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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

REF: 8EPR-SR

November 23, 1998

Mr. Anthony Thomas
3966 Adams Street
Denver, CO 80205

Re: Vasquez Boulevard
and Interstate 70 Site

Dear Anthony:

A copy of the draft report summarizing the results of physico-chemical characterization of soils for the Vasquez Boulevard & I-70 site was provided to members of the Working Group at our meeting on November 12, 1998. As discussed at that meeting, I am providing the enclosed information related to that report:

1. Replacement pages (enclosure 1);

2. Revised figures 1A through 1D which illustrate the relationship between the bulk and fine concentrations of soils in lower concentration ranges (enclosure 2); and

3. Supporting calculations for relative arsenic mass by phase (enclosure 3).

Please review the report and the enclosed information and provide me with any written comments by November 30, 1998. Comments will be discussed at the next working group meeting. EPA will revise the report as necessary to respond to comments received and will incorporate this report into a final report on the results of risk-based sampling and physico-chemical characterization of soils described in the project plans provided to working group members in August, 1998.

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If you have any questions as you review the report and the enclosed information, please call me at (303)312-6579 or Chris Weis at (303) 312-6671.

Sincerely,

Bonnie Lavelle
Remedial Project Manager

enclosures

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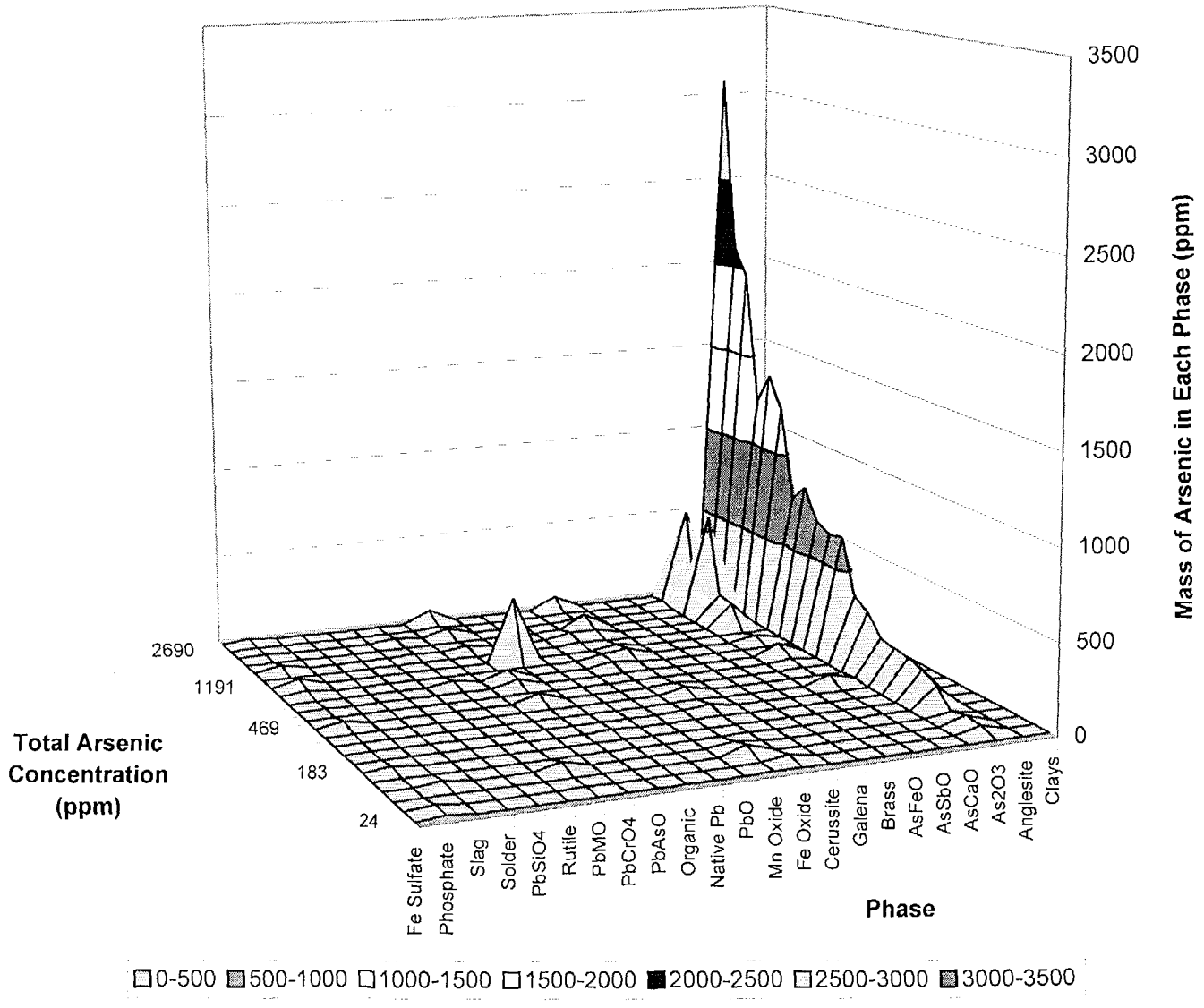
Figure 2A: Distribution of Arsenic Mass by Phase



ENCL 1

Figure 2B: Distribution of Lead Mass by Phase

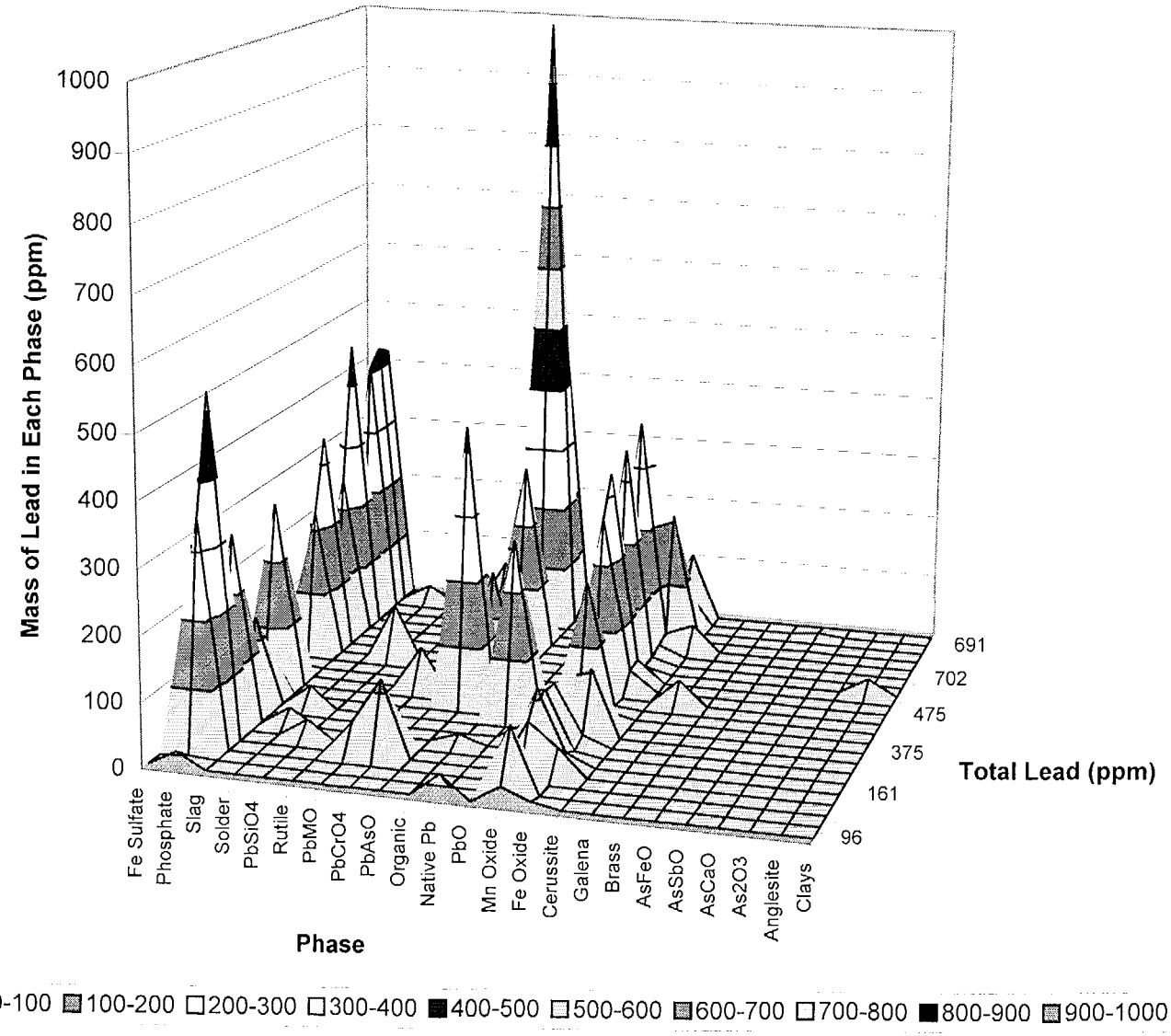
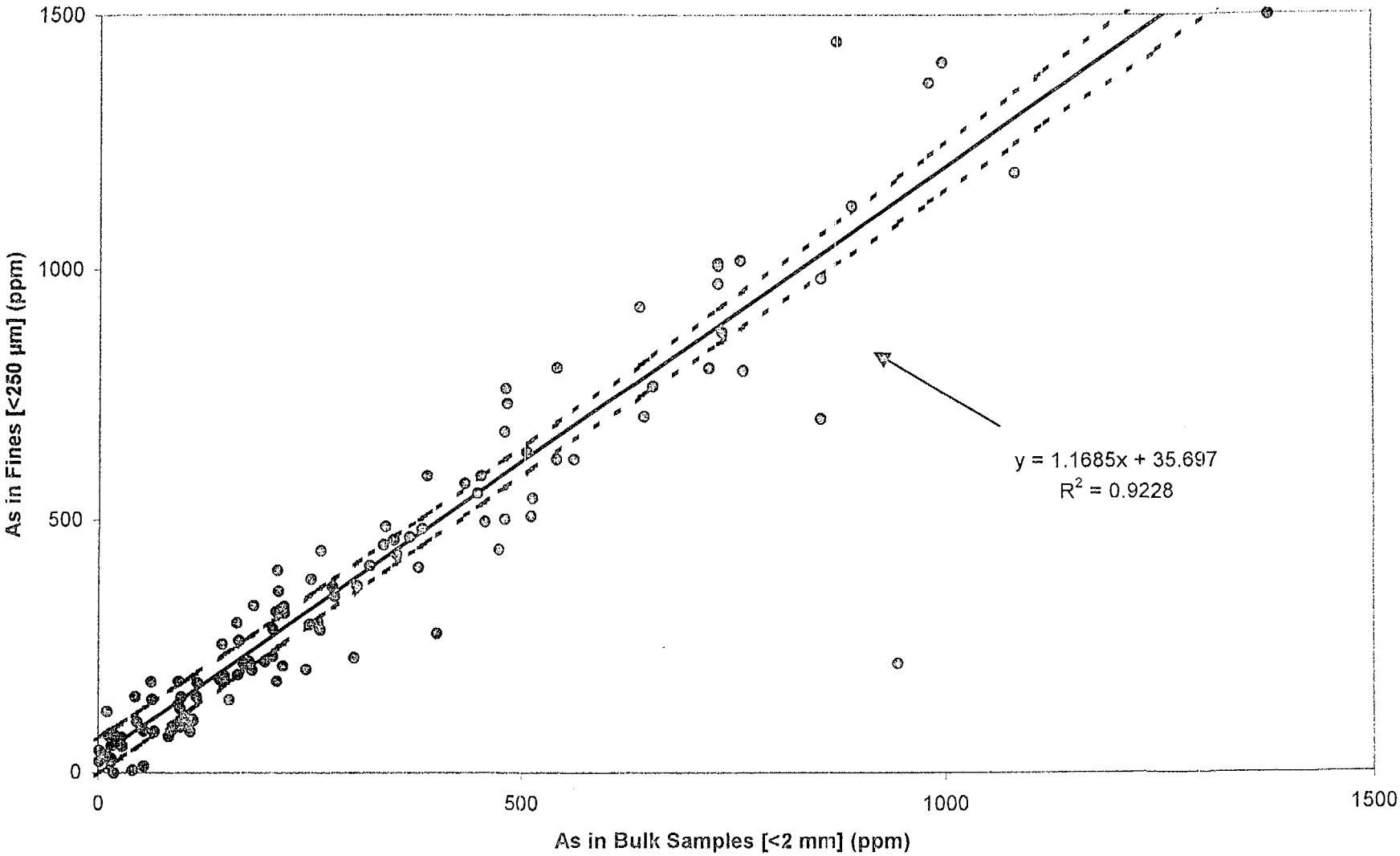


Figure 1A - Comparison of Arsenic Concentrations in Bulk Samples and Fines



ENCL 2

Figure 1B - Comparison of Lead Concentrations in Bulk Samples and Fines

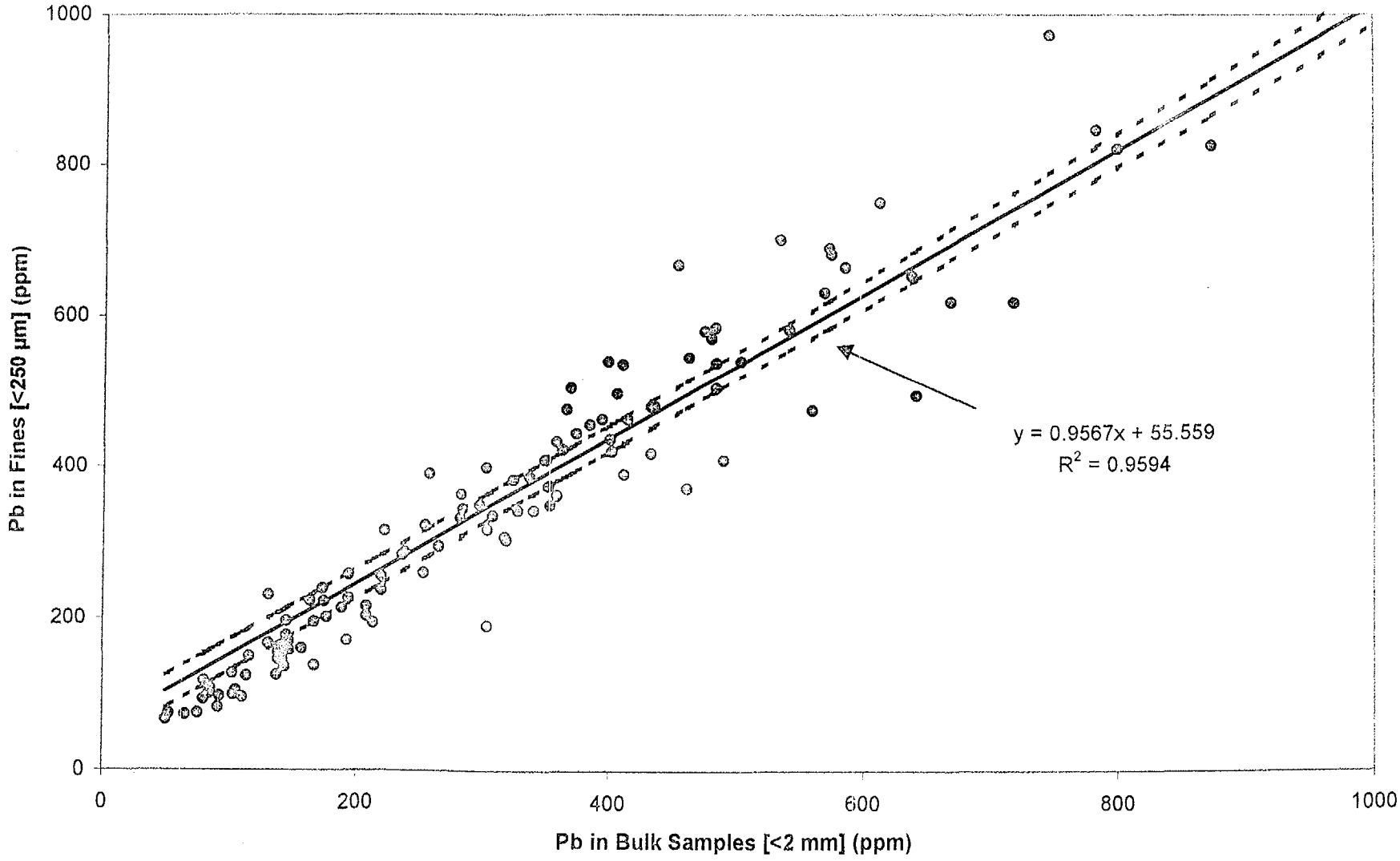


Figure 1C - Comparison of Cadmium Concentrations in Bulk Samples and Fines

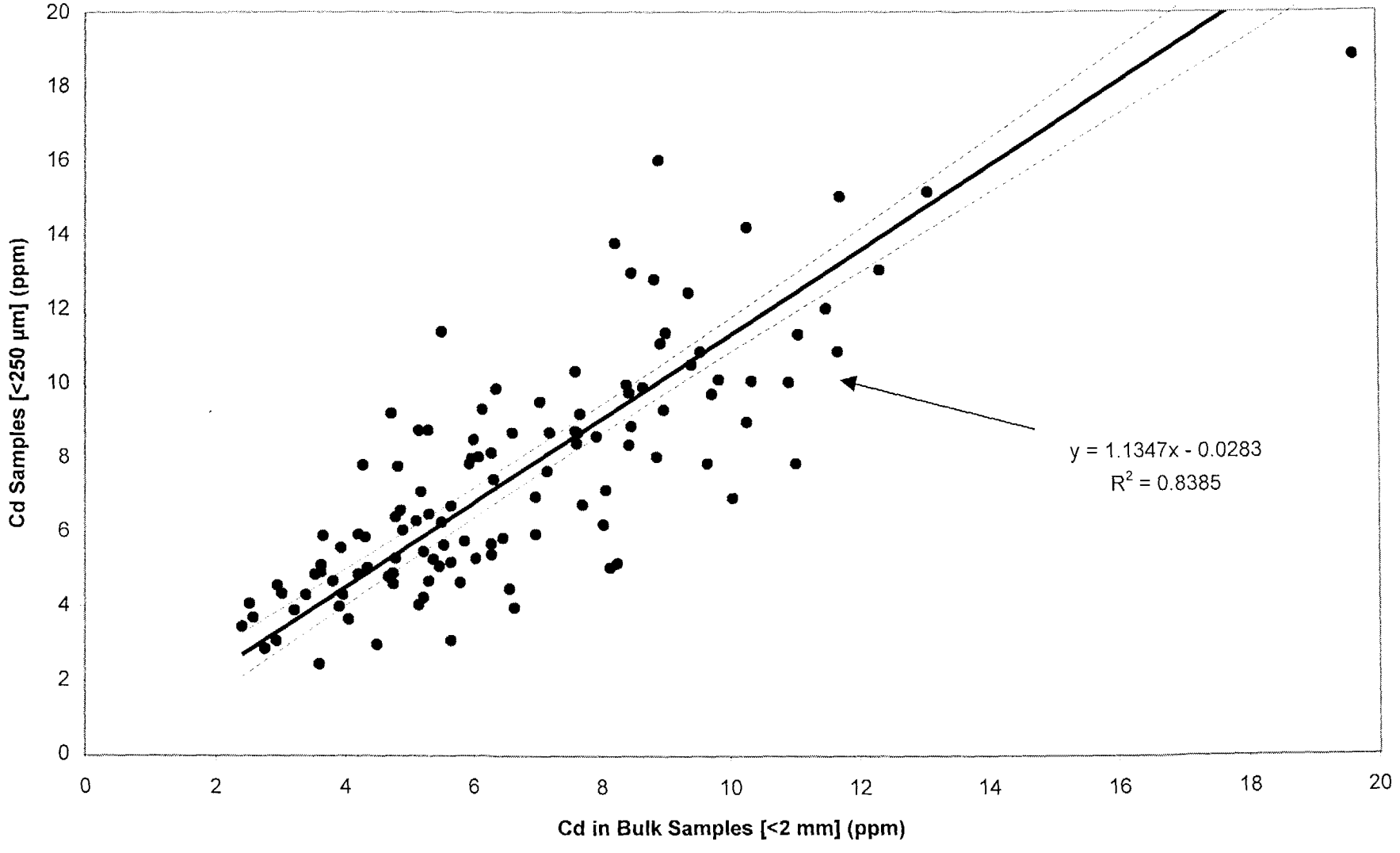
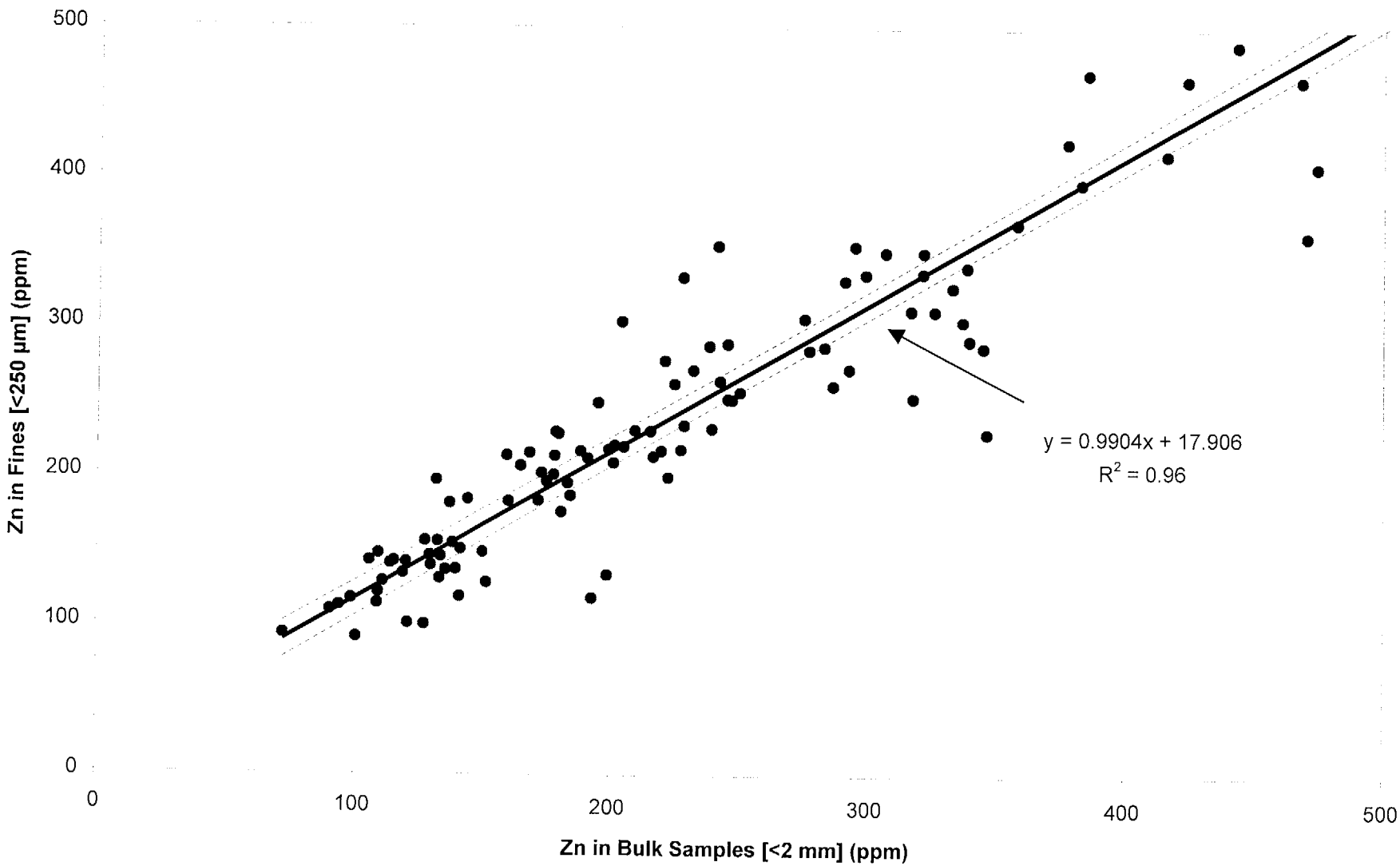


Figure 1D - Comparison of Zinc Concentrations in Bulk Samples and Fines



Supporting Calculations for Relative Arsenic Mass by Phase

Table _-_: Total Lead and Arsenic Concentrations

Sample Number	As (ppm)	Pb (ppm)
ND-98-22	130	96
ND-98-26	104	105
ND-98-27	183	349
ND-98-31	85	822
ND-98-44	286	161
ND-98-47	206	437
ND-98-56	234	135
ND-98-66	363	317
ND-98-72	24	375
ND-98-81	770	751
ND-98-98	805	386
ND-98-100	109	99
ND-98-102	704	475
ND-98-106	973	682
ND-98-110	469	541
ND-98-113	1409	362
ND-98-114	2042	702
ND-98-115	1691	1074
ND-98-117	1907	423
ND-98-118	1191	1434
ND-98-119	2690	691
ND-98-120	3390	1405

ENCLOSURE 3

Supporting Calculations for Relative Arsenic Mass by Phase

Total Arsenic-Bearing Particles Contributing to Arsenic Mass

ND-98-22		ND-98-26		ND-98-27		ND-98-31		ND-98-44		ND-98-47	
As2O3	619935.2	As2O3	33818.98	As2O3	619620.7	As2O3	53391.55	As2O3	764071.6	As2O3	243601.2
AsSbO	29262.91	Fe Oxide	3106.569	Phosphate	62168.67	AsSbO	1915.391	AsCaO	39157.89	Fe Oxide	6581.443
Brass	221.831	Mn Oxide	35868.61			Fe Oxide	34331.37	AsSbO	167671.3	Mn Oxide	6030.928
Fe Oxide	25239.44	Phosphate	778.5888			Mn Oxide	4194.622	Fe Oxide	24954.39	Organic	10721.65
Mn Oxide	5218.31	Rutile	109.4891			PbCrO4		Mn Oxide	9464.912	Solder	64.94845
Native Pb						PbMO	7418.182	PbSiO4		Phosphate	
Phosphate	4131.455					Phosphate	23969.27			Fe Sulfate	
Fe Sulfate	3793.803					Fe Sulfate	1293.342				

Supporting Calculations for Relative Arsenic Mass by Phase

ND-98-56		ND-98-66		ND-98-72		ND-98-81		ND-98-98		ND-98-100	
As2O3	314470.6	As2O3	458989.9	Fe Oxide	11068.24	As2O3	1503067	As2O3	632928.2	As2O3	6514.165
Fe Oxide	36488.69	Fe Oxide	48986.92	Mn Oxide	10552.94	AsSbO	142017.7	Fe Oxide	6900	Fe Oxide	1574.692
Mn Oxide	13235.29	Mn Oxide	1457.944	Native Lea		Fe Oxide	9053.165	Mn Oxide	22808.04	Galena	
PbO		Solder	39.25234	Phosphate	33411.76	Mn Oxide	705.2441	PbAsO	46406.25	Mn Oxide	6351.494
		Phosphate	3489.097			PbAsO	85632.91	PbMO	21553.57	PbMO	10182.07
						Phosphate	14032.55			Phosphate	421.7926
										Slag	5483.304
										Fe Sulfate	788.9865

Supporting Calculations for Relative Arsenic Mass by Phase

ND-98-102		ND-98-106		ND-98-110		ND-98-113		ND-98-114		ND-98-115	
Clays	258.5085	As2O3	298324.5	Anglesite		As2O3	1399622	As2O3	2095337	Clays	755.4235
As2O3	1550159	AsSbO	9408.302	As2O3	501639.7	AsSbO	148552.1	Fe Oxide	12256.85	As2O3	2168585
AsSbO	34228.68	Fe Oxide	14239.77	AsSbO	6561.053	Fe Oxide	6673.287	PbAsO	44525.32	AsSbO	225981
Brass	13.34746	Mn Oxide	9113.208	Fe Oxide	18189.47	Mn Oxide	13167.83	PbMO	18334.18	Cerussite	
Fe Oxide	7460.339	PbSiO4		Mn Oxide	1319.549			Phosphate	9482.163	Fe Oxide	42137.3
Mn Oxide	4263.559	Phosphate	5224.964	PbAsO	60789.47			Fe Sulfate	387.4568	Mn Oxide	43867.76
PbAsO	8809.322			Phosphate	34285.71					PbAsO	32607.73
Phosphate	4610.169									PbCrO4	
Fe Sulfate	57.0678									PbMO	12195.54
										Phosphate	45884.1
										Fe Sulfate	1200.713

Supporting Calculations for Relative Arsenic Mass by Phase

ND-98-117		ND-98-118		ND-98-119		ND-98-120	
As2O3	470499	As2O3	513216	As2O3	2697928	Clays	40.86817
AsSbO	216929.2	Fe Oxide	17293.43	AsFeO	23772.47	As2O3	1226830
Fe Oxide	29795.47	Mn Oxide	490.9091	AsSbO	693333.7	AsSbO	60125.4
Mn Oxide	2045.292	PbAsO	243923.1	Fe Oxide	8400	Fe Oxide	27171.7
PbAsO		PbMO	1350.49	Mn Oxide	328.6517	Mn Oxide	250.8039
PbMO		Phosphate	25398.6	Organics	1369.382	PbAsO	27853.7
Slag		Slag	100.6993	PbAsO	14599.72	PbCrO4	
				Solder	8.848315	PbMO	776.2058
				Phosphate	3483.146	Phosphate	6109.325
				PbMO	2034.27		

Supporting Calculations for Relative Arsenic Mass by Phase

Number of Particles in Each Phase

PHASE	ND-98-22	ND-98-26	ND-98-27	ND-98-31	ND-98-44	ND-98-47	ND-98-56	ND-98-66	ND-98-72	ND-98-81	ND-98-98	ND-98-100
Clays												
Anglesite												
As2O3	619935	33819	619621	53392	764072	243601	314471	458990		1503067	632928	6514
AsCaO					39158							
AsSbO	29263			1915	167671					142018		
AsFeO												
Brass	222											
Galena												
Cerussite												
Fe Oxide	25239	3107		34331	24954	6581	36489	48987	11068	9053	6900	1575
Mn Oxide	5218	35869		4195	9465	6031	13235	1458	10553	705	22808	6351
PbO												
Native Pb												
Organic						10722						
PbAsO										85633	46406	
PbCrO4												
PbMO				7418							21554	10182
Rutile		109										
PbSiO4												
Solder						65		39				
Slag												5483
Phosphate	4131	779	62169	23969				3489	33412	14033		422
Fe Sulfate	3794			1293								789
Sum=	687803	73682	681789	126514	1005320	267000	364195	512963	55033	1754509	730596	31317

Supporting Calculations for Relative Arsenic Mass by Phase

ND-98-102	ND-98-106	ND-98-110	ND-98-113	ND-98-114	ND-98-115	ND-98-117	ND-98-118	ND-98-119	ND-98-120
259					755				41
1550159	298325	501640	1399622	2095337	2168585	470499	513216	2697928	1226830
34229	9408	6561	148552		225981	216929		693334	60125
								23772	
13									
7460	14240	18189	6673	12257	42137	29795	17293	8400	27172
4264	9113	1320	13168		43868	2045	491	329	251
							243923	1369	
8809		60789		44525	32608			14600	27854
				18334	12196		1350	2034	776
								9	
							101		
4610	5225	34286		9482	45884		25399	3483	6109
57				387	1201				
1609860	336311	622785	1568015	2180323	2573215	719269	801773	3445258	1349158

Supporting Calculations for Relative Arsenic Mass by Phase

Percent of Particles Contributing to Each Phase

PHASE	ND-98-22	ND-98-26	ND-98-27	ND-98-31	ND-98-44	ND-98-47	ND-98-56	ND-98-66	ND-98-72	ND-98-81	ND-98-98	ND-98-100
Clays												
Anglesite												
As2O3	90.1%	45.9%	90.9%	42.2%	76.0%	91.2%	86.3%	89.5%		85.7%	86.6%	20.8%
AsCaO					3.9%							
AsSbO	4.3%			1.5%	16.7%					8.1%		
AsFeO												
Brass	0.0%											
Galena												
Cerussite												
Fe Oxide	3.7%	4.2%		27.1%	2.5%	2.5%	10.0%	9.5%	20.1%	0.5%	0.9%	5.0%
Mn Oxide	0.8%	48.7%		3.3%	0.9%	2.3%	3.6%	0.3%	19.2%	0.0%	3.1%	20.3%
PbO												
Native Pb												
Organic						4.0%						
PbAsO										4.9%	6.4%	
PbCrO4												
PbMO				5.9%							3.0%	32.5%
Rutile		0.1%										
PbSiO4												
Solder						0.0%		0.0%				
Slag												17.5%
Phosphate	0.6%	1.1%	9.1%	18.9%				0.7%	60.7%	0.8%		1.3%
Fe Sulfate	0.6%			1.0%								2.5%
Sum=	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Supporting Calculations for Relative Arsenic Mass by Phase

ND-98-102	ND-98-106	ND-98-110	ND-98-113	ND-98-114	ND-98-115	ND-98-117	ND-98-118	ND-98-119	ND-98-120
0.0%					0.0%				0.0%
96.3%	88.7%	80.5%	89.3%	96.1%	84.3%	65.4%	64.0%	78.3%	90.9%
2.1%	2.8%	1.1%	9.5%		8.8%	30.2%		20.1%	4.5%
								0.7%	
0.0%									
0.5%	4.2%	2.9%	0.4%	0.6%	1.6%	4.1%	2.2%	0.2%	2.0%
0.3%	2.7%	0.2%	0.8%		1.7%	0.3%	0.1%	0.0%	0.0%
							30.4%	0.0%	
0.5%		9.8%		2.0%	1.3%			0.4%	2.1%
				0.8%	0.5%		0.2%	0.1%	0.1%
								0.0%	
							0.0%		
0.3%	1.6%	5.5%		0.4%	1.8%		3.2%	0.1%	0.5%
0.0%				0.0%	0.0%				
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Supporting Calculations for Relative Arsenic Mass by Phase

Arsenic Mass in Each Phase

Sample Number	ND-98-22	ND-98-26	ND-98-27	ND-98-31	ND-98-44	ND-98-47	ND-98-56	ND-98-66	ND-98-72	ND-98-81	ND-98-98	ND-98-100
Total As (ppm)	130	104	183	85	286	206	234	363	24	770	805	109
PHASE												
Clays												
Anglesite												
As2O3	117.17	47.73	166.31	35.87	217.37	187.95	202.05	324.81		659.65	697.39	22.67
AsCaO					11.14							
AsSbO	5.53			1.29	47.70					62.33		
AsFeO												
Brass	0.04											
Galena												
Cerussite												
Fe Oxide	4.77	4.38		23.07	7.10	5.08	23.44	34.67	4.83	3.97	7.60	5.48
Mn Oxide	0.99	50.63		2.82	2.69	4.65	8.50	1.03	4.60	0.31	25.13	22.11
PbO												
Native Pb												
Organic						8.27						
PbAsO										37.58	51.13	
PbCrO4												
PbMO				4.98							23.75	35.44
Rutile		0.15										
PbSiO4												
Solder						0.05		0.03				
Slag												19.09
Phosphate	0.78	1.10	16.69	16.10				2.47	14.57	6.16		1.47
Fe Sulfate	0.72			0.87								2.75

Supporting Calculations for Relative Arsenic Mass by Phase

ND-98-102	ND-98-106	ND-98-110	ND-98-113	ND-98-114	ND-98-115	ND-98-117	ND-98-118	ND-98-119	ND-98-120
704	973	469	1409	2042	1691	1907	1191	2690	3390
0.11					0.50				0.10
677.89	863.10	377.77	1257.68	1962.41	1425.10	1247.44	762.36	2106.50	3082.63
14.97	27.22	4.94	133.49		148.50	575.15		541.34	151.08
								18.56	
0.01									
3.26	41.20	13.70	6.00	11.48	27.69	79.00	25.69	6.56	68.27
1.86	26.37	0.99	11.83		28.83	5.42	0.73	0.26	0.63
							362.34	1.07	
3.85		45.78		41.70	21.43			11.40	69.99
				17.17	8.01		2.01	1.59	1.95
								0.01	
							0.15		
2.02	15.12	25.82		8.88	30.15		37.73	2.72	15.35
0.02				0.36	0.79				