the potential separation of their bottom and fly ash streams. Analyses included leachate pH, total elemental concentrations, TCLP, a modified 1313 pH-dependent leaching test in the presence of acetate concentration equal to that of TCLP, and a bottom/fly ash blending experiment. The results demonstrate that all three ash streams, in the current state of operation at the Wheelabrator South Broward WTE facility, are nonhazardous. The testing results demonstrate that neither bottom ash, fly ash, nor combined ash exceeded the RCRA TC limit and are not hazardous wastes. These findings, along with the modified 1313 testing, support that if some bottom ash were split from the fly ash, the remainder would be nonhazardous. The data also supports that all blends of bottom ash and fly ash are similarly non-hazardous. The results also support that the bottom ash would be a good candidate for potential beneficial reuse applications.