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Division of Solid & Hazardous Materials

New York State Department of Environmental Conservation
Bureau of Hazardous Waste and Radiation Management
Radiological Sites Section – Ninth Floor
625 Broadway
Albany, NY 12233

Attention: Thomas Papura
EMLab P&K #: 397422
Billing Ref.: Elemental Analysis of Slag

March 27,2008

Dear Thomas:

Please find enclosed the results of the four (4) slag samples you submitted for oxide analysis and elemental composition.

METHODS:

A portion of material from each submitted bag was removed with tweezers and placed into a mortar and pestle. A portion of this material was then ground into a finer powder, and mounted onto an analysis stub using double sided adhesive tape. These sample mounts were then coated with evaporated graphite in order to increase sample stability and provide a conductive layer. A representative area of each sample area was then examined using EDX spectroscopy in the SEM. These areas were chosen to represent the most homogenous grains and powder in the sample mount area. The resultant EDX spectra were then analyzed, performing peak integrations and nuclear interaction calculations in order to compute the composition of the dust material. In each sample, a number of discrete, larger grains were also assessed in order to determine the extent to which the dust portions were representative of the bulk material. In each case, there were only slight variations between larger grains and the average composition findings, and so the initial average composition readings were used.

FINDINGS:

Please refer to the EDX spectra and composition tables for the four samples. Most of the material examined in these samples appeared to be quite similar. It appeared that calcium was the predominant oxide in all four samples. Many of the other elements noted appeared in small quantities, and were likely only trace elemental contributions, potentially from multiple sources. Small amounts of rare earth elements, metals, and silver were all documented in the sample. Zirconium was found in all the samples, but in low concentrations.

If you have further questions please feel free to contact me through client services at any time.

Sincerely,

Jared Kelly
Analyst

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Bruker AXS Microanalysis GmbH, Germany 3/31/2008

Quantax

Results NR908 02035 022104 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Magnesium	12	K-series	50337	7.494586733	16.88189792	21.64900958	0.46042966
Aluminium	13	K-series	134268	15.18587671	34.20687885	39.51473775	0.78754857
Silicon	14	K-series	40117	4.344439447	9.7860477	10.86019333	0.22134391
Sulfur	16	K-series	4708	0.41396768	0.93248105	0.906374367	0.07281045
Potassium	19	K-series	4300	0.328632449	0.740259556	0.590117557	0.03886785
Calcium	20	K-series	156456	13.38155815	30.14256913	23.44156556	0.41925204
Titanium	22	K-series	6803	0.716630616	1.614243099	1.050817228	0.06992363
Iron	26	K-series	3814	0.471057982	1.061079557	0.592189206	0.04194185
Zirconium	40	K-series	844	1.351044289	3.043288788	1.039791931	0.08648835
Barium	56	L-series	815	0.122343137	0.275583488	0.062546089	0.08227435
Cerium	58	L-series	3944	0.584081802	1.315670859	0.292657403	0.23039853
			Sum:	44.39421899	100	100	

Parameter	MWt	Wt %
Magnesium	24.305	– 7.494586733
Calcium	40.078	13.38155815
Aluminium	26.982	15.18587671

Parameter	MWt	Stoich Ratio w/Oxide	Wt %
MgO	40.304	1	12.428
CaO	56.072	1	18.722
Al_2O_3	101.961	2	28.693

2 moles of Al for every one mole of Al_2O_3

Tom: Here's the equation that I used. It works because we assume a 100 gram slag sample:

$$X\ Wt\ \%\ Al_2O_3 = (15.186\ grams\ Al)\frac{(1\ mole\ Al)}{(26.982\ grams\ Al)}\frac{(1\ mole\ Al_2O_3)}{(2\ moles\ Al)}\frac{(101.961\ grams)}{(1\ mole\ Al_2O_3)} = 28.693\ \%$$

Holy Trinity Sample
Road bed near Roberts

Bruker AXS Microanalysis GmbH, Germany 3/31/2008

Quantax

Results NR908 02035 022101 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Magnesium	12	K-series	18164	2.290345742	5.193110132	7.351879538	0.160244176
Aluminium	13	K-series	45837	4.430029326	10.04461019	12.80951918	0.249014004
Silicon	14	K-series	165937	14.44437212	32.75104445	40.12448482	0.669310615
Sulfur	16	K-series	12574	1.15969514	2.629482733	2.821577673	0.117066377
Potassium	19	K-series	7089	0.491164782	1.113662781	0.980081758	0.15264418
Calcium	20	K-series	188851	14.94718993	33.8911292	29.09688336	0.488871074
Titanium	22	K-series	8526	0.844777149	1.915440402	1.37651509	0.073066178
Manganese	25	K-series	2505	0.305857549	0.693498761	0.434349494	0.038449494
Iron	26	K-series	8904	1.187920969	2.693481734	1.659513009	0.058640817
Zinc	30	K-series	1558	0.319541135	0.724524807	0.381248723	0.036702841
Zirconium	40	K-series	1429	2.89975076	6.5748698	2.479959113	0.137692874
Silver	47	L-series	2176	0.22835609	0.517772624	0.165163065	0.059418505
Cadmium	48	L-series	288	0.030059073	0.068155683	0.020862368	0.013476241
Barium	56	L-series	3714	0.524486741	1.189216702	0.297962806	0.083617867
			Sum:	44.10354651	100	100	

Parameter	MWt	Wt %
Magnesium	24.305	2.290345742
Calcium	40.078	14.947189930
Aluminium	26.982	4.430029326

Parameter	MWt	Stoich Ratio w/Oxide	Wt %
MgO	40.304	1	3.798
CaO	56.072	1	20.912
Al_2O_3	101.961	2	8.370

Rapids Bowl behind fenced area

Bruker AXS Microanalysis GmbH, Germany 3/31/2008

Quantax

Results NR908 02035 022103 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Magnesium	12	K-series	12160	1.73180619	3.080107316	4.328402433	0.128161017
Aluminium	13	K-series	81003	8.187029594	14.56105764	18.43247258	0.437096379
Silicon	14	K-series	169863	16.11642014	28.66389084	34.8586361	0.743838246
Sulfur	16	K-series	14418	1.23649176	2.199164859	2.342450427	0.1186732
Potassium	19	K-series	11230	0.725966374	1.291168927	1.127931176	0.050344854
Calcium	20	K-series	296461	21.93558194	39.01357254	33.24811972	0.669451225
Titanium	22	K-series	16548	1.4495027	2.578015887	1.839030184	0.084206819
Manganese	25	K-series	1695	0.171361918	0.304776076	0.1894809	0.035142575
Iron	26	K-series	10972	1.232734459	2.192482304	1.340891562	0.059205493
Copper	29	K-series	4728	0.724827924	1.289144134	0.69290017	0.046164179
Zirconium	40	K-series	1184	1.806231755	3.212477052	1.20278591	0.099019285
Lanthanum	57	L-series	7302	0.907559886	1.614142426	0.396898831	0.053313322
			Sum:	56.22551464	100	100	

Parameter	MWt	Wt %
Magnesium	24.305	1.732
Calcium	40.078	21.936
Aluminium	26.982	8.187

Parameter	MWt	Stoich Ratio w/Oxide	Wt %
MgO	40.304	1	2.872
CaO	56.072	1	30.689
Al_2O_3	101.961	2	15.469

Dunn Tire behind fenced area

Bruker AXS Microanalysis GmbH, Germany 3/31/2008

Quantax

Results NR908 02035 022102 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Magnesium	12	K-series	12438	1.3568028	2.087530352	3.068418653	0.10576576
Aluminium	13	K-series	95409	7.630379979	11.73984149	15.54436337	0.408726658
Silicon	14	K-series	200718	15.19074979	23.37196773	29.72970218	0.702174406
Phosphorus	15	K-series	645	0.058474709	0.089967186	0.103769004	0.058373508
Sulfur	16	K-series	2002	0.149875133	0.23059275	0.256908398	0.050662969
Potassium	19	K-series	5868	0.336021374	0.516990985	0.472392002	0.044697697
Calcium	20	K-series	480853	32.74835922	50.3855047	44.91351168	0.988031465
Titanium	22	K-series	25130	2.323021985	3.574122122	2.666813755	0.162748261
Chromium	24	K-series	1068	0.096018188	0.147730298	0.101502579	0.039852566
Manganese	25	K-series	2684	0.264859945	0.407504446	0.264994553	0.041822527
Iron	26	K-series	6789	0.715077143	1.100193218	0.703795613	0.04595306
Zirconium	40	K-series	2129	2.581000151	3.971038499	1.555150509	0.115829155
Silver	47	L-series	573	0.050185582	0.077213818	0.025572892	0.030147443
Barium	56	L-series	2685	0.355374119	0.546766457	0.142237426	0.137684188
Lanthanum	57	L-series	8813	1.139396172	1.753035955	0.450867387	0.092713912
			Sum:	64.99559629	100	100	

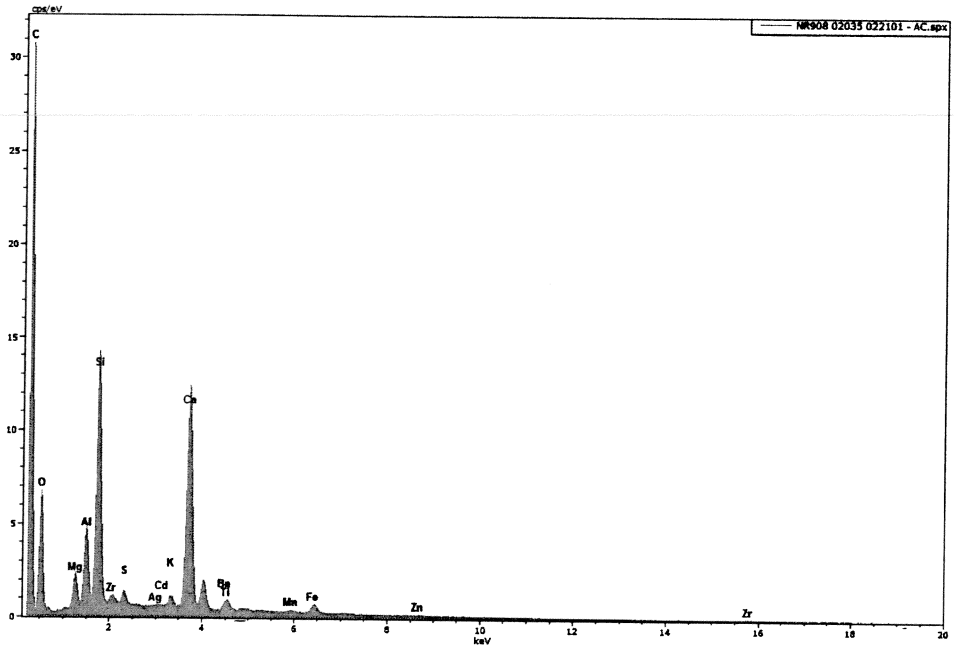
Parameter	MWt	Wt %
Magnesium	24.305	1.357
Calcium	40.078	32.748
Aluminium	26.982	7.630

Parameter	MWt	Stoich Ratio w/Oxide	Wt %
MgO	40.304	1	2.250
CaO	56.072	1	45.817
Al_2O_3	101.961	2	14.417

Rapids Bowl

Front flower bed

APPENDIX I: Compiled Elemental Composition Data



Results NR908 02035 022101 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Carbon	6	K-series	149484	17.23189	14.36292	20.72467	4.321716
Magnesium	12	K-series	19727	1.775677	1.480042	1.055364	0.129657
Aluminium	13	K-series	46766	3.01511	2.513119	1.614249	0.177434
Silicon	14	K-series	164601	8.735558	7.28116	4.493063	0.414668
Sulfur	16	K-series	10159	0.49701	0.414262	0.2239	0.067593
Potassium	19	K-series	8247	0.381998	0.318398	0.141136	0.118631
Calcium	20	K-series	193166	10.42913	8.692765	3.759032	0.348276
Titanium	22	K-series	8330	0.477903	0.398336	0.144185	0.052548
Manganese	25	K-series	3138	0.228418	0.190388	0.060061	0.034131
Iron	26	K-series	9586	0.779262	0.649521	0.201566	0.046912
Zinc	30	K-series	2229	0.261716	0.218143	0.057817	0.033763
Zirconium	40	K-series	1254	1.088777	0.907505	0.172411	0.068878
Silver	47	L-series	2425	0.159163	0.132664	0.021315	0.052958
Cadmium	48	L-series	1206	0.080651	0.067223	0.010364	0.048263
Barium	56	L-series	3748	0.305872	0.254947	0.032174	0.058672
Oxygen	8	K-series	61266	74.52667	62.11861	67.28869	62.79357
			Sum:	119.9748	100	100	

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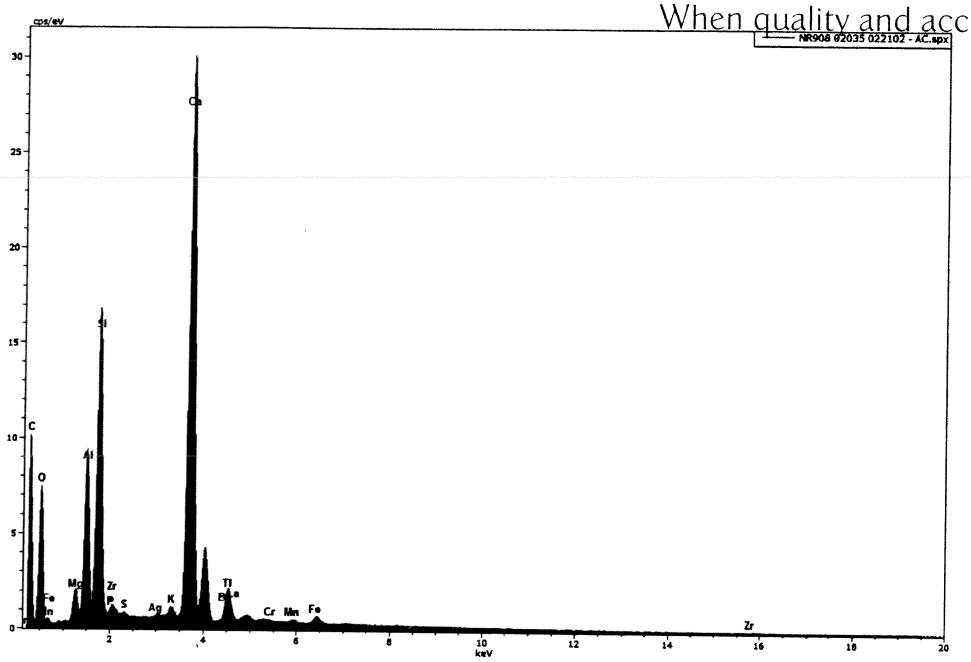

Results NR908 02035 022102 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Carbon	6	K-series	38454	0.991276	0.991296	2.029164	3.473246
Magnesium	12	K-series	16706	2.132586	2.132629	2.157311	0.150935
Aluminium	13	K-series	101599	9.162376	9.162559	8.349166	0.485625
Silicon	14	K-series	206109	16.46821	16.46854	14.41671	0.759058
Phosphorus	15	K-series	840	0.073476	0.073477	0.058324	0.064136
Sulfur	16	K-series	4073	0.287039	0.287044	0.220088	0.060936
Potassium	19	K-series	8438	0.468615	0.468625	0.294687	0.048052
Calcium	20	K-series	485982	30.87606	30.87668	18.94164	0.932936
Titanium	22	K-series	25156	1.784444	1.78448	0.916327	0.129049
Chromium	24	K-series	1097	0.078329	0.07833	0.037039	0.036788
Manganese	25	K-series	2947	0.231703	0.231707	0.103696	0.039107
Iron	26	K-series	7469	0.654864	0.654877	0.288305	0.043962
Zirconium	40	K-series	2208	1.968214	1.968254	0.530475	0.0937
Silver	47	L-series	4383	0.3735	0.373507	0.085133	0.057341
Barium	56	L-series	1848	0.187203	0.187207	0.033516	0.116206
Lanthanum	57	L-series	8171	0.816457	0.816474	0.144516	0.07463
Oxygen	8	K-series	72552	33.44364	33.44431	51.39391	62.60391
			Sum:	99.998	100	100	

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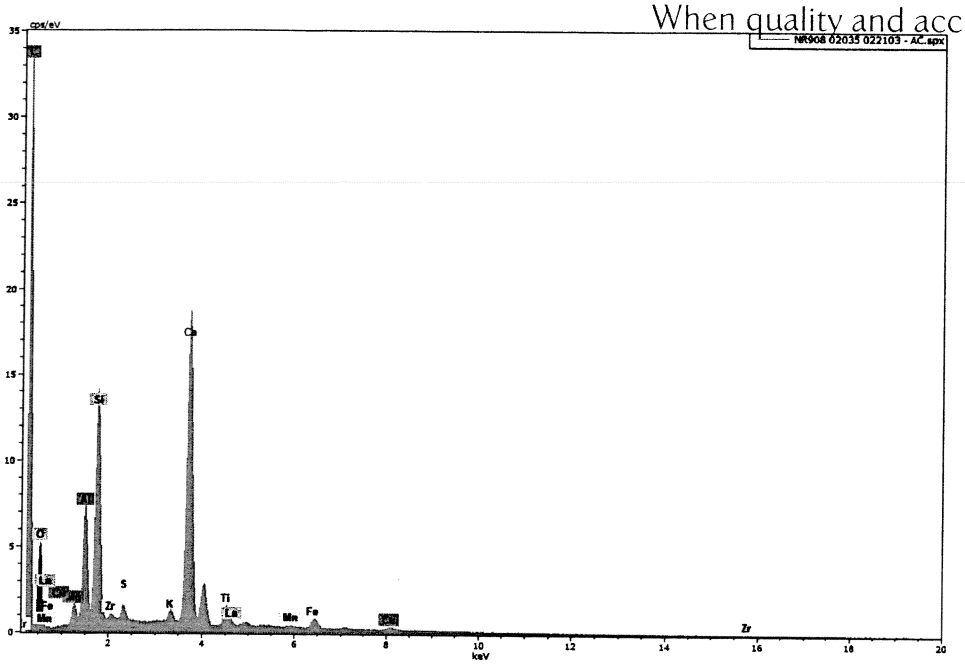

Results NR908 02035 022103 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Carbon	6	K-series	230132	22.59848	15.88683	23.78443	4.102958
Magnesium	12	K-series	12836	1.331315	0.93592	0.692433	0.104173
Aluminium	13	K-series	81286	5.760363	4.049561	2.698831	0.314943
Silicon	14	K-series	167023	9.628454	6.768846	4.333782	0.454478
Sulfur	16	K-series	11701	0.575778	0.404775	0.226988	0.071899
Potassium	19	K-series	9645	0.397214	0.279243	0.128428	0.039293
Calcium	20	K-series	296205	14.3333	10.07637	4.520982	0.446103
Titanium	22	K-series	16430	0.932368	0.655459	0.246165	0.063167
Manganese	25	K-series	1192	0.073142	0.051419	0.01683	0.030577
Iron	26	K-series	11403	0.838962	0.589794	0.189904	0.048196
Copper	29	K-series	5949	0.5759	0.404861	0.114565	0.041301
Zirconium	40	K-series	4086	5.852714	4.114484	0.811037	0.20697
Lanthanum	57	L-series	8089	0.656137	0.461267	0.059713	0.045221
Oxygen	8	K-series	50367	78.69248	55.32117	62.17592	66.48873
			Sum:	142.2466	100	100	

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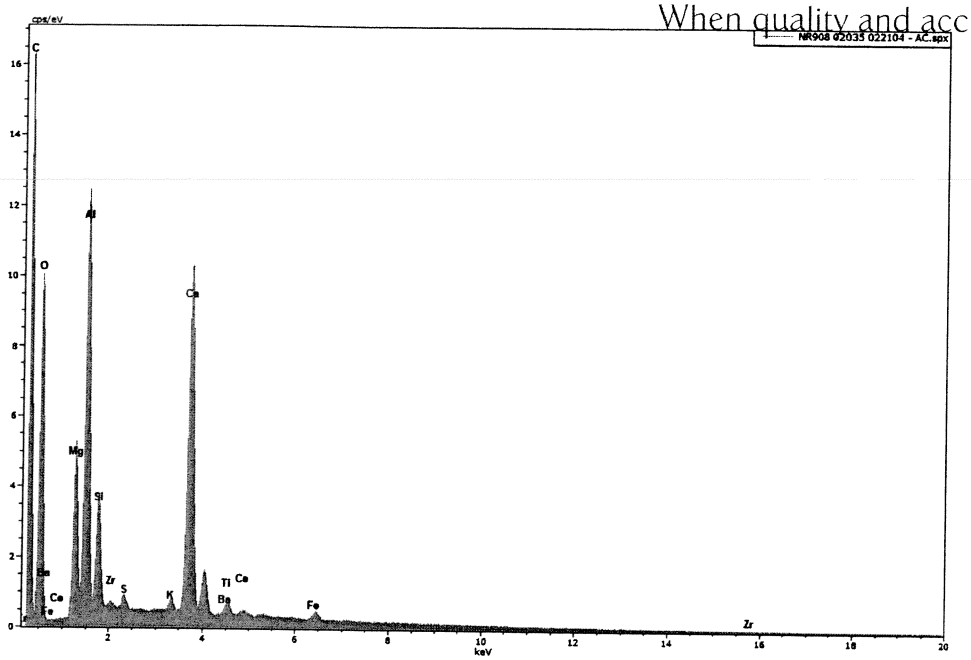

Results NR908 02035 022104 - AC.spx
Date: 3/11/2008

Element	AN	series	Net	[wt.-%]	[norm. wt.-%]	[norm. at.-%]	Error in %
Carbon	6	K-series	107893	8.383366	8.710533	13.78876	1.832385
Magnesium	12	K-series	52377	7.427364	7.717223	6.037054	0.456384
Aluminium	13	K-series	136025	13.374	13.89593	9.792205	0.696534
Silicon	14	K-series	40834	3.30866	3.437783	2.327319	0.174491
Sulfur	16	K-series	6531	0.477163	0.495785	0.293974	0.073303
Potassium	19	K-series	5830	0.348917	0.362534	0.176299	0.038358
Calcium	20	K-series	159629	10.82413	11.24655	5.335475	0.343868
Titanium	22	K-series	6060	0.426164	0.442796	0.175836	0.053248
Iron	26	K-series	5138	0.480127	0.498864	0.169841	0.041076
Zirconium	40	K-series	893	0.810327	0.84195	0.175484	0.061215
Barium	56	L-series	852	0.085395	0.088728	0.012284	0.06136
Cerium	58	L-series	3589	0.357423	0.371372	0.050393	0.157415
Oxygen	8	K-series	97967	49.94097	51.88995	61.66507	22.49946
			Sum:	96.24401	100	100	

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