Appendix A

PM_{10} Data Summary

Hygiene

SampDate	Conc Amb (STP)
12/01/98	29
12/04/98	30
12/08/98	20
12/11/98	18
12/15/98	19
12/18/98	13
12/22/98	19
12/25/98	16
12/29/98	12
01/01/99	15
01/04/99	16
01/06/99	20
01/09/99	17
01/12/99	17
01/15/99	7
01/18/99	12
01/21/99	7
01/24/99	26
01/27/99	9
02/05/99	20
02/08/99	25
02/11/99	10
02/14/99	18
02/17/99	22
02/20/99	18
02/23/99	13
02/26/99	21
03/01/99	14
03/04/99	5
03/07/99	31
03/10/99	11
03/13/99	13
03/19/99	20
03/22/99	23
03/25/99	33
03/28/99	39
03/31/99	32
04/03/99	14
04/06/99	18
04/09/99	20
04/12/99	27
04/15/99	8
04/21/99	14
04/27/99	13
04/30/99	2
05/03/99	8

SampDate	Conc Amb (STP)
05/06/99	15
05/18/99	18
05/21/99	15
05/29/99	21
06/01/99	21
06/08/99	17
06/11/99	11
06/14/99	16
06/17/99	13
06/22/99	26
06/27/99	49
07/11/99	40
07/20/99	27
07/26/99	26
08/03/99	19
08/09/99	43
08/17/99	19
08/20/99	23
08/23/99	22
08/26/99	30
09/06/99	21
09/12/99	15
09/18/99	15
09/21/99	9
09/24/99	15
10/06/99	25
10/09/99	18
10/12/99	27
10/18/99	5
10/24/99	21
11/05/99	42
11/11/99	42
11/17/99	54
11/20/99	8

Appendix B

Analytical Reports

LYONS PM-10
EMISSION INVENTORY

The 1997 annual particulate matter (PM-10) emissions inventory was developed using geographic information system (GIS) techniques. The inventory includes all known sources of PM-10 in the study area. The inventory was broken out by source classification code (SCC), for area, mobile and point sources.

AREA SOURCE METHODOLOGY

Area sources are non-mobile sources, which are not included in the point source inventory. They include such sources as residential and commercial fuel combustion, aircraft, railroads, structural fires and prescribed burning. Area sources were based on the EPA 1996 National Emissions Trends (NET) Inventory, which is a by county inventory, with corrections to minimize double counting with the point source inventory. The allocation from the State level to the county and census tract level was changed for sources such as railroads, which were apportioned based on population in the NET inventory. Railroad emissions were allocated based on miles of track from the Colorado Department of Transportation's GIS data.

Wood burning emissions were calculated using wood burning by household survey information from the Denver-Boulder and Fort Collins State Implementation plans. These data were then used with the number of households in the Lyons census tract (adjusted to 1997) and EPA PM-10 emission factors to calculate emissions.

MOBILE SOURCE METHODOLOGY

Mobile sources can be broken into two major subcategories: highway vehicles emissions (or on-road), and non-road.

Highway vehicle emissions were calculated based on vehicle miles traveled (VMT) and the EPA Mobile emission factor model. The VMT has been obtained from the Federal Highway Administration's Highway Performance Management System (HPMS) and is based on the Colorado Department of Transportation (CDOT) traffic counts. The latest year available for VMT data is 1997. CDOT breaks the traffic data by county into rural and four urban classes based on urban population. This breakout has been used to allocate the HPMS VMT data to the census tract level. PM-10 emissions from highway vehicles were based on AP-42 emission factors from paved and unpaved roads. These emissions are based on the VMT and the silt loading on the roadway. For paved roads, the silt loading represents an area of uncertainty, and emissions can vary by more than a factor of ten, depending on this value. A range of values was provided for the paved road category. For unpaved roads, the VMT on the roadway is the most uncertain sensitive value, since there are little available traffic count data for unpaved roads. A conservative assumption that the percent of roadway length times 1% of the total VMT for arterial and lower functional classes was used to determine the unpaved VMT. There are four counties with traffic counts for unpaved roads in the CDOT database. These data indicate that unpaved roads have 2.9% of the roadway length, and 0.0017% of the VMT. These data would indicate that 0.06% of the total VMT times the percent of unpaved roadway length equals the unpaved roadway VMT, indicating that the assumed 1% is conservative.

Emissions from non-road mobile sources (such as lawn mowers and forklifts) were calculated using the EPA Non-road Emission Factor Model. The default allocation tables used to apportion emissions to the county level were modified for some source categories based on better surrogates. For example, allocation of light commercial emissions in the Non-road Model is

based on the number of wholesale establishments, and allocation of industrial emissions is based on the number of employees in manufacturing. The allocation of commercial and industrial non-road was based on total point source emissions by county for the applicable SIC code classes for these categories. Table 1 below is a summary of the non-road allocation factors. The surrogate allocation data were used to apportion non-road sources by census tract.

POINT SOURCE METHODOLOGY

Point source emissions have been obtained from the Colorado Air Pollution Control Division's stationary source permit system data, as reflected in the EPA point source emission data base, AIRS, and were summarized by the plant total actual emissions.

The 1997 Lyons area PM-10 Inventory is summarized in Figure 1 and Table 2, below. Figure 2 is a map of the study area.

Figure 1

Lyons Area 1997 PM-10 Emissions

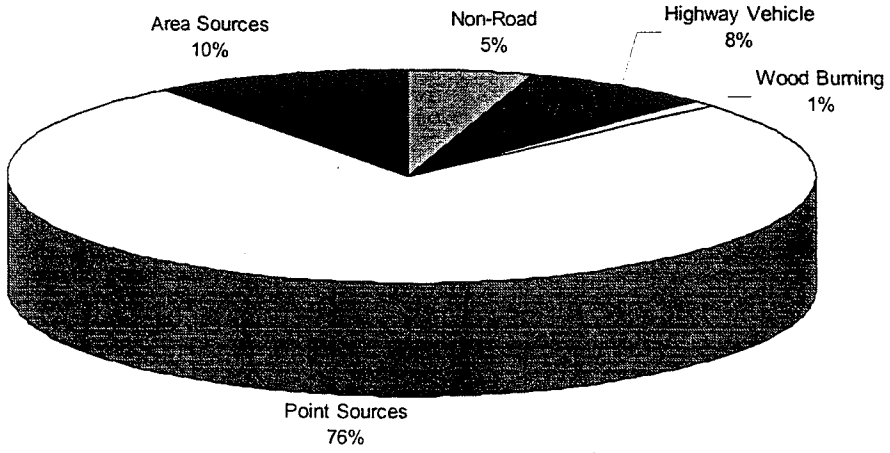

Figure 2

Lyons Emissions Inventory Area (Census Tract 13601)

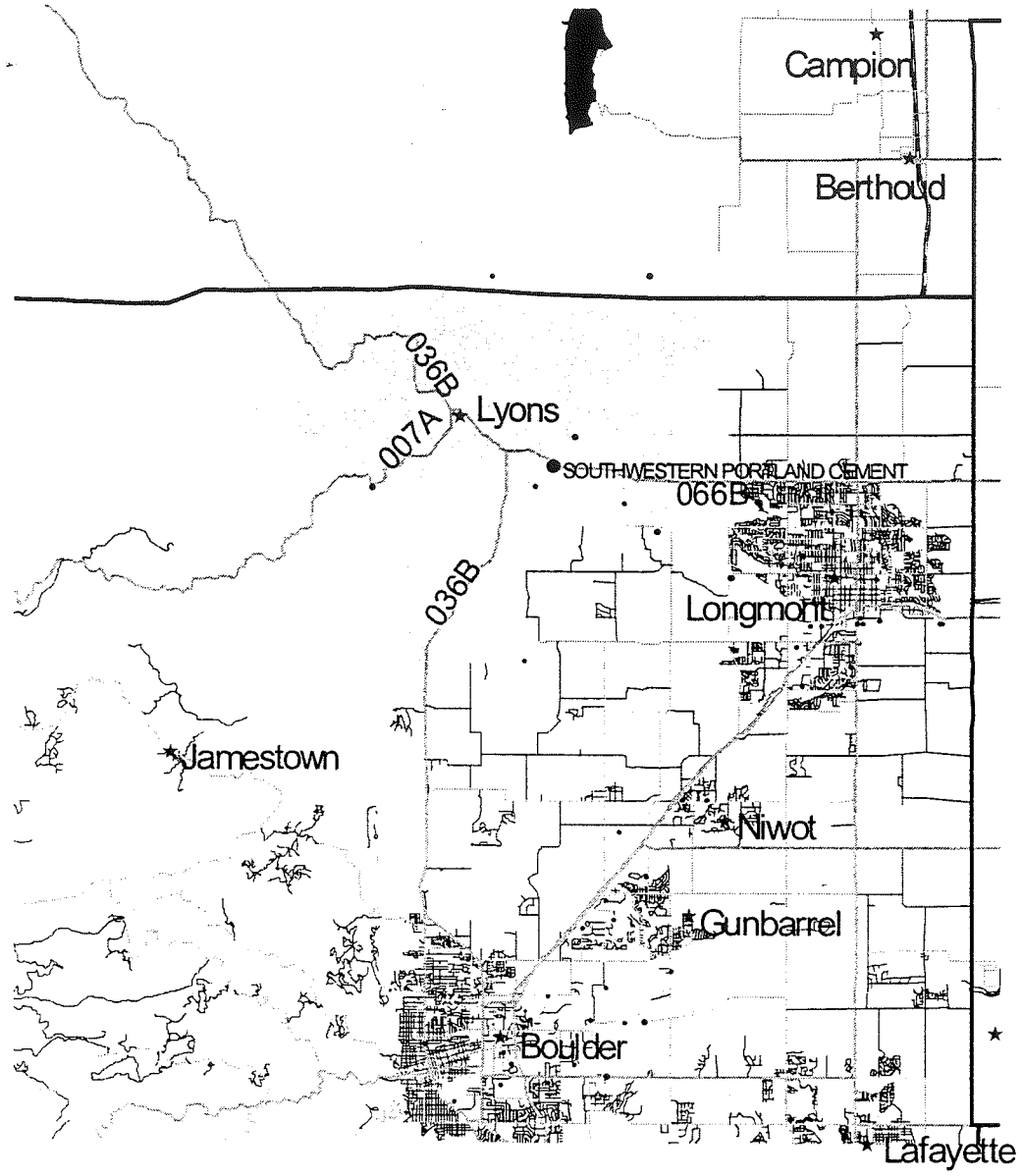

Table 1. NONROAD surrogate allocation factors

Category/Type	Nonroad Model Allocation	New Allocation Factor
Lawn and Garden Residential	Number of single and double (duplex) family housing units from 1990 Adjusted by 1997 Census by county.	Same
Lawn and Garden Commercial	Number of employees in landscape and horticultural services, County Bus. Patterns (CBP), Standard Industrial Code (SIC)78.	Apportioned to census tracts by number of single and double (duplex) family housing units from 1990 Adjusted by 1997 Census by county.
Residential Snowblowers	Same as residential lawn and garden, adjusted by annual average snowfall.	Same
Commercial Snowblowers	Same as commercial lawn and garden, adjusted by annual average snowfall.	Same
Construction	Total dollar value of construction by county.	Not apportioned to tract.
Agricultural	Harvested cropland (U.S. Census Bureau, USA Counties database).	Apportioned to census tracts by area of private land in tracts with less than 200 people per square mile.
Recreational (except snowmobiles and golf carts)	Number of camps and recreational vehicle park establishments (CBP SIC 7030).	Public land area available for recreational vehicle use.
Snowmobiles	State level populations from registration data compiled by the International Snowmobile Manufacturers Association, then allocated to counties using same factors as other recreational equipment.	Same
Golf Carts	Number of public golf course employees (CBP SIC 7992).	Same
Aircraft Ground Support Equipment	Number of landings and takeoffs (LTOs) of commercial aircraft	Same
Light Commercial	Number of wholesale establishments (CBP SIC 50).	Total emissions by SIC
Industrial	Number of employees in manufacturing (CBP SIC 20)	Total emissions by SIC
Logging	Number of employees in logging plus saw and planing mills (CBP SIC 2410 and 2420).	Total emissions by SIC
Oil Field Equipment	Number of employees engaged in oil and gas extraction (CBP SIC 1300).	Total emissions by SIC
Railroad Maintenance Equipment	1990 Human Population	Miles of rail
Underground Mining Equipment	Number of employees Coal Mining (CBP SIC 1200).	Total emissions by SIC

Table 2: Lyons Area 1997 PM-10 Inventory (tons per year)				
Non-Road		Sub-Totals		TOTALS
	Agricultural Equipment	1.06		
	Recreational	0.01		
	Airport Equipment	0.00		
	Commercial Equipment	0.18		
	Construction and Mining Equipment	4.07		
	Industrial Equipment	35.02		
	Lawn and Garden Equipment (Com)	0.62		
	Lawn and Garden Equipment (Res)	0.05		
	Logging Equipment	0.00		
	Other Oil Field Equipment	0.00		
	Railroad Equipment	0.01		
			Non-Road Total	41.0 ✓
Highway Vehicle				
	Paved Roads (Depends on silt loading)	25 to 79	Paved Roads Average	52.1 ✓
	Unpaved Roads	11.7	Unpaved Roads	11.7
			Highway Total	63.8 ✓
Wood Burning			Wood Burning Total	6.1
Point Sources (Year)				
1996	SOUTHDOWN INC LYONS CEMENT PLANT			
	stack emissions	161.8		
	fugitive dust emissions	390.2		
	Total	552.0	CEMENT	552
1996	SOUTHWESTERN PORTLAND CEMENT CO	32.0	CRUSHED AND BROKEN STONE	
1997	WESTERN MOBILE BOULDER INC LYONS PIT	30.0		
1996	GOLDENS GRAVEL CO OLIGARCHY HYGIENE PIT	8.0		70
			Point Total	622.0 ✓
Area Sources				
	agricultural livestock	7.4		
	agricultural crops	22.9		
	Commercial/Institutional Coal	0.0		
	Commercial/Institutional Gas	0.1		
	Commercial/Institutional Oil	0.0		
	construction	49.5		
	wind erosion	0.5		
	Other Combustion	0.1		
	residential coal	0.0		
	residential oil	0.0		
	residential gas	0.2		
	railroads	3.6		84.3

TOTAL 817.2

Area Total				84.1
Total Emissions				817.0

Chester LabNet - Portland

XRF-K XRF Analytical Quality Assurance Report

Client: State of Colorado - Report: 99-095
Analysis Period: June 7 through June 10, 1999

1. Precision Data

Micromatter Multi-elemental Quality Control Standard: QS285

QC Standard Results

Analyte	n	Counts per Second			c.v.	%E
		Calib.	Meas.	S.D.		
Si(0)	0	182.73	na	na	na	na
Si(1)	0	7.85	na	na	na	na
Ti(2)	5	134.29	137.69	2.84	2.06	2.53
Fe(3)	5	183.38	183.81	2.34	1.27	0.23
Se(4)	5	46.00	46.22	0.84	1.82	0.48
Pb(4)	5	33.20	32.74	0.50	1.53	-1.39
Cd(5)	5	44.34	45.96	0.93	2.02	3.65

2. Accuracy Data

NIST Standard Reference Materials: SRM 1832, SRM 1833

Analyte/ SRM	n	Certified Value(µg/cm²)	Measured Value (µg/cm²)					% Rec.
			High	Low	Average			
Al 1832	4	14.6 +/- .97	14.41	13.83	14.06	+/-	0.23	96.3
Si 1832	4	34.0 +/- 1.1	34.47	32.10	33.41	+/-	1.06	98.3
Si 1833	4	33.0 +/- 2.1	33.16	30.37	31.83	+/-	1.19	96.5
S 2708	4	2.46 +/- .25	2.62	2.43	2.49	+/-	0.08	100.8
K 1833	4	17.3 +/- 1.64	17.12	15.86	16.73	+/-	0.50	96.7
Ca 1832	4	19.4 +/- 1.30	21.45	20.06	20.71	+/-	0.53	106.7
Ti 1833	4	12.8 +/- 1.79	13.09	12.36	12.84	+/-	0.28	100.3
V 1832	4	4.70 +/- .49	4.85	4.56	4.71	+/-	0.13	100.2
Mn 1832	4	4.54 +/- .49	4.50	4.27	4.41	+/-	0.10	97.0
Fe 1833	4	14.2 +/- .45	15.25	14.65	14.97	+/-	0.25	105.5
Cu 1832	4	2.43 +/- .16	2.46	2.36	2.41	+/-	0.05	99.2
Zn 1833	4	4.01 +/- .23	4.29	4.11	4.20	+/-	0.07	104.7
Pb 1833	4	16.7 +/- .85	17.47	17.01	17.33	+/-	0.19	103.8

NIST: National Institute of Standards and Technology
% Rec: Percent Recovery = (Experimental/Given) x 100
n: Number of Observations
S.D.: Standard Deviation
c.v.: Coefficient of Variation = (S.D./Measured) x 100
% E: Percent Error = [(Measured-Calibrated)/Calibrated] x 100

REPLICATE REPORT

Original ID: 99-Q801
Replicate ID: RQ801

Filter Lot:
Deposit Mass: 296 µg
Deposit Area: 1.0 cm^2
Particle Size: P

Element	Original ug/cm2	Replicate ug/cm2	Difference ug/cm2		RPD
Al	8.2976 +- 1.9307	6.5793 +- 1.8363	1.7182 +- 2.6645	+	23.1 +- 35.8
P	0.0000 +- 0.4299	0.0000 +- 0.4212	0.0000 +- 0.6018		
S	8.9683 +- 1.4742	8.6420 +- 1.4314	0.3263 +- 2.0548	+	3.7 +- 23.3
Cl	0.2771 +- 0.0662	0.3975 +- 0.0950	-0.1204 +- 0.1158	0	-35.7 +- 34.3
K	7.1151 +- 0.9556	7.0450 +- 0.9492	0.0701 +- 1.3470	+	1.0 +- 19.0
Ca	17.4117 +- 2.2634	17.4097 +- 2.2663	0.0020 +- 3.2030	+	0.0 +- 18.4
Ti	1.1438 +- 0.1456	1.1184 +- 0.1444	0.0254 +- 0.2050	+	2.2 +- 18.1
V	0.0511 +- 0.0120	0.0400 +- 0.0144	0.0111 +- 0.0187	+	24.3 +- 41.1
Cr	0.0163 +- 0.0060	0.0224 +- 0.0086	-0.0061 +- 0.0105		
Mn	0.3417 +- 0.0444	0.3937 +- 0.0527	-0.0520 +- 0.0689	+	-14.1 +- 18.7
Fe	9.5816 +- 1.1573	9.6532 +- 1.1681	-0.0716 +- 1.6444	+	-0.7 +- 17.1
Co	0.0000 +- 0.0135	0.0108 +- 0.0189	-0.0108 +- 0.0232		
Ni	0.0101 +- 0.0056	0.0266 +- 0.0076	-0.0165 +- 0.0094		
Cu	0.0835 +- 0.0074	0.0741 +- 0.0094	0.0094 +- 0.0120	+	11.9 +- 15.2
Zn	0.1117 +- 0.0092	0.1059 +- 0.0116	0.0058 +- 0.0148	+	5.3 +- 13.6
Ga	0.0291 +- 0.0128	0.0198 +- 0.0203	0.0093 +- 0.0240		
Ge	0.0062 +- 0.0115	0.0068 +- 0.0152	-0.0005 +- 0.0191		
As	0.0131 +- 0.0170	0.0538 +- 0.0235	-0.0407 +- 0.0291		
Se	0.0000 +- 0.0086	0.0036 +- 0.0126	-0.0036 +- 0.0153		
Br	0.0221 +- 0.0092	0.0109 +- 0.0130	0.0113 +- 0.0159		
Rb	0.0603 +- 0.0099	0.0380 +- 0.0136	0.0223 +- 0.0169	0	45.3 +- 34.3
Sr	0.1674 +- 0.0145	0.1236 +- 0.0173	0.0438 +- 0.0226	0	30.1 +- 15.5
Y	0.0027 +- 0.0132	0.0192 +- 0.0185	-0.0165 +- 0.0227		
Zr	0.1337 +- 0.0182	0.1386 +- 0.0253	-0.0049 +- 0.0312	+	-3.6 +- 22.9
Mo	0.1423 +- 0.0237	0.1583 +- 0.0328	-0.0160 +- 0.0405	+	-10.6 +- 27.0
Pd	0.0204 +- 0.0213	0.0013 +- 0.0310	0.0191 +- 0.0376		
Ag	0.0000 +- 0.0204	0.0150 +- 0.0311	-0.0150 +- 0.0372		
Cd	0.0000 +- 0.0239	0.0329 +- 0.0318	-0.0329 +- 0.0397		
In	0.0000 +- 0.0259	0.0000 +- 0.0342	0.0000 +- 0.0428		
Sn	0.0198 +- 0.0297	0.0961 +- 0.0449	-0.0764 +- 0.0539		
Sb	0.0129 +- 0.0351	0.0122 +- 0.0516	0.0008 +- 0.0624		
Ba	1.5685 +- 0.1599	1.7268 +- 0.2265	-0.1583 +- 0.2772	+	-9.6 +- 16.8
La	0.0000 +- 0.1836	0.0000 +- 0.2621	0.0000 +- 0.3201		
Hg	0.0000 +- 0.0212	0.0000 +- 0.0266	0.0000 ± 0.0340		
Pb	0.0259 +- 0.0254	0.0000 +- 0.0358	0.0259 ± 0.0439		

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

REPLICATE REPORT

Original ID: 99-Q808
Replicate ID: RQ808

Filter Lot:
Deposit Mass: 314 µg
Deposit Area: 1.0 cm^2
Particle Size: P

Element	Original ug/cm2	Replicate ug/cm2	Difference ug/cm2		RPD
Al	13.5106 +- 2.6209	15.0295 +- 2.8137	-1.5189 +- 3.8453	+	-10.6 +- 26.9
P	0.0000 +- 0.3787	0.0000 +- 0.4555	0.0000 +- 0.5924		
S	0.6168 +- 0.1274	0.6725 +- 0.1532	-0.0557 +- 0.1992	+	-8.6 +- 30.9
Cl	0.0000 +- 0.0415	0.0000 +- 0.0573	0.0000 +- 0.0708		
K	7.8502 +- 1.0635	7.8315 +- 1.0598	0.0187 +- 1.5014	+	0.2 +- 19.1
Ca	12.0757 +- 1.5820	11.6435 +- 1.5230	0.4323 +- 2.1960	+	3.6 +- 18.5
Ti	1.0439 +- 0.1335	1.0864 +- 0.1405	-0.0425 +- 0.1938	+	-4.0 +- 18.2
V	0.0260 +- 0.0106	0.0240 +- 0.0148	0.0020 +- 0.0182		
Cr	0.0158 +- 0.0060	0.0000 +- 0.0083	0.0158 +- 0.0102		
Mn	0.2444 +- 0.0332	0.2875 +- 0.0401	-0.0431 +- 0.0521	+	-16.2 +- 19.6
Fe	10.7812 +- 1.3042	11.0475 +- 1.3360	-0.2664 +- 1.8670	+	-2.4 +- 17.1
Co	0.0000 +- 0.0143	0.0000 +- 0.0202	0.0000 +- 0.0247		
Ni	0.0060 +- 0.0058	0.0029 +- 0.0081	0.0030 +- 0.0100		
Cu	0.9800 +- 0.0511	0.9747 +- 0.0528	0.0053 +- 0.0735	+	0.5 +- 7.5
Zn	0.0408 +- 0.0084	0.0380 +- 0.0118	0.0029 +- 0.0144	+	7.3 +- 36.7
Ga	0.0000 +- 0.0136	0.0000 +- 0.0200	0.0000 +- 0.0242		
Ge	0.0000 +- 0.0116	0.0195 +- 0.0175	-0.0195 +- 0.0210		
As	0.0126 +- 0.0161	0.0126 +- 0.0230	0.0000 +- 0.0281		
Se	0.0135 +- 0.0088	0.0000 +- 0.0123	0.0135 +- 0.0151		
Br	0.0187 +- 0.0085	0.0000 +- 0.0120	0.0187 +- 0.0148		
Rb	0.0286 +- 0.0097	0.0277 +- 0.0141	0.0009 +- 0.0171		
Sr	0.1408 +- 0.0140	0.1153 +- 0.0175	0.0255 +- 0.0224	0	19.9 +- 17.5
Y	0.0017 +- 0.0132	0.0193 +- 0.0186	-0.0176 +- 0.0229		
Zr	0.1465 +- 0.0184	0.1291 +- 0.0246	0.0174 +- 0.0307	+	12.6 +- 22.3
Mo	0.1133 +- 0.0239	0.1535 +- 0.0336	-0.0403 +- 0.0413	+	-30.2 +- 30.9
Pd	0.0000 +- 0.0222	0.0000 +- 0.0309	0.0000 +- 0.0381		
Ag	0.0170 +- 0.0229	0.0000 +- 0.0304	0.0170 +- 0.0380		
Cd	0.0000 +- 0.0240	0.0000 +- 0.0329	0.0000 +- 0.0407		
In	0.0000 +- 0.0253	0.0000 +- 0.0380	0.0000 +- 0.0457		
Sn	0.0000 +- 0.0313	0.0000 +- 0.0423	0.0000 +- 0.0527		
Sb	0.0000 +- 0.0369	0.0435 +- 0.0515	-0.0435 +- 0.0634		
Ba	1.5962 +- 0.1712	1.5817 +- 0.2260	0.0145 +- 0.2835	+	0.9 +- 17.8
La	0.1209 +- 0.1886	0.0000 +- 0.2607	0.1209 +- 0.3218		
Hg	0.0000 +- 0.0208	0.0381 +- 0.0313	-0.0381 ± 0.0376		
Pb	0.0000 +- 0.0245	0.0000 +- 0.0356	0.0000 ± 0.0432		

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

REPLICATE REPORT

Original ID: 99-Q824
Replicate ID: RQ824

Filter Lot:
Deposit Mass: 295 µg
Deposit Area: 1.0 cm^2
Particle Size: P

Element	Original ug/cm2	Replicate ug/cm2	Difference ug/cm2	RPD
Al	15.2650 +- 2.7200	13.5907 +- 2.5650	1.6743 +- 3.7386	+ 11.6 +- 25.9
P	0.0000 +- 0.2732	0.0000 +- 0.3295	0.0000 +- 0.4281	
S	1.0994 +- 0.2199	1.1340 +- 0.2520	-0.0346 +- 0.3345	+ -3.1 +- 30.0
Cl	2.9056 +- 0.4593	2.8270 +- 0.4760	0.0786 +- 0.6615	+ 2.7 +- 23.1
K	10.3482 +- 1.3828	10.6989 +- 1.4332	-0.3508 +- 1.9916	+ -3.3 +- 18.9
Ca	9.5053 +- 1.2331	9.5876 +- 1.2466	-0.0823 +- 1.7534	+ -0.9 +- 18.4
Ti	1.6000 +- 0.2017	1.4955 +- 0.1905	0.1045 +- 0.2775	+ 6.7 +- 17.9
V	0.0651 +- 0.0138	0.0787 +- 0.0190	-0.0137 +- 0.0234	+ -19.1 +- 32.6
Cr	0.0000 +- 0.0068	0.0048 +- 0.0089	-0.0048 +- 0.0112	
Mn	0.3968 +- 0.0511	0.3915 +- 0.0534	0.0052 +- 0.0739	+ 1.3 +- 18.7
Fe	16.0272 +- 1.9289	16.0816 +- 1.9380	-0.0544 +- 2.7343	+ -0.3 +- 17.0
Co	0.0198 +- 0.0173	0.0000 +- 0.0237	0.0198 +- 0.0294	
Ni	0.0105 +- 0.0063	0.0048 +- 0.0082	0.0057 +- 0.0103	
Cu	0.1070 +- 0.0086	0.1293 +- 0.0112	-0.0223 +- 0.0141	0 -18.9 +- 12.0
Zn	0.1492 +- 0.0108	0.1467 +- 0.0130	0.0025 +- 0.0169	+ 1.7 +- 11.4
Ga	0.0000 +- 0.0145	0.0000 +- 0.0192	0.0000 +- 0.0241	
Ge	0.0062 +- 0.0124	0.0119 +- 0.0163	-0.0057 +- 0.0204	
As	0.0162 +- 0.0169	0.0304 +- 0.0234	-0.0142 +- 0.0289	
Se	0.0071 +- 0.0091	0.0144 +- 0.0129	-0.0073 +- 0.0158	
Br	0.0130 +- 0.0086	0.0014 +- 0.0125	0.0116 +- 0.0152	
Rb	0.0679 +- 0.0109	0.0684 +- 0.0148	-0.0005 +- 0.0183	+ -0.7 +- 26.9
Sr	0.0689 +- 0.0125	0.0717 +- 0.0169	-0.0028 +- 0.0210	+ -4.0 +- 29.9
Y	0.0529 +- 0.0139	0.0518 +- 0.0194	0.0011 +- 0.0239	+ 2.1 +- 45.6
Zr	0.2243 +- 0.0202	0.2125 +- 0.0261	0.0118 +- 0.0330	+ 5.4 +- 15.1
Mo	0.1107 +- 0.0238	0.1378 +- 0.0333	-0.0271 +- 0.0409	+ -21.8 +- 33.0
Pd	0.0188 +- 0.0215	0.0000 +- 0.0293	0.0188 +- 0.0363	
Ag	0.0069 +- 0.0225	0.0116 +- 0.0304	-0.0047 +- 0.0378	
Cd	0.0126 +- 0.0237	0.0290 +- 0.0316	-0.0164 +- 0.0395	
In	0.0429 +- 0.0257	0.0000 +- 0.0361	0.0429 +- 0.0443	
Sn	0.0000 +- 0.0296	0.0000 +- 0.0406	0.0000 +- 0.0503	
Sb	0.0000 +- 0.0363	0.0000 +- 0.0509	0.0000 +- 0.0625	
Ba	1.4483 +- 0.1670	1.6303 +- 0.2288	-0.1821 +- 0.2832	+ -11.8 +- 18.4
La	0.0812 +- 0.1861	0.0000 +- 0.2698	0.0812 +- 0.3278	
Hg	0.0000 +- 0.0215	0.0344 +- 0.0302	-0.0344 ± 0.0370	
Pb	0.0297 +- 0.0251	0.0015 +- 0.0358	0.0281 ± 0.0437	

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

REPLICATE REPORT

Original ID: 99-Q832
Replicate ID: RQ832

Filter Lot:
Deposit Mass: 296 µg
Deposit Area: 1.0 cm^2
Particle Size: P

Element	Original ug/cm2	Replicate ug/cm2	Difference ug/cm2	RPD
Al	18.1060 +- 3.0877	19.1363 +- 3.2435	-1.0303 +- 4.4782	+ -5.5 +- 24.0
P	0.0000 +- 0.4100	0.0000 +- 0.4708	0.0000 +- 0.6243	
S	0.6160 +- 0.1281	0.6842 +- 0.1565	-0.0682 +- 0.2023	+ -10.5 +- 31.1
Cl	0.2540 +- 0.0547	0.2978 +- 0.0813	-0.0438 +- 0.0980	+ -15.9 +- 35.5
K	9.0227 +- 1.2072	9.0725 +- 1.2144	-0.0498 +- 1.7123	+ -0.6 +- 18.9
Ca	11.5461 +- 1.4982	11.4413 +- 1.4848	0.1048 +- 2.1093	+ 0.9 +- 18.4
Ti	1.2237 +- 0.1551	1.1817 +- 0.1518	0.0420 +- 0.2170	+ 3.5 +- 18.0
V	0.0461 +- 0.0122	0.0300 +- 0.0154	0.0161 +- 0.0197	+ 42.3 +- 51.7
Cr	0.0000 +- 0.0062	0.0000 +- 0.0086	0.0000 +- 0.0106	
Mn	0.3695 +- 0.0476	0.3024 +- 0.0404	0.0671 +- 0.0624	0 20.0 +- 18.6
Fe	13.5142 +- 1.6277	13.4919 +- 1.6261	0.0223 +- 2.3008	+ 0.2 +- 17.0
Co	0.0251 +- 0.0158	0.0164 +- 0.0226	0.0087 +- 0.0276	
Ni	0.0406 +- 0.0063	0.0397 +- 0.0095	0.0008 +- 0.0114	+ 2.1 +- 28.5
Cu	0.1354 +- 0.0098	0.1344 +- 0.0123	0.0011 +- 0.0157	+ 0.8 +- 11.7
Zn	0.3017 +- 0.0178	0.3009 +- 0.0201	0.0008 +- 0.0268	+ 0.3 +- 8.9
Ga	0.0112 +- 0.0135	0.0000 +- 0.0187	0.0112 +- 0.0231	
Ge	0.0000 +- 0.0116	0.0208 +- 0.0158	-0.0208 +- 0.0196	
As	0.0000 +- 0.0164	0.0136 +- 0.0226	-0.0136 +- 0.0280	
Se	0.0000 +- 0.0085	0.0170 +- 0.0128	-0.0170 +- 0.0153	
Br	0.0023 +- 0.0086	0.0112 +- 0.0123	-0.0089 +- 0.0150	
Rb	0.0440 +- 0.0100	0.0260 +- 0.0133	0.0180 +- 0.0167	0 51.5 +- 47.7
Sr	0.1230 +- 0.0133	0.1120 +- 0.0174	0.0110 +- 0.0218	+ 9.4 +- 18.6
Y	0.0279 +- 0.0132	0.0257 +- 0.0183	0.0022 +- 0.0226	
Zr	0.1661 +- 0.0190	0.1412 +- 0.0257	0.0249 +- 0.0319	+ 16.2 +- 20.8
Mo	0.1375 +- 0.0239	0.0799 +- 0.0322	0.0576 +- 0.0401	0 53.0 +- 36.9
Pd	0.0000 +- 0.0207	0.0000 +- 0.0298	0.0000 +- 0.0363	
Ag	0.0000 +- 0.0221	0.0113 +- 0.0306	-0.0113 +- 0.0377	
Cd	0.0000 +- 0.0240	0.0174 +- 0.0331	-0.0174 +- 0.0409	
In	0.0107 +- 0.0243	0.0273 +- 0.0370	-0.0165 +- 0.0443	
Sn	0.0456 +- 0.0301	0.0480 +- 0.0432	-0.0024 +- 0.0527	
Sb	0.0000 +- 0.0366	0.0306 +- 0.0500	-0.0306 +- 0.0619	
Ba	1.8281 +- 0.1801	1.9227 +- 0.2465	-0.0946 +- 0.3053	+ -5.0 +- 16.3
La	0.0000 +- 0.1886	0.0319 +- 0.2649	-0.0319 +- 0.3252	
Hg	0.0000 +- 0.0216	0.0354 +- 0.0286	-0.0354 ± 0.0358	
Pb	0.0358 +- 0.0243	0.0505 +- 0.0346	-0.0147 ± 0.0423	

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

REPLICATE REPORT

Original ID: 99-Q842
Replicate ID: RQ842

Filter Lot:
Deposit Mass: 320 µg
Deposit Area: 1.0 cm^2
Particle Size: P

Element	Original ug/cm2	Replicate ug/cm2	Difference ug/cm2	RPD
Al	8.9681 +- 2.1996	7.4238 +- 2.1529	1.5443 +- 3.0778	+ 18.8 +- 37.6
P	0.0000 +- 0.4731	0.0000 +- 0.4408	0.0000 +- 0.6466	
S	0.5587 +- 0.1182	0.4321 +- 0.1259	0.1266 +- 0.1727	+ 25.6 +- 34.9
Cl	1.7461 +- 0.2738	1.5908 +- 0.2588	0.1554 +- 0.3768	+ 9.3 +- 22.6
K	4.1829 +- 0.5716	4.2602 +- 0.5869	-0.0773 +- 0.8193	+ -1.8 +- 19.4
Ca	6.2523 +- 0.8234	6.4113 +- 0.8488	-0.1590 +- 1.1826	+ -2.5 +- 18.7
Ti	0.5474 +- 0.0720	0.5173 +- 0.0716	0.0301 +- 0.1015	+ 5.7 +- 19.1
V	0.0000 +- 0.0093	0.0000 +- 0.0135	0.0000 +- 0.0164	
Cr	0.0177 +- 0.0061	0.0012 +- 0.0082	0.0165 +- 0.0102	
Mn	0.1094 +- 0.0175	0.0929 +- 0.0199	0.0165 +- 0.0265	+ 16.4 +- 26.2
Fe	5.9033 +- 0.7144	5.9930 +- 0.7281	-0.0897 +- 1.0201	+ -1.5 +- 17.1
Co	0.0000 +- 0.0114	0.0078 +- 0.0166	-0.0078 +- 0.0202	
Ni	0.0000 +- 0.0054	0.0000 +- 0.0073	0.0000 +- 0.0091	
Cu	0.0683 +- 0.0069	0.0653 +- 0.0087	0.0030 +- 0.0111	+ 4.5 +- 16.6
Zn	0.1264 +- 0.0096	0.1252 +- 0.0120	0.0012 +- 0.0154	+ 1.0 +- 12.2
Ga	0.0067 +- 0.0130	0.0349 +- 0.0181	-0.0282 +- 0.0223	
Ge	0.0086 +- 0.0111	0.0028 +- 0.0165	0.0058 +- 0.0199	
As	0.0000 +- 0.0165	0.0000 +- 0.0222	0.0000 +- 0.0277	
Se	0.0003 +- 0.0091	0.0107 +- 0.0132	-0.0104 +- 0.0160	
Br	0.0000 +- 0.0084	0.0000 +- 0.0117	0.0000 +- 0.0144	
Rb	0.0270 +- 0.0096	0.0366 +- 0.0130	-0.0095 +- 0.0162	
Sr	0.0453 +- 0.0114	0.0471 +- 0.0158	-0.0018 +- 0.0195	+ -4.0 +- 42.2
Y	0.0033 +- 0.0131	0.0393 +- 0.0177	-0.0360 +- 0.0220	
Zr	0.1223 +- 0.0177	0.1308 +- 0.0248	-0.0085 +- 0.0305	+ -6.7 +- 24.1
Mo	0.1262 +- 0.0238	0.1124 +- 0.0333	0.0138 +- 0.0409	+ 11.6 +- 34.3
Pd	0.0205 +- 0.0218	0.0000 +- 0.0306	0.0205 +- 0.0375	
Ag	0.0241 +- 0.0215	0.0000 +- 0.0314	0.0241 +- 0.0381	
Cd	0.0000 +- 0.0221	0.0348 +- 0.0343	-0.0348 +- 0.0408	
In	0.0363 +- 0.0263	0.0470 +- 0.0356	-0.0108 +- 0.0443	
Sn	0.0475 +- 0.0307	0.1436 +- 0.0419	-0.0961 +- 0.0520	
Sb	0.0000 +- 0.0373	0.0807 +- 0.0495	-0.0807 +- 0.0620	
Ba	1.5722 +- 0.1712	1.6839 +- 0.2329	-0.1117 +- 0.2890	+ -6.9 +- 17.8
La	0.0143 +- 0.1892	0.0000 +- 0.2641	0.0143 +- 0.3249	
Hg	0.0120 +- 0.0204	0.0000 +- 0.0295	0.0120 ± 0.0359	
Pb	0.0297 +- 0.0257	0.0000 +- 0.0330	0.0297 ± 0.0418	

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

QA/QC Report

Client Name: State of Colorado
Project Number: C007
Analytical Technique: Ion Chromatography
Sample Description: 8x10 Quartz
Report Number: 99-095

Calibration QC/LCS Recovery

Analyte	Sample ID	Standard Conc. mg/L	Measured Conc. mg/L	Percent Recovery
NO3	ICV LO	1.00	1.02	102.1
NO3	ICV MID	10.0	9.43	94.3
NO3	CCV LO1	1.00	0.97	97.3
NO3	CCV MID1	10.0	9.27	92.7
NO3	CCV LO2	1.00	1.02	101.6
NO3	CCV MID2	10.0	9.55	95.5
NO3	CCV LO3	1.00	1.05	104.8
NO3	CCV MID3	10.0	9.58	95.8
NO3	CCV LO4	1.00	1.04	104.2
NO3	CCV MID4	10.0	9.23	92.3
NO3	CCV LO5	1.00	1.07	106.6
NO3	CCV MID5	10.0	10.3	102.8
NO3	CCV LO6	1.00	1.05	104.9
NO3	CCV MID6	10.0	10.1	100.7
NO3	CCV LO7	1.00	0.99	99.2
NO3	ICV MID	10.0	9.39	93.9
NO3	CCV MID	10.0	9.48	94.8
NO3	ICV MID	10.0	10.3	103.0
NO3	CCV MID	10.0	9.08	90.8
NO3	LCS A	10.0	9.63	96.3
NO3	LCS B	10.0	9.65	96.5
NO3	LCS C	10.0	9.92	99.2
SO4	ICV LO	1.00	0.98	98.3
SO4	ICV MID	10.0	9.37	93.7
SO4	CCV LO1	1.00	0.97	97.3
SO4	CCV MID1	10.0	9.27	92.7
SO4	CCV LO2	1.00	0.99	99.0
SO4	CCV MID2	10.0	9.40	94.0
SO4	CCV LO3	1.00	1.00	100.2
SO4	CCV MID3	10.0	9.34	93.4
SO4	CCV LO4	1.00	1.05	104.8
SO4	CCV MID4	10.0	9.36	93.6
SO4	CCV LO5	1.00	1.01	100.9
SO4	CCV MID5	10.0	10.1	101.4
SO4	CCV LO6	1.00	1.00	99.9
SO4	CCV MID6	10.0	10.6	106.2
SO4	CCV LO7	1.00	1.06	105.9
SO4	CCV MID7	10.0	10.2	102.0
SO4	ICV MID	10.0	9.39	93.9
SO4	CCV MID	10.0	9.48	94.8
SO4	ICV MID	10.0	9.03	90.3
SO4	CCV MID	10.0	9.19	91.9
SO4	LCS A	10.0	9.60	96.0
SO4	LCS B	10.0	9.62	96.2
SO4	LCS B	10.0	9.82	98.2
NH4	ICV	5.00	5.27	105.3
NH4	CCV 1	5.00	5.26	105.1
NH4	CCV 2	5.00	5.14	102.8
NH4	ICV	5.00	5.32	106.3
NH4	CCV 1	5.00	5.30	106.1
NH4	ICV	5.00	5.22	104.4
NH4	CCV 1	5.00	5.36	107.2
NH4	CCV 2	5.00	5.36	107.3
NH4	CCV 3	5.00	5.37	107.4
NH4	ICV	5.00	5.32	106.4

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: ± 20% RPD *Spikes: ± 25%*

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC Report

Client Name: State of Colorado
Project Number: C007
Analytical Technique: Ion Chromatography
Sample Description: 8x10 Quartz
Report Number: 99-095

NH4	CCV 1	5.00	5.13	102.6
NH4	LCS A	5.00	5.21	104.3
NH4	LCS B	5.00	5.16	103.2
NH4	LCS C	5.00	5.46	109.1
K	ICV	5.00	5.02	100.4
K	CCV1	5.00	4.99	99.8
K	CCV2	5.00	5.14	102.8
K	ICV	5.00	5.03	100.6
K	CCV1	5.00	5.02	100.4
K	ICV	5.00	5.01	100.2
K	CCV1	5.00	5.46	109.2
K	CCV2	5.00	5.44	108.8
K	CCV3	5.00	5.04	100.8
K	ICV	5.00	5.04	100.8
K	CCV1	5.00	5.31	106.2
K	LCSA	5.00	5.06	101.2
K	LCSB	5.00	4.93	98.6
K	LCSC	5.00	5.70	114.0

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: ± 20% RPD *Spikes: ± 25%*

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC Report

Client Name: State of Colorado
Project Number: C007
Analytical Technique: Ion Chromatography
Sample Description: 8x10 Quartz
Report Number: 99-095

Blank Data

Analyte	Sample ID	Measured Conc. mg/L	MDL Conc. mg/L
NO3	ICB	< MDL	0.100
NO3	CCB1	< MDL	0.100
NO3	CCB2	< MDL	0.100
NO3	CCB3	< MDL	0.100
NO3	CCB4	< MDL	0.100
NO3	CCB4	< MDL	0.100
NO3	CCB6	< MDL	0.100
NO3	CCB7	< MDL	0.100
NO3	ICB	< MDL	0.100
NO3	CCB	< MDL	0.100
NO3	ICB	< MDL	0.100
NO3	CCB	< MDL	0.100
SO4	ICB	< MDL	0.100
SO4	CCB1	< MDL	0.100
SO4	CCB2	< MDL	0.100
SO4	CCB3	< MDL	0.100
SO4	CCB4	< MDL	0.100
SO4	CCB5	< MDL	0.100
SO4	CCB6	< MDL	0.100
SO4	CCB7	< MDL	0.100
SO4	ICB	< MDL	0.100
SO4	CCB	< MDL	0.100
SO4	ICB	< MDL	0.100
SO4	CCB	< MDL	0.100
SO4	PREP BLKA	< MDL	0.100
SO4	PREP BLKB	< MDL	0.100
SO4	PREP BLKC	< MDL	0.100
NH4	ICB	< MDL	0.100
NH4	CCB 1	< MDL	0.100
NH4	CCB 2	< MDL	0.100
NH4	ICB	< MDL	0.100
NH4	CCB 1	< MDL	0.100
NH4	ICB	< MDL	0.100
NH4	CCB 1	< MDL	0.100
NH4	CCB 2	< MDL	0.100
NH4	CCB 3	< MDL	0.100
NH4	ICB	< MDL	0.100
NH4	CCB 1	< MDL	0.100
NH4	PREP BLKA	< MDL	0.100
NH4	PREP BLKB	< MDL	0.100
NH4	PREP BLKC	< MDL	0.100
K	ICB	< MDL	0.100
K	CCB1	< MDL	0.100
K	CCB2	< MDL	0.100
K	ICB	< MDL	0.100
K	CCB1	< MDL	0.100
K	ICB	< MDL	0.100
K	CCB1	< MDL	0.100
K	CCB2	< MDL	0.100
K	CCB3	< MDL	0.100
K	ICB	< MDL	0.100
K	CCB1	< MDL	0.100
K	PREP BLKA	< MDL	0.100
K	PREP BLKB	< MDL	0.100
K	PREP BLKC	< MDL	0.100

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: ± 20% RPD *Spikes: ± 25%*

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC Report

Client Name: State of Colorado
Project Number: C007
Analytical Technique: Ion Chromatography
Sample Description: 8x10 Quartz
Report Number: 99-095

Duplicate Data

Analyte	Sample ID	Sample Conc. mg/L	Duplicate Conc. mg/L	RPD	
NO3	99-Q797	6.30	6.21	-1.42	
NO3	99-Q817	3.06	3.06	0.23	
NO3	99-Q842	4.09	3.90	-4.71	
SO4	99-Q797	7.79	8.59	9.83	
SO4	99-Q817	6.86	6.94	1.23	
SO4	99-Q842	3.60	3.20	-12.0	
NH4	99-Q797	1.20	1.13	-5.92	
NH4	99-Q817	1.35	1.31	-2.78	
NH4	99-Q842	0.370	0.366	-1.09	#
K	99-Q797	0.495	0.609	20.7	#
K	99-Q817	0.311	0.321	3.16	#
K	99-Q842	0.239	0.251	4.90	#

Matrix Spike Analysis

Analyte	Sample ID	Sample Conc. mg/L	Spike Conc. mg/L	Spike Amount mg/L	Percent Recovery	
NO3	99-Q797	6.30	16.7	10.0	104.	
NO3	99-Q817	3.06	12.9	10.0	98.6	
NO3	99-Q842	4.09	15.0	10.0	109.	
SO4	99-Q797	7.79	18.7	10.0	109.	
SO4	99-Q817	6.86	17.1	10.0	103.	
SO4	99-Q842	3.60	14.0	10.0	104.	
NH4	99-Q798	1.38	6.46	5.00	101.	
NH4	99-Q818	1.71	6.95	5.00	105.	
NH4	99-Q842	0.370	6.39	5.00	120.	#
K	99-Q798	1.60	6.54	5.00	98.8	
K	99-Q818	0.324	5.32	5.00	99.9	#
K	99-Q842	0.239	5.92	5.00	114.	#

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: ± 20% RPD *Spikes: ± 25%*

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC REPORT: CARBON ANALYZER KHP STANDARD ANALYSIS

Client: Colorado APCD
Analytical Technique: CARBON ANALYZER
Sample Description: 8x10" Quartz
Chester Analysis Range: 99Q797-99Q824
Date: 6/9/99

Sample ID	KHP Std.Conc. µg/cm²	Measured Conc. µg/cm²	Recovery %
S2146	31.77	30.59	96.3
S2147	31.77	29.55	93.0
S2148	31.77	34.01	107.1
S2149	31.77	32.98	103.8
S2150	31.77	33.64	105.9

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
KHP = potassium hydrogen pthalate
QA/QC control limits = 90-110% recovery
% recovery = (measured conc./standard conc.) x 100

QA/QC REPORT: CARBON ANALYZER OC/EC SPLIT ANALYSIS

Client: Colorado APCD
Analytical Technique: CARBON ANALYZER
Sample Description: 8x10" Quartz
Chester Analysis Range: 99Q797-99Q824
Date: 6/9/99

Sample ID	Analyte	%OC Given	%OC Measured	Recovery %
R2137	% OC	62.0	74.5	120
R2138	% OC	62.0	63.6	103
R2139	% OC	62.0	62.4	101
R2140	% OC	62.0	58.5	94.4
R2141	% OC	62.0	53.0	85.5

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
QA/QC control limits = 80-120% recovery (~ ± 2s) of measured organic carbon
% recovery = (% OC measured/% OC given) x 100
% OC given determined by the average of 10 measurements of a prepared 8x10" filter

QA/QC REPORT: CARBON ANALYZER DUPLICATE ANALYSIS

Client: Colorado APCD
Analytical Technique: CARBON ANALYZER
Sample Description: 8x10" Quartz
Chester Analysis Range: 99Q797-99Q824
Date: 6/9/99

Sample ID	Analyte	MDL µg/cm²	Sample Conc. µg/cm²	Duplicate Conc. µg/cm²	RPD %
99-Q797	OC	0.2	26.92	25.71	4.6
	EC	0.2	16.52	19.45	16.3
	TC	0.2	43.44	45.16	3.9
99-Q807	OC	0.2	24.31	24.35	0.2
	EC	0.2	14.03	14.05	0.1
	TC	0.2	38.34	38.40	0.2
99-Q817	OC	0.2	34.10	34.62	1.5
	EC	0.2	24.84	26.76	7.4
	TC	0.2	58.94	61.38	4.1
99-Q827	OC	0.2	28.60	26.00	9.5
	EC	0.2	6.23	5.76	7.8
	TC	0.2	34.83	31.76	9.2
99-Q837	OC	0.2	14.00	15.20	8.2
	EC	0.2	9.25	8.85	4.4
	TC	0.2	23.25	24.05	3.4

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
QA/QC control limits = ± 20 relative percent difference (RPD)
RPD = {(sample - duplicate)/[(sample + duplicate)/2]} x 100
OC = organic carbon; EC = elemental carbon; TC = total carbon
N/C = RPD not calculated when sample and/or duplicate is below the detection limit
= per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC REPORT: CARBON ANALYZER KHP STANDARD ANALYSIS

Client: Colorado APCD
Analytical Technique: CARBON ANALYZER
Sample Description: 47mm Quartz: Resuspensions
Chester Analysis Range: 99Q843&844
Date: 6/15/99

Sample ID	KHP Std.Conc. µg/cm²	Measured Conc. µg/cm²	Recovery %
S2151	31.77	34.41	108.3

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
KHP = potassium hydrogen pthalate
QA/QC control limits = 90-110% recovery
% recovery = (measured conc./standard conc.) x 100

QA/QC REPORT: CARBON ANALYZER OC/EC SPLIT ANALYSIS

Client: Colorado APCD
Analytical Technique: CARBON ANALYZER
Sample Description: 47mm Quartz: Resuspensions
Chester Analysis Range: 99Q843&844
Date: 6/15/99

Sample ID	Analyte	%OC Given	%OC Measured	Recovery %
R2142	% OC	62.0	67.5	109

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
QA/QC control limits = 80-120% recovery (~ $\pm$ 2s) of measured organic carbon
% recovery = (% OC measured/% OC given) x 100
% OC given determined by the average of 10 measurements of a prepared 8x10" filter

QA/QC REPORT: CARBON ANALYZER DUPLICATE ANALYSIS

Client: Colorado APCD
Analytical Technique: CARBON ANALYZER
Sample Description: 47mm Quartz: Resuspensions
Chester Analysis Range: 99Q843&844
Date: 6/15/99

Sample ID	Analyte	MDL µg/cm²	Sample Conc. µg/cm²	Duplicate Conc. µg/cm²	RPD %
99-Q843	OC	0.2	9.10	11.24	21.0
	EC	0.2	2.42	0.00	200.0 #
	TC	0.2	11.52	11.24	2.5

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
QA/QC control limits = ± 20 relative percent difference (RPD)
RPD = {(sample - duplicate)/[(sample + duplicate)/2]} x 100
OC = organic carbon; EC = elemental carbon; TC = total carbon
N/C = RPD not calculated when sample and/or duplicate is below the detection limit
= per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

Client: State of Colorado
Project Number: C007

Lab ID: 99-Q837
Client ID: 057853
Site: Hygiene
Sample Date: 12/ 1/98
Mass: 47618. +- 500. ug
Volume: 1642. +- 164.2 m3
Deposit Area: 406. cm2
Size Fraction: PM10
Suspended
Particulates: 29.00 +- 2.92 µg/m3

Analyte	µg/filter	percent	µg/m3
XRF			
Al	2363. ± 792.5	4.962 ± 1.665	1.439 ± 0.5036
P	0.0000 ± 215.5	0.0000 ± 0.4527	0.0000 ± 0.1313
S	224.9 ± 48.40	0.4724 ± 0.1018	0.1370 ± 0.0325
Cl	42.31 ± 18.19	0.0888 ± 0.0382	0.0258 ± 0.0114
K	1407. ± 192.7	2.954 ± 0.4058	0.8568 ± 0.1453
Ca	4360. ± 574.1	9.157 ± 1.209	2.656 ± 0.4390
Ti	121.1 ± 17.34	0.2543 ± 0.0365	0.0738 ± 0.0129
V	0.0000 ± 3.816	0.0000 ± 0.0080	0.0000 ± 0.0023
Cr	4.263 ± 2.395	0.0090 ± 0.0050	0.0026 ± 0.0015
Mn	28.30 ± 5.278	0.0594 ± 0.0111	0.0172 ± 0.0036
Fe	1520. ± 184.5	3.192 ± 0.3889	0.9257 ± 0.1456
Co	0.0000 ± 3.938	0.0000 ± 0.0083	0.0000 ± 0.0024
Ni	0.5278 ± 2.233	0.0011 ± 0.0047	0.0003 ± 0.0014
Cu	67.72 ± 4.466	0.1422 ± 0.0095	0.0412 ± 0.0049
Zn	24.68 ± 2.923	0.0518 ± 0.0062	0.0150 ± 0.0023
Ga	0.0000 ± 5.359	0.0000 ± 0.0113	0.0000 ± 0.0033
Ge	0.0000 ± 4.425	0.0000 ± 0.0093	0.0000 ± 0.0027
As	0.0000 ± 6.577	0.0000 ± 0.0138	0.0000 ± 0.0040
Se	0.0000 ± 3.329	0.0000 ± 0.0070	0.0000 ± 0.0020
Br	6.334 ± 3.492	0.0133 ± 0.0073	0.0039 ± 0.0022
Rb	5.319 ± 3.735	0.0112 ± 0.0078	0.0032 ± 0.0023
Sr	24.97 ± 4.750	0.0524 ± 0.0100	0.0152 ± 0.0033
Y	8.201 ± 5.197	0.0172 ± 0.0109	0.0050 ± 0.0032
Zr	64.11 ± 7.430	0.1346 ± 0.0157	0.0390 ± 0.0060
Mo	63.94 ± 9.866	0.1343 ± 0.0208	0.0389 ± 0.0072
Pd	9.216 ± 8.688	0.0194 ± 0.0182	0.0056 ± 0.0053
Ag	13.32 ± 8.688	0.0280 ± 0.0182	0.0081 ± 0.0054
Cd	0.0000 ± 9.135	0.0000 ± 0.0192	0.0000 ± 0.0056
In	5.562 ± 10.47	0.0117 ± 0.0220	0.0034 ± 0.0064
Sn	18.72 ± 12.38	0.0393 ± 0.0260	0.0114 ± 0.0076
Sb	0.0000 ± 15.14	0.0000 ± 0.0318	0.0000 ± 0.0092
Ba	890.4 ± 76.73	1.870 ± 0.1623	0.5422 ± 0.0716
La	0.0000 ± 75.07	0.0000 ± 0.1576	0.0000 ± 0.0457
Hg	0.0000 ± 8.242	0.0000 ± 0.0173	0.0000 ± 0.0050
Pb	0.0000 ± 10.03	0.0000 ± 0.0211	0.0000 ± 0.0061
IC			
NO3	3797. ± 379.7	7.974 ± 0.0838	2.312 ± 0.3270
SO4	1262. ± 126.2	2.649 ± 0.0279	0.7683 ± 0.1087
NH4	145.1 ± 14.51	0.3047 ± 0.0033	0.0884 ± 0.0125
K	213.5 ± 21.35	0.4484 ± 0.0048	0.1300 ± 0.0184
OC/EC			
OC	5684. ± 365.4	11.94 ± 0.7775	3.462 ± 0.4115
EC	3756. ± 268.8	7.887 ± 0.5705	2.287 ± 0.2813
TC	9419. ± 454.7	19.78 ± 0.9773	5.736 ± 0.6370

Client: State of Colorado
Project Number: C007

Lab ID: 99-Q838
Client ID: 058043
Site: Hygiene
Sample Date: 12/ 4/98
Mass: 47100. +- 500. ug
Volume: 1570. +- 157.0 m3
Deposit Area: 406. cm2
Size Fraction: PM10
Suspended Particulates: 30.00 +- 3.02 μg/m3

Analyte	μg/filter	percent	μg/m3
XRF			
Al	2680. ± 832.7	5.691 ± 1.769	1.707 ± 0.5572
P	0.0000 ± 206.2	0.0000 ± 0.4377	0.0000 ± 0.1313
S	303.2 ± 61.22	0.6437 ± 0.1302	0.1931 ± 0.0435
Cl	16.12 ± 17.78	0.0342 ± 0.0378	0.0103 ± 0.0114
K	1393. ± 191.6	2.958 ± 0.4079	0.8875 ± 0.1509
Ca	5059. ± 667.9	10.74 ± 1.423	3.222 ± 0.5336
Ti	154.2 ± 21.11	0.3275 ± 0.0450	0.0982 ± 0.0167
V	4.222 ± 3.898	0.0090 ± 0.0083	0.0027 ± 0.0025
Cr	4.994 ± 2.355	0.0106 ± 0.0050	0.0032 ± 0.0015
Mn	29.96 ± 5.684	0.0636 ± 0.0121	0.0191 ± 0.0041
Fe	1486. ± 180.6	3.154 ± 0.3850	0.9462 ± 0.1490
Co	0.0000 ± 3.857	0.0000 ± 0.0082	0.0000 ± 0.0025
Ni	0.0000 ± 2.233	0.0000 ± 0.0047	0.0000 ± 0.0014
Cu	70.77 ± 4.669	0.1502 ± 0.0100	0.0451 ± 0.0054
Zn	25.66 ± 3.004	0.0545 ± 0.0064	0.0163 ± 0.0025
Ga	0.0000 ± 5.440	0.0000 ± 0.0116	0.0000 ± 0.0035
Ge	1.746 ± 4.628	0.0037 ± 0.0098	0.0011 ± 0.0030
As	0.0000 ± 6.252	0.0000 ± 0.0133	0.0000 ± 0.0040
Se	0.1624 ± 3.573	0.0003 ± 0.0076	0.0001 ± 0.0023
Br	0.3654 ± 3.289	0.0008 ± 0.0070	0.0002 ± 0.0021
Rb	6.171 ± 3.573	0.0131 ± 0.0076	0.0039 ± 0.0023
Sr	15.10 ± 4.304	0.0321 ± 0.0091	0.0096 ± 0.0029
Y	0.0000 ± 4.994	0.0000 ± 0.0106	0.0000 ± 0.0032
Zr	44.82 ± 6.780	0.0952 ± 0.0144	0.0285 ± 0.0052
Mo	67.96 ± 9.135	0.1443 ± 0.0195	0.0433 ± 0.0073
Pd	0.0000 ± 8.201	0.0000 ± 0.0174	0.0000 ± 0.0052
Ag	0.0000 ± 8.242	0.0000 ± 0.0175	0.0000 ± 0.0052
Cd	5.116 ± 9.013	0.0109 ± 0.0191	0.0033 ± 0.0058
In	3.979 ± 10.07	0.0084 ± 0.0214	0.0025 ± 0.0064
Sn	12.30 ± 11.86	0.0261 ± 0.0252	0.0078 ± 0.0076
Sb	0.0000 ± 13.15	0.0000 ± 0.0279	0.0000 ± 0.0084
Ba	559.9 ± 66.10	1.189 ± 0.1409	0.3566 ± 0.0552
La	0.0000 ± 73.57	0.0000 ± 0.1562	0.0000 ± 0.0469
Hg	2.842 ± 8.567	0.0060 ± 0.0182	0.0018 ± 0.0055
Pb	0.0000 ± 9.663	0.0000 ± 0.0205	0.0000 ± 0.0062
IC			
NO3	3068. ± 306.8	6.513 ± 0.0692	1.954 ± 0.2763
SO4	1466. ± 146.6	3.112 ± 0.0331	0.9335 ± 0.1320
NH4	175.2 ± 17.52	0.3719 ± 0.0040	0.1116 ± 0.0158
K	196.7 ± 19.67	0.4177 ± 0.0045	0.1253 ± 0.0177
OC/EC			
OC	6131. ± 387.7	13.02 ± 0.8347	3.905 ± 0.4620
EC	4466. ± 304.5	9.482 ± 0.6543	2.845 ± 0.3443
TC	10600 ± 491.3	22.50 ± 1.070	6.749 ± 0.7439

Client: State of Colorado
Project Number: C007

Lab ID: 99-Q839
Client ID: 062058
Site: Hygiene
Sample Date: 3/25/99
Mass: 42966. +- 500. ug
Volume: 1302. +- 130.2 m3
Deposit Area: 406. cm2
Size Fraction: PM10
Suspended
Particulates: 33.00 +- 3.32 µg/m3

Analyte	µg/filter	percent	µg/m3
XRF			
Al	2515. ± 792.9	5.853 ± 1.847	1.931 ± 0.6389
P	0.0000 ± 228.5	0.0000 ± 0.5317	0.0000 ± 0.1755
S	863.2 ± 151.5	2.009 ± 0.3534	0.6629 ± 0.1339
Cl	0.0000 ± 14.41	0.0000 ± 0.0335	0.0000 ± 0.0111
K	1130. ± 154.7	2.631 ± 0.3613	0.8681 ± 0.1471
Ca	3509. ± 461.2	8.168 ± 1.078	2.695 ± 0.4451
Ti	122.5 ± 17.46	0.2852 ± 0.0408	0.0941 ± 0.0164
V	0.0000 ± 3.857	0.0000 ± 0.0090	0.0000 ± 0.0030
Cr	0.0000 ± 2.192	0.0000 ± 0.0051	0.0000 ± 0.0017
Mn	22.37 ± 4.913	0.0521 ± 0.0114	0.0172 ± 0.0041
Fe	1184. ± 143.6	2.756 ± 0.3358	0.9096 ± 0.1430
Co	0.0000 ± 3.451	0.0000 ± 0.0080	0.0000 ± 0.0027
Ni	0.0000 ± 2.071	0.0000 ± 0.0048	0.0000 ± 0.0016
Cu	49.37 ± 3.735	0.1149 ± 0.0088	0.0379 ± 0.0048
Zn	9.094 ± 2.558	0.0212 ± 0.0060	0.0070 ± 0.0021
Ga	0.0000 ± 5.237	0.0000 ± 0.0122	0.0000 ± 0.0040
Ge	2.964 ± 4.628	0.0069 ± 0.0108	0.0023 ± 0.0036
As	0.0000 ± 6.496	0.0000 ± 0.0151	0.0000 ± 0.0050
Se	6.131 ± 3.532	0.0143 ± 0.0082	0.0047 ± 0.0028
Br	7.552 ± 3.289	0.0176 ± 0.0077	0.0058 ± 0.0026
Rb	9.176 ± 3.857	0.0214 ± 0.0090	0.0070 ± 0.0030
Sr	11.49 ± 4.628	0.0267 ± 0.0108	0.0088 ± 0.0037
Y	0.0000 ± 5.319	0.0000 ± 0.0124	0.0000 ± 0.0041
Zr	49.61 ± 7.349	0.1155 ± 0.0172	0.0381 ± 0.0068
Mo	76.45 ± 10.11	0.1779 ± 0.0236	0.0587 ± 0.0097
Pd	0.0000 ± 7.998	0.0000 ± 0.0186	0.0000 ± 0.0061
Ag	11.00 ± 9.013	0.0256 ± 0.0210	0.0085 ± 0.0070
Cd	3.126 ± 8.851	0.0073 ± 0.0206	0.0024 ± 0.0068
In	0.5278 ± 10.15	0.0012 ± 0.0236	0.0004 ± 0.0078
Sn	27.45 ± 12.14	0.0639 ± 0.0283	0.0211 ± 0.0096
Sb	8.688 ± 14.94	0.0202 ± 0.0348	0.0067 ± 0.0115
Ba	669.1 ± 73.16	1.557 ± 0.1712	0.5139 ± 0.0761
La	0.0000 ± 76.41	0.0000 ± 0.1778	0.0000 ± 0.0587
Hg	2.801 ± 8.364	0.0065 ± 0.0195	0.0022 ± 0.0064
Pb	35.32 ± 10.03	0.0822 ± 0.0234	0.0271 ± 0.0082
IC			
NO3	2724. ± 272.4	6.340 ± 0.0739	2.092 ± 0.2959
SO4	4002. ± 400.2	9.315 ± 0.1085	3.074 ± 0.4347
NH4	944.8 ± 94.48	2.199 ± 0.0257	0.7257 ± 0.1026
K	197.0 ± 19.70	0.4585 ± 0.0054	0.1513 ± 0.0214
OC/EC			
OC	5928. ± 377.6	13.80 ± 0.8933	4.553 ± 0.5398
EC	2529. ± 207.9	5.887 ± 0.4886	1.943 ± 0.2515
TC	8445. ± 430.4	19.65 ± 1.027	6.486 ± 0.7280

Client: State of Colorado
Project Number: C007

Lab ID: 99-Q840
Client ID: 061391
Site: Hygiene
Sample Date: 3/28/99
Mass: 53001. +- 500. ug
Volume: 1359. +- 135.9 m3
Deposit Area: 406. cm2
Size Fraction: PM10
Suspended
Particulates: 39.00 +- 3.92 μg/m3

Analyte	μg/filter	percent	μg/m3
XRF			
Al	3060. ± 831.9	5.774 ± 1.571	2.252 ± 0.6522
P	0.0000 ± 207.1	0.0000 ± 0.3907	0.0000 ± 0.1524
S	725.5 ± 128.4	1.369 ± 0.2426	0.5339 ± 0.1085
Cl	0.0000 ± 15.79	0.0000 ± 0.0298	0.0000 ± 0.0116
K	1403. ± 191.7	2.647 ± 0.3626	1.032 ± 0.1748
Ca	4047. ± 531.9	7.636 ± 1.006	2.978 ± 0.4918
Ti	128.9 ± 18.19	0.2432 ± 0.0344	0.0949 ± 0.0164
V	0.0000 ± 3.857	0.0000 ± 0.0073	0.0000 ± 0.0028
Cr	4.182 ± 2.355	0.0079 ± 0.0044	0.0031 ± 0.0018
Mn	36.46 ± 6.131	0.0688 ± 0.0116	0.0268 ± 0.0052
Fe	1592. ± 193.0	3.004 ± 0.3652	1.171 ± 0.1841
Co	0.0000 ± 3.938	0.0000 ± 0.0074	0.0000 ± 0.0029
Ni	0.0000 ± 2.233	0.0000 ± 0.0042	0.0000 ± 0.0016
Cu	35.61 ± 3.126	0.0672 ± 0.0059	0.0262 ± 0.0035
Zn	20.22 ± 2.761	0.0381 ± 0.0052	0.0149 ± 0.0025
Ga	0.0000 ± 5.481	0.0000 ± 0.0103	0.0000 ± 0.0040
Ge	0.3654 ± 4.710	0.0007 ± 0.0089	0.0003 ± 0.0035
As	1.259 ± 6.577	0.0024 ± 0.0124	0.0009 ± 0.0048
Se	1.177 ± 3.735	0.0022 ± 0.0070	0.0009 ± 0.0027
Br	0.0000 ± 3.370	0.0000 ± 0.0064	0.0000 ± 0.0025
Rb	23.18 ± 3.898	0.0437 ± 0.0074	0.0171 ± 0.0033
Sr	39.91 ± 4.872	0.0753 ± 0.0092	0.0294 ± 0.0046
Y	10.03 ± 5.440	0.0189 ± 0.0103	0.0074 ± 0.0041
Zr	51.44 ± 7.349	0.0971 ± 0.0139	0.0379 ± 0.0066
Mo	68.90 ± 9.866	0.1300 ± 0.0187	0.0507 ± 0.0089
Pd	0.0000 ± 8.973	0.0000 ± 0.0169	0.0000 ± 0.0066
Ag	0.0000 ± 8.770	0.0000 ± 0.0165	0.0000 ± 0.0065
Cd	0.0000 ± 9.176	0.0000 ± 0.0173	0.0000 ± 0.0068
In	0.0000 ± 10.68	0.0000 ± 0.0201	0.0000 ± 0.0079
Sn	5.846 ± 12.59	0.0110 ± 0.0237	0.0043 ± 0.0093
Sb	13.72 ± 15.18	0.0259 ± 0.0287	0.0101 ± 0.0112
Ba	857.5 ± 76.21	1.618 ± 0.1446	0.6310 ± 0.0844
La	76.61 ± 75.88	0.1445 ± 0.1432	0.0564 ± 0.0561
Hg	0.0000 ± 8.567	0.0000 ± 0.0162	0.0000 ± 0.0063
Pb	2.111 ± 9.866	0.0040 ± 0.0186	0.0016 ± 0.0073
IC			
NO3	2428. ± 242.8	4.581 ± 0.0433	1.786 ± 0.2526
SO4	3053. ± 305.3	5.759 ± 0.0544	2.246 ± 0.3177
NH4	483.7 ± 48.37	0.9126 ± 0.0087	0.3559 ± 0.0503
K	308.3 ± 30.83	0.5816 ± 0.0056	0.2268 ± 0.0321
OC/EC			
OC	7389. ± 450.7	13.94 ± 0.8604	5.437 ± 0.6369
EC	2830. ± 222.5	5.339 ± 0.4228	2.082 ± 0.2649
TC	10230 ± 503.4	19.30 ± 0.9672	7.528 ± 0.8391

Client: State of Colorado
Project Number: C007

Lab ID: 99-Q841
Client ID: 063508
Site: Hygiene
Sample Date: 3/31/99
Mass: 41664. +- 500. ug
Volume: 1302. +- 130.2 m3
Deposit Area: 406. cm2
Size Fraction: PM10
Suspended
Particulates: 32.00 +- 3.22 µg/m3

Analyte	µg/filter	percent	µg/m3
XRF			
Al	3485. ± 869.2	8.365 ± 2.089	2.677 ± 0.7193
P	0.0000 ± 250.0	0.0000 ± 0.6000	0.0000 ± 0.1920
S	552.2 ± 99.59	1.325 ± 0.2396	0.4241 ± 0.0875
Cl	0.0000 ± 14.29	0.0000 ± 0.0343	0.0000 ± 0.0110
K	1146. ± 156.6	2.750 ± 0.3773	0.8800 ± 0.1490
Ca	3381. ± 444.2	8.115 ± 1.070	2.597 ± 0.4287
Ti	137.5 ± 19.08	0.3300 ± 0.0460	0.1056 ± 0.0181
V	0.0000 ± 3.654	0.0000 ± 0.0088	0.0000 ± 0.0028
Cr	0.0000 ± 2.192	0.0000 ± 0.0053	0.0000 ± 0.0017
Mn	33.09 ± 5.806	0.0794 ± 0.0140	0.0254 ± 0.0051
Fe	1345. ± 162.9	3.227 ± 0.3930	1.033 ± 0.1623
Co	0.0000 ± 3.654	0.0000 ± 0.0088	0.0000 ± 0.0028
Ni	0.0000 ± 2.111	0.0000 ± 0.0051	0.0000 ± 0.0016
Cu	42.14 ± 3.248	0.1011 ± 0.0079	0.0324 ± 0.0041
Zn	13.15 ± 2.558	0.0316 ± 0.0062	0.0101 ± 0.0022
Ga	0.0000 ± 5.359	0.0000 ± 0.0129	0.0000 ± 0.0041
Ge	4.425 ± 4.791	0.0106 ± 0.0115	0.0034 ± 0.0037
As	0.0000 ± 6.496	0.0000 ± 0.0156	0.0000 ± 0.0050
Se	0.0000 ± 3.613	0.0000 ± 0.0087	0.0000 ± 0.0028
Br	6.861 ± 3.451	0.0165 ± 0.0083	0.0053 ± 0.0027
Rb	4.222 ± 3.938	0.0101 ± 0.0095	0.0032 ± 0.0030
Sr	21.84 ± 4.791	0.0524 ± 0.0115	0.0168 ± 0.0040
Y	6.618 ± 5.319	0.0159 ± 0.0128	0.0051 ± 0.0041
Zr	50.47 ± 7.267	0.1211 ± 0.0175	0.0388 ± 0.0068
Mo	80.23 ± 10.27	0.1926 ± 0.0248	0.0616 ± 0.0100
Pd	0.0000 ± 8.079	0.0000 ± 0.0194	0.0000 ± 0.0062
Ag	3.004 ± 8.810	0.0072 ± 0.0211	0.0023 ± 0.0068
Cd	5.481 ± 9.460	0.0132 ± 0.0227	0.0042 ± 0.0073
In	8.242 ± 10.60	0.0198 ± 0.0254	0.0063 ± 0.0082
Sn	34.14 ± 12.26	0.0820 ± 0.0294	0.0262 ± 0.0098
Sb	7.552 ± 14.86	0.0181 ± 0.0357	0.0058 ± 0.0114
Ba	640.7 ± 70.24	1.538 ± 0.1696	0.4921 ± 0.0730
La	1.746 ± 77.34	0.0042 ± 0.1856	0.0013 ± 0.0594
Hg	3.857 ± 8.770	0.0093 ± 0.0210	0.0030 ± 0.0067
Pb	12.42 ± 9.825	0.0298 ± 0.0236	0.0095 ± 0.0076
IC			
NO3	2322. ± 232.2	5.572 ± 0.0670	1.783 ± 0.2522
SO4	2626. ± 262.6	6.304 ± 0.0758	2.017 ± 0.2853
NH4	460.4 ± 46.04	1.105 ± 0.0134	0.3536 ± 0.0500
K	169.9 ± 16.99	0.4078 ± 0.0050	0.1305 ± 0.0185
OC/EC			
OC	5887. ± 375.6	14.13 ± 0.9172	4.522 ± 0.5363
EC	2473. ± 204.6	5.934 ± 0.4963	1.899 ± 0.2465
TC	8364. ± 426.3	20.07 ± 1.051	6.424 ± 0.7210

Client: State of Colorado
Project Number: C007

Lab ID: 99-Q843
Client ID: Type I/II Cement
Site: Southdown Facility
Mass: 10479. +- 40. ug
Deposit Area: 13.9 cm2
Size Fraction: PM10

Analyte	µg/g
IC	
NO3	603.1 ± 2.303
SO4	83,270 ± 317.9
NH4	0.0000 ± 0.1350
K	11,410 ± 43.57
OC/EC	
OC	12,070 ± 870.1
EC	3,210. ± 426.0
TC	15,250 ± 968.7

Lab ID: 99-Q844
Client ID: CKD
Site: Southdown Facility
Mass: 5274. +- 40. ug
Deposit Area: 13.9 cm2
Size Fraction: PM10

Analyte	µg/g
IC	
NO3	424.7 ± 3.223
SO4	34,550 ± 262.0
NH4	0.0000 ± 0.2681
K	8,760. ± 66.44
OC/EC	
OC	73,270 ± 4,227.
EC	0.0000 ± 527.1
TC	73,270 ± 4,253.

Client: State of Colorado
Project Number: C007

Lab ID: 97-T1659
Client ID: CKD
Site: Southdown Facility
Mass: 3373. +- 10. ug
Deposit Area: 12.6 cm2
Size Fraction: PM10

Analyte	µg/g
XRF	
Al	17,980 ± 2,538.
Si	37,320 ± 4,940.
P	0.0000 ± 183.4
S	12,110 ± 1,519.
Cl	634.3 ± 105.7
K	11,740 ± 1,421.
Ca	314,600 ± 37,630
Ti	645.9 ± 44.12
V	179.7 ± 23.91
Cr	59.40 ± 16.81
Mn	585.7 ± 37.40
Fe	11,090 ± 559.1
Co	0.0000 ± 19.80
Ni	33.62 ± 13.45
Cu	0.0000 ± 6.350
Zn	82.18 ± 7.475
Ga	6.350 ± 10.83
Ge	0.0000 ± 8.218
As	39.60 ± 13.82
Se	75.46 ± 8.968
Br	13.45 ± 6.351
Rb	68.73 ± 8.968
Sr	1,667. ± 86.43
Y	8.218 ± 9.339
Zr	54.91 ± 13.82
Mo	0.0000 ± 14.94
Pd	0.0000 ± 42.21
Ag	57.53 ± 42.59
Cd	107.6 ± 43.33
In	0.0000 ± 46.32
Sn	81.43 ± 52.67
Sb	6.724 ± 56.03
Ba	752.0 ± 238.7
La	0.0000 ± 207.3
Hg	0.0000 ± 15.69
Pb	27.64 ± 19.80

Client: State of Colorado
Project Number: C007

Lab ID: 97-T1660
Client ID: Type I/II Cement
Site: Southdown Facility
Mass: 3409. +- 10. ug
Deposit Area: 12.6 cm2
Size Fraction: PM10

Analyte	µg/g
XRF	
Al	17,950 ± 2,591.
Si	56,850 ± 7,653.
P	0.0000 ± 227.7
S	18,070 ± 2,302.
Cl	0.0000 ± 81.31
K	11,850 ± 1,452.
Ca	376,300 ± 45,400
Ti	735.9 ± 50.31
V	70.60 ± 25.50
Cr	120.1 ± 20.33
Mn	687.1 ± 43.29
Fe	20,790 ± 1,045.
Co	0.0000 ± 25.50
Ni	44.35 ± 16.63
Cu	0.0000 ± 7.762
Zn	91.66 ± 8.505
Ga	14.41 ± 9.980
Ge	14.78 ± 8.871
As	11.09 ± 11.46
Se	7.762 ± 6.283
Br	0.0000 ± 5.544
Rb	51.01 ± 7.763
Sr	1,669. ± 86.63
Y	29.20 ± 8.132
Zr	88.34 ± 13.68
Mo	32.90 ± 13.68
Pd	0.0000 ± 43.98
Ag	0.0000 ± 44.72
Cd	0.0000 ± 46.94
In	0.0000 ± 47.68
Sn	17.00 ± 52.85
Sb	0.0000 ± 56.92
Ba	639.1 ± 227.7
La	277.2 ± 192.2
Hg	32.90 ± 16.63
Pb	14.78 ± 17.00

STATE OF COLORADO

JOB # S015
REPORT # 99-103

SUBMITTED BY:
CHESTER LABNET - PORTLAND
12242 S.W. GARDEN PLACE
TIGARD, OR 97223
☎(503)624-2183/FAX (503)624-2653

CHESTER LabNet
Portland
12242 S.W. Garden Place
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Case Narrative

Date: July 8, 1999

General Information

Client:	State of Colorado
Sample Description:	Soils resuspended onto 47mm QMA and Teflon
Sample Numbers:	99Q1247 – 99Q1249, 99T2448 - 99T2450
Job Number:	S015
Report Number:	99-103

Analysis

Analytes:	XRF Metals (Al - Pb), F, Cl, NO_3, SO_4, NH_4, K, OC, EC
Analytical Protocols:	X-Ray Fluorescence protocol 4, Ion Chromatography EPA Method 300, OC/EC
Analytical Notes:	No problems were encountered during the analysis.
QA/QC Review:	All of the data have been reviewed by the analysts performing the analyses and the quality assurance officer. All of the quality control and sample-specific information in this package is complete and meets or exceeds the minimum requirements for acceptability.
Comments:	If you have any questions or concerns regarding this analysis, please feel free to contact the project manager.

7/8/99
QA Officer Date
Charles Lytle

7/8/99
Project Manager Date
Paul Duda

Client: State of Colorado
Project Number: S015

Lab ID: 99-T2448
Client ID: Kiln Feed
Sample Date: 4/ 7/99
Mass: 3801. +- 10. ug
Deposit Area: 12.6 cm2

Analyte	µg/g
XRF	
Al	19,430 ± 2,828.
Si	43,360 ± 5,875.
P	0.0000 ± 257.9
S	3,287. ± 410.8
Cl	0.0000 ± 69.28
K	3,188. ± 396.9
Ca	333,800 ± 40,220
Ti	649.1 ± 43.46
V	183.6 ± 23.54
Cr	86.19 ± 16.91
Mn	575.1 ± 36.16
Fe	10,620 ± 534.8
Co	0.0000 ± 19.23
Ni	33.15 ± 13.92
Cu	0.0000 ± 5.967
Zn	57.68 ± 6.632
Ga	23.87 ± 8.619
Ge	7.624 ± 7.293
As	0.0000 ± 9.945
Se	5.967 ± 5.304
Br	5.967 ± 4.641
Rb	18.90 ± 6.299
Sr	1,290. ± 67.38
Y	15.25 ± 7.293
Zr	47.07 ± 11.60
Mo	8.619 ± 11.93
Pd	7.956 ± 37.13
Ag	0.0000 ± 37.46
Cd	0.0000 ± 38.12
In	41.10 ± 42.43
Sn	3.978 ± 45.41
Sb	28.51 ± 50.72
Ba	383.5 ± 136.6
La	0.0000 ± 173.4
Hg	6.961 ± 13.26
Pb	44.42 ± 14.92

Client: State of Colorado
Project Number: S015

Lab ID: 99-T2449
Client ID: Leukonen's Pasture
Sample Date: 4/ 7/99
Mass: 3002. +- 10. ug
Deposit Area: 12.6 cm2

Analyte	µg/g
XRF	
Al	94,020 ± 12,430
Si	186,800 ± 23,940
P	564.1 ± 89.84
S	893.6 ± 111.7
Cl	0.0000 ± 47.43
K	23,390 ± 2,773.
Ca	23,140 ± 2,723.
Ti	3,242. ± 166.6
V	91.08 ± 16.37
Cr	76.39 ± 8.818
Mn	642.2 ± 38.67
Fe	45,330 ± 2,276.
Co	0.0000 ± 30.64
Ni	66.32 ± 9.236
Cu	80.59 ± 8.399
Zn	127.2 ± 9.663
Ga	39.03 ± 15.11
Ge	12.59 ± 7.975
As	56.66 ± 13.85
Se	0.0000 ± 6.296
Br	20.57 ± 6.716
Rb	149.4 ± 12.18
Sr	186.4 ± 14.28
Y	55.82 ± 10.08
Zr	146.9 ± 14.28
Mo	12.59 ± 14.27
Pd	0.0000 ± 39.03
Ag	10.91 ± 39.45
Cd	0.0000 ± 39.87
In	0.0000 ± 43.23
Sn	92.34 ± 49.95
Sb	77.65 ± 54.14
Ba	1,258. ± 246.4
La	387.8 ± 206.1
Hg	0.0000 ± 14.69
Pb	43.23 ± 20.57

Client: State of Colorado
Project Number: S015

Lab ID: 99-T2450
Client ID: 59th Street
Sample Date: 4/ 7/99
Mass: 2882. +- 10. ug
Deposit Area: 12.6 cm2

Analyte	µg/g
XRF	
Al	95,220 ± 12,510
Si	184,100 ± 23,490
P	135.1 ± 51.15
S	306.0 ± 63.40
Cl	0.0000 ± 48.09
K	28,540 ± 3,376.
Ca	22,090 ± 2,595.
Ti	3,476. ± 178.3
V	63.39 ± 16.61
Cr	118.0 ± 10.50
Mn	795.3 ± 45.99
Fe	44,590 ± 2,239.
Co	0.0000 ± 31.04
Ni	45.03 ± 9.620
Cu	92.69 ± 9.187
Zn	121.1 ± 9.627
Ga	27.11 ± 11.37
Ge	12.68 ± 8.307
As	0.0000 ± 14.43
Se	0.0000 ± 6.121
Br	0.0000 ± 6.995
Rb	230.0 ± 15.76
Sr	302.1 ± 19.27
Y	50.28 ± 10.06
Zr	110.6 ± 14.43
Mo	10.06 ± 15.30
Pd	34.98 ± 39.79
Ag	23.61 ± 40.66
Cd	41.53 ± 43.28
In	0.0000 ± 43.28
Sn	119.8 ± 51.15
Sb	42.41 ± 55.09
Ba	1,060. ± 261.5
La	230.8 ± 212.9
Hg	17.93 ± 15.30
Pb	115.4 ± 22.74

Client: State of Colorado
Project Number: S015

Lab ID: 99-Q1247
Client ID: Kiln Feed
Mass: 2146. +- 40. ug
Deposit Area: 13.9 cm2

Analyte	µg/g
IC	
F	2,199. ± 41.00
Cl	0.0000 ± 0.6590
NO3	0.0000 ± 0.6590
SO4	2,544. ± 47.42
NH4	0.0000 ± 0.6590
K	0.0000 ± 0.6590
OC/EC	
OC	130,200 ± 8,143.
EC	17,230 ± 2,181.
TC	147,700 ± 8,552.

Lab ID: 99-Q1248
Client ID: Leukonen's Pasture
Sample Date: 4/ 7/99
Mass: 7365. +- 40. ug
Deposit Area: 13.9 cm2

Analyte	µg/g
IC	
F	646.3 ± 3.511
Cl	0.0000 ± 0.1920
NO3	0.0000 ± 0.1920
SO4	0.0000 ± 0.1920
NH4	0.0000 ± 0.1920
K	1,580. ± 8.585
OC/EC	
OC	54,350 ± 3,109.
EC	0.0000 ± 377.5
TC	54,350 ± 3,128.

Lab ID: 99-Q1249
Client ID: 59th Street
Sample Date: 4/ 7/99
Mass: 7890. +- 40. ug
Deposit Area: 13.9 cm2

Analyte	µg/g
IC	
F	0.0000 ± 0.1792
Cl	0.0000 ± 0.1792
NO3	0.0000 ± 0.1792
SO4	0.0000 ± 0.1792
NH4	3,536. ± 17.93
K	294.0 ± 1.492
OC/EC	
OC	16,650 ± 1,187.
EC	0.0000 ± 352.3
TC	16,650 ± 1,238.

Chester LabNet - Portland

XRF-K **XRF Analytical Quality Assurance Report**

Client: State of Colorado (Southdown) - Report: 99-103
Analysis Period: June 24, 1999

1. Precision Data

Micromatter Multi-elemental Quality Control Standard: QS285

QC Standard Results

Analyte	n	Counts per Second			c.v.	%E
		Calib.	Meas.	S.D.		
Si(0)	1	182.73	190.00	na	na	3.98
Si(1)	1	7.85	7.84	na	na	-0.16
Ti(2)	1	134.29	142.30	na	na	5.97
Fe(3)	1	183.38	187.40	na	na	2.19
Se(4)	1	46.00	47.81	na	na	3.93
Pb(4)	1	33.20	34.34	na	na	3.43
Cd(5)	1	44.34	46.69	na	na	5.30

2. Accuracy Data

NIST Standard Reference Materials: SRM 1832, SRM 1833

Analyte/ SRM	n	Certified Value(µg/cm²)	Measured Value (µg/cm²)					% Rec.
			High	Low	Average			
Al 1832	4	14.6 +/- .97	15.22	13.89	14.59	+/-	0.60	99.9
Si 1832	4	34.0 +/- 1.1	36.39	32.10	34.81	+/-	1.75	102.4
Si 1833	4	33.0 +/- 2.1	35.59	30.37	33.58	+/-	2.07	101.8
S 2708	4	2.46 +/- .25	2.49	2.43	2.46	+/-	0.02	99.9
K 1833	4	17.3 +/- 1.64	16.92	15.86	16.60	+/-	0.43	96.0
Ca 1832	4	19.4 +/- 1.30	21.00	20.38	20.79	+/-	0.25	107.2
Ti 1833	4	12.8 +/- 1.79	13.10	12.36	12.89	+/-	0.31	100.7
V 1832	4	4.70 +/- .49	4.86	4.61	4.77	+/-	0.10	101.6
Mn 1832	4	4.54 +/- .49	4.56	4.35	4.48	+/-	0.08	98.6
Fe 1833	4	14.2 +/- .45	15.20	14.29	14.69	+/-	0.34	103.5
Cu 1832	4	2.43 +/- .16	2.47	2.36	2.43	+/-	0.04	100.0
Zn 1833	4	4.01 +/- .23	4.23	4.17	4.20	+/-	0.02	104.8
Pb 1833	4	16.7 +/- .85	17.47	17.28	17.40	+/-	0.08	104.2

NIST: National Institute of Standards and Technology
% Rec: Percent Recovery = (Experimental/Given) x 100
n: Number of Observations
S.D.: Standard Deviation
c.v.: Coefficient of Variation = (S.D./Measured) x 100
% E: Percent Error = [(Measured-Calibrated)/Calibrated] x 100

REPLICATE REPORT

Original ID: 99-T2449
Replicate ID: RT2449

Filter Lot:
Deposit Mass: 3002 µg
Deposit Area: 12.6 cm^2
Particle Size: P

Element	Original ug/cm2	Replicate ug/cm2	Difference ug/cm2		RPD
Al	22.4005 +- 2.9601	22.0354 +- 2.9134	0.3650 +- 4.1534	+	1.6 +- 18.7
Si	44.5144 +- 5.7030	43.9636 +- 5.6290	0.5508 +- 8.0131	+	1.2 +- 18.1
P	0.1344 +- 0.0214	0.1286 +- 0.0240	0.0058 +- 0.0322	+	4.4 +- 24.5
S	0.2129 +- 0.0266	0.2566 +- 0.0367	-0.0437 +- 0.0453	+	-18.6 +- 19.3
Cl	0.0000 +- 0.0113	0.0000 +- 0.0134	0.0000 +- 0.0175		
K	5.5729 +- 0.6605	5.5347 +- 0.6560	0.0382 +- 0.9309	+	0.7 +- 16.8
Ca	5.5141 +- 0.6486	5.5384 +- 0.6515	-0.0243 +- 0.9193	+	-0.4 +- 16.6
Ti	0.7724 +- 0.0396	0.8104 +- 0.0416	-0.0380 +- 0.0574	+	-4.8 +- 7.3
V	0.0217 +- 0.0039	0.0264 +- 0.0046	-0.0047 +- 0.0060	+	-19.5 +- 24.9
Cr	0.0182 +- 0.0021	0.0173 +- 0.0024	0.0009 +- 0.0032	+	5.3 +- 18.2
Mn	0.1530 +- 0.0092	0.1549 +- 0.0101	-0.0019 +- 0.0137	+	-1.2 +- 8.9
Fe	10.8044 +- 0.5410	10.7419 +- 0.5384	0.0625 +- 0.7632	+	0.6 +- 7.1
Co	0.0000 +- 0.0073	0.0000 +- 0.0095	0.0000 +- 0.0119		
Ni	0.0158 +- 0.0022	0.0148 +- 0.0027	0.0010 +- 0.0035	+	6.5 +- 22.7
Cu	0.0192 +- 0.0020	0.0200 +- 0.0025	-0.0008 +- 0.0032	+	-4.0 +- 16.4
Zn	0.0303 +- 0.0023	0.0273 +- 0.0027	0.0030 +- 0.0035	+	10.5 +- 12.2
Ga	0.0093 +- 0.0036	0.0000 +- 0.0035	0.0093 +- 0.0050		
Ge	0.0030 +- 0.0019	0.0000 +- 0.0026	0.0030 +- 0.0033		
As	0.0135 +- 0.0033	0.0082 +- 0.0041	0.0053 +- 0.0053	0	48.6 +- 48.6
Se	0.0000 +- 0.0015	0.0000 +- 0.0018	0.0000 +- 0.0024		
Br	0.0049 +- 0.0016	0.0023 +- 0.0022	0.0026 +- 0.0027		
Rb	0.0356 +- 0.0029	0.0343 +- 0.0035	0.0013 +- 0.0045	+	3.7 +- 13.0
Sr	0.0444 +- 0.0034	0.0470 +- 0.0039	-0.0027 +- 0.0052	+	-5.8 +- 11.3
Y	0.0133 +- 0.0024	0.0158 +- 0.0031	-0.0025 +- 0.0039	+	-17.4 +- 26.5
Zr	0.0350 +- 0.0034	0.0392 +- 0.0042	-0.0042 +- 0.0054	+	-11.3 +- 14.6
Mo	0.0030 +- 0.0034	0.0000 +- 0.0044	0.0030 +- 0.0056		
Pd	0.0000 +- 0.0093	0.0000 +- 0.0128	0.0000 +- 0.0158		
Ag	0.0026 +- 0.0094	0.0000 +- 0.0130	0.0026 +- 0.0160		
Cd	0.0000 +- 0.0095	0.0129 +- 0.0140	-0.0129 +- 0.0169		
In	0.0000 +- 0.0103	0.0167 +- 0.0140	-0.0167 +- 0.0173		
Sn	0.0220 +- 0.0119	0.0000 +- 0.0156	0.0220 +- 0.0196		
Sb	0.0185 +- 0.0129	0.0226 +- 0.0183	-0.0040 +- 0.0224		
Ba	0.2997 +- 0.0587	0.2170 +- 0.0823	0.0828 +- 0.1011	+	32.0 +- 39.1
La	0.0924 +- 0.0491	0.0000 +- 0.0671	0.0924 +- 0.0831		
Hg	0.0000 +- 0.0035	0.0000 +- 0.0045	0.0000 ± 0.0057		
Pb	0.0103 +- 0.0049	0.0110 +- 0.0062	-0.0007 ± 0.0079		

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

QA/QC Report

Client Name: State of Colorado
Project Number: S015
Analytical Technique: Ion Chromatography
Sample Description: 47mm QMA
Report Number: 99-103

Calibration QC/LCS Recovery

Analyte	Sample ID	Standard Conc. mg/L	Measured Conc. mg/L	Percent Recovery
F	ICV_LO	1.00	0.96	96.0
F	ICV_MID	10.0	10.6	106.4
F	CCV_LO	1.00	0.93	93.2
F	CCV_MID	10.0	10.8	107.5
Cl	ICV_LO	1.00	0.93	93.3
Cl	ICV_MID	10.0	9.78	97.8
Cl	LCS	10.0	9.88	98.8
Cl	CCV_LO	1.00	0.95	95.2
Cl	CCV_MID	10.0	9.87	98.7
NO3	ICV_LO	1.00	1.03	103.2
NO3	ICV_MID	10.0	9.14	91.4
NO3	LCS	10.0	9.48	94.8
NO3	CCV_LO	1.00	1.01	101.4
NO3	CCV_MID	10.0	9.27	92.7
SO4	ICV_LO	1.00	0.96	95.7
SO4	ICV_MID	10.0	9.23	92.3
SO4	LCS	10.0	9.62	96.2
SO4	CCV_LO	1.00	0.99	98.8
SO4	CCV_MID	10.0	9.39	93.9
NH4	ICV	5.00	5.04	100.8
NH4	LCS	5.00	5.56	111.2
NH4	CCV	5.00	4.59	91.8
K	ICV	5.00	5.05	101.0
K	LCS	5.00	5.28	105.6
K	CCV	5.00	4.58	91.6

Blank Data

Analyte	Sample ID	Measured Conc. mg/L	MDL Conc. mg/L
F	ICB	< MDL	0.100
F	Prep_Blk	< MDL	0.100
F	CCB	< MDL	0.100
Cl	ICB	< MDL	0.100
Cl	Prep_Blk	< MDL	0.100
Cl	CCB	< MDL	0.100
NO3	ICB	< MDL	0.100
NO3	Prep_Blk	< MDL	0.100
NO3	CCB	< MDL	0.100
SO4	ICB	< MDL	0.100
SO4	Prep_Blk	< MDL	0.100
SO4	CCB	< MDL	0.100
NH4	ICB	< MDL	0.100
NH4	Prep_Blk	< MDL	0.100
NH4	CCB	< MDL	0.100
K	ICB	< MDL	0.100
K	Prep_Blk	< MDL	0.100
K	CCB	< MDL	0.100

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: ± 20% RPD *Spikes: ± 25%*

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC Report

Client Name: State of Colorado
Project Number: S015
Analytical Technique: Ion Chromatography
Sample Description: 47mm QMA
Report Number: 99-103

Duplicate Data

Insufficient sample to perform duplicate
and/or duplicate not required

Matrix Spike Analysis

Insufficient sample to perform matrix spike
and/or matrix spike not required

QA/QC Limits
Continuing Calibration: ± 10% *LCS: ± 20%*
Duplicates: ± 20% RPD *Spikes: ± 25%*

RPD = {(sample-duplicate)/[(sample+duplicate)/2]}x100
N/C: RPD is not calculated when sample or duplicate is below detection limit
#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

QA/QC REPORT: CARBON ANALYZER KHP STANDARD ANALYSIS

Client: Colorado APCD (Southdown)
Analytical Technique: CARBON ANALYZER
Sample Description: 47mm Quartz: Resuspensions
Chester Analysis Range: 99Q1247-99Q1249
Date: 6/25/99

Sample ID	KHP Std.Conc. µg/cm²	Measured Conc. µg/cm²	Recovery %
S2152	31.77	31.96	100.6

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
KHP = potassium hydrogen pthalate
QA/QC control limits = 90-110% recovery
% recovery = (measured conc./standard conc.) x 100

QA/QC REPORT: CARBON ANALYZER OC/EC SPLIT ANALYSIS

Client: Colorado APCD (Southdown)
Analytical Technique: CARBON ANALYZER
Sample Description: 47mm Quartz: Resuspensions
Chester Analysis Range: 99Q1247-99Q1249
Date: 6/25/99

Sample ID	Analyte	%OC Given	%OC Measured	Recovery %
R2143	% OC	62.0	72.0	116

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
QA/QC control limits = 80-120% recovery (~ ± 2s) of measured organic carbon
% recovery = (% OC measured/% OC given) x 100
% OC given determined by the average of 10 measurements of a prepared 8x10" filter

QA/QC REPORT: CARBON ANALYZER DUPLICATE ANALYSIS

Client: Colorado APCD (Southdown)
Analytical Technique: CARBON ANALYZER
Sample Description: 47mm Quartz: Resuspensions
Chester Analysis Range: 99Q1247-99Q1249
Date: 6/25/99

Sample ID	Analyte	MDL µg/cm²	Sample Conc. µg/cm²	Duplicate Conc. µg/cm²	RPD %
99-Q1247	OC	0.2	20.06	19.75	1.6
	EC	0.2	2.66	2.23	17.6
	TC	0.2	22.72	21.98	3.3

Notes:
CONCENTRATIONS ARE NOT BLANK CORRECTED
QA/QC control limits = ± 20 relative percent difference (RPD)
RPD = {(sample - duplicate)/[(sample + duplicate)/2]} x 100
OC = organic carbon; EC = elemental carbon; TC = total carbon
N/C = RPD not calculated when sample and/or duplicate is below the detection limit
= per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

Southdown
Lyons Cement Plant

June 9, 1999

Mr. Chuck Lytle
Chester Lab Net
Tigard, PA
503-624-2183

Dear Mr. Lytle:

Southdown, Inc. is cooperating with the Colorado Department of Public Health and Environment to complete a characterization of the background and process materials at our Lyons site. We have agreed to share the costs but allow the State to control all sample custody, laboratory/analytical selection, and analytical data.

Southdown will directly fund the cost of 3 bulk samples while the state pays for the analyticals on the remaining samples. Southdown is requesting the same suite of tests as requested by the Health Department for the following bulk samples:

- Sample #1: Kiln Feed
- Sample #6: Loukonen Alfalfa Field
- Sample #7: 59th Street Unpaved Road Sample

These samples will be provided to you along with specific test instructions by the State Health Department.

Please bill Southdown, Inc. for the analytical work on Samples 1, 6, & 7.
Attn. Mr. John Lohr, Plant Mgr
Southdown, Inc.
P.O. Box 529
Lyons, CO 80540

Please report all analytical results directly to the State Health Department.

Thank you in advance for your cooperation. Please call if you need confirmation of any of these requests (direct line: 303-823-2109; fax 303-823-2199).

Sincerely,

John Lohr
Plant Manager

P. O. Box 529 • Lyons, Colorado 80540
(303) 823-2100 • Fax: (303) 823-2199

Source profile analysis for CMB

CHESTER *LabNet*
12242 S.W. Garden Place, Bldg. One
Tigard, OR 97223

contact: Chuck Lytle, ph. 503 624-2183

Perform Chemical Mass Balance (CMB) profile analysis on each of 3 bulk samples (#1, #6 and #7) to be mailed by CDPHE and report results directly to CDPHE (Colorado Department of Public Health and Environment/Air Pollution Control Division, Sheila Burns, 4300 Cherry Creek Dr. South, Denver, CO 80246 (303 692-3223)):

- 1550

Resuspension onto PM10 teflon and quartz substrates	@ 100
Elemental analysis byXRF (protocol #4)	@ 50
Organic/elemental carbon by thermal/optical method	@ 40
F, Cl, NO3, SO4 by ion chromatography	@ 80
NH4, K by ion chromatography	@ 50

CHAIN OF CUSTODY RECORD – ENVIRONMENTAL SAMPLES

FACILITY	SAMPLING FIRM	SAMPLE
NAME: SouthDown, Inc.	NAME:	☐ Effluent ☐ Groundwater ☒ Solid ☐ Surface Water ☐
ADDRESS: 5134 Lite Hwy, Lyons, CO	ADDRESS:	
	SIGNATURE:	

NO.	LOCATION	DATE	TIME	WEATHER TEMP.	WEATHER PREC.	SAMPLE TYPE AND METHOD COMP.	GRAB	MECH.	MAN.	TIME CASING CLEARED	NO. OF CONTAINERS	Lab ID ~~ANALYSIS REQUIRED~~	REMARKS
1	KILN FEED	4/7/99										99-TC448 99-Q1247	Sent to Chester Lab Net 6/14/99 SB
2	~~BAGGED CEMENT~~	4/7/99											SENT TO HAZEN Research, Inc. KJG on MAY 27, 1999 under seperate COC
3	~~3RD [illegible] KILN DUST~~	4/7/99											
4	LIMESTONE	4/7/99											
5	~~CEMENT KILN DUST~~	4/7/99											SENT to HAZEN Research, Inc. KJG on MAY 27, 1999 under seperate COC
6	KEUKONEN'S PASTURE	4/7/99										99-TC449 99-Q1248	Sent to Chester Lab Net 6/14/99
7	59th STREET	4/7/99										99-TC450 99-Q1249	Sent to Chester Lab Net 6/14/99

RELINQUISHED BY (SIGNATURE) [signature]	RECEIVED BY (SIGNATURE) [signature]	DATE 4/7/99	TIME 5:30 pm	ADDITIONAL REMARKS Boulder County to CDPHE-APCD
RELINQUISHED BY (SIGNATURE) [signature]	RECEIVED BY (SIGNATURE) [signature]	DATE 4/8/99	TIME 10:00 am	CDPHE-APCD
RELINQUISHED BY (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE	TIME	

DISPATCHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY (SIGNATURE)	DATE	TIME
			[signature]	6/14/99	12:00

CARRIER	LABORATORY	
	Chester Lab Net	
ADDRESS	ADDRESS	ALL ANALYSIS PERFORMED BY EPA APPROVED PROCEDURES
	12242 SW Garden Place	☐ Yes ☐ No, explain above
METHOD OF SHIPMENT: Certified Mail	Tigard, OR 97223	

RAW DATA

Available upon request

RJ LeeGroup, Inc.

350 Hochberg Road
Monroeville, PA 15146
Tel: (724) 325-1776
Fax: (724) 733-1799

The Materials Characterization Specialists

June 25, 1999

Mr. Kevin J. Goohs
Colorado Department of Public Health and Environment
Air Pollution Control Division
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

RE: Results from CCSEM Analysis of Five PM-10 Filters
RJ Lee Group Project No. ESH906080
State of Colorado Purchase Order No. PC FAA AIR990000091

Dear Mr. Goohs:

Enclosed you will find a summary of the analytical results for the five PM-10 filter samples which we received on June 3, 1999 (reference your fax to Ms. Barbara Smith received on June 2, 1999). The samples were identified as follows:

CO Dept. of Public Health/Env. Sample ID	RJ Lee Group Inc. Sample No.	Description
057853	615023	PM-10 Quartz fiber filter
058043	615024	PM-10 Quartz fiber filter
062058	615025	PM-10 Quartz fiber filter
061391	615026	PM-10 Quartz fiber filter
063508	615027	PM-10 Quartz fiber filter

The purpose of this investigation was to provide particle size distribution and elemental data related to the particulate matter collected on the samples.

The samples were prepared using our standard techniques involving the redeposition of particulate matter onto a polycarbonate filter. The particles were analyzed by computer-controlled scanning electron microscopy (CCSEM) techniques.

Attached to this report are four tables for each sample. Table 1 reports the relative abundance of the various particle species detected during the analysis. Table 2 reports the number percent distribution by measured physical diameter, Table 3 reports the mass distribution by measured physical diameter and Table 4 reports the mass distribution by calculated aerodynamic equivalent diameter.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered by this report, RJ Lee Group will store them for a period of thirty (30) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact me.

Sincerely,

John C. Johns, Project Manager
Environmental Services

JCJ:ptb
Attachments

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799 FAX

Client_Name	Colorado DPH&E
Client_Number	057853
Project_Number	ESH906080
Sample_Number	615023
DataFiles	500946_A\615023.*

Mag	Fields
200	35.1450
800	35.6876

Table 1

Classes	#	Number %	Wt %
Si/Al/K-rich	215	18.67	23.48
Si/Al-rich	269	32.46	19.70
Si/Al/Mg-rich	106	7.96	14.56
Si-rich	120	11.87	12.60
Fe-rich	46	6.15	6.51
Si/Al/Ca-rich	49	2.95	5.58
Si/Al/Fe-rich	23	1.46	4.21
C-rich	38	2.07	4.10
Ca-rich	67	8.78	3.13
Misc.	46	6.27	2.61
Ca/S-rich	8	0.43	2.09
Al-rich	10	0.93	1.44
Totals	997	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	18.7	17.5	47.8	27.3	6.9	0.5	0.0
Si/Al-rich	32.5	30.5	49.9	15.7	3.7	0.2	0.0
Si/Al/Mg-rich	8.0	17.0	41.1	32.0	8.8	1.0	0.0
Si-rich	11.9	19.0	53.7	21.5	5.0	0.9	0.0
Fe-rich	6.2	47.3	44.3	5.9	2.3	0.2	0.0
Si/Al/Ca-rich	3.0	30.8	43.2	12.3	12.9	0.8	0.0
Si/Al/Fe-rich	1.5	25.0	37.4	25.0	10.3	2.4	0.0
C-rich	2.1	75.0	8.8	0.0	15.1	1.1	0.0
Ca-rich	8.8	20.7	76.7	0.0	2.5	0.1	0.0
Misc.	6.3	48.1	43.6	5.8	2.4	0.2	0.0
Ca/S-rich	0.4	0.0	0.0	84.0	13.3	2.7	0.0
Al-rich	0.9	52.1	0.0	39.2	8.7	0.0	0.0
Totals	100.0	27.8	48.9	17.5	5.3	0.5	0.0

RJ LeeGroup, Inc.

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Client_Name Colorado DPH&E
Client_Number 057853
Project_Number ESH906080
Sample_Number 615023
DataFiles 500946_A\615023.*

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	23.5	0.1	6.7	29.5	43.9	19.8	0.0
Si/Al-rich	19.7	0.3	10.4	34.5	40.5	14.2	0.0
Si/Al/Mg-rich	14.6	0.1	4.8	26.5	37.8	30.9	0.0
Si-rich	12.6	0.1	7.0	24.3	36.1	32.5	0.0
Fe-rich	6.5	0.8	7.6	13.2	33.9	44.5	0.0
Si/Al/Ca-rich	5.6	0.2	4.2	6.7	66.4	22.5	0.0
Si/Al/Fe-rich	4.2	0.1	1.2	19.0	36.4	43.3	0.0
C-rich	4.1	0.1	0.2	0.0	29.0	70.7	0.0
Ca-rich	3.1	0.9	25.1	0.0	61.1	13.0	0.0
Misc.	2.6	1.2	16.0	35.7	31.8	15.3	0.0
Ca/S-rich	2.1	0.0	0.0	35.4	19.1	45.4	0.0
Al-rich	1.4	0.0	0.0	55.6	44.4	0.0	0.0
Totals	100.0	0.2	7.2	25.2	40.7	26.7	0.0

Table 4 - Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	23.5	0.0	2.7	19.5	44.6	27.0	6.2
Si/Al-rich	19.7	0.0	4.0	23.3	48.7	23.9	0.0
Si/Al/Mg-rich	14.6	0.0	1.4	15.4	39.9	35.3	8.0
Si-rich	12.6	0.1	3.7	18.0	32.7	45.5	0.0
Fe-rich	6.5	0.1	3.2	5.1	17.1	30.0	44.5
Si/Al/Ca-rich	5.6	0.0	1.0	10.1	36.0	52.9	0.0
Si/Al/Fe-rich	4.2	0.0	0.6	0.7	30.3	68.4	0.0
C-rich	4.1	0.1	0.2	0.0	29.0	8.4	62.3
Ca-rich	3.1	0.0	11.4	14.6	36.5	37.5	0.0
Misc.	2.6	0.2	4.8	12.2	60.9	21.9	0.0
Ca/S-rich	2.1	0.0	0.0	8.5	27.9	63.6	0.0
Al-rich	1.4	0.0	0.0	12.8	64.2	23.0	0.0
Totals	100.0	0.0	2.9	15.7	39.8	33.4	8.1

RJ LeeGroup, Inc.

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724/325-1776 • 724/733-1799-FAX

Client_Name	Colorado DPH&E
Client_Number	058043
Project_Number	ESH906080
Sample_Number	615024
DataFiles	500944_A\615024.*

Mag	Fields
200	65.7267
800	31.8207

Table 1

Classes	#	Number %	Wt %
Si/Al/K-rich	218	14.30	24.16
Si/Al-rich	252	29.01	20.03
Si/Al/Mg-rich	122	6.54	18.72
Si-rich	143	20.70	13.12
Si/Al/Ca-rich	72	4.02	9.16
Ca-rich	58	8.27	4.46
Si/Al/Fe-rich	24	1.69	3.13
Ca/S-rich	6	0.21	1.84
Fe-rich	18	2.69	1.49
C-rich	45	7.80	1.28
Al-rich	7	0.40	1.13
Misc.	29	3.85	1.12
Ca/Mg-rich	3	0.53	0.36
Totals	997	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	14.3	21.0	48.6	24.9	5.3	0.2	0.0
Si/Al-rich	29.0	44.6	43.6	9.8	1.9	0.1	0.0
Si/Al/Mg-rich	6.5	10.9	54.6	27.3	6.9	0.3	0.0
Si-rich	20.7	62.6	24.1	12.1	1.1	0.1	0.0
Si/Al/Ca-rich	4.0	8.9	44.4	39.9	6.8	0.0	0.0
Ca-rich	8.3	32.4	56.1	10.8	0.8	0.0	0.0
Si/Al/Fe-rich	1.7	31.7	42.3	21.2	4.2	0.6	0.0
Ca/S-rich	0.2	0.0	0.0	86.9	10.5	2.6	0.0
Fe-rich	2.7	26.5	72.9	0.0	0.4	0.2	0.0
C-rich	7.8	96.7	2.3	0.0	0.8	0.1	0.0
Al-rich	0.4	48.4	0.0	44.9	6.8	0.0	0.0
Misc.	3.8	66.4	32.4	0.0	1.1	0.0	0.0
Ca/Mg-rich	0.5	66.7	0.0	33.3	0.0	0.0	0.0
Totals	100.0	44.5	38.7	14.1	2.6	0.1	0.0

RJ LeeGroup, Inc.

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724/325-1776 • 724/733-1799 FAX

Client_Name Colorado DPH&E
Client_Number 058043
Project_Number ESH906080
Sample_Number 615024
DataFiles 500944_A\615024.*

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	24.2	0.2	7.9	31.4	50.7	9.8	0.0
Si/Al-rich	20.0	0.8	15.7	26.1	40.9	16.5	0.0
Si/Al/Mg-rich	18.7	0.1	6.9	30.2	50.9	11.9	0.0
Si-rich	13.1	0.8	7.4	40.8	22.4	28.6	0.0
Si/Al/Ca-rich	9.2	0.0	6.0	44.7	49.3	0.0	0.0
Ca-rich	4.5	1.0	36.0	39.9	23.1	0.0	0.0
Si/Al/Fe-rich	3.1	0.1	4.6	32.6	33.1	29.5	0.0
Ca/S-rich	1.8	0.0	0.0	20.4	22.2	57.4	0.0
Fe-rich	1.5	1.4	55.7	0.0	18.2	24.7	0.0
C-rich	1.3	3.0	2.0	0.0	44.7	50.3	0.0
Al-rich	1.1	0.0	0.0	66.8	33.2	0.0	0.0
Misc.	1.1	5.7	21.0	0.0	73.4	0.0	0.0
Ca/Mg-rich	0.4	3.7	0.0	96.3	0.0	0.0	0.0
Totals	100.0	0.5	10.7	32.2	41.9	14.6	0.0

Table 4 - Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	24.2	0.0	3.1	25.5	41.5	29.9	0.0
Si/Al-rich	20.0	0.2	9.5	20.8	37.2	22.5	9.8
Si/Al/Mg-rich	18.7	0.0	2.0	13.5	42.5	42.0	0.0
Si-rich	13.1	0.4	5.5	23.8	35.3	12.3	22.7
Si/Al/Ca-rich	9.2	0.0	2.0	33.0	44.6	20.4	0.0
Ca-rich	4.5	0.4	9.5	55.4	24.9	9.8	0.0
Si/Al/Fe-rich	3.1	0.1	2.4	13.0	50.5	33.9	0.0
Ca/S-rich	1.8	0.0	0.0	0.0	27.8	14.7	57.4
Fe-rich	1.5	0.4	13.7	43.1	4.6	38.3	0.0
C-rich	1.3	1.7	3.3	0.0	44.7	50.3	0.0
Al-rich	1.1	0.0	0.0	0.0	82.2	17.8	0.0
Misc.	1.1	0.9	15.6	10.1	18.4	54.9	0.0
Ca/Mg-rich	0.4	0.0	3.7	96.3	0.0	0.0	0.0
Totals	100.0	0.2	4.9	23.0	39.1	26.9	6.0

RJ LeeGroup, Inc.

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Client_Name	Colorado DPH&E
Client_Number	062058
Project_Number	ESH906080
Sample_Number	615025
DataFiles	500944_B\615025.*

Mag	Fields
200	105.2622
800	58.9183

Table 1

Classes	#	Number %	Wt %
Si/Al/K-rich	262	20.70	26.71
Si/Al-rich	215	24.37	23.27
Si/Al/Mg-rich	186	15.19	19.45
Si-rich	147	17.54	10.43
Fe-rich	45	6.11	7.50
Si/Al/Ca-rich	48	4.39	5.91
Si/Al/Fe-rich	34	2.84	2.60
Ca/S-rich	16	2.87	1.23
Ca-rich	16	1.49	0.98
Misc.	19	3.56	0.93
Ca/Mg-rich	5	0.38	0.78
Al-rich	3	0.19	0.20
C-rich	2	0.36	0.00
Totals	998	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	20.7	14.2	53.2	27.9	4.6	0.0	0.0
Si/Al-rich	24.4	29.5	40.0	28.2	2.2	0.1	0.0
Si/Al/Mg-rich	15.2	31.0	39.2	25.0	4.7	0.2	0.0
Si-rich	17.5	42.2	43.2	12.4	2.2	0.0	0.0
Fe-rich	6.1	60.1	32.5	5.9	1.4	0.1	0.0
Si/Al/Ca-rich	4.4	26.3	45.2	24.7	3.5	0.3	0.0
Si/Al/Fe-rich	2.8	19.4	57.3	19.1	4.0	0.2	0.0
Ca/S-rich	2.9	67.9	12.6	18.9	0.7	0.0	0.0
Ca-rich	1.5	24.2	72.5	0.0	3.4	0.0	0.0
Misc.	3.6	49.1	50.7	0.0	0.0	0.2	0.0
Ca/Mg-rich	0.4	0.0	47.5	47.5	5.0	0.0	0.0
Al-rich	0.2	93.5	0.0	0.0	6.5	0.0	0.0
C-rich	0.4	100.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	32.2	43.3	21.3	3.1	0.1	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799 FAX

Client_Name Colorado DPH&E
Client_Number 062058
Project_Number ESH906080
Sample_Number 615025
DataFiles 500944_B\615025.*

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	26.7	0.1	10.4	48.1	40.3	1.0	0.0
Si/Al-rich	23.3	0.3	8.8	61.0	26.6	3.3	0.0
Si/Al/Mg-rich	19.4	0.1	6.7	29.4	49.3	14.5	0.0
Si-rich	10.4	0.4	16.2	54.8	26.5	2.1	0.0
Fe-rich	7.5	0.9	9.8	42.8	41.3	5.3	0.0
Si/Al/Ca-rich	5.9	0.2	7.1	42.6	33.7	16.3	0.0
Si/Al/Fe-rich	2.6	0.1	17.7	27.7	42.2	12.3	0.0
Ca/S-rich	1.2	2.8	5.2	69.2	22.7	0.0	0.0
Ca-rich	1.0	0.7	22.1	0.0	77.2	0.0	0.0
Misc.	0.9	2.8	49.0	0.0	0.0	48.3	0.0
Ca/Mg-rich	0.8	0.0	10.7	37.0	52.2	0.0	0.0
Al-rich	0.2	1.5	0.0	0.0	98.5	0.0	0.0
C-rich	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.3	10.3	46.1	37.1	6.2	0.0

Table 4 - Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/K-rich	26.7	0.0	3.4	26.7	55.6	14.3	0.0
Si/Al-rich	23.3	0.1	3.4	25.7	58.0	12.8	0.0
Si/Al/Mg-rich	19.4	0.0	3.4	20.5	37.1	39.0	0.0
Si-rich	10.4	0.2	5.9	31.1	58.7	4.1	0.0
Fe-rich	7.5	0.2	2.9	7.6	46.2	43.1	0.0
Si/Al/Ca-rich	5.9	0.1	3.5	15.4	48.7	32.4	0.0
Si/Al/Fe-rich	2.6	0.1	7.6	37.8	42.2	12.3	0.0
Ca/S-rich	1.2	0.0	8.0	42.0	32.6	17.4	0.0
Ca-rich	1.0	0.1	12.8	9.9	35.8	41.4	0.0
Misc.	0.9	0.5	13.0	38.3	0.0	48.3	0.0
Ca/Mg-rich	0.8	0.0	0.0	47.8	8.2	44.1	0.0
Al-rich	0.2	0.0	1.5	0.0	23.5	75.0	0.0
C-rich	0.0	3.3	96.7	0.0	0.0	0.0	0.0
Totals	100.0	0.1	3.9	24.2	50.0	21.8	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799 FAX

Client_Name	Colorado DPH&E
Client_Number	061391
Project_Number	ESH906080
Sample_Number	615026
DataFiles	500944_C\615026.*

Mag	Fields
200	99.6760
800	31.0862

Table 1

Classes	#	Number %	Wt %
Si/Al/Mg-rich	290	24.98	34.46
Si/Al/K-rich	206	11.61	16.62
Si/Al-rich	199	25.90	16.06
Fe-rich	30	1.98	13.00
Si-rich	91	10.41	6.42
Si/Al/Ca-rich	50	4.59	3.58
Ca-rich	46	7.39	3.48
Ca/S-rich	27	4.39	2.45
Si/Al/Fe-rich	27	2.53	1.65
Ca/Mg-rich	13	2.47	1.32
Misc.	17	3.55	0.87
Al-rich	2	0.19	0.10
Totals	998	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/Mg-rich	25.0	16.2	56.3	25.1	2.3	0.1	0.0
Si/Al/K-rich	11.6	28.1	45.8	21.3	4.7	0.1	0.0
Si/Al-rich	25.9	31.5	52.9	14.7	1.0	0.0	0.0
Fe-rich	2.0	67.4	28.9	0.0	2.1	1.7	0.0
Si-rich	10.4	25.6	58.4	14.6	1.2	0.2	0.0
Si/Al/Ca-rich	4.6	31.4	45.6	20.7	2.3	0.0	0.0
Ca-rich	7.4	32.7	56.6	10.3	0.4	0.1	0.0
Ca/S-rich	4.4	13.0	78.0	8.7	0.3	0.0	0.0
Si/Al/Fe-rich	2.5	52.5	37.5	7.5	2.5	0.0	0.0
Ca/Mg-rich	2.5	23.1	69.2	7.7	0.0	0.0	0.0
Misc.	3.6	83.8	16.0	0.0	0.0	0.1	0.0
Al-rich	0.2	98.1	0.0	0.0	1.9	0.0	0.0
Totals	100.0	28.9	52.7	16.5	1.7	0.1	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	Colorado DPH&E
Client_Number	061391
Project_Number	ESH906080
Sample_Number	615026
DataFiles	500944_C\615026.*

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/Mg-rich	34.5	0.2	14.5	49.9	26.8	8.6	0.0
Si/Al/K-rich	16.6	0.2	9.5	40.5	45.6	4.2	0.0
Si/Al-rich	16.1	1.0	23.8	52.1	20.0	3.2	0.0
Fe-rich	13.0	0.2	4.0	0.0	14.5	81.2	0.0
Si-rich	6.4	0.5	23.9	34.6	21.6	19.4	0.0
Si/Al/Ca-rich	3.6	0.4	13.6	45.6	40.3	0.0	0.0
Ca-rich	3.5	1.8	24.6	44.2	16.8	12.6	0.0
Ca/S-rich	2.5	1.1	37.6	51.6	9.7	0.0	0.0
Si/Al/Fe-rich	1.7	0.9	14.8	47.2	37.1	0.0	0.0
Ca/Mg-rich	1.3	1.1	49.0	49.9	0.0	0.0	0.0
Misc.	0.9	5.5	10.6	0.0	0.0	83.9	0.0
Al-rich	0.1	7.2	0.0	0.0	92.8	0.0	0.0
Totals	100.0	0.5	15.7	40.4	26.3	17.1	0.0

Table 4 - Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/Mg-rich	34.5	0.0	4.5	28.4	46.3	18.3	2.4
Si/Al/K-rich	16.6	0.0	3.4	28.4	50.1	18.1	0.0
Si/Al-rich	16.1	0.1	9.7	43.7	37.6	8.9	0.0
Fe-rich	13.0	0.1	0.4	3.8	0.0	17.3	78.4
Si-rich	6.4	0.1	14.0	44.9	20.2	20.8	0.0
Si/Al/Ca-rich	3.6	0.0	7.3	37.0	41.4	14.3	0.0
Ca-rich	3.5	0.1	14.8	34.7	26.0	24.4	0.0
Ca/S-rich	2.5	0.0	16.3	22.4	56.4	4.9	0.0
Si/Al/Fe-rich	1.7	0.1	6.8	8.8	80.6	3.7	0.0
Ca/Mg-rich	1.3	0.2	9.0	40.9	49.9	0.0	0.0
Misc.	0.9	0.6	15.5	0.0	0.0	0.0	83.9
Al-rich	0.1	0.0	7.2	0.0	0.0	92.8	0.0
Totals	100.0	0.1	6.2	28.7	37.4	16.0	11.7

RJ LeeGroup, Inc.

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724/325-1776 • 724/733-1799 FAX

Client_Name	Colorado DPH&E
Client_Number	063508
Project_Number	ESH906080
Sample_Number	615027
DataFiles	500944_D\615027.*

Mag	Fields
200	198.0000
800	87.5042

Table 1

Classes	#	Number %	Wt %
Si/Al/Mg-rich	254	23.19	29.60
Si/Al/K-rich	219	19.71	24.63
Si/Al-rich	183	22.98	14.46
Fe-rich	34	3.10	8.54
Si-rich	115	12.13	7.15
Si/Al/Fe-rich	37	3.37	6.34
Si/Al/Ca-rich	40	4.09	4.29
Ca-rich	35	4.98	2.97
Ca/S-rich	8	1.10	1.35
Misc.	19	4.62	0.40
Ca/Mg-rich	4	0.55	0.21
Al-rich	2	0.19	0.05
Totals	950	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

		0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Classes	Number %						
Si/Al/Mg-rich	23.2	38.0	40.0	18.8	3.0	0.2	0.0
Si/Al/K-rich	19.7	29.7	41.5	25.8	3.0	0.1	0.0
Si/Al-rich	23.0	34.5	47.5	16.6	1.4	0.0	0.0
Fe-rich	3.1	50.2	41.0	5.9	2.1	0.8	0.0
Si-rich	12.1	31.8	51.0	15.0	2.2	0.0	0.0
Si/Al/Fe-rich	3.4	32.4	43.2	21.6	2.5	0.3	0.0
Si/Al/Ca-rich	4.1	17.8	53.3	26.7	2.2	0.0	0.0
Ca-rich	5.0	48.1	40.1	10.9	0.8	0.0	0.0
Ca/S-rich	1.1	0.0	49.5	49.5	0.9	0.0	0.0
Misc.	4.6	76.4	23.6	0.0	0.0	0.0	0.0
Ca/Mg-rich	0.6	0.0	99.1	0.0	0.9	0.0	0.0
Al-rich	0.2	97.3	0.0	0.0	2.7	0.0	0.0
Totals	100.0	35.9	43.6	18.2	2.2	0.1	0.0

RJ LeeGroup, Inc.

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724/325-1776 • 724/733-1799-FAX

Client_Name Colorado DPH&E
Client_Number 063508
Project_Number ESH906080
Sample_Number 615027
DataFiles 500944_D\615027.*

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/Mg-rich	29.6	0.2	11.6	44.6	29.5	14.0	0.0
Si/Al/K-rich	24.6	0.2	11.3	54.7	30.3	3.4	0.0
Si/Al-rich	14.5	0.7	22.5	50.5	23.9	2.5	0.0
Fe-rich	8.5	0.4	5.6	2.2	26.4	65.4	0.0
Si-rich	7.2	0.4	19.9	37.5	38.1	4.1	0.0
Si/Al/Fe-rich	6.3	0.1	7.9	33.9	20.6	37.5	0.0
Si/Al/Ca-rich	4.3	0.1	14.6	52.2	33.1	0.0	0.0
Ca-rich	3.0	1.0	25.4	58.6	15.0	0.0	0.0
Ca/S-rich	1.3	0.0	5.7	76.1	18.2	0.0	0.0
Misc.	0.4	8.1	91.9	0.0	0.0	0.0	0.0
Ca/Mg-rich	0.2	0.0	75.9	0.0	24.1	0.0	0.0
Al-rich	0.0	2.3	0.0	0.0	97.7	0.0	0.0
Totals	100.0	0.4	13.9	44.0	28.2	13.6	0.0

Table 4 - Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 50.0
Si/Al/Mg-rich	29.6	0.0	2.7	14.2	59.3	21.7	2.0
Si/Al/K-rich	24.6	0.0	2.9	26.0	57.8	13.3	0.0
Si/Al-rich	14.5	0.1	10.0	44.4	37.7	7.8	0.0
Fe-rich	8.5	0.1	1.4	4.5	3.8	42.7	47.5
Si-rich	7.2	0.2	11.5	42.4	30.6	15.4	0.0
Si/Al/Fe-rich	6.3	0.1	0.7	21.1	32.7	14.2	31.3
Si/Al/Ca-rich	4.3	0.0	8.6	43.2	38.9	9.3	0.0
Ca-rich	3.0	0.2	6.4	26.2	67.2	0.0	0.0
Ca/S-rich	1.3	0.0	5.7	21.1	59.8	13.4	0.0
Misc.	0.4	1.8	34.9	63.3	0.0	0.0	0.0
Ca/Mg-rich	0.2	0.0	75.9	0.0	24.1	0.0	0.0
Al-rich	0.0	2.3	0.0	0.0	97.7	0.0	0.0
Totals	100.0	0.1	4.9	24.9	46.4	17.0	6.6

HAZEN

Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501
FAX: (303) 278-1528

July 14, 1999

Kevin Goohs
Colorado Department of Public Health and Environment
APCD-TS-B1
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Dear Mr. Goohs:

Enclosed you will find a revised report for the x-ray diffraction analysis that was originally reported to you on June 25, 1999. While analyzing another set of similar samples, our spectroscopist found that there is an interference on the cristobalite peak caused by plagioclase feldspar. This caused the cristobalite concentration to be over-estimated.

If you have any questions about this, or if I can be of any other help, please contact me.

Sincerely,

Robert Rostad
Manager
General Analytical

002-1AE
F018/99

MEMORANDUM

TO: John Jarvis

FROM: Bob Johnson

DATE: June 11, 1999 **Revised July 14, 1999**

RE: HRI Project 002-1AE XRD Analysis for crystalline silica
HRI Control No. F18/99

A sample of bagged cement and cement kiln dust were analyzed by XRD to determine the amounts of crystalline silica present. Quartz, cristobalite and tridymite are the three forms of silica that were analyzed for.

If the amount of quartz is less than about 0.5%, it can be determined quantitatively by comparing an unspiked sample to a sample spiked with a known amount of finely pulverized quartz and mixing in a slurry of acetone to get good dispersion. If the amount is greater than 0.5%, Chung's[1] matrix flushing method using corundum as a flushing agent gives better results.

The samples were first scanned over the peaks of interest at a normal rate to get a rough idea of the amounts of silica present. The bagged cement had less than 0.5% quartz, so it was analyzed with the spiking technique. The kiln dust sample appeared to have about 5% quartz, so Chung's method was used on this sample. In the final analysis using these procedures the samples were scanned very slowly over the peaks of interest to reduce the "noise" in the patterns and improve the detection limits. An estimate of the cristobalite and tridymite content was made from published reference intensity ratios.

The XRD pattern of the kiln dust showed that it consists primarily of lime and calcite. Cristobalite and tridymite were not detected, so in an effort to increase the detection limits of cristobalite and tridymite, a portion of this sample was leached with a dilute acetic acid solution buffered with sodium acetate to dissolve the lime and calcite concentrating any silica in the residue. As a check on the quartz analysis Chung's method was also used on the residue and the results calculated based on the original sample weight. The two results compared favorably as shown in Table 1.

[1] Chung, F.H., *Journal of Applied Crystallography*, 1974 vol 7, pgs 519-525

Table 1

	weight %		
	Quartz	Cristobalite	Tridymite
Bagged Cement	0.1 to 0.2 [2]	<0.3	2-3
Cement Kiln Dust	4.4	N.D.	N.D.
Cement Kiln Dust (based on analysis of Residue)	4.3	<0.05	<0.2
Cement Kiln Dust Residue[3]	26	<0.3	<1.1

N.D. = not detected

Revision Note:

In the original report of these analyses (Memo dated June 11, 1999) 0.1% cristobalite was reported in the Cement Kiln Dust sample based on 0.6% found in the residue after concentrating the sample by leaching out the acid soluble components. While running a subsequent set of samples (Samples 1, 6 and 7), it was realized that a minor peak of the plagioclase feldspar that is present in those samples interferes with the cristobalite peak. There is less of the feldspar in the Cement Kiln Dust sample reported above, and the interference was not noticed previously. Consequently there is no cristobalite detected in the Cement Kiln Dust sample.

[2] There is a minor tridymite peak that could potentially interfere with the quartz peak, but it may be too weak to actually contribute. If the peak in the sample pattern is due to tridymite, then the amount of quartz is less than 0.1%, but to be on the safe side it is assumed that the peak is due to quartz in which case the quartz content is about 0.1 to 0.2%.

[3] 2.00g Kiln dust produced 0.332g leach residue concentrating the quartz, cristobalite and tridymite by a factor of 6.0.

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	June 25, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F018/99
DATE REC'D	5/28/99
CUST. P.O.#	PC FAA AIR99000095

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F018/99-1

SAMPLE IDENTIFICATION: SouthDown, Inc. Bagged Cement - 04/07/99

Arsenic, ppm	17.8
Barium, %	0.051
Bicarbonate as HCO3, % **	<0.05
Cadmium, %	<0.001
Carbonate as CO3, % **	<0.05
Chromium, %	<0.001
Gross Alpha (+-Precision*), pCi/g	18(+-10)
Gross Beta (+-Precision*), pCi/g	9.7(+-6.7)
Gross Gamma (Ra-226 Equiv.)(+-Precision*), pCi/g	3.8(+-0.7)
Hydroxide as OH, % **	0.38
Lead, %	0.002
Mercury, ppm	<0.1
pH of a 1:5 extract	12.1
Selenium, ppm	2
Silver, %	<0.0002
Specific Gravity	3.21

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	June 25, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F018/99
DATE REC'D	5/28/99
CUST. P.O.#	PC FAA AIR99000095

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F018/99-2

SAMPLE IDENTIFICATION: SouthDown, Inc. Cement Kiln Dust - 04/07/99

Arsenic, ppm	16.2
Barium, %	0.044
Bicarbonate as HCO3, % **	<0.05
Cadmium, %	0.003
Carbonate as CO3, % **	<0.05
Chromium, %	<0.001
Gross Alpha (+-Precision*), pCi/g	31(+-10)
Gross Beta (+-Precision*), pCi/g	28(+-7)
Gross Gamma (Ra-226 Equiv.)(+-Precision*), pCi/g	5.4(+-1.5)
Hydroxide as OH, % **	0.33
Lead, %	0.006
Mercury, ppm	<0.1
pH of a 1:5 extract	12.1
Selenium, ppm	64
Silver, %	<0.0002
Specific Gravity	2.54

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

HAZEN RESEARCH, INC.
Quantachrome Microscan
Particle Size Analysis by Sedimentation

SUBMITTER:	CDH	DATE:	June 4, 1999
HRI PROJECT:	002-1AE	SEDIMENTATION FLUID:	Ethyl Alcohol
SAMPLE ID:	F18/99-1	FLUID TEMP.:	30 deg.C
SAMPLE DENS.:	3.2100 g/cc	FLUID DENS.:	0.7810 g/cc
ANALYST:	L. Weeks	FLUID VISC.:	0.9909 centipoise

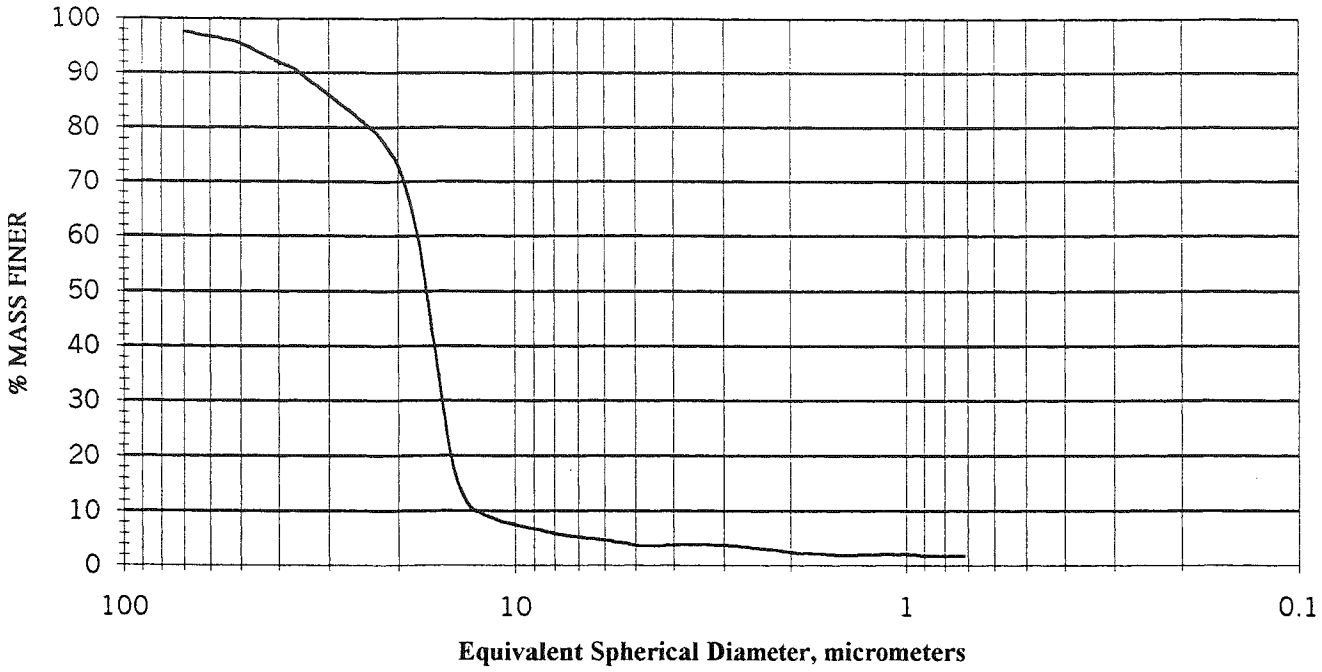
SAMPLE DESCRIPTION: Bagged Cement 4/7/99
COMMENTS:

Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer
70.00	97.63	32.00	87.65	14.62	20.59	6.68	5.12	3.06	3.81	1.40	1.94
68.41	97.57	31.27	87.06	14.29	17.49	6.53	5.03	2.99	3.78	1.36	1.96
66.85	97.48	30.56	86.48	13.97	15.09	6.38	5.01	2.92	3.72	1.33	1.97
65.33	97.30	29.86	85.97	13.65	13.35	6.24	4.94	2.85	3.66	1.30	2.00
63.84	97.12	29.18	85.38	13.34	11.99	6.10	4.81	2.79	3.60	1.27	2.06
62.39	96.94	28.52	84.74	13.03	10.96	5.96	4.75	2.72	3.52	1.24	2.06
60.97	96.85	27.87	84.28	12.74	10.28	5.82	4.63	2.66	3.45	1.22	2.05
59.58	96.74	27.23	83.78	12.45	9.79	5.69	4.49	2.60	3.40	1.19	2.05
58.22	96.60	26.61	83.27	12.16	9.56	5.56	4.39	2.54	3.30	1.16	2.09
56.90	96.52	26.01	82.69	11.89	9.27	5.43	4.34	2.48	3.24	1.14	2.09
55.60	96.34	25.42	81.98	11.62	9.03	5.31	4.25	2.43	3.17	1.11	2.13
54.34	96.23	24.84	81.39	11.35	8.78	5.19	4.03	2.37	3.10	1.08	2.13
53.10	96.13	24.27	80.81	11.09	8.49	5.07	3.89	2.32	3.06	1.06	2.08
51.89	95.98	23.72	80.25	10.84	8.22	4.96	3.78	2.27	2.94	1.04	2.12
50.71	95.76	23.18	79.74	10.59	8.08	4.84	3.67	2.21	2.88	1.01	2.12
49.56	95.47	22.65	79.11	10.35	7.95	4.73	3.61	2.16	2.82	0.99	2.10
48.43	95.17	22.14	78.29	10.12	7.76	4.62	3.60	2.11	2.70	0.97	2.08
47.33	94.79	21.63	77.32	9.89	7.51	4.52	3.59	2.07	2.66	0.94	1.99
46.25	94.35	21.14	76.34	9.66	7.33	4.42	3.60	2.02	2.54	0.92	1.95
45.20	93.98	20.66	75.25	9.44	7.18	4.32	3.63	1.97	2.45	0.90	1.82
44.17	93.62	20.19	73.88	9.23	7.03	4.22	3.77	1.93	2.38	0.88	1.75
43.16	93.31	19.73	72.12	9.02	6.87	4.12	3.77	1.88	2.30	0.86	1.77
42.18	92.94	19.28	70.18	8.81	6.74	4.03	3.83	1.84	2.27	0.84	1.72
41.22	92.64	18.84	67.75	8.61	6.54	3.94	3.88	1.80	2.25	0.82	1.75
40.28	92.29	18.41	65.01	8.42	6.36	3.85	3.91	1.76	2.20	0.80	1.74
39.36	91.94	17.99	61.86	8.22	6.19	3.76	3.90	1.72	2.17	0.79	1.80
38.47	91.68	17.58	58.01	8.04	6.01	3.67	3.90	1.68	2.15	0.77	1.83
37.59	91.34	17.18	53.56	7.85	5.84	3.59	3.91	1.64	2.11	0.75	1.85
36.74	90.94	16.79	48.73	7.68	5.72	3.51	3.92	1.60	2.09	0.73	1.82
35.90	90.50	16.41	43.69	7.50	5.61	3.43	3.91	1.57	1.99	0.72	1.85
35.08	89.95	16.04	38.67	7.33	5.48	3.35	3.92	1.53	1.97	0.67	1.12
34.28	89.39	15.67	33.56	7.16	5.42	3.27	3.90	1.50	1.95		
33.50	88.73	15.31	28.89	7.00	5.37	3.20	3.85	1.46	1.92		
32.74	88.23	14.97	24.39	6.84	5.24	3.13	3.83	1.43	1.93		

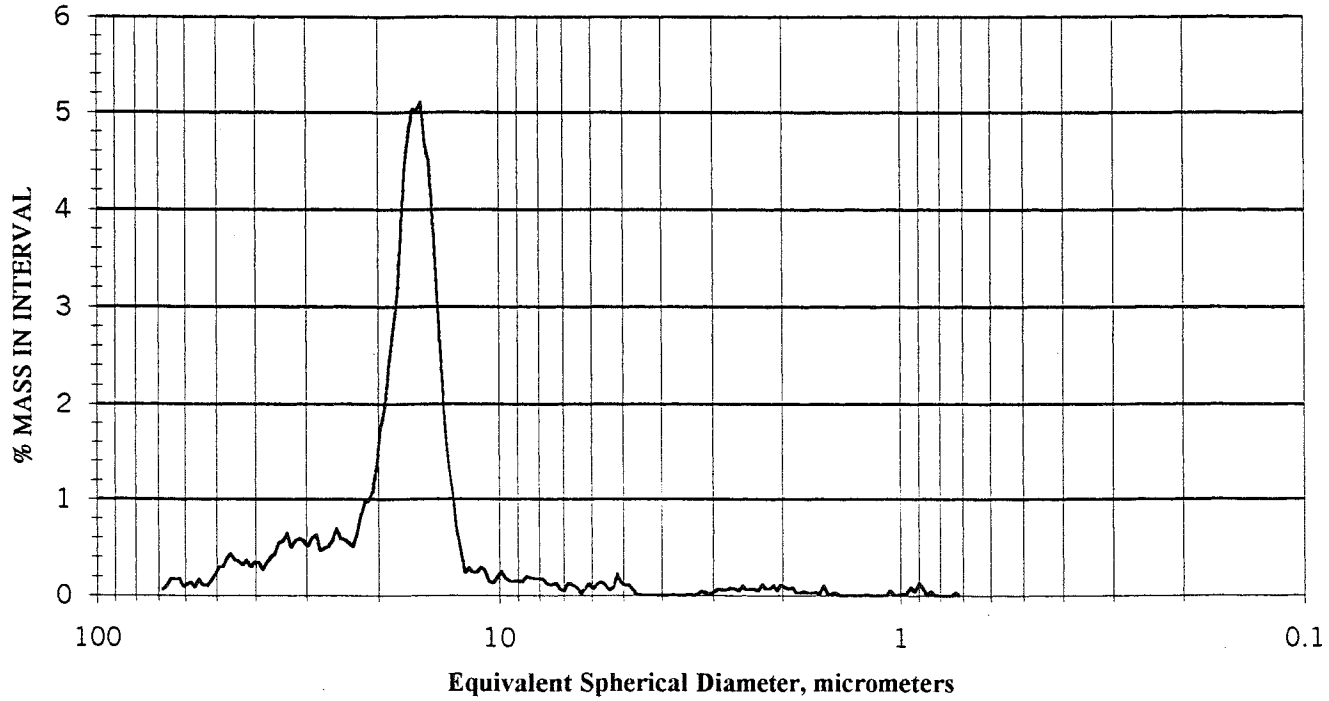
Hazen Research, Inc., Particle Size Analysis by Sedimentation
June 4, 1999

Sample ID: F18/99-1 HRI Project: 002-1AE
Sample Desc.: Bagged Cement 4/7/99

MASS DISTRIBUTION



MASS POPULATION vs DIAMETER



HAZEN RESEARCH, INC.
Quantachrome Microscan
Particle Size Analysis by Sedimentation

SUBMITTER:	CDH	DATE:	June 4, 1999
HRI PROJECT:	002-1AE	SEDIMENTATION FLUID:	Ethyl Alcohol
SAMPLE ID:	F18/99-2	FLUID TEMP.:	30 deg.C
SAMPLE DENS.:	2.5400 g/cc	FLUID DENS.:	0.7810 g/cc
ANALYST:	L. Weeks	FLUID VISC.:	0.9909 centipoise

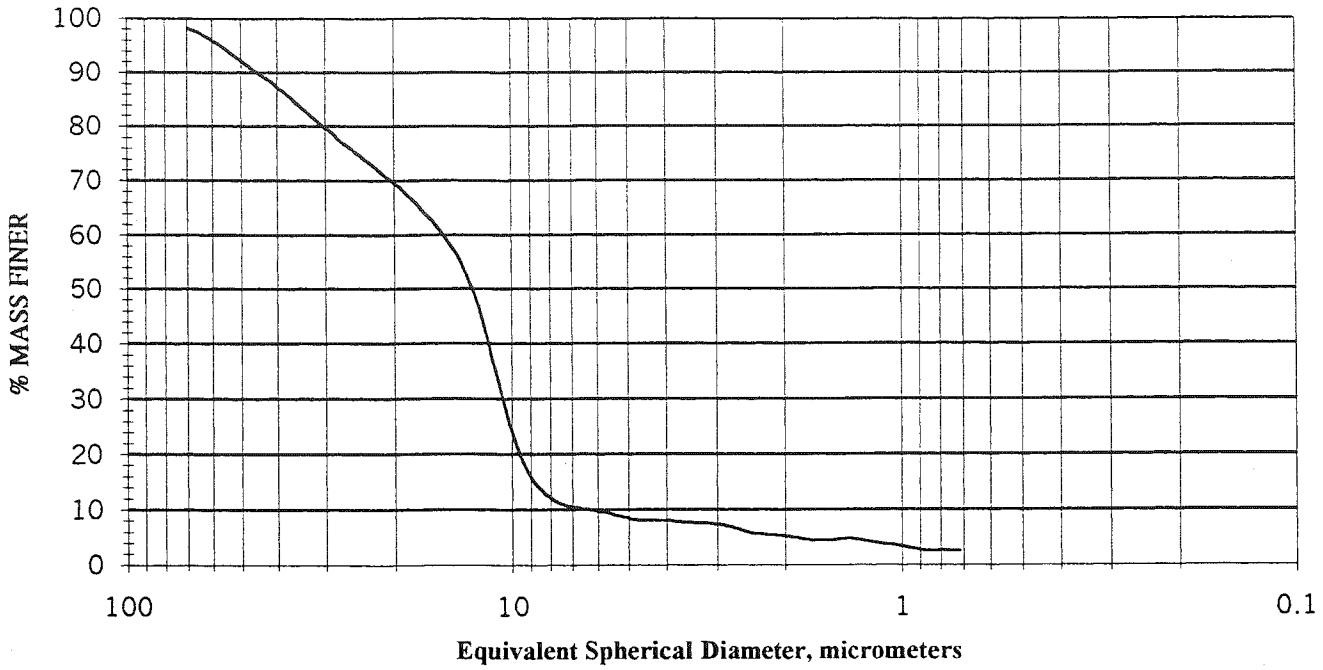
SAMPLE DESCRIPTION: Cement Kiln Dust 4/7/99
COMMENTS:

Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer
70.00	98.13	32.00	81.44	14.62	59.24	6.68	10.31	3.06	7.49	1.40	4.77
68.41	97.96	31.27	80.83	14.29	58.17	6.53	10.20	2.99	7.40	1.36	4.82
66.85	97.75	30.56	80.23	13.97	57.04	6.38	10.12	2.92	7.33	1.33	4.81
65.33	97.51	29.86	79.64	13.65	55.92	6.24	10.00	2.85	7.13	1.30	4.71
63.84	97.17	29.18	79.10	13.34	54.51	6.10	9.92	2.79	7.01	1.27	4.60
62.39	96.79	28.52	78.49	13.03	52.86	5.96	9.84	2.72	6.82	1.24	4.48
60.97	96.34	27.87	77.85	12.74	51.09	5.82	9.72	2.66	6.66	1.22	4.33
59.58	95.87	27.23	77.26	12.45	49.24	5.69	9.53	2.60	6.39	1.19	4.20
58.22	95.45	26.61	76.72	12.16	47.17	5.56	9.30	2.54	6.16	1.16	4.13
56.90	95.08	26.01	76.17	11.89	44.75	5.43	9.16	2.48	5.99	1.14	4.02
55.60	94.53	25.42	75.66	11.62	42.16	5.31	8.98	2.43	5.84	1.11	3.85
54.34	94.10	24.84	75.08	11.35	39.34	5.19	8.77	2.37	5.73	1.08	3.81
53.10	93.57	24.27	74.55	11.09	36.44	5.07	8.64	2.32	5.72	1.06	3.74
51.89	93.07	23.72	73.93	10.84	33.56	4.96	8.39	2.27	5.64	1.04	3.62
50.71	92.59	23.18	73.41	10.59	30.75	4.84	8.24	2.21	5.57	1.01	3.49
49.56	92.08	22.65	72.86	10.35	27.99	4.73	8.15	2.16	5.46	0.99	3.37
48.43	91.58	22.14	72.24	10.12	25.35	4.62	8.11	2.11	5.45	0.97	3.20
47.33	91.02	21.63	71.72	9.89	22.86	4.52	8.08	2.07	5.45	0.94	3.07
46.25	90.52	21.14	71.11	9.66	20.74	4.42	8.08	2.02	5.40	0.92	2.95
45.20	90.10	20.66	70.56	9.44	18.97	4.32	8.04	1.97	5.28	0.90	2.85
44.17	89.54	20.19	69.90	9.23	17.49	4.22	8.08	1.93	5.20	0.88	2.73
43.16	89.09	19.73	69.26	9.02	16.17	4.12	8.10	1.88	5.04	0.86	2.63
42.18	88.67	19.28	68.72	8.81	15.10	4.03	8.10	1.84	4.93	0.84	2.61
41.22	88.19	18.84	68.06	8.61	14.12	3.94	8.01	1.80	4.76	0.82	2.66
40.28	87.62	18.41	67.41	8.42	13.37	3.85	7.95	1.76	4.64	0.80	2.67
39.36	87.02	17.99	66.76	8.22	12.72	3.76	7.87	1.72	4.55	0.79	2.68
38.47	86.48	17.58	65.99	8.04	12.23	3.67	7.83	1.68	4.46	0.77	2.64
37.59	85.88	17.18	65.29	7.85	11.78	3.59	7.75	1.64	4.41	0.75	2.64
36.74	85.28	16.79	64.38	7.68	11.38	3.51	7.76	1.60	4.48	0.73	2.60
35.90	84.61	16.41	63.63	7.50	11.09	3.43	7.70	1.57	4.45	0.72	2.58
35.08	83.97	16.04	62.88	7.33	10.87	3.35	7.64	1.53	4.49	0.67	2.04
34.28	83.31	15.67	62.04	7.16	10.66	3.27	7.63	1.50	4.53		
33.50	82.66	15.31	61.11	7.00	10.57	3.20	7.62	1.46	4.68		
32.74	82.04	14.97	60.17	6.84	10.45	3.13	7.58	1.43	4.74		

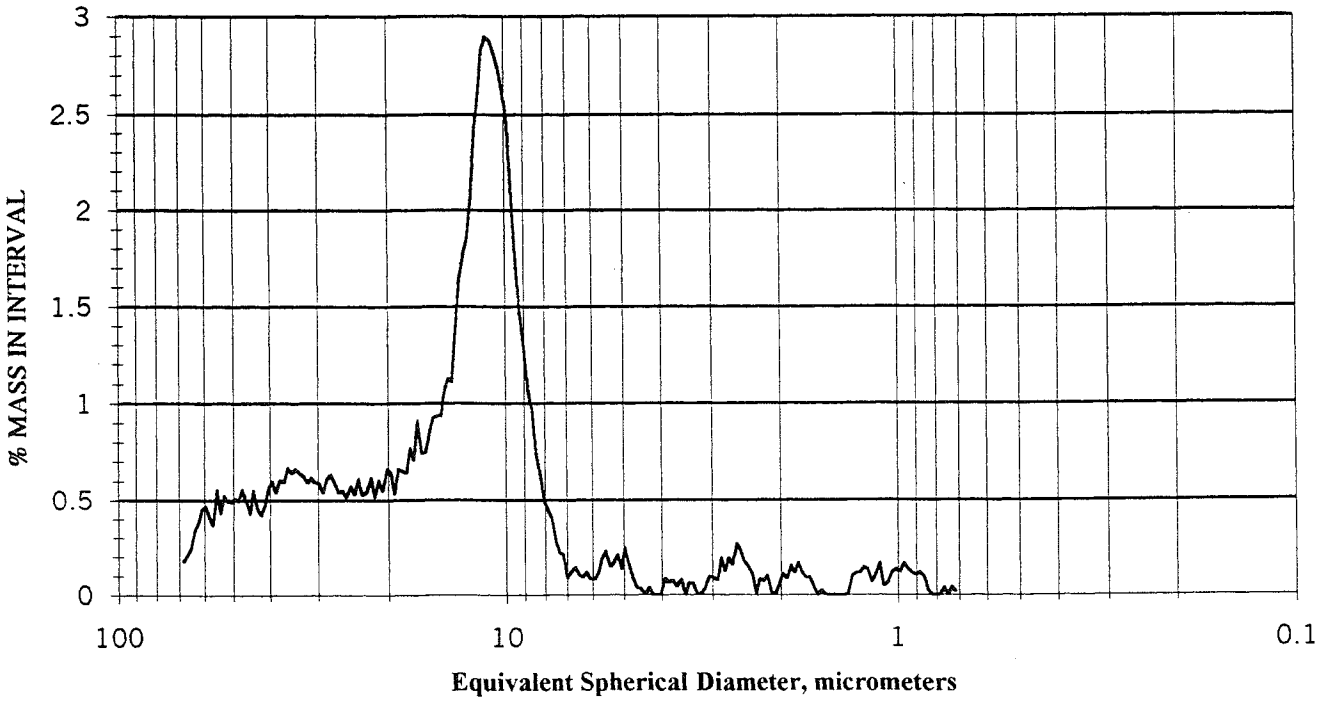
Hazen Research, Inc., Particle Size Analysis by Sedimentation
June 4, 1999

Sample ID: F18/99-2 HRI Project: 002-1AE
Sample Desc.: Cement Kiln Dust 4/7/99

MASS DISTRIBUTION



MASS POPULATION vs DIAMETER



MEMORANDUM

TO: John Jarvis

FROM: Bob Johnson

DATE: June 11, 1999

RE: HRI Project 002-1AE XRD Analysis for crystalline silica
HRI Control No. F18/99

A sample of bagged cement and cement kiln dust were analyzed by XRD to determine the amounts of crystalline silica present. Quartz, cristobalite and tridymite are the three forms of silica that were analyzed for.

If the amount of quartz is less than about 0.5%, it can be determined quantitatively by comparing an unspiked sample to a sample spiked with a known amount of finely pulverized quartz and mixing in a slurry of acetone to get good dispersion. If the amount is greater than 0.5%, Chung's[1] matrix flushing method using corundum as a flushing agent gives better results.

The samples were first scanned over the peaks of interest at a normal rate to get a rough idea of the amounts of silica present. The bagged cement had less than 0.5% quartz, so it was analyzed with the spiking technique. The kiln dust sample appeared to have about 5% quartz, so Chung's method was used on this sample. In the final analysis using these procedures the samples were scanned very slowly over the peaks of interest to reduce the "noise" in the patterns and improve the detection limits. An estimate of the cristobalite and tridymite content was made from published reference intensity ratios.

The XRD pattern of the kiln dust showed that it consists primarily of lime and calcite. Cristobalite and tridymite were not detected, so in an effort to increase the detection limits of cristobalite and tridymite, a portion of this sample was leached with a dilute acetic acid solution buffered with sodium acetate to dissolve the lime and calcite concentrating any silica in the residue. As a check on the quartz analysis Chung's method was also used on the residue and the results calculated based on the original sample weight. The two results compared favorably as shown in Table 1.

[1] Chung, F.H., *Journal of Applied Crystallography*, 1974 vol 7, pgs 519-525

Table 1

	weight %		
	Quartz	Cristobalite	Tridymite
Bagged Cement	0.1 to 0.2 [2]	<0.3	2-3
Cement Kiln Dust	4.4	N.D.	N.D.
Cement Kiln Dust (based on analysis of Residue)	4.3	0.1	<0.2
Cement Kiln Dust Residue[3]	26	0.6	<1.1

N.D. = not detected

[2] There is a minor tridymite peak that could potentially interfere with the quartz peak, but it may be too weak to actually contribute. If the peak in the sample pattern is due to tridymite, then the amount of quartz is less than 0.1%, but to be on the safe side it is assumed that the peak is due to quartz in which case the quartz content is about 0.1 to 0.2%.

[3] 2.00g Kiln dust produced 0.332g leach residue concentrating the quartz, cristobalite and tridymite by a factor of 6.0.

ıple collection and chemical analy-
changes with time and characteriz-
r the latter, use of EM and four-
ith supplemental use of the other
obtaining aqueous extracts of soil

ethods for determining soluble salts
hods and procedures for obtaining

KTRACT AND OTHER EXTRACTS

Principles

omposition of solutes in soil water at
owever, present methods of obtaining
er contents are not practical for routine
cts often must be made at higher than
absolute and relative amounts of vari-
soil/water ratio at which the extract is
must be standardized to obtain results
l universally. Soil salinity is convention-
ous extracts of saturated soil pastes (U.S.
This soil/water ratio is used because it is
which enough extract for analysis can be
th pressure or vacuum and because it is
ıner to field soil water contents. For these
y is often related to the electrical conduc-
ntration, of the saturation extract (U.S.

, 1:5, etc., are easier to use than that of
well related to field soil water contents.
ysis, cation exchange, and mineral dissolu-
h extracts. As a compromise, Sonnevelt and
nded a 1:2 volume extract. When relative
solute concentrations are monitored, these
ısed to advantage.
are obtained, laboratory chemical analyses
he electrical conductivity of the extract (σ_e)
or solutes (section 10–3).

10–2.2 Reagent

ate [$(NaPO_3)_6$] solutions, 0.1%: Dissolve 0.1
dilute the solution to 100 ml.

10–2.3 Procedure

10–2.3.1 SATURATION EXTRACT

Weigh 200 to 400 g of air-dry soil of known water content into a plastic container having a snaptight lid. Weigh the container plus contents. Add distilled water to the soil with stirring until it is nearly saturated. Allow the mixture to stand covered for several hours to permit the soil to imbibe the water, and then add more water to achieve a uniformly saturated soil-water paste. At this point, which is generally reproducible to within ± 5%, the soil paste glistens as it reflects light, flows slightly when the container is tipped, slides freely and cleanly off a spatula, and consolidates easily by tapping or jarring the container after a trench is formed in the paste with the side of the spatula. After mixing, allow the sample to stand (preferably overnight, but at least 4 hours), and then recheck the criteria for saturation. Free water should not collect on the soil surface, nor should the paste stiffen markedly or lose its glisten. If the paste is too wet, add additional dry soil to the paste mixture. Upon attainment of saturation, reweigh the container plus contents. Record the increase in weight, which is the amount of water added. Calculate the saturation water percentage from the weight of oven-dry soil and the sum of the weights of water added and that initially present in the air-dry sample. After allowing the saturated soil paste to stand 4 or more hours, transfer it to a Büchner or Richards (1949) filter funnel fitted with highly retentive filter paper. Apply vacuum, and collect the filtrate in a test tube or bottle. If the initial filtrate is turbid, refilter or discard it. Terminate the filtration when air begins to pass through the filter. Add 1 drop of 0.1% $(NaPO_3)_6$ solution for each 25 ml of extract.

10–2.3.2 EXTRACTS AT SOIL/WATER RATIOS OF 1:1 AND 1:5

Weigh a sample of air-dry soil of appropriate size, and transfer it to a flask or bottle. Add the required amount of distilled water, stopper the container, and shake it in a mechanical shaker for 1 hour. If a mechanical shaker is not available, shake the container vigorously by hand for 1 min at least 4 times at 30-min intervals. Filter the suspension using highly retentive filter paper. (Discard or refilter the initial filtrate if it is turbid.) Add 0.1% $(NaPO_3)_6$ solution at the rate of 1 drop/25 ml of extract.

10–2.4 Comments

The weight of soil required will depend on the number and kind of determinations to be made on the extract, the analytical methods employed, and the salt content of the soil. In general, from one fourth to one third of the water in saturated soil pastes can be removed by vacuum filtration.

Soil samples should not be oven-dried before extracting for determination of soluble salts, because heating to 105°C converts at least a part of the gypsum ($CaSO_4 \cdot 2H_2O$) to plaster of paris ($CaSO_4 \cdot 1/2H_2O$). The latter hydrate has a higher solubility in water than does the former.

ents when a low ratio of soil to
he water content of the air-dry
ining 2% water on an oven-dry
f 1:1 by adding 98 ml of water to
f 1:5 or greater, no correction is
ple.

preparing a saturated soil paste
y coarse-textured soils. If possi-
owed to dry following collection
ges. Peat and muck, especially if
bition period to obtain a definite
he first wetting, pastes of these
water and remixing then give a
istics of a saturated paste. With
added immediately, with a mini-
ly to saturation. This minimizes
rring, speeds the mixing process,
Care should also be taken not to
e of free water on the surface of
t indication of oversaturation in
ll amounts of free water can lead
ater contents for these materials.
to the extract to prevent the pre-
upon standing. The quantity of
concentration ~0.5 ppm, or 0.02
pared with the possible loss of
he extract could be immediately
lkalinity determinations.
saturated soil paste have been de-
4), who proposed wetting the soil
Beatty and Loveday (1974) and
etermining the amount of water at
a capillary wetting technique, and
y adding soil to water (oversatura-
d with these methods. The choice
eference.
o minimize the effect of microbial
on during equilibration (Carlson et

°C until analyzed.

TS IN SOIL WATERS AND XTRACTS

in soil waters and aqueous extracts
Ca^{2+}, K^+, CO_3^{2-}, HCO_3^-, SO_4^{2-}, Cl^-,
sfactory analytical methods for de-

termining these solutes. These methods range from wholly automated to manual. The choice of which to use is usually determined by the number of samples being processed and the availability of analysts, automated equipment, or both. The methods described here are those in common use in laboratories having typical modern but not fully automated instrumentation. Methodology more suited to laboratories without such conveniences was given previously by Bower and Wilcox (1965).

10-3.1 Sequence of Analyses

Alkalinity and pH determinations should be made immediately on fresh extracts or on the solutions treated with hexametaphosphate. Next, electrical conductivity, σ, should be determined; it is a useful means of estimating total salt concentration (meq/liter $\cong 10\ \sigma$, in deci-Siemens per meter, dS/m). The cations can be determined in any sequence. After any three of the four major cations have been determined, the appropriate aliquot for the remaining cation can be estimated by deducting the sum of the three concentrations, in milliequivalents per liter, from 10 σ, in deci-Siemens per meter. Among the anions, NO_3^- and Cl^- determinations are normally made after alkalinity since they are simpler to measure than SO_4^{2-}. After that, SO_4^{2-} is determined; the appropriate aliquot is estimated from the difference between (Ca^{2+} + Mg^{2+} + Na^+ + K^+) and (alkalinity + NO_3^- + Cl^-). Finally, B is determined. Concentration of this solute is negligible compared with that of the major cations and anions, but it is still extremely important because of its pronounced toxicity even in small concentrations to many plants.

10-3.2 pH and Alkalinity

10-3.2.1 APPARATUS

1. Automatic potentiometric titrator.
2. Single probe combination pH electrode.

10-3.2.2 REAGENTS

1. Standard buffer solutions, pH 4.00 and 7.00.
2. Standard hydrochloric acid (HCl), approximately 0.0200*N*.

10-3.2.3 PROCEDURE

With electrode immersed in standard pH buffer, set the potentiometer to the pH (7.00) of the first buffer solution. Rinse electrode, and repeat calibration using the second pH buffer. Rinse electrode, immerse in 1 to 20 ml of sample solution (contained in a 50-ml plastic beaker along with a microsize, Teflon-coated magnetic stirring bar), and initiate the automatic titration operation using the full titration curve display mode. The initial potential recorded on the strip chart gives the sample pH. The volumes of titrant delivered to produce inflection points for CO_3^{2-} and HCO_3^- are ob-

tained from the titration curve (pH vs. volume of standard acid delivered from automatic burette).

10-3.2.4 CALCULATIONS

$$CO_3^{2-} \text{ in meq/liter} = 2P\,N\,1{,}000/\text{aliq}$$

where P is the number of milliliters of standard HCl of normality N to reach the CO_3^{2-} inflection point (pH = 8.3), and aliquot is the sample volume in milliliters.

$$HCO_3^- \text{ in meq/liter} = (T - 2P)\,N\,1{,}000/\text{aliquot}$$

where T is the total number of milliliters of standard HCl of normality N to reach the HCO_3^- inflection point (pH = 4.5), P is the number of milliliters of standard HCl required to reach the CO_3^{2-} inflection point, and aliquot is the sample volume in milliliters. The blank is determined using CO_3^{2-} free distilled water.

10-3.3 Electrical Conductivity

For this determination, use a direct readout from a temperature compensating conductivity meter.

10-3.3.1 APPARATUS

1. Conductivity meter.
2. Conductivity flow cell with automatic temperature compensation.
3. Vacuum line and suction flask.

10-3.3.2 REAGENT

1. Standard potassium chloride (KCl) solutions, 0.010 and 0.100N: For 0.010N solution (1.412 dS/m at 25°C) dissolve 0.7456 g of KCl in distilled water, and add water to make 1 liter at 25°C. For 0.100N solution (12.900 dS/m at 25°C), use 7.456 g of KCl.

10-3.3.3 PROCEDURE

Rinse and fill the conductivity cell with standard KCl solution. Adjust the conductivity meter to read the standard conductivity. Rinse and fill the cell with the soil extract or water sample, and read the σ, corrected to 25°C, directly from the digital display.

10-3.3.4 COMMENTS

Because of marked differences in the equivalent weights, equivalent conductivities, and proportions of major solutes in soil extracts and water samples, the relationships between σ and salt concentration or between σ

and osmotic pressure ar
ever. These relationshi
1) Total cation (or
2) Salt concentrati
3) Osmotic pressur

Determine Ca^{2+}, M
trometer or by method
13-4.3.3 and 13-4.3.5 f
of samples are to be ro
unit equipped for autom
ing, and recording.

10-3.4.1 APPARATUS

1. Atomic absorption sp
2. Sampling and sequen
3. Acetylene gas (C_2H_2)

10-3.4.2 REAGENTS

1. Suppressant solution
(La_2O_3), 250 ml of c
water to make up t
diluent (distilled wat
in the final solution.
2. Suppressant solution
(LiCl) and make to
aliquot, and diluent
LiCl solution in the f
3. Standard cation sol
liter), Na^+ (0–1.0 mec

10-3.4.3 PROCEDURE

Adjust the atomic
the cation to be run as
absorption spectrometer
tions. Then initiate tra
tions a sequence of sam
acetylene flame, and re
tration of the cation in
serted into the sampling
ment calibration during
processed per hour wi
cessing system is initiat
can be performed by ha

CHAIN OF CUSTODY RECORD – ENVIRONMENTAL SAMPLES

FACILITY	SAMPLING FIRM	SAMPLE
NAME: SouthDown, Inc.	NAME:	☐ Effluent ☐ Groundwater
ADDRESS: 5134 Ute Hwy Lyons, CO	ADDRESS:	☒ Solid ☐ Surface Water
	SIGNATURE:	☐

NO.	LOCATION	DATE	TIME	WEATHER TEMP.	WEATHER PREC.	SAMPLE TYPE AND METHOD COMP.	GRAB	MECH.	MAN.	TIME CASING CLEARED	NO. OF CONTAINERS	ANALYSIS REQUIRED	REMARKS
1	KILN FEED	4/7/99											
2	BAGGED CEMENT	4/7/99											SENT TO HAZEN Research, Inc. on MAY 27, 1999 under seperate COC
3	3RD RIDGE SHALE	4/7/99											
4	LIMESTONE	4/7/99											
5	CEMENT KILN DUST	4/7/99											SENT to HAZEN Research, Inc. on MAY 27, 1999 under seperate COC
6	LEUCONE/STABILIZE	4/7/99											
7	59th STREET	4/7/99											

RELINQUISHED BY (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE 4/7/99	TIME 5:30 pm	ADDITIONAL REMARKS: Boulder County to CDPHE-APCD
RELINQUISHED BY (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE 4/8/99	TIME 10:00 am	CDPHE-APCD
RELINQUISHED BY (SIGNATURE) 5/27/99 0800	RECEIVED BY (SIGNATURE)	DATE 5/28/99	TIME 1100	
DISPATCHED BY (SIGNATURE) / DATE / TIME	RECEIVED FOR LABORATORY (SIGNATURE) / DATE / TIME			
CARRIER	LABORATORY: Hazen Research, Inc.			
ADDRESS	ADDRESS: Golden, CO.			
METHOD OF SHIPMENT				

ALL ANALYSIS PERFORMED BY EPA APPROVED PROCEDURES

☐ Yes ☐ No, explain above

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	July 27, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F241/99
DATE REC'D	6/15/99
CUST. P.O.#	None Rec'd

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F241/99-1

SAMPLE IDENTIFICATION: Sample #1 - Kiln Feed - collected 04/07/99 (As Received)

Arsenic, ppm	10.0
Barium, %	0.029
Bicarbonate as HCO3, % **	<0.05
Cadmium, %	<0.001
Carbonate as CO3, % **	<0.05
Chromium, %	0.004
Gross Alpha (+-Precision*), pCi/g	9.9(+-7.2)
Gross Beta (+-Precision*), pCi/g	12(+-6)
Gross Gamma (Ra-226 Equiv.)(+-Precision*), pCi/g	0.6(+-0.7)
Hydroxide as OH, % **	<0.01
Lead, %	<0.001
Mercury, ppm	<0.1
pH of a 1:5 extract	10.2
Selenium, ppm	4
Silver, %	<0.0002
Specific Gravity	2.75

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	July 27, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F241/99
DATE REC'D	6/15/99
CUST. P.O.#	None Rec'd

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F241/99-2

SAMPLE IDENTIFICATION: Sample #6 - Leukonen Alfalfa Pasture - collected on 04/07/99 (-65 mesh fraction)

Arsenic, ppm	6.1
Barium, %	0.051
Bicarbonate as HCO3, % **	0.05
Cadmium, %	<0.001
Carbonate as CO3, % **	<0.05
Chromium, %	0.006
Gross Alpha (+-Precision*), pCi/g	19(+-8)
Gross Beta (+-Precision*), pCi/g	34(+-7)
Gross Gamma (Ra-226 Equiv.)(+-Precision*), pCi/g	7.0(+-0.7)
Hydroxide as OH, % **	<0.01
Lead, %	0.002
Mercury, ppm	<0.1
pH of a 1:5 extract	8.34
Selenium, ppm	<2
Silver, %	<0.0002
Specific Gravity	2.46

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	July 27, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F241/99
DATE REC'D	6/15/99
CUST. P.O.#	None Rec'd

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F241/99-3

SAMPLE IDENTIFICATION: Sample # 7 - 59th Street Unpaved Road - collected on 04/07/99 (-65 mesh fraction)

Arsenic, ppm	4.3
Barium, %	0.059
Bicarbonate as HCO3, % **	<0.05
Cadmium, %	<0.001
Carbonate as CO3, % **	<0.05
Chromium, %	0.005
Gross Alpha (+-Precision*), pCi/g	15(+-7)
Gross Beta (+-Precision*), pCi/g	29(+-7)
Gross Gamma (Ra-226 Equiv.)(+-Precision*), pCi/g	8.7(+-0.7)
Hydroxide as OH, % **	<0.01
Lead, %	0.002
Mercury, ppm	<0.1
pH of a 1:5 extract	9.19
Selenium, ppm	<2
Silver, %	<0.0002
Specific Gravity	2.71

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	July 27, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F241/99
DATE REC'D	6/15/99
CUST. P.O.#	None Rec'd

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F241/99-4

SAMPLE IDENTIFICATION: Sample #6 (As Received)

+65 mesh, %	92.6
-65 mesh, %	7.4

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

Hazen Research, Inc.
4601 Indiana Street • Golden, CO 80403
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	July 27, 1999
HRI PROJECT	002-1AE
HRI SERIES NO.	F241/99
DATE REC'D	6/15/99
CUST. P.O.#	None Rec'd

Colorado Dept of Public Health/Env
Kevin Goohs
4300 Cherry Creek Drive South
Denver, CO 80246-1530

REPORT OF ANALYSIS

SAMPLE NO. F241/99-5

SAMPLE IDENTIFICATION: Sample #7 (As Received)

+65 mesh, %	92.5
-65 mesh, %	7.5

By: _____
Robert Rostad
Laboratory Manager

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.
**From Alkalinity analysis per ASA Monograph No. 9, methods 10-2.3.2 and 10-3.2.

MEMORANDUM

TO: John Jarvis

FROM: Bob Johnson

DATE: July 14, 1999

RE: HRI Project 002-1AE XRD Analysis for crystalline silica
HRI Control No. F241/99

Three samples were analyzed by x-ray diffraction to determine their crystalline silica content. Quartz, cristobalite and tridymite are the three forms of silica that were analyzed for. The samples were scanned initially to get an estimate of their quartz content and determine the other compounds present. All three samples have significant quartz, so Chung's[1] matrix flushing method was used to determine the quartz content. Corundum was used as the matrix flushing agent. Cristobalite and tridymite are estimated from published reference intensity ratios.

		weight %		
		Quartz	Cristobalite	Tridymite
Sample 1	Kiln Feed	9	<0.2	<0.3
Sample 6	Loukonen Alfalfa Field (minus 65-mesh fraction)	38	<0.2	<0.3
Sample 7	59th St. Unpaved Road (minus 65-mesh fraction)	37	<0.2	<0.3

[1] Chung, F.H., *Journal of Applied Crystallography*, 1974 vol 7, pgs 519-525

HAZEN RESEARCH, INC.
Quantachrome Microscan
Particle Size Analysis by Sedimentation
ASTM C958-92

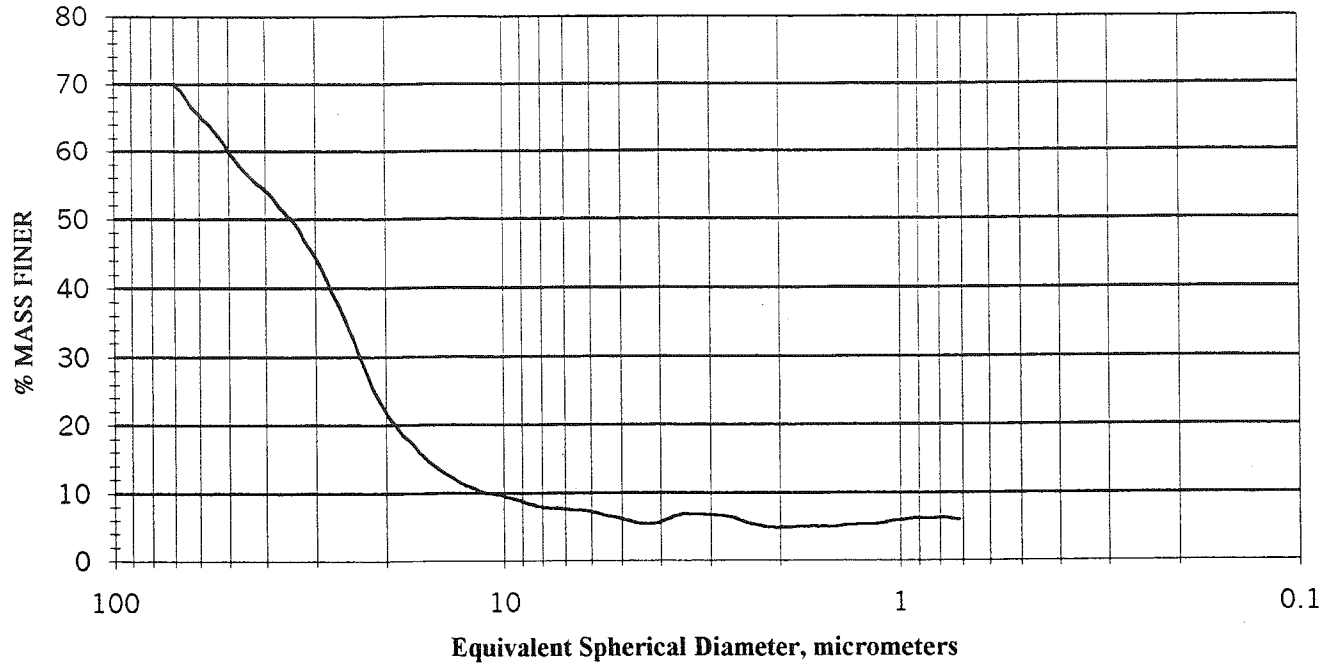
SUBMITTER:	CDH	DATE:	June 29, 1999
HRI PROJECT:	002-1AE	SEDIMENTATION FLUID:	Ethanol
SAMPLE ID:	F241/99-1	FLUID TEMP.:	30 deg.C
SAMPLE DENS.:	2.7500 g/cc	FLUID DENS.:	0.7810 g/cc
ANALYST:	L. Weeks	FLUID VISC.:	0.9909 centipoise

SAMPLE DESCRIPTION: Sample #1 Kiln Feed
COMMENTS: Sample was run as-received

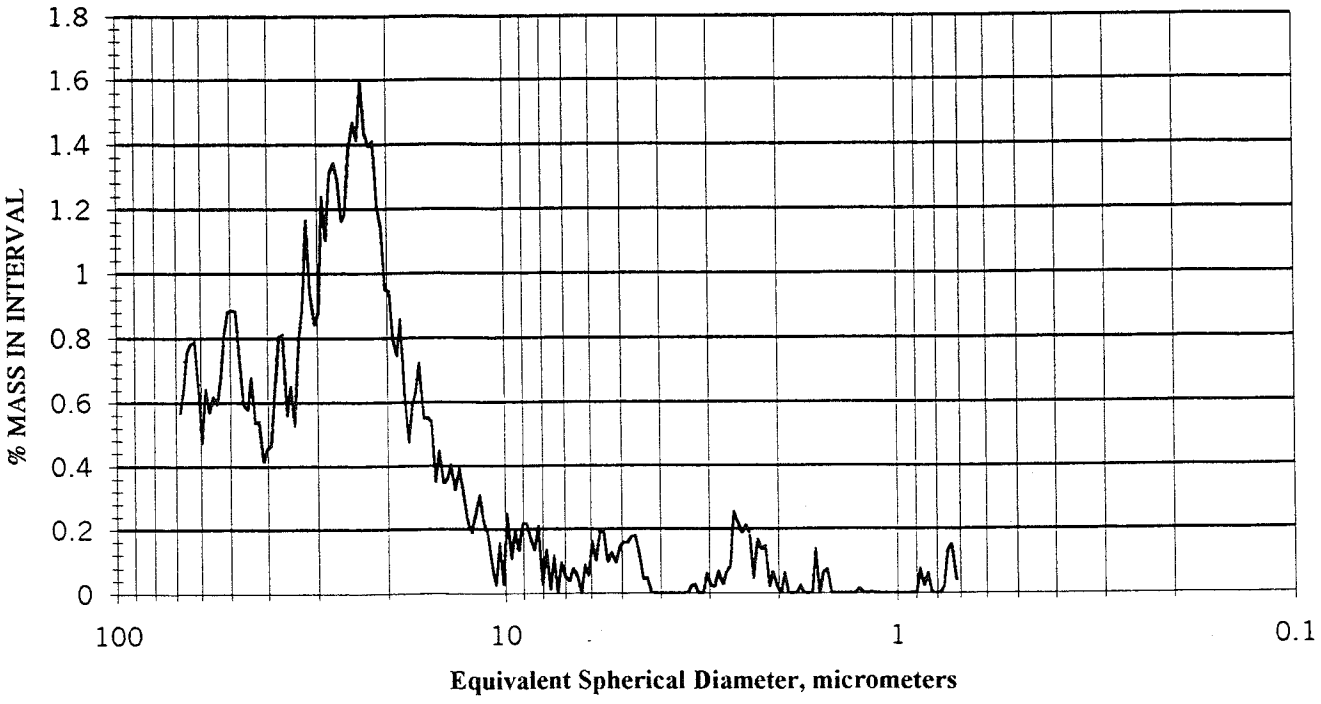
Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer
70.00	70.11	32.00	47.04	14.62	13.51	6.68	7.56	3.06	6.78	1.40	5.12
68.41	69.55	31.27	46.10	14.29	13.16	6.53	7.51	2.99	6.75	1.36	5.23
66.85	68.90	30.56	45.26	13.97	12.80	6.38	7.53	2.92	6.73	1.33	5.24
65.33	68.14	29.86	44.38	13.65	12.40	6.24	7.44	2.85	6.66	1.30	5.24
63.84	67.36	29.18	43.14	13.34	12.07	6.10	7.39	2.79	6.63	1.27	5.35
62.39	66.57	28.52	42.03	13.03	11.68	5.96	7.23	2.72	6.56	1.24	5.33
60.97	65.92	27.87	40.73	12.74	11.37	5.82	7.13	2.66	6.48	1.22	5.33
59.58	65.44	27.23	39.38	12.45	11.14	5.69	6.93	2.60	6.23	1.19	5.35
58.22	64.80	26.61	38.09	12.16	10.95	5.56	6.74	2.54	6.00	1.16	5.35
56.90	64.23	26.01	36.93	11.89	10.70	5.43	6.64	2.48	5.81	1.14	5.44
55.60	63.61	25.42	35.74	11.62	10.39	5.31	6.51	2.43	5.60	1.11	5.48
54.34	63.02	24.84	34.35	11.35	10.17	5.19	6.42	2.37	5.41	1.08	5.57
53.10	62.35	24.27	32.88	11.09	9.98	5.07	6.27	2.32	5.37	1.06	5.78
51.89	61.53	23.72	31.47	10.84	9.90	4.96	6.12	2.27	5.20	1.04	5.88
50.71	60.65	23.18	29.87	10.59	9.87	4.84	5.96	2.21	5.06	1.01	5.91
49.56	59.76	22.65	28.43	10.35	9.71	4.73	5.78	2.16	4.92	0.99	5.98
48.43	58.88	22.14	27.04	10.12	9.69	4.62	5.60	2.11	4.89	0.97	6.05
47.33	58.14	21.63	25.63	9.89	9.44	4.52	5.48	2.07	4.83	0.94	6.19
46.25	57.55	21.14	24.41	9.66	9.33	4.42	5.44	2.02	4.81	0.92	6.24
45.20	56.97	20.66	23.27	9.44	9.13	4.32	5.39	1.97	4.94	0.90	6.29
44.17	56.30	20.19	22.32	9.23	9.00	4.22	5.42	1.93	4.88	0.88	6.21
43.16	55.76	19.73	21.37	9.02	8.78	4.12	5.52	1.88	4.91	0.86	6.19
42.18	55.22	19.28	20.57	8.81	8.56	4.03	5.65	1.84	4.98	0.84	6.13
41.22	54.80	18.84	19.83	8.61	8.39	3.94	5.86	1.80	5.00	0.82	6.27
40.28	54.35	18.41	18.97	8.42	8.26	3.85	6.09	1.76	4.97	0.80	6.28
39.36	53.88	17.99	18.36	8.22	8.05	3.76	6.38	1.72	4.98	0.79	6.32
38.47	53.25	17.58	17.89	8.04	8.02	3.67	6.65	1.68	5.03	0.77	6.30
37.59	52.44	17.18	17.30	7.85	7.89	3.59	6.77	1.64	5.13	0.75	6.16
36.74	51.63	16.79	16.66	7.68	7.87	3.51	6.86	1.60	4.99	0.73	6.01
35.90	51.07	16.41	15.94	7.50	7.76	3.43	6.87	1.57	5.08	0.72	5.97
35.08	50.42	16.04	15.39	7.33	7.82	3.35	6.85	1.53	5.01	0.67	5.31
34.28	49.89	15.67	14.84	7.16	7.73	3.27	6.82	1.50	4.94		
33.50	49.10	15.31	14.30	7.00	7.68	3.20	6.83	1.46	4.96		
32.74	48.21	14.97	13.95	6.84	7.64	3.13	6.84	1.43	5.05		

Hazen Research, Inc., Particle Size Analysis by Sedimentation
Sample ID: F241/99-1 HRI Project: 002-1AE
Sample Desc.: Sample #1 Kiln Feed

MASS DISTRIBUTION



MASS POPULATION vs DIAMETER



HAZEN RESEARCH, INC.
Quantachrome Microscan
Particle Size Analysis by Sedimentation
ASTM C958-92

SUBMITTER:	CDH	DATE:	June 29, 1999
HRI PROJECT:	002-1AE	SEDIMENTATION FLUID:	Ethanol
SAMPLE ID:	F241/99-2	FLUID TEMP.:	30 deg.C
SAMPLE DENS.:	2.4600 g/cc	FLUID DENS.:	0.7810 g/cc
ANALYST:	L. Weeks	FLUID VISC.:	0.9909 centipoise

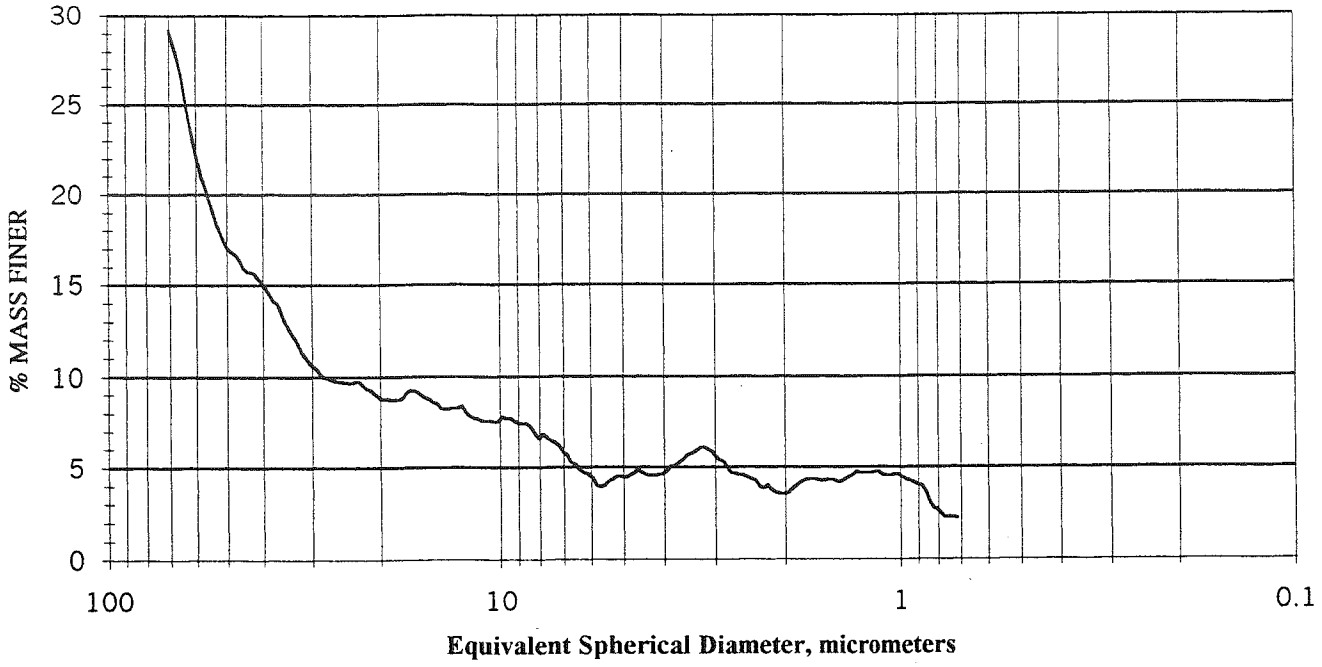
SAMPLE DESCRIPTION: Sample 6 Loukonen Alfalfa Field (minus 65 mesh fraction)
COMMENTS: Sample was screened at 65 mesh (212 micron)

Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer
70.00	29.18	32.00	11.45	14.62	8.60	6.68	5.28	3.06	5.88	1.40	4.36
68.41	28.44	31.27	11.09	14.29	8.52	6.53	5.18	2.99	5.62	1.36	4.51
66.85	27.54	30.56	10.84	13.97	8.27	6.38	4.87	2.92	5.41	1.33	4.62
65.33	26.52	29.86	10.61	13.65	8.25	6.24	4.72	2.85	5.31	1.30	4.78
63.84	25.34	29.18	10.43	13.34	8.28	6.10	4.69	2.79	5.04	1.27	4.68
62.39	24.07	28.52	10.18	13.03	8.29	5.96	4.43	2.72	4.73	1.24	4.70
60.97	22.90	27.87	9.99	12.74	8.32	5.82	4.03	2.66	4.67	1.22	4.70
59.58	21.92	27.23	9.95	12.45	8.41	5.69	3.92	2.60	4.58	1.19	4.69
58.22	21.09	26.61	9.86	12.16	8.06	5.56	4.00	2.54	4.58	1.16	4.76
56.90	20.40	26.01	9.76	11.89	7.87	5.43	4.26	2.48	4.47	1.14	4.75
55.60	19.68	25.42	9.74	11.62	7.75	5.31	4.37	2.43	4.39	1.11	4.59
54.34	19.04	24.84	9.74	11.35	7.73	5.19	4.52	2.37	4.27	1.08	4.55
53.10	18.36	24.27	9.71	11.09	7.62	5.07	4.51	2.32	3.96	1.06	4.54
51.89	17.79	23.72	9.69	10.84	7.58	4.96	4.45	2.27	3.85	1.04	4.63
50.71	17.35	23.18	9.79	10.59	7.62	4.84	4.53	2.21	4.01	1.01	4.61
49.56	17.00	22.65	9.74	10.35	7.55	4.73	4.67	2.16	3.77	0.99	4.47
48.43	16.83	22.14	9.56	10.12	7.56	4.62	4.87	2.11	3.65	0.97	4.33
47.33	16.64	21.63	9.35	9.89	7.84	4.52	4.72	2.07	3.55	0.94	4.26
46.25	16.36	21.14	9.28	9.66	7.74	4.42	4.62	2.02	3.52	0.92	4.16
45.20	15.95	20.66	9.03	9.44	7.75	4.32	4.55	1.97	3.62	0.90	4.05
44.17	15.74	20.19	8.86	9.23	7.61	4.22	4.54	1.93	3.82	0.88	3.99
43.16	15.70	19.73	8.75	9.02	7.48	4.12	4.63	1.88	3.98	0.86	3.66
42.18	15.65	19.28	8.80	8.81	7.45	4.03	4.65	1.84	4.16	0.84	3.13
41.22	15.38	18.84	8.74	8.61	7.46	3.94	4.81	1.80	4.28	0.82	2.76
40.28	15.14	18.41	8.75	8.42	7.25	3.85	5.07	1.76	4.32	0.80	2.68
39.36	14.84	17.99	8.74	8.22	6.92	3.76	5.09	1.72	4.32	0.79	2.48
38.47	14.54	17.58	8.88	8.04	6.60	3.67	5.32	1.68	4.36	0.77	2.25
37.59	14.19	17.18	9.15	7.85	6.83	3.59	5.48	1.64	4.31	0.75	2.30
36.74	13.97	16.79	9.28	7.68	6.67	3.51	5.69	1.60	4.22	0.73	2.27
35.90	13.47	16.41	9.27	7.50	6.50	3.43	5.78	1.57	4.34	0.72	2.21
35.08	13.00	16.04	9.11	7.33	6.40	3.35	5.90	1.53	4.30	0.67	3.33
34.28	12.57	15.67	8.95	7.16	6.17	3.27	6.09	1.50	4.30		
33.50	12.27	15.31	8.83	7.00	5.83	3.20	6.11	1.46	4.15		
32.74	11.94	14.97	8.76	6.84	5.65	3.13	5.99	1.43	4.29		

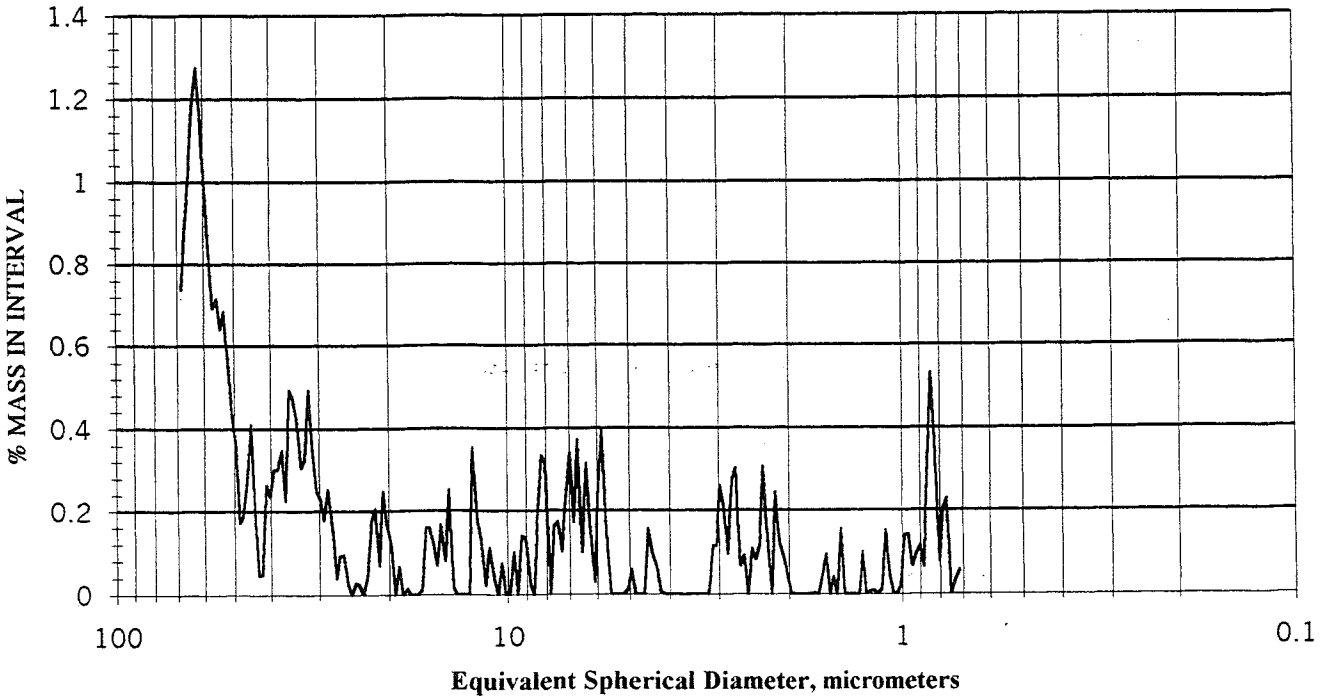
June 29, 1999

Hazen Research, Inc., Particle Size Analysis by Sedimentation
Sample ID: F241/99-2 HRI Project: 002-1AE
Sample Desc.: Sample 6 Loukonen Alfalfa Field (minus 65 mesh fraction)

MASS DISTRIBUTION



MASS POPULATION vs DIAMETER



HAZEN RESEARCH, INC.
Quantachrome Microscan
Particle Size Analysis by Sedimentation
ASTM C958-92

SUBMITTER:	CDH	DATE:	June 29, 1999
HRI PROJECT:	002-1AE	SEDIMENTATION FLUID:	Ethanol
SAMPLE ID:	F241/99-3	FLUID TEMP.:	30 deg.C
SAMPLE DENS.:	2.7100 g/cc	FLUID DENS.:	0.7810 g/cc
ANALYST:	L. Weeks	FLUID VISC.:	0.9909 centipoise

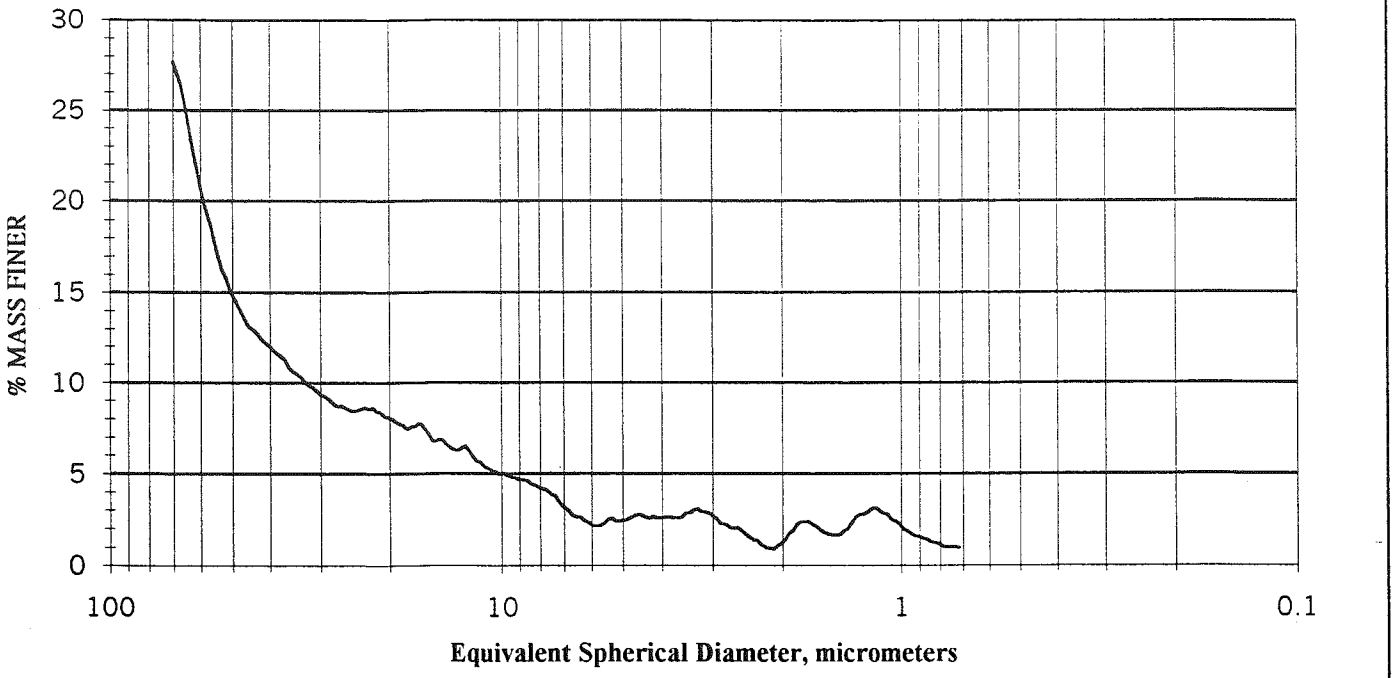
SAMPLE DESCRIPTION: Sample 7 59th St. Unpaved Road (minus 65 mesh fraction)
COMMENTS: Sample was screened at 65 mesh (212 micron)

Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer	Equiv. Spherical Diameter micrometer	Percent Mass Finer
70.00	27.67	32.00	9.84	14.62	6.88	6.68	2.75	3.06	2.83	1.40	1.86
68.41	27.00	31.27	9.72	14.29	6.81	6.53	2.64	2.99	2.71	1.36	2.02
66.85	26.21	30.56	9.52	13.97	6.61	6.38	2.64	2.92	2.51	1.33	2.30
65.33	25.18	29.86	9.34	13.65	6.44	6.24	2.45	2.85	2.26	1.30	2.63
63.84	23.91	29.18	9.23	13.34	6.32	6.10	2.34	2.79	2.22	1.27	2.76
62.39	22.61	28.52	9.04	13.03	6.27	5.96	2.18	2.72	2.11	1.24	2.80
60.97	21.41	27.87	8.84	12.74	6.39	5.82	2.16	2.66	2.01	1.22	2.90
59.58	20.40	27.23	8.71	12.45	6.52	5.69	2.18	2.60	2.08	1.19	3.08
58.22	19.59	26.61	8.72	12.16	6.26	5.56	2.30	2.54	1.91	1.16	3.15
56.90	18.80	26.01	8.63	11.89	5.93	5.43	2.56	2.48	1.75	1.14	2.99
55.60	17.92	25.42	8.52	11.62	5.69	5.31	2.57	2.43	1.59	1.11	2.84
54.34	17.06	24.84	8.43	11.35	5.62	5.19	2.40	2.37	1.42	1.08	2.79
53.10	16.30	24.27	8.48	11.09	5.43	5.07	2.45	2.32	1.37	1.06	2.53
51.89	15.77	23.72	8.55	10.84	5.30	4.96	2.47	2.27	1.12	1.04	2.40
50.71	15.19	23.18	8.64	10.59	5.18	4.84	2.57	2.21	0.99	1.01	2.28
49.56	14.72	22.65	8.57	10.35	5.11	4.73	2.68	2.16	0.97	0.99	2.01
48.43	14.33	22.14	8.61	10.12	4.97	4.62	2.75	2.11	0.87	0.97	1.85
47.33	13.85	21.63	8.41	9.89	5.02	4.52	2.78	2.07	1.05	0.94	1.70
46.25	13.49	21.14	8.37	9.66	4.90	4.42	2.67	2.02	1.18	0.92	1.62
45.20	13.12	20.66	8.13	9.44	4.81	4.32	2.57	1.97	1.42	0.90	1.57
44.17	12.96	20.19	8.05	9.23	4.79	4.22	2.69	1.93	1.71	0.88	1.48
43.16	12.73	19.73	8.01	9.02	4.69	4.12	2.58	1.88	1.90	0.86	1.39
42.18	12.48	19.28	7.81	8.81	4.70	4.03	2.59	1.84	2.26	0.84	1.28
41.22	12.26	18.84	7.74	8.61	4.65	3.94	2.62	1.80	2.38	0.82	1.23
40.28	12.03	18.41	7.64	8.42	4.46	3.85	2.66	1.76	2.39	0.80	1.16
39.36	11.79	17.99	7.43	8.22	4.35	3.76	2.58	1.72	2.41	0.79	1.01
38.47	11.62	17.58	7.58	8.04	4.24	3.67	2.58	1.68	2.25	0.77	1.00
37.59	11.50	17.18	7.57	7.85	4.16	3.59	2.64	1.64	2.15	0.75	1.02
36.74	11.27	16.79	7.75	7.68	4.06	3.51	2.82	1.60	1.92	0.73	1.01
35.90	10.81	16.41	7.71	7.50	3.86	3.43	2.83	1.57	1.79	0.72	0.96
35.08	10.61	16.04	7.45	7.33	3.77	3.35	3.03	1.53	1.73	0.67	0.97
34.28	10.49	15.67	7.18	7.16	3.40	3.27	3.08	1.50	1.64		
33.50	10.29	15.31	6.81	7.00	3.17	3.20	2.94	1.46	1.65		
32.74	10.04	14.97	6.77	6.84	3.01	3.13	2.90	1.43	1.68		

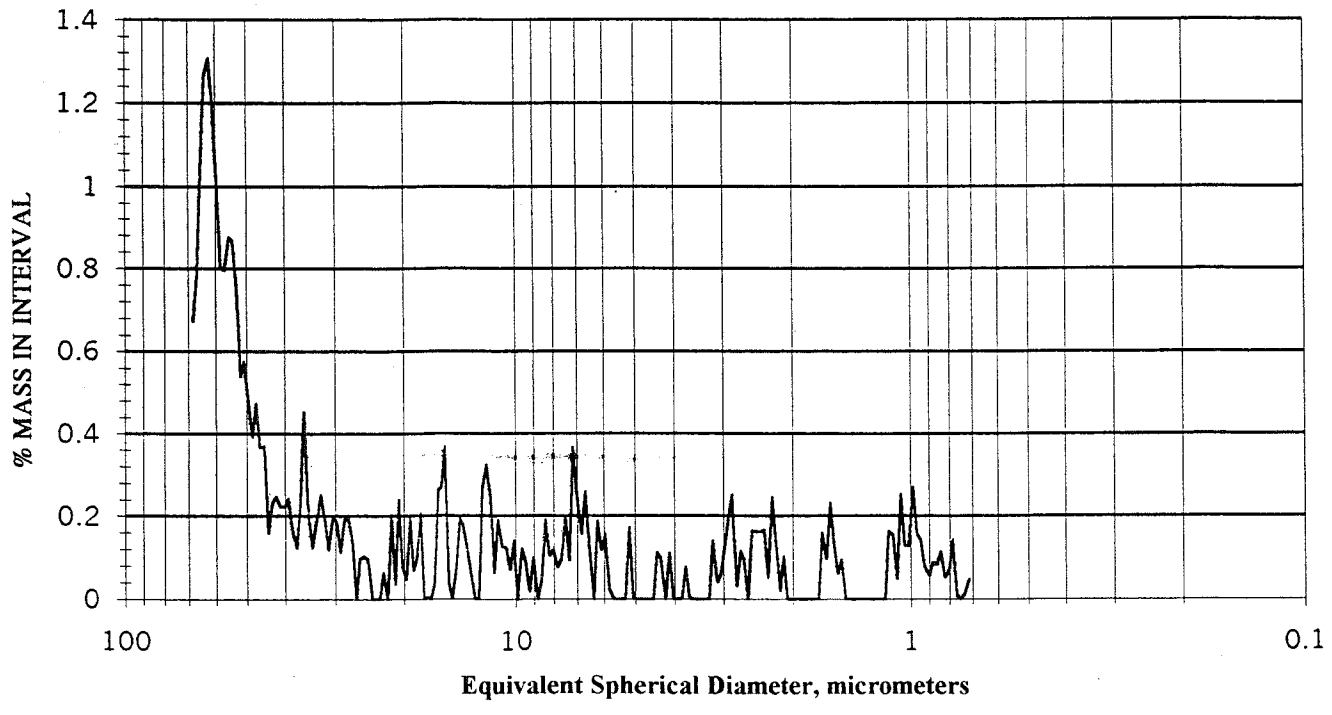
Hazen Research, Inc., Particle Size Analysis by Sedimentation
June 29, 1999

Sample ID: F241/99-3 HRI Project: 002-1AE
Sample Desc.: Sample 7 59th St. Unpaved Road (minus 65 mesh fraction)

MASS DISTRIBUTION



MASS POPULATION vs DIAMETER



CHAIN OF CUSTODY RECORD – ENVIRONMENTAL SAMPLES

FACILITY	SAMPLING FIRM	SAMPLE
NAME SouthDown, Inc.	NAME	☐ Effluent ☐ Groundwater
ADDRESS 5134 Ute Hwy Lyons, CO	ADDRESS	☒ Solid ☐ Surface Water
	SIGNATURE	☐ ______

NO.	LOCATION	DATE	TIME	WEATHER TEMP.	WEATHER PREC.	SAMPLE TYPE AND METHOD COMP.	GRAB	MECH.	MAN.	TIME CASING CLEARED	NO. OF CONTAINERS	ANALYSIS REQUIRED	REMARKS
1	KILN FEED	4/7/99											Sent to Hazen Research 6/14/99 SB
[redacted]	[redacted]	4/7/99											SENT TO HAZEN Research, Inc on May 27, 1999 under seperate COC
3	[redacted]	4/7/99											
[redacted]	[redacted]	4/7/99											
[redacted]	[redacted]	4/7/99											SENT to HAZEN Research, Inc. on May 27, 1999 under seperate COC
6	LEUKONEN'S PASTURE	4/7/99											Sent to Hazen Research 6/14/99 SB
7	59th STREET	4/7/99											Sent to Hazen Research 6/14/99 SB

RELINQUISHED BY (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE	TIME	ADDITIONAL REMARKS
[signature]	[signature]	4/7/99	5:30 pm	Boulder County to CDPHE-APCD
[signature]	[signature]	4/8/99	10:00 am	CDPHE-APCD
Michael Jenkins	[signature]	6/15/99	0906	

DISPATCHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY (SIGNATURE)	DATE	TIME

CARRIER

LABORATORY

ADDRESS

ADDRESS

METHOD OF SHIPMENT

ALL ANALYSIS PERFORMED BY EPA APPROVED PROCEDURES

☐ Yes ☐ No, explain above

Appendix C

CMB Model Runs

FILE NAMES FILE:

SOURCE CONTRIBUTION ESTIMATES - SITE: HYGIENE DATE: 12/01/98 CMB8 (97350)
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .96 PERCENT MASS 100.4
CHI SQUARE 1.40 DF 10
B and L: No SRC ELIM: No
WEIGHTS: CHISQR 1.000 R SQR 1.000 PCMASS 1.000 FRCEST 1.000

SOURCE EST	CODE	NAME	SCE(UG/M3)	STD ERR	TSTAT
YES	1	(NH4)2SO	.2346	.0534	4.3912
YES	34	FIREP	4.1540	1.6344	2.5416
YES	59	MD8510US	1.6391	.7890	2.0775
YES	72	PAVED	17.2931	2.1164	8.1711
YES	119	TP12CMNT	5.7843	.8329	6.9444

MEASURED CONCENTRATION FOR SIZE: PM10
29.0+- 2.9

ELIGIBLE SPACE DIM. = 5 FOR MAX. UNC. = 5.8000 (20.% OF TOTAL MEAS. MASS)

1 / SINGULAR VALUE				
.0507	.5604	.7630	1.6903	2.1710

NUMBER ESTIMABLE SOURCES = 5 FOR MIN. PROJ. = .95

PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE
1.0000 1	1.0000 34	1.0000 59	1.0000 72	1.0000 119

ESTIMABLE LINEAR COMBINATIONS OF INESTIMABLE SOURCES

COEFF. SOURCE	COEFF. SOURCE	COEFF. SOURCE	COEFF. SOURCE	SCE	STD ERR

SPECIES CONCENTRATIONS - SITE: HYGIENE DATE: 12/01/98 CMB 8.0
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .96 PERCENT MASS 100.4
CHI SQUARE 1.40 DF 10

SPECIES		I	MEAS	CALC		RATIO C/M		RATIO R/U
TOTAL	TOTAL		29.0000+- 2.9160	29.1050+-	2.0008	1.00+-	.12	.0
C13	AL	*	1.4391+- .5036	1.6932+-	.4392	1.18+-	.51	.4
C14	SI	*	3.6540+- .3654	5.5409+-	1.5204	1.52+-	.44	1.2
C15	P		.0000< .1312	.0060<	.0080	.00<	.00	.0
C16	S	*	.1370+- .0325	.2894+-	.0515	2.11+-	.63	2.5
C17	CL		.0258+- .0114	.4043+-	.2964	15.69+-	13.43	1.3
C19	K	*	.8569+- .1453	.6860+-	.1096	.80+-	.19	-.9
C20	CA	*	2.6553+- .4390	2.5193+-	.2715	.95+-	.19	-.3
C22	TI	*	.0738+- .0129	.0619+-	.0046	.84+-	.16	-.9
C23	V		.0000< .0023	.0042<	.0011	.00<	.00	1.6
C24	CR		.0026+- .0015	.0047+-	.0005	1.80+-	1.04	1.3
C25	MN	*	.0172+- .0036	.0193+-	.0016	1.12+-	.25	.5
C26	FE	*	.9257+- .1456	.7266+-	.0583	.78+-	.14	-1.3
C27	CO		.0000< .0024	.0000<	.0087	.00<	.00	.0
C28	NI		.0003< .0014	.0019<	.0020	6.00<	26.14	.7
C29	CU		.0412+- .0049	.0024+-	.0007	.06+-	.02	-7.8
C30	ZN	*	.0150+- .0023	.0163+-	.0043	1.08+-	.33	.3
C31	GA		.0000< .0033	.0001<	.0005	.00<	.00	.0
C32	GE		.0000< .0027	.0001<	.0001	.00<	.00	.0
C33	AS		.0000< .0040	.0002<	.0026	.00<	.00	.0
C34	SE		.0000< .0020	.0001<	.0002	.00<	.00	.0
C35	BR		.0039+- .0022	.0044+-	.0010	1.13+-	.68	.2
C37	RB		.0032+- .0023	.0034+-	.0004	1.06+-	.76	.1
C38	SR	*	.0152+- .0033	.0158+-	.0007	1.04+-	.23	.2
C39	Y		.0050+- .0032	.0002+-	.0018	.03+-	.36	-1.3
C40	ZR		.0390+- .0060	.0005+-	.0018	.01+-	.05	-6.2
C42	MO		.0389+- .0072	.0002+-	.0007	.00+-	.02	-5.4
C46	PD		.0056+- .0053	.0000+-	.0018	.00+-	.32	-1.0
C47	AG		.0081+- .0054	.0002+-	.0018	.02+-	.22	-1.4
C48	CD		.0000< .0056	.0003<	.0020	.00<	.00	.1
C49	IN		.0034< .0064	.0000<	.0018	.00<	.54	-.5
C50	SN		.0114+- .0076	.0001+-	.0019	.01+-	.16	-1.4
C51	SB		.0000< .0092	.0000<	.0019	.00<	.00	.0
C56	BA		.5423+- .0716	.0264+-	.0051	.05+-	.01	-7.2
C57	LA		.0000< .0457	.0016<	.0031	.00<	.00	.0
C80	HG		.0000< .0050	.0005<	.0009	.00<	.00	.1
C82	PB		.0000< .0061	.0228<	.0039	.00<	.00	3.1
C204	NO3		2.3124+- .3270	.0263+-	.0089	.01+-	.00	-7.0
C203	SO4	*	.7686+- .1087	.7800+-	.0411	1.01+-	.15	.1
C205	NH4	*	.0884+- .0125	.0797+-	.0082	.90+-	.16	-.6
C219	K2	*	.1300+- .0184	.1108+-	.0059	.85+-	.13	-1.0
C201	OC	*	3.4616+- .4115	3.9666+-	.5150	1.15+-	.20	.8
C202	EC	*	2.2875+- .2813	1.9684+-	.3447	.86+-	.18	-.7

SOURCE CONTRIBUTION ESTIMATES - SITE: HYGIENE DATE: 12/04/98 CMB8 (97350)
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .94 PERCENT MASS 102.6
CHI SQUARE 1.77 DF 11
B and L: No SRC ELIM: No
WEIGHTS: CHISQR 1.000 R SQR 1.000 PCMASS 1.000 FRCEST 1.000

SOURCE EST	CODE	NAME	SCE(UG/M3)	STD ERR	TSTAT
YES	1	(NH4)2SO	.3228	.0681	4.7408
YES	34	FIREP	4.3731	1.7662	2.4760
YES	59	MD8510US	2.2986	.9552	2.4064
YES	72	PAVED	18.0756	2.2630	7.9875
YES	119	TP12CMNT	5.7115	.9123	6.2608

MEASURED CONCENTRATION FOR SIZE: PM10
30.0+- 3.0

ELIGIBLE SPACE DIM. = 5 FOR MAX. UNC. = 6.0000 (20.% OF TOTAL MEAS. MASS)

1 / SINGULAR VALUE

.0647	.6775	.8274	1.8650	2.3160

NUMBER ESTIMABLE SOURCES = 5 FOR MIN. PROJ. = .95

PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE
1.0000 1	1.0000 34	1.0000 59	1.0000 72	1.0000 119

ESTIMABLE LINEAR COMBINATIONS OF INESTIMABLE SOURCES

COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	SCE	STD ERR

SPECIES CONCENTRATIONS - SITE: HYGIENE DATE: 12/04/98 CMB 8.0
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .94 PERCENT MASS 102.6
CHI SQUARE 1.77 DF 11

SPECIES		I	MEAS	CALC	RATIO C/M	RATIO R/U
TOTAL	TOTAL		30.0000+- 3.0170	30.7816+- 2.1194	1.03+- .13	.2
C13	AL	*	1.7070+- .5572	1.7638+- .4590	1.03+- .43	.1
C14	SI	*	3.9300+- .3930	5.7774+- 1.5892	1.47+- .43	1.1
C15	P		.0000< .1313	.0064< .0084	.00< .00	.0
C16	S	*	.1931+- .0435	.3234+- .0589	1.67+- .49	1.8
C17	CL		.0103< .0114	.4239< .3098	41.28< 54.78	1.3
C19	K	*	.8873+- .1509	.7134+- .1145	.80+- .19	-.9
C20	CA	*	3.2223+- .5337	2.5083+- .2692	.78+- .15	-1.2
C22	TI	*	.0982+- .0167	.0644+- .0048	.66+- .12	-1.9
C23	V		.0027+- .0025	.0044+- .0012	1.63+- 1.58	.6
C24	CR	*	.0032+- .0015	.0049+- .0006	1.54+- .76	1.0
C25	MN	*	.0191+- .0041	.0212+- .0020	1.11+- .26	.5
C26	FE	*	.9465+- .1490	.7558+- .0634	.80+- .14	-1.2
C27	CO		.0000< .0025	.0000< .0091	.00< .00	.0
C28	NI		.0000< .0014	.0022< .0028	.00< .00	.7
C29	CU		.0451+- .0054	.0026+- .0008	.06+- .02	-7.8
C30	ZN	*	.0163+- .0025	.0178+- .0048	1.09+- .34	.3
C31	GA		.0000< .0035	.0001< .0006	.00< .00	.0
C32	GE		.0011< .0030	.0001< .0001	.10< .28	-.3
C33	AS		.0000< .0040	.0002< .0032	.00< .00	.0
C34	SE		.0001< .0023	.0001< .0002	.55< 12.40	.0
C35	BR		.0002< .0021	.0060< .0014	25.60< *****	2.3
C37	RB		.0039+- .0023	.0036+- .0004	.91+- .55	-.1
C38	SR	*	.0096+- .0029	.0160+- .0007	1.66+- .51	2.1
C39	Y		.0000< .0032	.0002< .0019	.00< .00	.0
C40	ZR		.0285+- .0052	.0005+- .0019	.02+- .07	-5.1
C42	MO		.0433+- .0073	.0002+- .0008	.00+- .02	-5.9
C46	PD		.0000< .0052	.0000< .0019	.00< .00	.0
C47	AG		.0000< .0052	.0002< .0019	.00< .00	.0
C48	CD		.0033< .0058	.0004< .0021	.11< .67	-.5
C49	IN		.0025< .0064	.0000< .0019	.00< .76	-.4
C50	SN		.0078+- .0076	.0001+- .0020	.01+- .26	-1.0
C51	SB		.0000< .0084	.0000< .0021	.00< .00	.0
C56	BA		.3566+- .0552	.0273+- .0056	.08+- .02	-5.9
C57	LA		.0000< .0469	.0016< .0039	.00< .00	.0
C80	HG		.0018< .0055	.0005< .0009	.29< 1.03	-.2
C82	PB		.0000< .0062	.0281< .0054	.00< .00	3.4
C204	NO3		1.9541+- .2764	.0294+- .0098	.02+- .01	-7.0
C203	SO4	*	.9338+- .1321	.8521+- .0476	.91+- .14	-.6
C205	NH4	*	.1116+- .0158	.1077+- .0110	.97+- .17	-.2
C219	K2	*	.1253+- .0177	.1121+- .0063	.90+- .14	-.7
C201	OC	*	3.9051+- .4620	4.3332+- .5513	1.11+- .19	.6
C202	EC	*	2.8446+- .3443	2.4447+- .4533	.86+- .19	-.7

FILE NAMES FILE:

SOURCE CONTRIBUTION ESTIMATES - SITE: HYGIENE DATE: 03/25/99 CMB8 (97350)
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .93 PERCENT MASS 108.1
CHI SQUARE 2.04 DF 14
B and L: No SRC ELIM: No
WEIGHTS: CHISQR 1.000 R SQR 1.000 PCMASS 1.000 FRCEST 1.000

SOURCE EST	CODE	NAME	SCE(UG/M3)	STD ERR	TSTAT
YES	34	FIREP	5.2939	1.6868	3.1384
YES	59	MD8510US	1.3930	.5858	2.3778
YES	63	NH4HSO4	2.0535	.3817	5.3793
YES	64	NH4NO3	2.2736	.3579	6.3530
YES	72	PAVED	18.5621	2.3012	8.0664
YES	119	TP12CMNT	6.1058	1.0781	5.6635

MEASURED CONCENTRATION FOR SIZE: PM10
33.0+- 3.3

ELIGIBLE SPACE DIM. = 6 FOR MAX. UNC. = 6.6000 (20.% OF TOTAL MEAS. MASS)

1 / SINGULAR VALUE					
.3046	.4162	.4673	.9708	1.7068	2.3622

NUMBER ESTIMABLE SOURCES = 6 FOR MIN. PROJ. = .95

PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE
1.0000	34	1.0000	59	1.0000	63	1.0000	64	1.0000	72
1.0000	119								

ESTIMABLE LINEAR COMBINATIONS OF INESTIMABLE SOURCES

COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	SCE	STD ERR

SPECIES CONCENTRATIONS - SITE: HYGIENE DATE: 03/25/99 CMB 8.0
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .93 PERCENT MASS 108.1
CHI SQUARE 2.04 DF 14

SPECIES		I	MEAS		CALC		RATIO C/M		RATIO R/U
TOTAL	TOTAL		33.0000+-	3.3220	35.6819+-	2.2575	1.08+-	.13	.7
C13	AL	*	1.9316+-	.6389	1.8156+-	.4714	.94+-	.40	-.1
C14	SI	*	3.4320+-	.3432	5.9389+-	1.6320	1.73+-	.51	1.5
C15	P		.0000<	.1755	.0064<	.0086	.00<	.00	.0
C16	S	*	.6630+-	.1339	.7799+-	.0749	1.18+-	.26	.8
C17	CL		.0000<	.0111	.4352<	.3182	.00<	.00	1.4
C19	K	*	.8679+-	.1471	.7397+-	.1177	.85+-	.20	-.7
C20	CA	*	2.6951+-	.4451	2.6668+-	.2870	.99+-	.20	-.1
C22	TI	*	.0941+-	.0164	.0663+-	.0049	.70+-	.13	-1.6
C23	V		.0000<	.0030	.0045<	.0012	.00<	.00	1.4
C24	CR		.0000<	.0017	.0050<	.0006	.00<	.00	2.8
C25	MN	*	.0172+-	.0041	.0198+-	.0015	1.15+-	.29	.6
C26	FE	*	.9094+-	.1429	.7757+-	.0613	.85+-	.15	-.9
C27	CO		.0000<	.0027	.0000<	.0093	.00<	.00	.0
C28	NI		.0000<	.0016	.0019<	.0017	.00<	.00	.8
C29	CU		.0379+-	.0048	.0026+-	.0008	.07+-	.02	-7.3
C30	ZN	*	.0070+-	.0021	.0175+-	.0045	2.51+-	.99	2.1
C31	GA		.0000<	.0040	.0001<	.0007	.00<	.00	.0
C32	GE		.0023<	.0036	.0001<	.0001	.05<	.09	-.6
C33	AS		.0000<	.0050	.0002<	.0026	.00<	.00	.0
C34	SE		.0047+-	.0028	.0001+-	.0004	.01+-	.08	-1.7
C35	BR	*	.0058+-	.0026	.0038+-	.0009	.66+-	.33	-.7
C37	RB	*	.0070+-	.0030	.0037+-	.0005	.52+-	.24	-1.1
C38	SR	*	.0088+-	.0037	.0168+-	.0008	1.90+-	.80	2.1
C39	Y		.0000<	.0041	.0002<	.0020	.00<	.00	.0
C40	ZR		.0381+-	.0068	.0005+-	.0020	.01+-	.05	-5.3
C42	MO		.0587+-	.0097	.0002+-	.0008	.00+-	.01	-6.0
C46	PD		.0000<	.0061	.0000<	.0020	.00<	.00	.0
C47	AG		.0084+-	.0070	.0002+-	.0019	.02+-	.23	-1.1
C48	CD		.0024<	.0068	.0004<	.0021	.15<	.99	-.3
C49	IN		.0004<	.0078	.0000<	.0020	.00<	4.93	-.1
C50	SN	*	.0211+-	.0096	.0001+-	.0020	.01+-	.10	-2.1
C51	SB		.0067<	.0115	.0000<	.0021	.00<	.31	-.6
C56	BA		.5139+-	.0761	.0282+-	.0054	.05+-	.01	-6.4
C57	LA		.0000<	.0587	.0017<	.0030	.00<	.00	.0
C80	HG		.0022<	.0064	.0006<	.0010	.26<	.90	-.2
C82	PB	*	.0271+-	.0082	.0218+-	.0034	.80+-	.27	-.6
C204	NO3	*	2.0922+-	.2959	1.7899+-	.1765	.86+-	.15	-.9
C203	SO4	*	3.0737+-	.4347	2.3746+-	.1775	.77+-	.12	-1.5
C205	NH4	*	.7257+-	.1026	.8503+-	.0607	1.17+-	.19	1.0
C219	K2	*	.1513+-	.0214	.1220+-	.0071	.81+-	.12	-1.3
C201	OC	*	4.5530+-	.5398	4.5156+-	.5513	.99+-	.17	.0
C202	EC	*	1.9424+-	.2514	2.0077+-	.3351	1.03+-	.22	.2

SOURCE CONTRIBUTION ESTIMATES - SITE: HYGIENE DATE: 03/28/99 CMB8 (97350)
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .94 PERCENT MASS 100.8
CHI SQUARE 2.45 DF 11
B and L: No SRC ELIM: No
WEIGHTS: CHISQR 1.000 R SQR 1.000 PCMASS 1.000 FRCEST 1.000

SOURCE EST	CODE	NAME	SCE(UG/M3)	STD ERR	TSTAT
YES	34	FIREP	11.0874	1.3822	8.0216
YES	63	NH4HSO4	.6985	.3028	2.3071
YES	64	NH4NO3	1.4659	.2548	5.7531
YES	103	UNPAVED	15.3779	2.0185	7.6186
YES	119	TP12CMNT	10.7007	1.4184	7.5445

MEASURED CONCENTRATION FOR SIZE: PM10
39.0+- 3.9

ELIGIBLE SPACE DIM. = 5 FOR MAX. UNC. = 7.8000 (20.% OF TOTAL MEAS. MASS)

1 / SINGULAR VALUE				
.1876	.3326	1.2047	1.4350	2.1205

NUMBER ESTIMABLE SOURCES = 5 FOR MIN. PROJ. = .95

PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE
1.0000	34	1.0000	63	1.0000	64	1.0000	103	1.0000	119

ESTIMABLE LINEAR COMBINATIONS OF INESTIMABLE SOURCES

COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	SCE	STD ERR

SPECIES CONCENTRATIONS - SITE: HYGIENE DATE: 03/28/99 CMB 8.0
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .94 PERCENT MASS 100.8
CHI SQUARE 2.45 DF 11

SPECIES		I	MEAS	CALC	RATIO C/M	RATIO R/U
TOTAL	TOTAL		39.0000+- 3.9170	39.3303+- 2.1957	1.01+- .12	.1
C13	AL	*	2.2517+- .6522	1.8647+- .4591	.83+- .31	-.5
C14	SI	*	2.4960+- .2496	5.2769+- 1.3375	2.11+- .58	2.0
C15	P		.0000< .1524	.0278< .0105	.00< .00	.2
C16	S	*	.5338+- .1085	.4786+- .0693	.90+- .22	-.4
C17	CL		.0000< .0116	.0615< .0130	.00< .00	3.5
C19	K	*	1.0324+- .1748	.6292+- .0814	.61+- .13	-2.1
C20	CA	*	2.9779+- .4918	4.4997+- .4945	1.51+- .30	2.2
C22	TI	*	.0948+- .0164	.0854+- .0099	.90+- .19	-.5
C23	V		.0000< .0028	.0077< .0025	.00< .00	2.0
C24	CR		.0031+- .0018	.0062+- .0016	2.02+- 1.26	1.3
C25	MN	*	.0268+- .0052	.0300+- .0031	1.12+- .25	.5
C26	FE	*	1.1715+- .1841	1.1568+- .2829	.99+- .29	.0
C27	CO		.0000< .0029	.0000< .0135	.00< .00	.0
C28	NI		.0000< .0016	.0014< .0003	.00< .00	.8
C29	CU		.0262+- .0035	.0058+- .0017	.22+- .07	-5.2
C30	ZN	*	.0149+- .0025	.0152+- .0015	1.02+- .20	.1
C31	GA		.0000< .0040	.0001< .0007	.00< .00	.0
C32	GE		.0003< .0035	.0002< .0001	.80< 10.26	.0
C33	AS		.0009< .0048	.0015< .0013	1.61< 8.52	.1
C34	SE		.0009< .0027	.0001< .0004	.12< .59	-.3
C35	BR		.0000< .0025	.0007< .0003	.00< .00	.3
C37	RB		.0171+- .0033	.0034+- .0004	.20+- .05	-4.1
C38	SR	*	.0294+- .0046	.0230+- .0012	.78+- .13	-1.3
C39	Y		.0074+- .0041	.0003+- .0019	.04+- .26	-1.6
C40	ZR		.0379+- .0066	.0010+- .0019	.03+- .05	-5.4
C42	MO		.0507+- .0089	.0006+- .0010	.01+- .02	-5.6
C46	PD		.0000< .0066	.0000< .0020	.00< .00	.0
C47	AG		.0000< .0065	.0002< .0024	.00< .00	.0
C48	CD		.0000< .0068	.0003< .0026	.00< .00	.0
C49	IN		.0000< .0079	.0000< .0020	.00< .00	.0
C50	SN		.0043< .0093	.0002< .0020	.05< .47	-.4
C51	SB		.0101< .0112	.0000< .0020	.00< .20	-.9
C56	BA		.6310+- .0844	.0242+- .0099	.04+- .02	-7.1
C57	LA		.0564+- .0561	.0030+- .0028	.05+- .07	-.9
C80	HG		.0000< .0063	.0005< .0011	.00< .00	.1
C82	PB		.0016< .0073	.0048< .0022	3.11< 14.60	.4
C204	NO3	*	1.7866+- .2527	1.1815+- .1138	.66+- .11	-2.2
C203	SO4	*	2.2465+- .3177	1.7258+- .1696	.77+- .13	-1.4
C205	NH4	*	.3559+- .0503	.4582+- .0351	1.29+- .21	1.7
C219	K2	*	.2269+- .0321	.1947+- .0136	.86+- .14	-.9
C201	OC	*	5.4371+- .6369	5.7460+- .3244	1.06+- .14	.4
C202	EC	*	2.0824+- .2649	1.8865+- .4364	.91+- .24	-.4

FILE NAMES FILE:

SOURCE CONTRIBUTION ESTIMATES - SITE: HYGIENE DATE: 03/31/99 CMB8 (97350)
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .94 PERCENT MASS 101.7
CHI SQUARE 2.40 DF 10
B and L: No SRC ELIM: No
WEIGHTS: CHISQR 1.000 R SQR 1.000 PCMASS 1.000 FRCEST 1.000

SOURCE EST	CODE	NAME	SCE(UG/M3)	STD ERR	TSTAT
YES	34	FIREP	7.9515	1.5672	5.0738
YES	59	MD8510US	.5018	.7899	.6353
YES	63	NH4HSO4	.7615	.2733	2.7865
YES	64	NH4NO3	1.4379	.2469	5.8244
YES	103	UNPAVED	15.2456	1.9934	7.6481
YES	119	TP12CMNT	6.6392	1.0780	6.1586

MEASURED CONCENTRATION FOR SIZE: PM10
32.0+- 3.2

ELIGIBLE SPACE DIM. = 6 FOR MAX. UNC. = 6.4000 (20.% OF TOTAL MEAS. MASS)

1 / SINGULAR VALUE					
.1832	.3074	.5221	.9789	1.6876	2.0358

NUMBER ESTIMABLE SOURCES = 6 FOR MIN. PROJ. = .95

PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE	PROJ.	SOURCE
1.0000	34	1.0000	59	1.0000	63	1.0000	64	1.0000	103
1.0000	119								

ESTIMABLE LINEAR COMBINATIONS OF INESTIMABLE SOURCES

COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	COEFF.	SOURCE	SCE	STD ERR

SPECIES CONCENTRATIONS - SITE: HYGIENE DATE: 03/31/99 CMB 8.0
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .94 PERCENT MASS 101.7
CHI SQUARE 2.40 DF 10

SPECIES		I	MEAS		CALC		RATIO C/M		RATIO R/U
TOTAL	TOTAL		32.0000+-	3.2230	32.5375+-	2.0165	1.02+-	.12	.1
C13	AL	*	2.6767+-	.7192	1.7774+-	.4546	.66+-	.25	-1.1
C14	SI	*	2.3040+-	.2304	5.0091+-	1.3245	2.17+-	.61	2.0
C15	P		.0000<	.1920	.0277<	.0102	.00<	.00	.1
C16	S	*	.4241+-	.0875	.4235+-	.0670	1.00+-	.26	.0
C17	CL		.0000<	.0110	.0550<	.0125	.00<	.00	3.3
C19	K	*	.8802+-	.1490	.5600+-	.0792	.64+-	.14	-1.9
C20	CA	*	2.5968+-	.4288	2.9614+-	.3150	1.14+-	.22	.7
C22	TI	*	.1056+-	.0181	.0818+-	.0098	.77+-	.16	-1.2
C23	V		.0000<	.0028	.0073<	.0025	.00<	.00	2.0
C24	CR		.0000<	.0017	.0057<	.0015	.00<	.00	2.5
C25	MN	*	.0254+-	.0051	.0280+-	.0031	1.10+-	.25	.4
C26	FE	*	1.0330+-	.1623	1.0671+-	.2804	1.03+-	.32	.1
C27	CO		.0000<	.0028	.0000<	.0134	.00<	.00	.0
C28	NI		.0000<	.0016	.0014<	.0087	.00<	.00	.8
C29	CU		.0324+-	.0041	.0058+-	.0017	.18+-	.06	-6.0
C30	ZN	*	.0101+-	.0022	.0135+-	.0015	1.34+-	.33	1.3
C31	GA		.0000<	.0041	.0001<	.0006	.00<	.00	.0
C32	GE		.0034<	.0037	.0001<	.0001	.04<	.05	-.9
C33	AS		.0000<	.0050	.0014<	.0014	.00<	.00	.3
C34	SE		.0000<	.0028	.0001<	.0004	.00<	.00	.0
C35	BR		.0053+-	.0027	.0018+-	.0004	.35+-	.19	-1.3
C37	RB		.0032+-	.0030	.0032+-	.0004	.97+-	.92	.0
C38	SR	*	.0168+-	.0040	.0161+-	.0009	.96+-	.24	-.2
C39	Y		.0051+-	.0041	.0002+-	.0017	.04+-	.34	-1.1
C40	ZR		.0388+-	.0068	.0006+-	.0017	.02+-	.04	-5.4
C42	MO		.0616+-	.0100	.0005+-	.0009	.01+-	.02	-6.1
C46	PD		.0000<	.0062	.0000<	.0018	.00<	.00	.0
C47	AG		.0023<	.0068	.0002<	.0023	.07<	1.03	-.3
C48	CD		.0042<	.0073	.0003<	.0025	.07<	.61	-.5
C49	IN		.0063<	.0082	.0000<	.0018	.00<	.28	-.8
C50	SN		.0262+-	.0098	.0001+-	.0018	.01+-	.07	-2.6
C51	SB		.0058<	.0114	.0000<	.0018	.00<	.31	-.5
C56	BA		.4921+-	.0730	.0215+-	.0093	.04+-	.02	-6.4
C57	LA		.0013<	.0594	.0019<	.0023	1.39<	61.43	.0
C80	HG		.0030<	.0067	.0004<	.0011	.12<	.46	-.4
C82	PB		.0095+-	.0076	.0084+-	.0024	.88+-	.74	-.1
C204	NO3	*	1.7834+-	.2522	1.1551+-	.1117	.65+-	.11	-2.3
C203	SO4	*	2.0169+-	.2852	1.4350+-	.1702	.71+-	.13	-1.8
C205	NH4	*	.3536+-	.0500	.4592+-	.0348	1.30+-	.21	1.7
C219	K2	*	.1305+-	.0185	.1322+-	.0104	1.01+-	.16	.1
C201	OC	*	4.5215+-	.5363	4.4528+-	.2614	.98+-	.13	-.1
C202	EC	*	1.8994+-	.2465	1.6943+-	.3279	.89+-	.21	-.5

FILE NAMES FILE:

SOURCE CONTRIBUTION ESTIMATES - SITE: HYGIENE DATE: 11/17/99 CMB8 (97350)
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .92 PERCENT MASS 87.1
CHI SQUARE 1.91 DF 13
B and L: No SRC ELIM: No
WEIGHTS: CHISQR 1.000 R SQR 1.000 PCMASS 1.000 FRCEST 1.000

SOURCE EST	CODE	NAME	SCE(UG/M3)	STD ERR	TSTAT
YES	59	MD8510US	7.7136	1.8682	4.1289
YES	64	NH4NO3	.9214	.2221	4.1485
YES	72	PAVED	29.1167	4.0433	7.2012
YES	119	TP12CMNT	7.9111	1.5232	5.1939
YES	42324	BURNING	1.3673	.6010	2.2752

MEASURED CONCENTRATION FOR SIZE: PM10
54.0+- 5.4

ELIGIBLE SPACE DIM. = 5 FOR MAX. UNC. = 10.8000 (20.% OF TOTAL MEAS. MASS)

1 / SINGULAR VALUE				
.2128	.5133	1.4251	1.7896	4.1263

NUMBER ESTIMABLE SOURCES = 5 FOR MIN. PROJ. = .95

PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE	PROJ. SOURCE
1.0000 59	1.0000 64	1.0000 72	1.0000 119	1.0000 42324

ESTIMABLE LINEAR COMBINATIONS OF INESTIMABLE SOURCES

COEFF. SOURCE	COEFF. SOURCE	COEFF. SOURCE	COEFF. SOURCE	SCE	STD ERR

SPECIES CONCENTRATIONS - SITE: HYGIENE DATE: 11/17/99 CMB 8.0
SAMPLE DURATION 24 START HOUR 0 SIZE: PM10
R SQUARE .92 PERCENT MASS 87.1
CHI SQUARE 1.91 DF 13

SPECIES		I	MEAS	CALC	RATIO C/M	RATIO R/U
TOTAL	TOTAL		54.0000+- 5.4000	47.0301+- 3.5743	.87+- .11	-1.1
C13	AL	*	1.4768+- .5584	2.8190+- .7393	1.91+- .88	1.4
C14	SI		.0000+- .0000	9.2663+- 2.5605	.00+- .00	3.6
C15	P		.0000< .1038	.0114< .0146	.00< .00	.1
C16	S	*	.3350+- .0702	.4278+- .1399	1.28+- .50	.6
C17	CL	*	.0397+- .0151	.7896+- .4993	19.89+-14.68	1.5
C19	K	*	1.3128+- .2616	1.1781+- .1847	.90+- .23	-.4
C20	CA	*	3.6458+- .8254	3.5468+- .3776	.97+- .24	-.1
C22	TI	*	.1553+- .0272	.1029+- .0082	.66+- .13	-1.8
C23	V		.0040+- .0028	.0070+- .0023	1.74+- 1.35	.8
C24	CR	*	.0060+- .0020	.0081+- .0017	1.35+- .53	.8
C25	MN	*	.0389+- .0074	.0422+- .0057	1.09+- .25	.4
C26	FE	*	1.8931+- .3130	1.2135+- .1283	.64+- .13	-2.0
C27	CO		.0000< .0034	.0000< .0146	.00< .00	.0
C28	NI		.0000< .0017	.0051< .0093	.00< .00	.5
C29	CU		.0228+- .0037	.0046+- .0014	.20+- .07	-4.6
C30	ZN	*	.0206+- .0044	.0294+- .0102	1.43+- .58	.8
C31	GA		.0000< .0036	.0001< .0012	.00< .00	.0
C32	GE		.0009< .0032	.0002< .0001	.18< .63	-.2
C33	AS		.0024< .0029	.0004< .0091	.16< 3.78	-.2
C34	SE		.0000< .0024	.0001< .0003	.00< .00	.0
C35	BR		.0000< .0023	.0194< .0046	.00< .00	3.7
C37	RB	*	.0063+- .0030	.0058+- .0010	.92+- .46	-.2
C38	SR	*	.0149+- .0043	.0234+- .0011	1.57+- .46	1.9
C39	Y		.0073+- .0036	.0002+- .0030	.03+- .41	-1.5
C40	ZR	*	.0209+- .0086	.0007+- .0029	.03+- .14	-2.2
C42	MO		.0009< .0066	.0002< .0014	.26< 2.48	-.1
C46	PD		.0009< .0065	.0000< .0033	.00< 3.68	-.1
C47	AG		.0121+- .0068	.0003+- .0033	.02+- .27	-1.6
C48	CD		.0000< .0068	.0006< .0036	.00< .00	.1
C49	IN		.0039< .0073	.0000< .0033	.00< .85	-.5
C50	SN		.0019< .0085	.0002< .0037	.09< 2.01	-.2
C51	SB		.0000< .0104	.0000< .0043	.00< .00	.0
C56	BA		.0000< .0626	.0432< .0119	.00< .00	.7
C57	LA		.0719+- .0552	.0023+- .0113	.03+- .16	-1.2
C80	HG		.0043< .0054	.0008< .0017	.19< .46	-.6
C82	PB		.0000< .0068	.0745< .0178	.00< .00	3.9
C204	NO3		2.2052+- .3138	.7693+- .0744	.35+- .06	-4.5
C203	SO4	*	1.2527+- .1822	.9448+- .0893	.75+- .13	-1.5
C205	NH4	*	.2700+- .0382	.2700+- .0291	1.00+- .18	.0
C219	K2	*	.2100+- .0298	.2095+- .0091	1.00+- .15	.0
C201	OC	*	5.5371+- .7830	5.4609+- 1.0155	.99+- .23	-.1
C202	EC	*	5.9808+- .6975	5.5422+- 1.3875	.93+- .26	-.3

Appendix D

CMB Model Diagnostics

CMB Model Diagnostics

There are a large number of possible source profile combinations which can be used to "explain" the chemical composition of any ambient filter. These possible source combinations are evaluated in an iterative process as the analyst adds and deletes sources from the model in an effort to find an optimum solution. The selection of the optimum model is subjective and is based on statistical diagnostics provided with the model output. In order to aid interpretation of the CMB model outputs, several useful model performance measures are discussed briefly below. These CMB statistical diagnostics are discussed in greater detail in the CMB8 User's Manual. The optimum CMB runs prepared for this analysis are presented as Appendix B to this report.

- Source Contribution Estimate (SCE). This is the contribution of each source type to the apportioned PM_{10} in units of $\mu g/m^3$.

- Standard Error (STDERR). This is an indication of the precision or certainty of the SCE in units of $\mu g/m^3$. The STDERR is estimated by propagating the precision of the receptor data and source profiles through the CMB model least squares calculations. Ideally, STDERR will be much less than the SCE.

- t-Statistic (TSTAT). This is the ratio of the source contribution estimate to the standard error. A TSTAT value of 2.0 or greater indicates that the relative contribution of the source contribution estimate is high and that the contribution is significant. In this analysis, all of the source contribution estimates had acceptable TSTAT values.

- R-Square (R SQUARE). The R-square measures the amount of variance in the receptor concentrations which is explained by the calculated species concentrations. It is determined by a linear regression of measured versus calculated values for the fitting species. An R SQUARE of less than 0.80 indicates that the selected source profiles have not adequately accounted for the variance in the receptor concentrations. All of the model runs met this diagnostic criterion.

- Chi-square (CHI SQUARE). The Chi-square is the weighted sum of squares of the differences between the calculated and measured fitting species concentrations. The weighting is inversely proportional to the squares of the precision in the source profiles and ambient data. This means that analysis of quartz filters (with larger precision estimates for most species) should tend to result in lower model Chi-square values. Chi-square values greater than 4.0 indicate that one or more species concentrations are not well explained by the source contribution estimates.

Several factors can cause the values of both the R-square and Chi-square statistics to exceed their targets: (1) contributing sources have been omitted from the CMB calculation, (2) one or more unrepresentative source profiles have been selected, (3) precisions of receptor or source profiles have been underestimated, (4) source or receptor data are inadequate. All of the model runs in this analysis met the Chi-square diagnostic criterion.

- Percent of Mass Accounted For (PERCENT MASS). This is the ratio of the sum of the source contributions to the measured mass. The target value is 100%, with an acceptable range of 20%. Potential causes of percent mass values outside this range include (1) use of unrepresentative source profiles, (2) omission of significant source profiles, and (3) inaccurate or incomplete mass or chemical concentration determinations. All of the model runs in this analysis had acceptable percent mass statistics.

- Uncertainty/Similarity Clusters (U/S CLUSTERS). This display shows the result of a singular value decomposition analysis of collinearity. When source profiles are very similar in chemical composition, the CMB model doesn't accurately apportion species to the source types which they represent. There were no uncertainty/similarity clusters in the model runs presented in this report.

- Sum of Combined Sources (SUM OF CLUSTER SOURCES). This value is the sum of the source contributions in the cluster coupled with the standard error of that sum. In some cases it may be possible to use this value as an SCE for a source category.

- Ratio of Residual to Its Standard Error (RATIO R/U). This column contains the ratio of the signed difference between the calculated and the measured concentration (the residual) divided by the uncertainty of that residual. The model goal is a R/U values near zero for all species. As in the TSTAT, a RATIO R/U with an absolute value greater than 2 indicates a significant residual for that specie. A large positive residual indicates that one or more of the sources is contributing too much of that specie. A large negative R/U may indicate that a significant source is missing.

To a certain extent, these residuals are inevitable, and are present at levels greater than 2.0 for several species on nearly every model run. The reviewer should consider the relative importance of that chemical specie where a large R/U ratio is present on a given model run. For example, the R/U values for organic and elemental carbon, which are the predominant chemical species, are within acceptable limits on every model run. On the other hand, the R/U values for ammonium are always greater than 2.0 when ammonium data are available, indicating a significant loss of ammonia from the filters before analysis.

- Ratio of Calculated to Measured Species (RATIO C/M). This value is the ratio of the calculated to measured species concentration and the standard error of that ratio. Ideally, the RATIO C/M should be near unity.