Texas Custodial Trust

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Appendix S
Groundwater Sampling Method Comparison

6835001

MALCOLM PIRNIE

MALCOLM PIRNIE

Memorandum

Date: June 27, 2011

To: Scott Brown
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From: Lee Christoffersen
Adam Griffin

RE: Groundwater Sampling Method Comparison

INTRODUCTION

This memorandum presents the results of three groundwater sampling methods used during the semi-annual groundwater monitoring event of March 2011 at the former ASARCO Smelter Site located in El Paso, Texas (Site). As part of the semi-annual monitoring event, which is discussed in the approved Remedial Action Work Plan (Malcolm Pirnie, 2011), groundwater was sampled using the traditional three well-volume purge method at 31 groundwater monitoring wells. In an effort to reduce the amount of purge water generated and to reduce the effort required to perform the interim groundwater monitoring, two alternative methodologies were evaluated: a no-purge (Hydra-Sleeve ^{TM}) method (ITRC, 2007) and a low-flow method, per the United States Environmental Protection Agency (USEPA) Low-Flow Sampling Procedures (USEPA, 1996).

A subset of eight groundwater monitoring wells were sampled using all three sampling methodologies: EP-120, EP-12, EP-131, EP-132, EP-51, EP-58, EP-75, and EP-78 (Figure 1). The three sampling methods were implemented in the order of (1) the no-purge (HydraSleeve™) method, (2) the low-flow method, and (3) the standard three well-volume method; all samples were collected in the same interval within the screened interval of each monitoring well. Groundwater collected by each method was analyzed for total and dissolved metals, water quality parameters, and field parameters (Table 1). The water quality parameters were analyzed by the primary laboratory as well as a quality assurance laboratory (Malcolm Pirnie, 2011).

Table 1 Groundwater Parameters

Parameter Class	Parameter List
Total Metals (mg/L)	Aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, sodium, thallium, zinc
Dissolved Metals (mg/L)	Antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, molybdenum, nickel, selenium, thallium, zinc
Water Quality (mg/L)	Chloride, fluoride, nitrate, nitrate + nitrite, sulfate, sulfide, total alkalinity, total dissolved solids, total organic carbon, total suspended solids
Purge	Conductivity (µmhos/cm), turbidity (NTU)

Notes:
mg/L = milligrams per liter
NTU = Nephelometric Turbidity Units
µmhos/cm = micromhos per centimeter

STATISTICAL COMPARISON

An evaluation of method equivalency was performed using both the total and dissolved concentrations of the site constituents of concern (COCs): arsenic, cadmium, chromium, copper, iron, lead, selenium and zinc. Although turbidity is not a Site COC, it was included in the evaluation because of its significant role in groundwater data quality at the Site. Because the Site experiences both high mass flux and significant seasonality, data from this sampling event were not compared to historic data collected using the standard method; only results from the March 2011 event were considered.

Attachment 1 summarizes the comparison of method equivalency. The initial step of the comparison was counting the number of maximum and minimum concentrations that each method yielded. The second step was generating plots to compare the results between methods on a by-well basis (no-purge/standard and low-flow/standard).

The data that were used to count the maximum and minimum concentrations are included in Table A-2 of Attachment 1. The maximum concentrations are in red, and the minimum concentrations are in blue. The range of the data is also included. Data was excluded if all three methods yielded a non-detect value. The maximum and minimum analysis is summarized in Table 2.

Table 2 Maximum and Minimum Concentrations

Method	Number of Maximum Measurements	Number of Minimum Measurements	Total Number of Measurements
Metal COCs, Total			
Standard	20	24	165
No-Purge	11	31	
Low-Flow	26	9	
Metal COCs, Dissolved			
Standard	13	19	132
No-Purge	20	16	
Low-Flow	12	12	
Turbidity			
Standard	1	5	24
No-Purge	3	2	
Low-Flow	4	1	

The second tier of statistical evaluation included creating two types of plots to evaluate statistical difference between the methods, which are included in Attachment 1. The first set of plots (Tables A-4 to A-11) compare the COC concentrations by well. The second set of plots (Tables A-12 to A-20) compare the results from all eight wells for each individual analyte. Each type of plot includes both total and dissolved data as well as two pair combinations (no-purge/standard and low-flow/standard). For the purpose of this evaluation, non-detect results were plotted as one-half of the reporting limit and were included in the analysis.

Each plot was a log transform to accommodate for the range of concentrations. A linear trend line was added to each plot, with the intercept set to zero. Therefore, the slope of the linear trend line is the ratio of the concentration from the method plotted on the y axis to the concentration from the method plotted on the x axis. As the slope of the trend line approaches one, the results from each method are more similar. The R^2 value indicates the scatter of the data. Table 3 includes the slopes of the trend lines for the no-purge/standard and low-flow/standard analyses; slopes for trend lines with R^2 values of less than 0.9 are italicized and highlighted in gray, as the scatter of the data may be too great to make any meaningful conclusions.

STATISTICAL INTERPRETATION

The slope of the linear trend lines allows for a quick comparison of the alternative methods to the standard method. If the slope is greater than one, the alternative method

(either no-purge or low-flow) yielded (on average) a higher concentration than that from the standard method; if the slope is less than one, the alternative method yielded a lower concentration (on average) than the standard method. Excluding results for which the R^2 value is less than 0.9, the no-purge data is higher than the standard data 40% of the time and the low-flow data is higher than the standard data 55% of the time when wells are evaluated individually.

Table 3 Summary Statistics of Method Equivalency Comparison

Slopes				
Well ID	**No-Purge / Standard**		**Low-Flow / Standard**	
	Total	**Dissolved**	**Total**	**Dissolved**
EP-120	*0.8155*	1.0927	*1.1414*	1.0392
EP-12	0.3266	*0.0899*	1.2671	0.6329
EP-131	0.9897	1.0865	*1.3636*	1.0198
EP-132	0.9622	0.759	0.9673	0.8263
EP-51	*0.1134*	*0.9615*	2.4752	*1.6886*
EP-58	*0.1568*	*0.1444*	0.9835	0.8193
EP-75	1.2854	1.0931	0.9983	1.087
EP-78	1.0117	1.0001	1.0114	0.9959

COC	**No-Purge / Standard**		**Low-Flow / Standard**	
	Total	**Dissolved**	**Total**	**Dissolved**
Arsenic	*1.0263*	*0.9082*	0.9928	1.0351
Cadmium	0.142	0.1671	*0.7625*	*0.7228*
Chromium	*0.0438*	*1.093*	7.2516	*5.0576*
Copper	*0.1751*	*0.3292*	0.4692	*0.5364*
Iron	*2.168*	*3.0917*	*1.8001*	*1.1256*
Lead	*0.0672*	*0.6463*	*0.6997*	1.2056
Selenium	1.1794	1.0611	1.0325	1.1663
Zinc	0.39	0.6089	*0.3909*	0.4447
Turbidity	*1.0585*	--	*0.12542*	--

Note:
Italics and gray highlighting indicate trend line slopes with R^2 values less than 0.9

The results of the method equivalency comparison reveal that the three methods yield comparable results, and differences between them are not statistically significant. Either the no-purge or low-flow method could be used for future monitoring and would yield statistically similar results to the standard sampling method.

OTHER CONSIDERATIONS

There are other factors that should be considered when selecting an alternate sampling methodology. The low-flow method has no limit on water volume collected, but the Hydra-Sleeve™ method only provides 2.5 liters of sample water. In some instances of the Interim monitoring program (e.g., a triplicate sample) the Hydra-Sleeve™ would have to be re-deployed for the specified time to collect the volume of water needed for the sample.

Another important consideration is the inherent differences in a no-purge vs. purging sampling method. The sample using the Hydra-Sleeve™ method can be biased towards the concentration stratification in the well. Alternatively, since the low-flow method is a purged sample, the sample obtained is more homogenized and less biased towards any well stratification. Further, the standard sampling method used historically was also a purge method; thus, results from a low-flow method will be more comparable to historical sampling results.

There is significant internal experience with both low-flow and Hydra-Sleeve™ but the project team prefers low-flow method over the Hydra-Sleeve™ method because of these reasons and other implementation considerations.

PATH FORWARD AND RECOMMENDATIONS

Based on the statistical comparison discussed above, both alternative sampling methods provide statistically comparable results to the standard sampling method, but based on the other considerations the low-flow method is recommended for future monitoring events. This method is less time-consuming, less expensive, produces less purge water, and yields comparable results to the standard sampling method.

REFERENCES

Interstate Technology & Regulatory Council. 2007. Protocol for the Use of Five Passive Samplers to Sample for a Variety of Contaminants in Groundwater. February.

Malcolm Pirnie. 2011. Remedial Action Work Plan, Former ASARCO Smelter Site, El Paso, Texas. April.

United States Environmental Protection Agency (USEPA). 1996. Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures. Office of Solid Waste and Emergency Response. EPA/540/S-95/504. April.

Attachments:

Attachment 1	Analytical Data and Method Comparison
Figure 1	Monitoring Wells Sampled Using Alternative Methods

EP-120

EP-78

EP-75

EP-12

EP-131

EP-51

EP-132

EP-58

Legend

Monitoring Wells Sampled Using Alternative Methods

Arroyo Trace Lines

Property Boundary

N

0 260 520

Feet

SCALE 1"=260'

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Texas Custodial Trust
El Paso Smelter Site
Technical Memorandum

MONITORING WELLS SAMPLED USING ALTERNATIVE METHODS

JUNE 2011

FIGURE 1

ATTACHMENT 1

ANALYTICAL DATA AND METHOD COMPARISON

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Table A-1

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

Slopes				
Well ID	No-Purge / Standard		Low-Flow / Standard	
	Total	Dissolved	Total	Dissolved
EP-120	*0.8155*	1.0927	*1.1414*	1.0392
EP-12	0.3266	*0.0899*	1.2671	0.6329
EP-131	0.9897	1.0865	*1.3636*	1.0198
EP-132	0.9622	0.759	0.9673	0.8263
EP-51	*0.1134*	*0.9615*	2.4752	*1.6886*
EP-58	*0.1568*	*0.1444*	0.9835	0.8193
EP-75	1.2854	1.0931	0.9983	1.087
EP-78	1.0117	1.0001	1.0114	0.9959

R^2				
Well ID	No-Purge / Standard		Low-Flow / Standard	
	Total	Dissolved	Total	Dissolved
EP-120	0.8016	0.996	0.2563	0.9975
EP-12	0.9157	0.4059	0.9767	0.9962
EP-131	0.9166	0.9995	0.6061	0.9998
EP-132	1	0.9968	0.9772	0.9987
EP-51	-0.451	0.5987	0.9191	-0.143
EP-58	-0.144	-0.138	0.9854	0.9798
EP-75	0.9997	1	1	0.9999
EP-78	0.9999	1	0.9999	1

COC	No-Purge / Standard		Low-Flow / Standard	
	Total	Dissolved	Total	Dissolved
Arsenic	*1.0263*	*0.9082*	0.9928	1.0351
Cadmium	0.142	0.1671	*0.7625*	*0.7228*
Chromium	*0.0438*	*1.093*	7.2516	*5.0576*
Copper	*0.1751*	*0.3292*	0.4692	*0.5364*
Iron	*2.168*	*3.0917*	*1.8001*	*1.1256*
Lead	*0.0672*	*0.6463*	*0.6997*	1.2056
Selenium	1.1794	1.0611	1.0325	1.1663
Zinc	0.39	0.6089	*0.3909*	0.4447
Turbidity	*1.0585*	--	*0.12542*	--

COC	No-Purge / Standard		Low-Flow / Standard	
	Total	Dissolved	Total	Dissolved
Arsenic	0.7784	0.8144	0.9998	0.9863
Cadmium	0.9524	0.9638	0.8169	0.8272
Chromium	0.6527	-0.268	0.9916	0.3749
Copper	0.7192	0.4993	0.9006	0.4739
Iron	0.0716	0.2389	0.7897	0.3966
Lead	-0.755	-1.663	-0.1	0.9297
Selenium	0.999	0.9995	0.999	0.9999
Zinc	0.971	0.9809	0.7829	0.9394
	-0.777	--	-0.494	--

Table A-2
Purge Technique Comparison Results

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

Parameters	EP-120 3/1/2011				EP-12 3/3/201				EP-131 3/2/2011			
	Standard	No-Purge	Low-Flow	Range	Standard	No-Purge	Low-Flow	Range	Standard	No-Purge	Low-Flow	Range
Total Metals (mg/L)												
Arsenic	0.376	0.272	0.26	0.26 - 0.376	0.856	0.184	0.51	0.184 - 0.856	0.718	0.774	0.774	0.718 - 0.774
Cadmium	0.00257	<0.000854	<0.000854	<0.000854 - 0.00257	<0.000854	<0.000854	<0.000854	ND	0.00224	<0.000854	0.000979	<0.000854 - 0.00224
Chromium	0.00433	0.00391	0.0045	0.00391 - 0.0045	0.00375	0.00445	0.00802	0.00375 - 0.00802	0.00386	<0.0014	0.00203	<0.0014 - 0.00386
Copper	0.0072	0.0154	0.0217	0.0072 - 0.0217	<0.00154 U	<0.0049 U	<0.00486 U	ND	0.0021	<0.00115	0.00823	<0.00115 - 0.00823
Iron	0.145	0.239	0.659	0.145 - 0.659	3.28	1.08	4.3	1.08 - 4.3	0.247	<0.101	0.953	<0.101 - 0.953
Lead	0.000965	0.00477	0.00997	0.000965 - 0.00997	0.00226	0.00279	0.00331	0.00226 - 0.00331	0.00103	<0.000733	0.00891	<0.000733 - 0.00891
Selenium	0.101	0.0392	0.0364	0.0364 - 0.101	0.196	0.336	0.351	0.196 - 0.351	0.136	0.153	0.149	0.136 - 0.153
Zinc	0.0266	0.0144	0.0273	0.0144 - 0.0273	0.00402	0.00401	0.00565	0.00401 - 0.00565	0.0109	<0.00355	0.0128	<0.00355 - 0.0128
Dissolved Metals (mg/L)												
Arsenic	0.287	0.315	0.299	0.287 - 0.315	0.765	0.116	0.417	0.116 - 0.765	0.732	0.798	0.747	0.732 - 0.798
Cadmium	0.00246	<0.000854	<0.000854	<0.000854 - 0.00246	<0.000854	<0.000854	<0.000854	ND	0.00159	<0.000854	<0.000854	<0.000854 - 0.00159
Chromium	0.00358	0.00365	0.00335	0.00335 - 0.00365	0.00196	0.00402	0.0065	0.00196 - 0.0065	0.00153	<0.0014	<0.0014	<0.0014 - 0.00153
Copper	0.00664	0.0105	0.00989	0.00664 - 0.0105	<0.00115 U	0.00215	0.0016	<0.00115 - 0.00215	<0.00115	<0.00115	<0.00115	ND
Iron	<0.101	<0.101	<0.101	ND	2.95	0.241	1.88	0.241 - 2.95	<0.101	<0.101	<0.101	ND
Lead	<0.000733	<0.000733	<0.000733	ND	<0.000733	<0.000733	<0.000733	ND	<0.000733	<0.000733	<0.000733	ND
Selenium	0.0293	0.0392	0.036	0.0293 - 0.0392	0.169	0.222	0.184	0.169 - 0.222	0.131	0.13	0.132	0.13 - 0.132
Zinc	0.0258	0.013	0.0155	0.013 - 0.0258	<0.00355 U	0.00762	0.0243	<0.00355 - 0.0243	0.0109	<0.00355	<0.00355	<0.00355 - 0.0109
Purge Parameters												
Turbidity (NTU)	21	10.5	34.3	10.5 - 34.3	7.81	49.9	45.1	7.81 - 49.9	24.8	31.6	41.2	24.8 - 41.2
Total												
Max	3	0	5		1	0	5		2	2	5	
Min	3	3	3		3	3	0		2	6	0	
Dissolved												
Max	1	4	0		2	2	2		3	4	1	
Min	3	2	2		4	2	0		1	1	3	
Turbidity												
Max	0	0	1		0	1	0		0	0	1	
Min	0	1	0		1	0	0		1	0	0	

Table A-2
Purge Technique Comparison Results

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

Parameters	EP-132 2/28/201				EP-51 3/3/201				EP-58 2/28/201			
	Standard	No-Purge	Low-Flow	Range	Standard	No-Purge	Low-Flow	Range	Standard	No-Purge	Low-Flow	Range
Total Metals (mg/L)												
Arsenic	1.61	1.55	1.55	1.55 - 1.61	0.152	0.23	0.066	0.066 - 0.23	24.5	2.35	23.9	2.35 - 24.5
Cadmium	<0.000854	<0.000854	<0.000854	ND	0.0315	0.00426	0.0293	0.00426 - 0.0315	<0.000854	<0.000854	0.00127	<0.000854 - 0.00127
Chromium	<0.0014	<0.0014	<0.0014	ND	0.211	0.00917	1.54	0.00917 - 1.54	0.00791	0.208	0.0353	0.00791 - 0.208
Copper	<0.00115	0.00177	<0.00115	<0.00115 - 0.00177	0.171	0.0294	0.0825	0.0294 - 0.171	<0.00115	<0.00115	<0.00115	ND
Iron	<0.101	<0.101	0.253	<0.101 - 0.253	2.13	0.182	5.39	0.182 - 5.39	1.79	20.7	4.43	1.79 - 20.7
Lead	<0.000733	<0.000733	0.00111	<0.000733 - 0.00111	0.0191	<0.00107 U	0.0125	<0.00107 - 0.0191	<0.000733	0.000876	0.00147	<0.000733 - 0.00147
Selenium	0.278	0.262	0.274	0.262 - 0.278	0.164	0.324	0.22	0.164 - 0.324	<0.024 U	<0.0168 U	<0.025 U	ND
Zinc	<0.00355	0.0094	0.0589	<0.00355 - 0.0589	0.397	0.16	0.158	0.158 - 0.397	<0.00355	0.00876	0.00387	<0.00355 - 0.00876
Dissolved Metals (mg/L)												
Arsenic	2.03	1.53	1.67	1.53 - 2.03	0.0446	0.104	0.00393	0.00393 - 0.104	24.8	2.02	20.1	2.02 - 24.8
Cadmium	<0.000854	<0.000854	<0.000854	ND	0.0317	0.00503	0.0279	0.00503 - 0.0317	<0.000854	<0.000854	<0.000854	ND
Chromium	<0.0014	<0.0014	<0.0014	ND	0.00348	<0.0014	0.0402	<0.0014 - 0.0402	<0.0014	0.0146	<0.0014	<0.0014 - 0.0146
Copper	0.00158	<0.00115	0.00216	<0.00115 - 0.00216	0.046	0.0243	0.0461	0.0243 - 0.0461	<0.00115	<0.00115	<0.00115	ND
Iron	<0.101	<0.101	<0.101	ND	<0.101	<0.101	2.2	<0.101 - 2.2	2.06	19.1	4.33	2.06 - 19.1
Lead	<0.000733	<0.000733	<0.000733	ND	0.00119	<0.000733	0.00166	<0.000733 - 0.00166	<0.000733	<0.000733	<0.000733	ND
Selenium	0.268	0.282	0.275	0.268 - 0.282	0.175	0.306	0.231	0.175 - 0.306	0.0216	0.0172	0.0248	0.0172 - 0.0248
Zinc	0.00512	<0.00355	0.0067	<0.00355 - 0.0067	0.269	0.165	0.119	0.119 - 0.269	0.00375	0.0178	0.00721	0.00375 - 0.0178
Purge Parameters												
Turbidity (NTU)	8.34	12.5	20.4	8.34 - 20.4	38.2	12	37.6	12 - 38.2	19.9	60.3	13.9	13.9 - 60.3
Total												
Max	2	1	3		5	1	2		1	3	2	
Min	4	4	2		1	5	2		5	2	0	
Dissolved												
Max	1	1	1		2	2	4		1	3	1	
Min	1	2	0		2	5	2		3	2	1	
Turbidity												
Max	0	0	1		1	0	0		0	1	0	
Min	1	0	0		0	1	0		0	0	1	

Table A-2
Purge Technique Comparison Results

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

Parameters	EP-75 3/1/2011				EP-78 3/1/2011			
	Standard	No-Purge	Low-Flow	Range	Standard	No-Purge	Low-Flow	Range
Total Metals (mg/L)								
Arsenic	46.3	59.6	46.2	46.2 - 59.6	1.85	1.87	1.87	1.85 - 187
Cadmium	0.0163	0.00266	0.00253	0.00253 - 0.0163	<0.000854	<0.000854	<0.000854	ND
Chromium	0.0233	<0.0014	0.00204	<0.0014 - 0.0233	<0.0014	<0.0014	<0.0014	ND
Copper	0.0461	0.00779	0.00995	0.00779 - 0.0461	<0.00115	<0.00115	0.00207	<0.00115 - 0.00207
Iron	0.596	<0.101	0.397	<0.101 - 0.596	<0.101	<0.101	<0.101	ND
Lead	0.00464	0.000939	0.00195	0.000939 - 0.00464	<0.000733	<0.000733	0.00154	<0.000733 - 0.00154
Selenium	5.7	6.72	5.88	5.7 - 6.72	0.144	0.166	0.159	0.144 - 0.166
Zinc	0.11	0.0231	0.0266	0.0231 - 0.11	<0.00355	<0.00355	0.00737	<0.00355 - 0.00737
Dissolved Metals (mg/L)								
Arsenic	52.4	57.3	56.9	52.4 - 57.3	2.29	2.29	2.28	2.28 - 2.29
Cadmium	0.0167	0.00324	0.00286	0.00286 - 0.0167	<0.000854	<0.000854	<0.000854	ND
Chromium	<0.0014	<0.0014	<0.0014	ND	<0.0014	<0.0014	<0.0014	ND
Copper	0.0524	0.00811	0.00843	0.00811 - 0.0524	<0.00115	0.00142	<0.00115	<0.00115 - 0.00142
Iron	<0.101	<0.101	<0.101	ND	<0.101	<0.101	<0.101	ND
Lead	0.000748	0.000743	0.000765	0.000743 - 0.000765	<0.000733	<0.000733	<0.000733	ND
Selenium	6.12	6.49	7.14	6.12 - 7.14	0.153	0.157	0.161	0.153 - 0.161
Zinc	0.0522	0.0264	0.0233	0.0233 - 0.0522	<0.00355	0.00876	0.00405	<0.00355 - 0.00876
Purge Parameters								
Turbidity (NTU)	35.6	36.6	40.2	35.6 - 40.2	10.5	20.8	12.8	10.5 - 20.8
Total								
Max	6	2	0		0	2	4	
Min	1	5	2		5	3	0	
Dissolved								
Max	2	1	2		1	3	1	
Min	2	2	2		3	0	2	
Turbidity								
Max	0	0	1		0	1	0	
Min	1	0	0		1	0	0	

Table A-3

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

Slopes

Well ID	No-Purge / Standard		Low-Flow / Standard		Low-Flow / No-Purge	
	Total	Dissolved	Total	Dissolved	Total	Dissolved
EP-120	0.8155	1.0927	1.1414	1.0392	1.731	0.9504
EP-12	0.3266	0.0899	1.2671	0.6329	3.6977	4.4873
EP-131	0.9897	1.0865	1.3636	1.0198	1.072	0.9384
EP-132	0.9622	0.759	0.9673	0.8263	1.0056	1.0876
EP-51	0.1134	0.9615	2.4752	1.6886	5.0991	1.5063
EP-58	0.1568	0.1444	0.9835	0.8193	0.3407	0.3343
EP-75	1.2854	1.0931	0.9983	1.087	0.7764	0.9944
EP-78	1.0117	1.0001	1.0114	0.9959	0.9997	0.9958

COC	No-Purge / Standard		Low-Flow / Standard		Low-Flow / No-Purge	
	Total	Dissolved	Total	Dissolved	Total	Dissolved
Arsenic	1.0263	0.9082	0.9928	1.0351	0.7901	1.0042
Cadmium	0.142	0.1671	0.7625	0.7228	5.0628	4.0848
Chromium	0.0438	1.093	7.2516	5.0576	137.9	0.2863
Copper	0.1751	0.3292	0.4692	0.5364	2.4314	1.6775
Iron	2.168	3.0917	1.8001	1.1256	0.227	0.2282
Lead	0.0672	0.6463	0.6997	1.2056	2.1547	1.3286
Selenium	1.1794	1.0611	1.0325	1.1663	0.8753	1.0988
Zinc	0.39	0.6089	0.3909	0.4447	1.0153	0.7291
Turbidity	1.0585	--	0.12542	--	0.773	--

R^2

Well ID	No-Purge / Standard		Low-Flow / Standard		Low-Flow / No-Purge	
	Total	Dissolved	Total	Dissolved	Total	Dissolved
EP-120	0.8016	0.996	0.2563	0.9975	0.718	0.9998
EP-12	0.9157	0.4059	0.9767	0.9962	0.9409	0.5569
EP-131	0.9166	0.9995	0.6061	0.9998	0.2446	0.9998
EP-132	1	0.9968	0.9772	0.9987	0.9779	0.9995
EP-51	-0.451	0.5987	0.9191	-0.143	-0.056	-0.145
EP-58	-0.144	-0.138	0.9854	0.9798	-0.103	-0.097
EP-75	0.9997	1	1	0.9999	0.9997	0.9998
EP-78	0.9999	1	0.9999	1	1	1

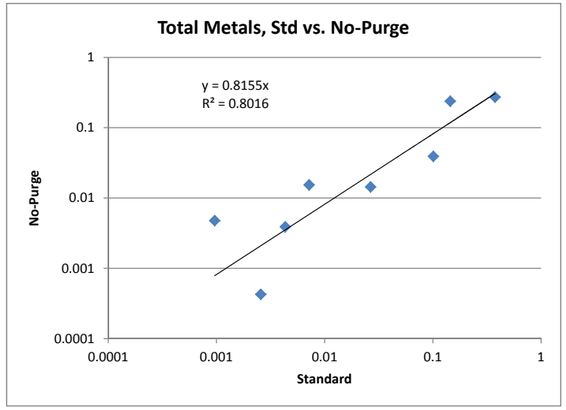
COC	No-Purge / Standard		Low-Flow / Standard		Low-Flow / No-Purge	
	Total	Dissolved	Total	Dissolved	Total	Dissolved
Arsenic	0.7784	0.8144	0.9998	0.9863	0.7573	0.8832
Cadmium	0.9524	0.9638	0.8169	0.8272	0.7265	0.7347
Chromium	0.6527	-0.268	0.9916	0.3749	0.7628	-0.25
Copper	0.7192	0.4993	0.9006	0.4739	0.903	0.9267
Iron	0.0716	0.2389	0.7897	0.3966	-0.332	0.5422
Lead	-0.755	-1.663	-0.1	0.9297	-0.372	-0.026
Selenium	0.999	0.9995	0.999	0.9999	0.9997	0.9996
Zinc	0.971	0.9809	0.7829	0.9394	0.8512	0.9551
	-0.777	--	-0.494	--	-1.676	--

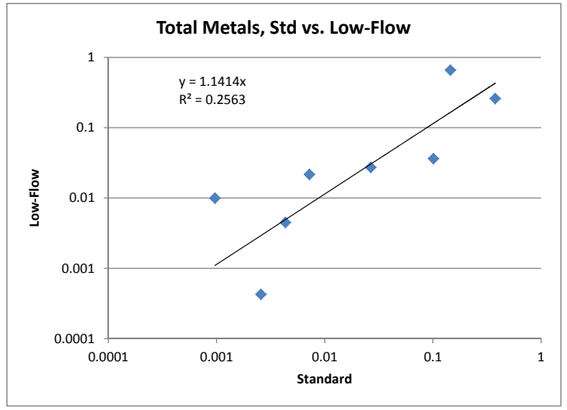
<1 Alternative sampling method is higher than standard sampling method
>1 Alternative sampling method is lower than standard sampling method

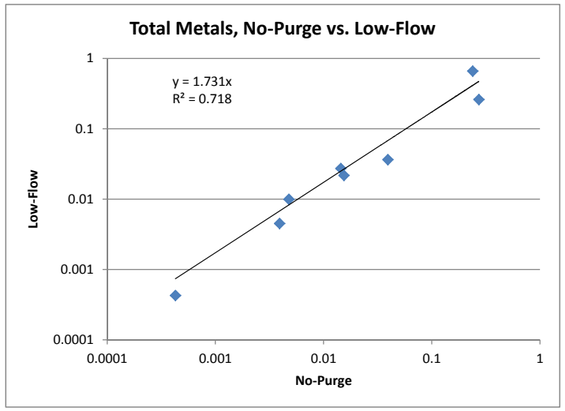
Table A-4
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-120

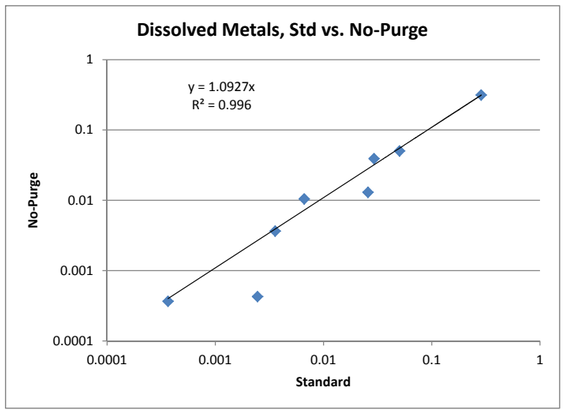
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

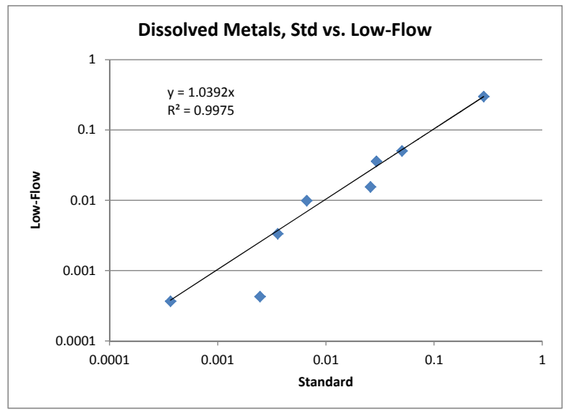
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	0.376	0.272	0.26
Cadmium	0.00257	0.000427	0.000427
Chromium	0.00433	0.00391	0.0045
Copper	0.0072	0.0154	0.0217
Iron	0.145	0.239	0.659
Lead	0.000965	0.00477	0.00997
Selenium	0.101	0.0392	0.0364
Zinc	0.0266	0.0144	0.0273
Dissolved Metals (mg/L)			
Arsenic	0.287	0.315	0.299
Cadmium	0.00246	0.000427	0.000427
Chromium	0.00358	0.00365	0.00335
Copper	0.00664	0.0105	0.00989
Iron	0.0505	0.0505	0.0505
Lead	0.0003665	0.0003665	0.0003665
Selenium	0.0293	0.0392	0.036
Zinc	0.0258	0.013	0.0155
Purge Parameters			
Turbidity (NTU)	21	10.5	34.3











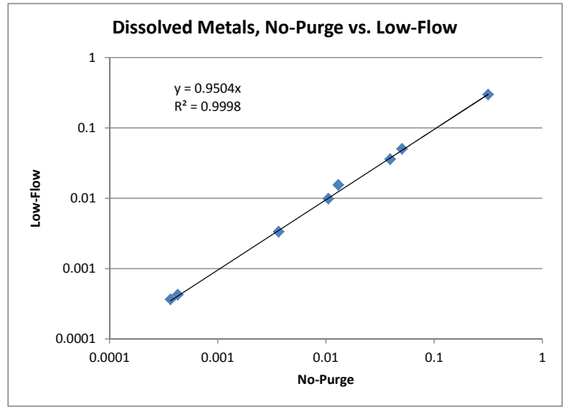
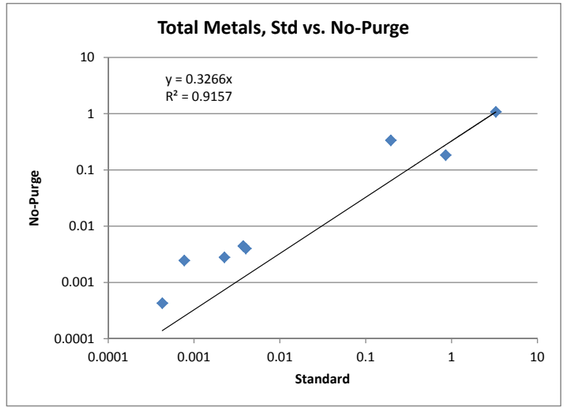
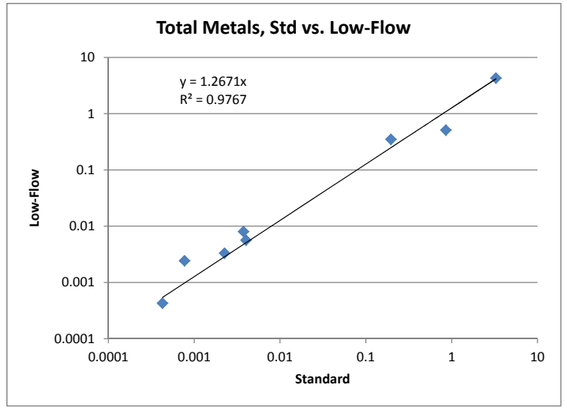


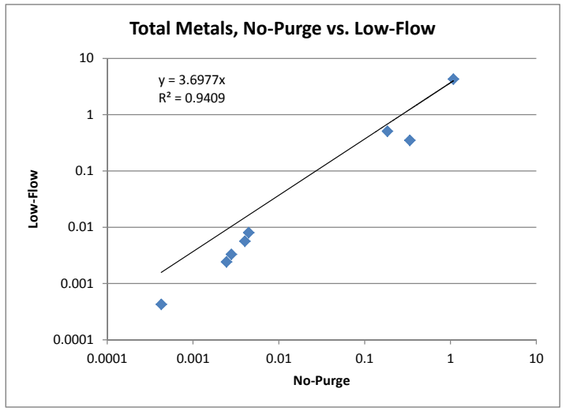
Table A-5
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-12

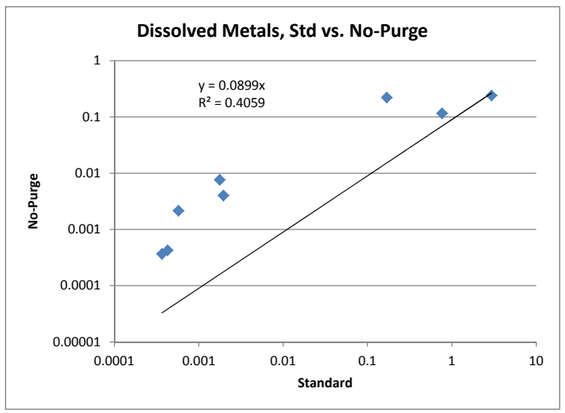
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

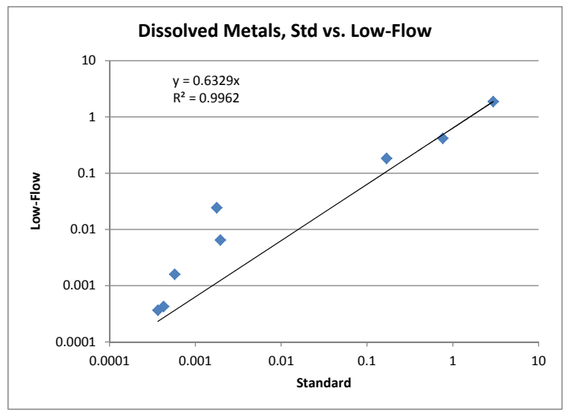
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	0.856	0.184	0.51
Cadmium	0.000427	0.000427	0.000427
Chromium	0.00375	0.00445	0.00802
Copper	0.00077	0.00245	0.00243
Iron	3.28	1.08	4.3
Lead	0.00226	0.00279	0.00331
Selenium	0.196	0.336	0.351
Zinc	0.00402	0.00401	0.00565
Dissolved Metals (mg/L)			
Arsenic	0.765	0.116	0.417
Cadmium	0.000427	0.000427	0.000427
Chromium	0.00196	0.00402	0.0065
Copper	0.000575	0.00215	0.0016
Iron	2.95	0.241	1.88
Lead	0.0003665	0.0003665	0.0003665
Selenium	0.169	0.222	0.184
Zinc	0.001775	0.00762	0.0243
Purge Parameters			
Turbidity (NTU)	7.81	49.9	45.1











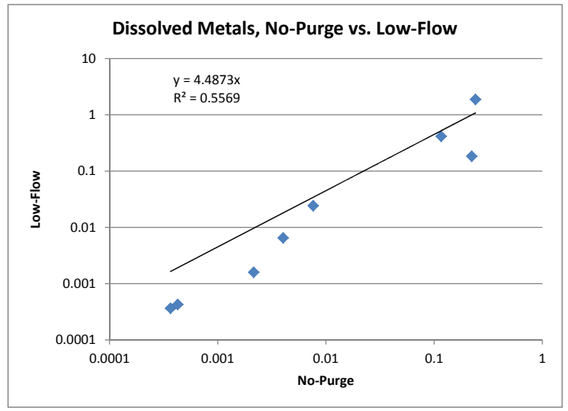
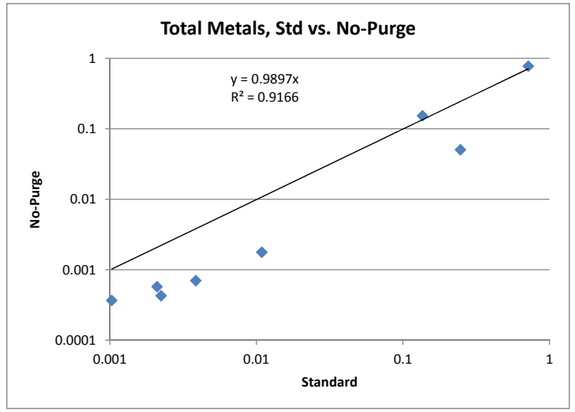
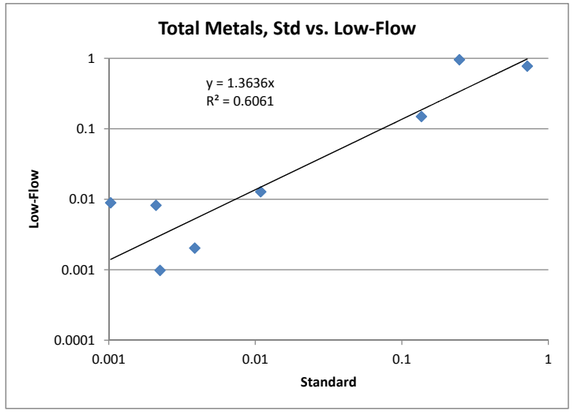


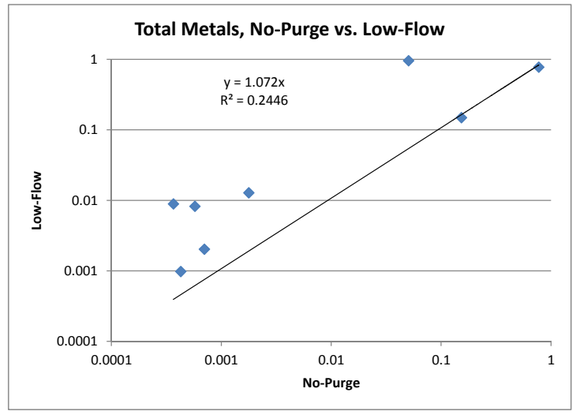
Table A-6
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-131

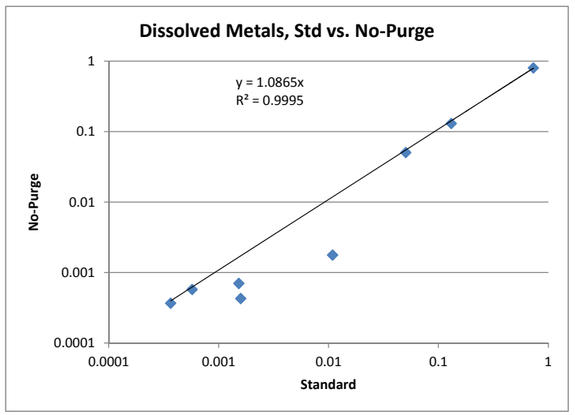
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

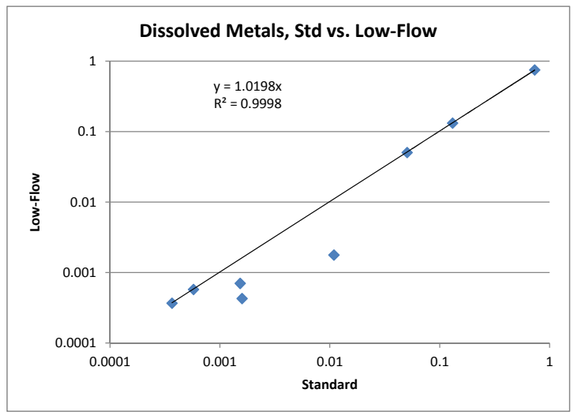
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	0.718	0.774	0.774
Cadmium	0.00224	0.000427	0.000979
Chromium	0.00386	0.0007	0.00203
Copper	0.0021	0.000575	0.00823
Iron	0.247	0.0505	0.953
Lead	0.00103	0.0003665	0.00891
Selenium	0.136	0.153	0.149
Zinc	0.0109	0.001775	0.0128
Dissolved Metals (mg/L)			
Arsenic	0.732	0.798	0.747
Cadmium	0.00159	0.000427	0.000427
Chromium	0.00153	0.0007	0.0007
Copper	0.000575	0.000575	0.000575
Iron	0.0505	0.0505	0.0505
Lead	0.0003665	0.0003665	0.0003665
Selenium	0.131	0.13	0.132
Zinc	0.0109	0.001775	0.001775
Purge Parameters			
Turbidity (NTU)	24.8	31.6	41.2











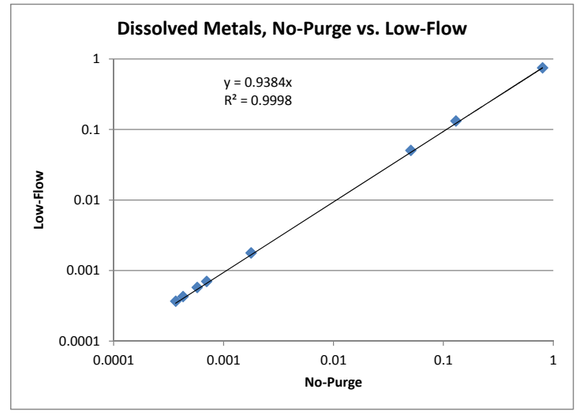
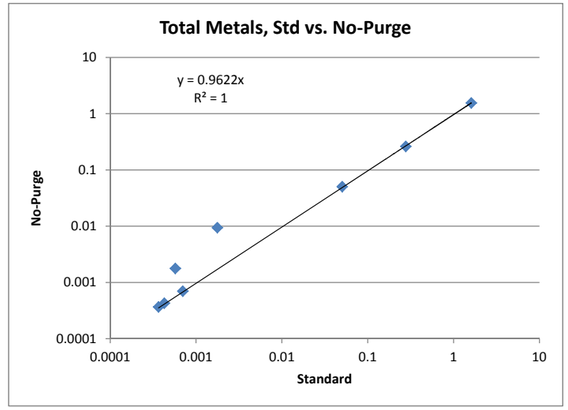
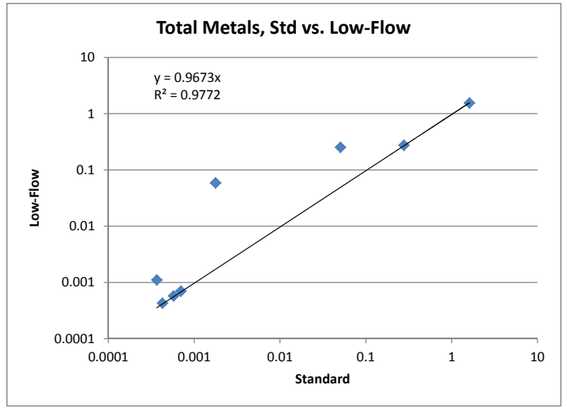


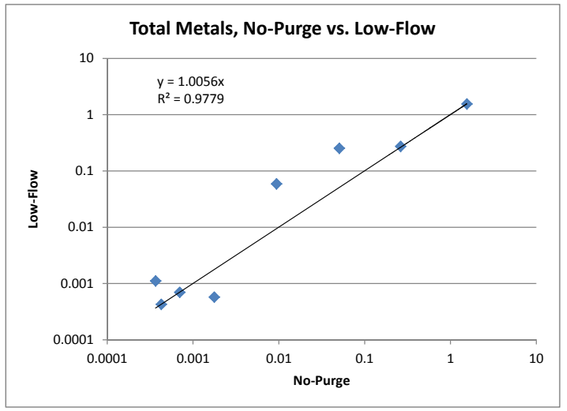
Table A-7
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-132

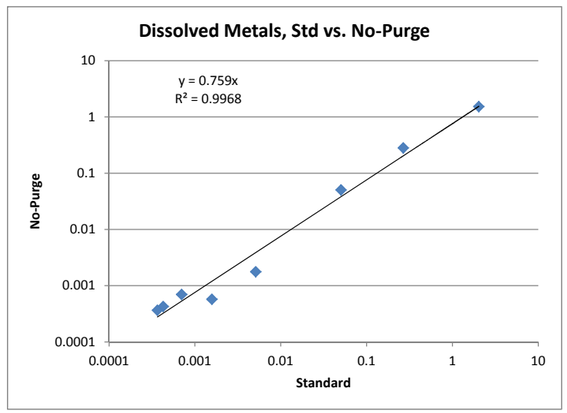
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

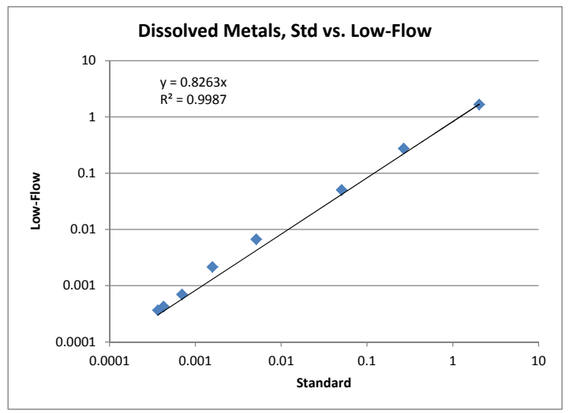
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	1.61	1.55	1.55
Cadmium	0.000427	0.000427	0.000427
Chromium	0.0007	0.0007	0.0007
Copper	0.000575	0.00177	0.000575
Iron	0.0505	0.0505	0.253
Lead	0.0003665	0.0003665	0.00111
Selenium	0.278	0.262	0.274
Zinc	0.001775	0.0094	0.0589
Dissolved Metals (mg/L)			
Arsenic	2.03	1.53	1.67
Cadmium	0.000427	0.000427	0.000427
Chromium	0.0007	0.0007	0.0007
Copper	0.00158	0.000575	0.00216
Iron	0.0505	0.0505	0.0505
Lead	0.0003665	0.0003665	0.0003665
Selenium	0.268	0.282	0.275
Zinc	0.00512	0.001775	0.0067
Purge Parameters			
Turbidity (NTU)	8.34	12.5	20.4











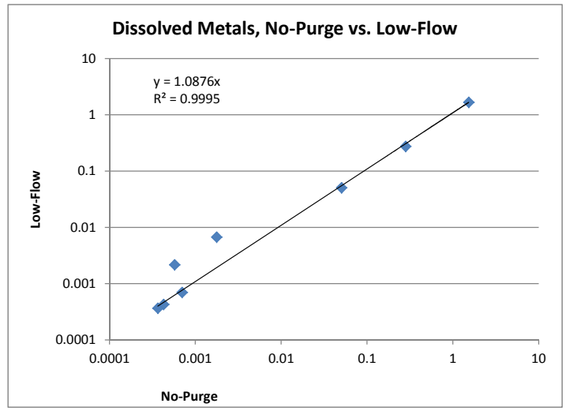
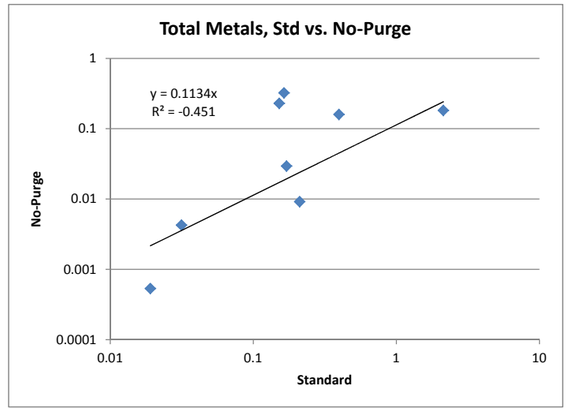
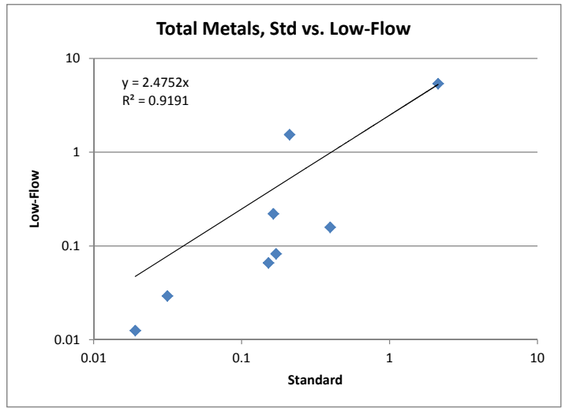


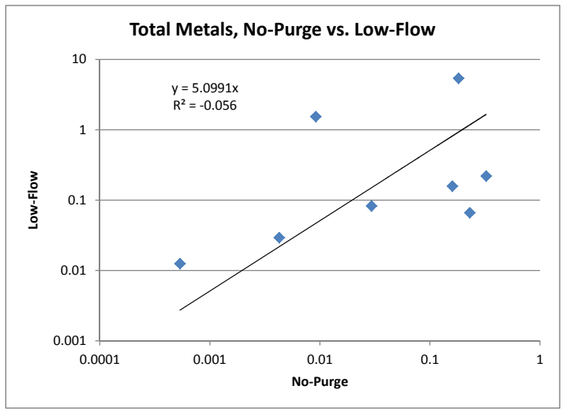
Table A-8
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-51

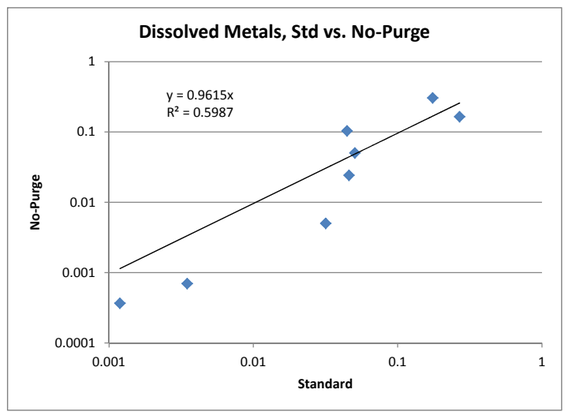
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

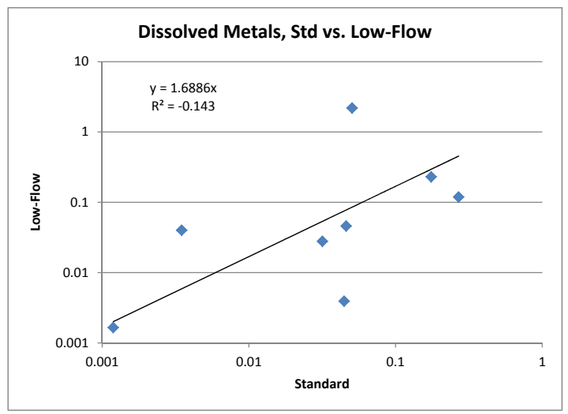
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	0.152	0.23	0.066
Cadmium	0.0315	0.00426	0.0293
Chromium	0.211	0.00917	1.54
Copper	0.171	0.0294	0.0825
Iron	2.13	0.182	5.39
Lead	0.0191	0.000535	0.0125
Selenium	0.164	0.324	0.22
Zinc	0.397	0.16	0.158
Dissolved Metals (mg/L)			
Arsenic	0.0446	0.104	0.00393
Cadmium	0.0317	0.00503	0.0279
Chromium	0.00348	0.0007	0.0402
Copper	0.046	0.0243	0.0461
Iron	0.0505	0.0505	2.2
Lead	0.00119	0.0003665	0.00166
Selenium	0.175	0.306	0.231
Zinc	0.269	0.165	0.119
Purge Parameters			
Turbidity (NTU)	38.2	12	37.6











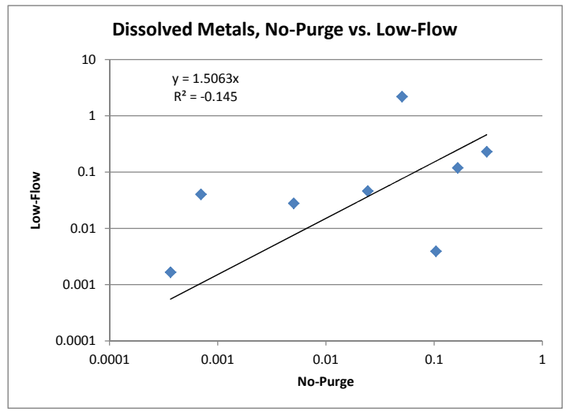
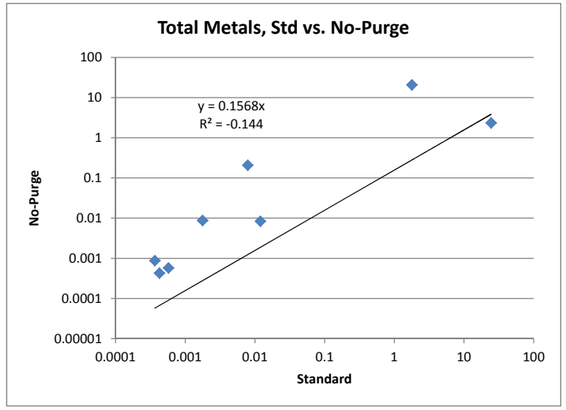
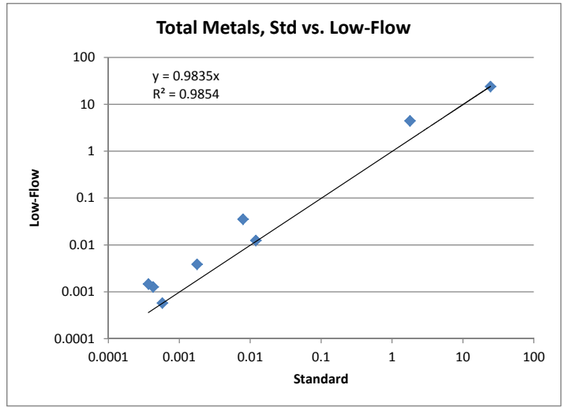


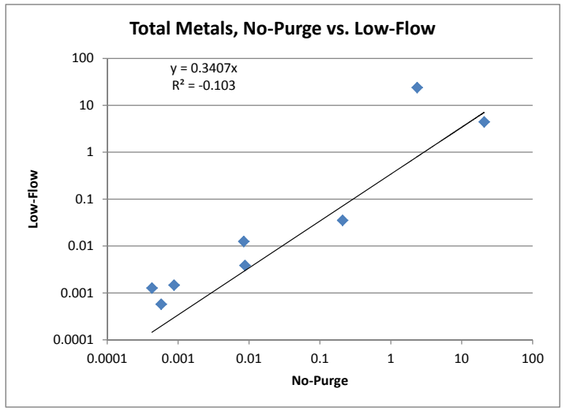
Table A-9
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-58

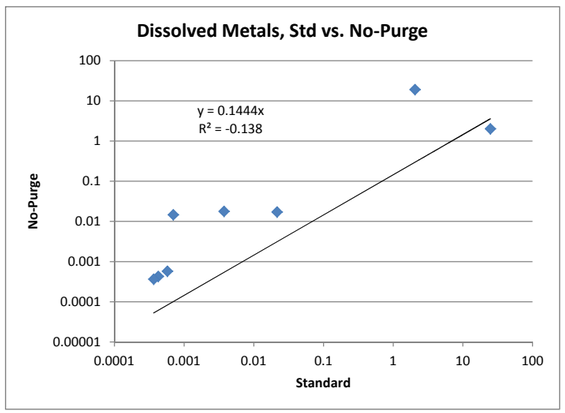
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

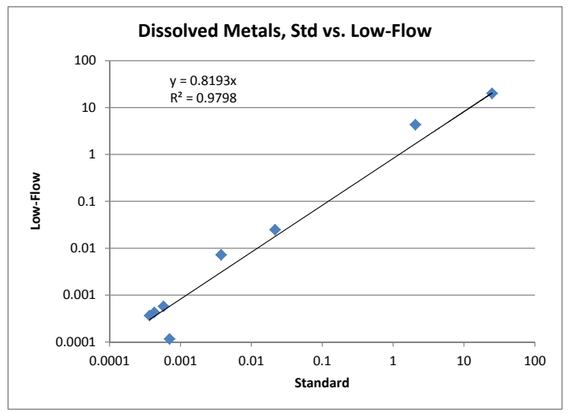
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	24.5	2.35	23.9
Cadmium	0.000427	0.000427	0.00127
Chromium	0.00791	0.208	0.0353
Copper	0.000575	0.000575	0.000575
Iron	1.79	20.7	4.43
Lead	0.0003665	0.000876	0.00147
Selenium	0.012	0.0084	0.0125
Zinc	0.001775	0.00876	0.00387
Dissolved Metals (mg/L)			
Arsenic	24.8	2.02	20.1
Cadmium	0.000427	0.000427	0.000427
Chromium	0.0007	0.0146	0.000116667
Copper	0.000575	0.000575	0.000575
Iron	2.06	19.1	4.33
Lead	0.0003665	0.0003665	0.0003665
Selenium	0.0216	0.0172	0.0248
Zinc	0.00375	0.0178	0.00721
Purge Parameters			
Turbidity (NTU)	19.9	60.3	13.9











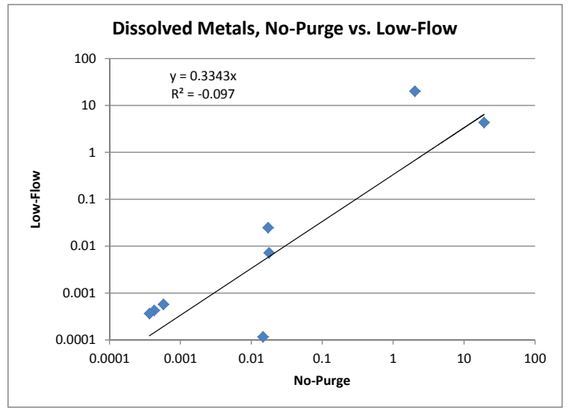
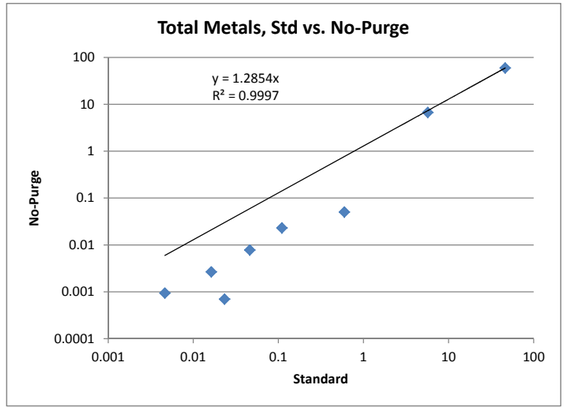
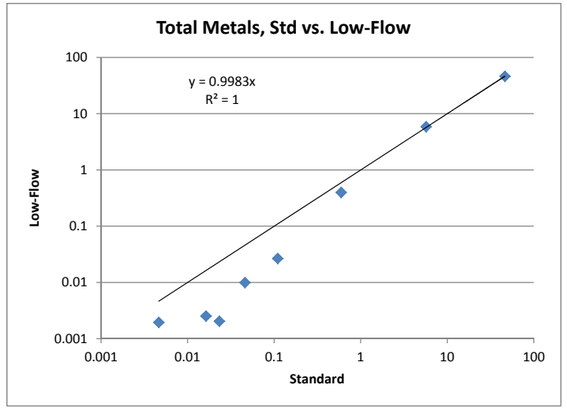


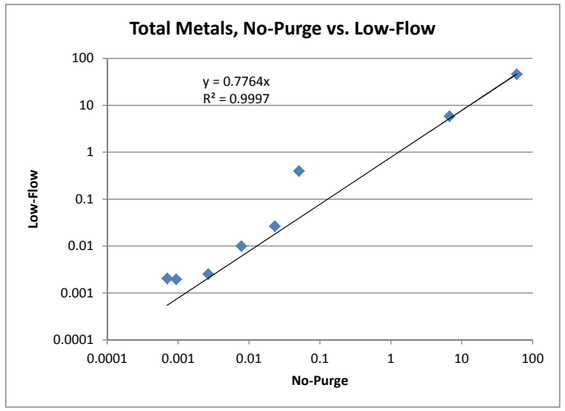
Table A-10
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-75

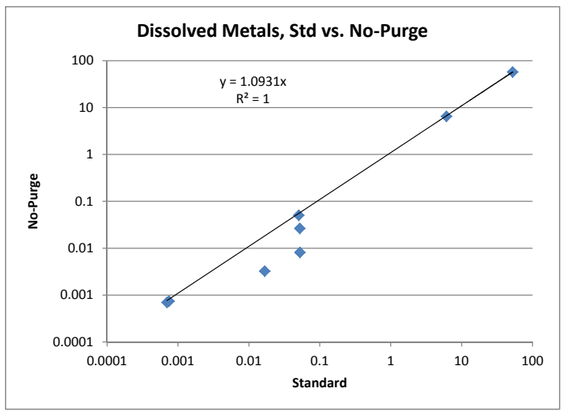
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

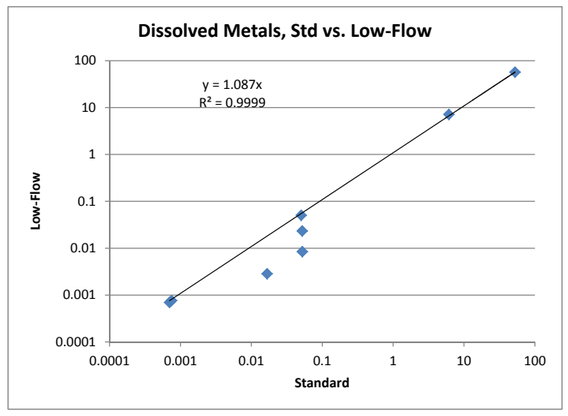
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	46.3	59.6	46.2
Cadmium	0.0163	0.00266	0.00253
Chromium	0.0233	0.0007	0.00204
Copper	0.0461	0.00779	0.00995
Iron	0.596	0.0505	0.397
Lead	0.00464	0.000939	0.00195
Selenium	5.7	6.72	5.88
Zinc	0.11	0.0231	0.0266
Dissolved Metals (mg/L)			
Arsenic	52.4	57.3	56.9
Cadmium	0.0167	0.00324	0.00286
Chromium	0.0007	0.0007	0.0007
Copper	0.0524	0.00811	0.00843
Iron	0.0505	0.0505	0.0505
Lead	0.000748	0.000743	0.000765
Selenium	6.12	6.49	7.14
Zinc	0.0522	0.0264	0.0233
Purge Parameters			
Turbidity (NTU)	35.6	36.6	40.2











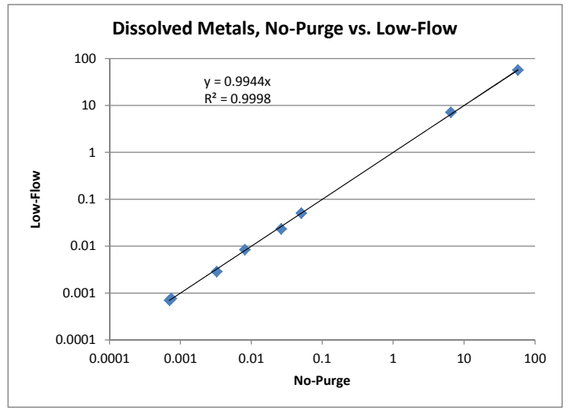
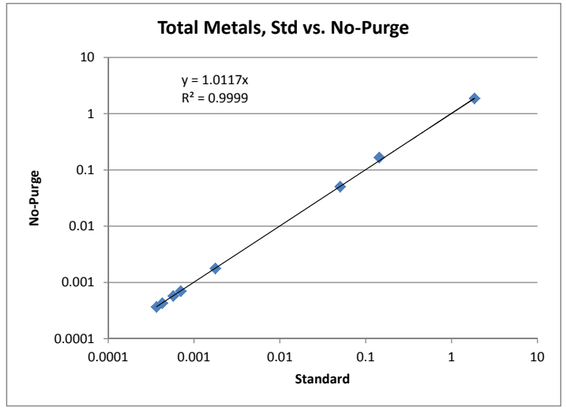
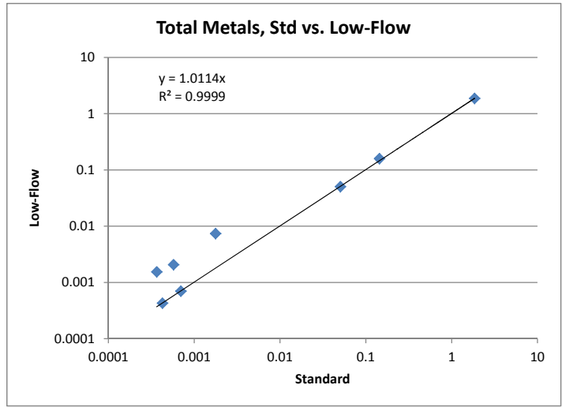


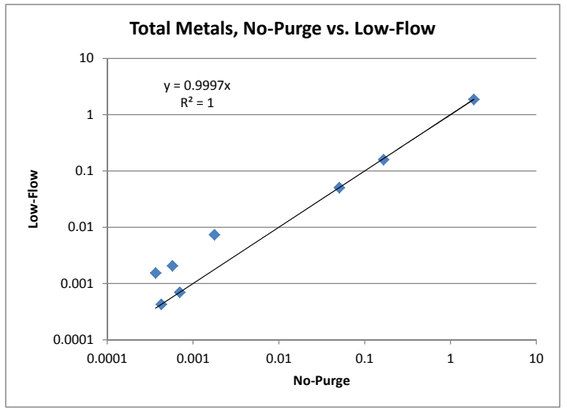
Table A-11
Statistical Differences Between Sampling Methods: COC Concentrations in Well EP-78

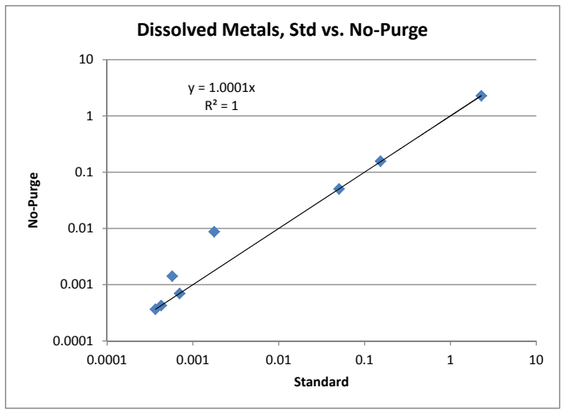
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

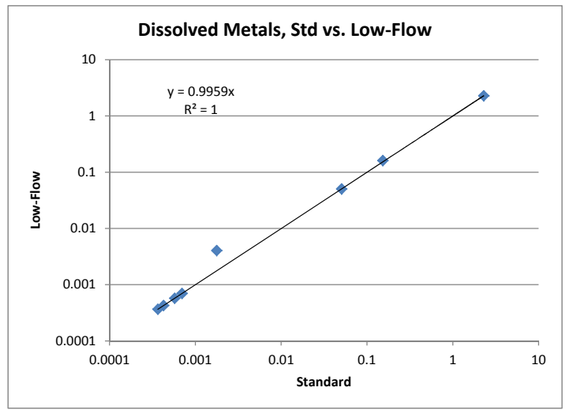
	Standard	No-Purge	Low-Flow
Total Metals (mg/L)			
Arsenic	1.85	1.87	1.87
Cadmium	0.000427	0.000427	0.000427
Chromium	0.0007	0.0007	0.0007
Copper	0.000575	0.000575	0.00207
Iron	0.0505	0.0505	0.0505
Lead	0.0003665	0.0003665	0.00154
Selenium	0.144	0.166	0.159
Zinc	0.001775	0.001775	0.00737
Dissolved Metals (mg/L)			
Arsenic	2.29	2.29	2.28
Cadmium	0.000427	0.000427	0.000427
Chromium	0.0007	0.0007	0.0007
Copper	0.000575	0.00142	0.000575
Iron	0.0505	0.0505	0.0505
Lead	0.0003665	0.0003665	0.0003665
Selenium	0.153	0.157	0.161
Zinc	0.001775	0.00876	0.00405
Purge Parameters			
Turbidity (NTU)	10.5	20.8	12.8











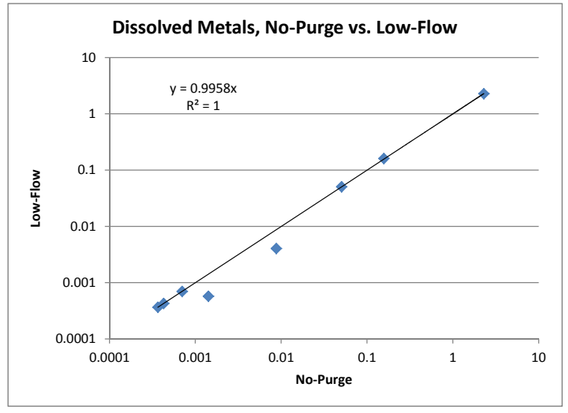
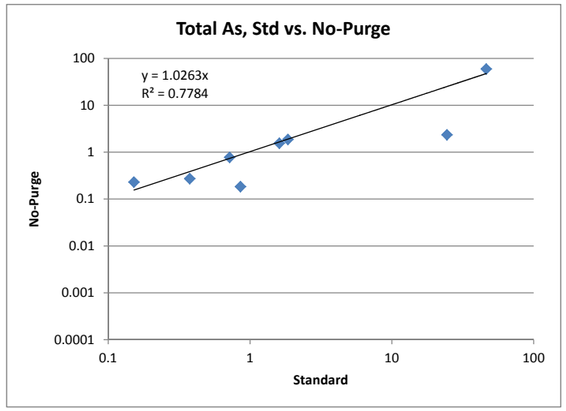
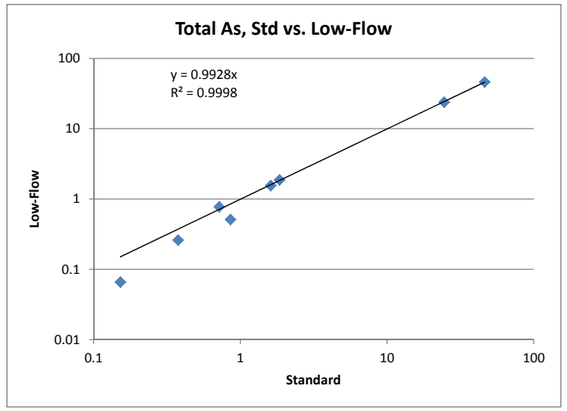


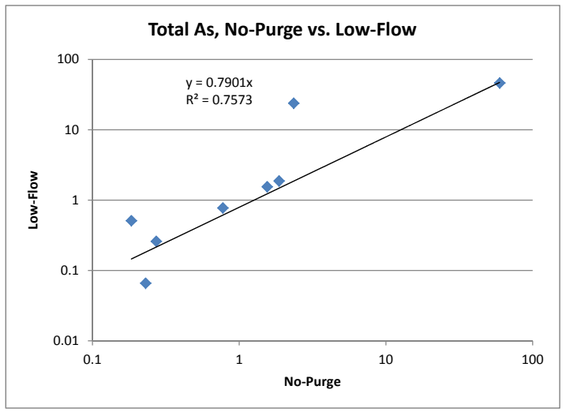
Table A-12
Statistical Differences Between Sampling Methods: Arsenic Concentrations

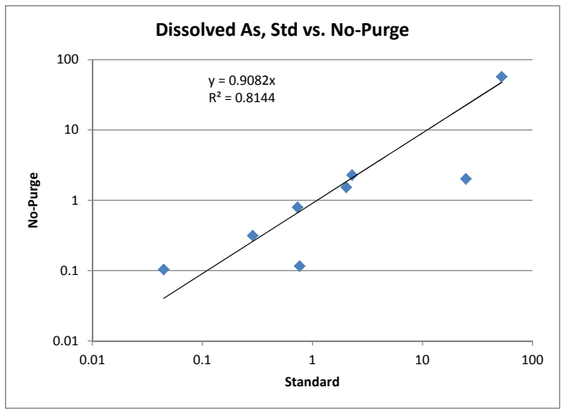
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

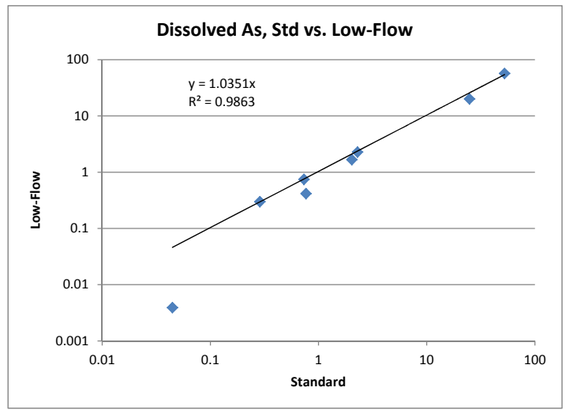
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.376	0.272	0.26
EP-12	0.856	0.184	0.51
EP-131	0.718	0.774	0.774
EP-132	1.61	1.55	1.55
EP-51	0.152	0.23	0.066
EP-58	24.5	2.35	23.9
EP-75	46.3	59.6	46.2
EP-78	1.85	1.87	1.87
Dissolved (mg/L)			
EP-120	0.287	0.315	0.299
EP-12	0.765	0.116	0.417
EP-131	0.732	0.798	0.747
EP-132	2.03	1.53	1.67
EP-51	0.0446	0.104	0.00393
EP-58	24.8	2.02	20.1
EP-75	52.4	57.3	56.9
EP-78	2.29	2.29	2.28











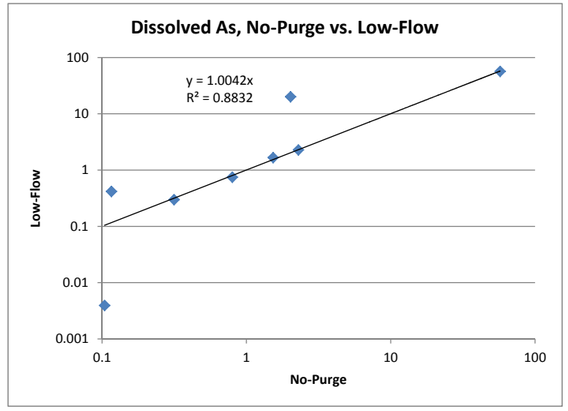
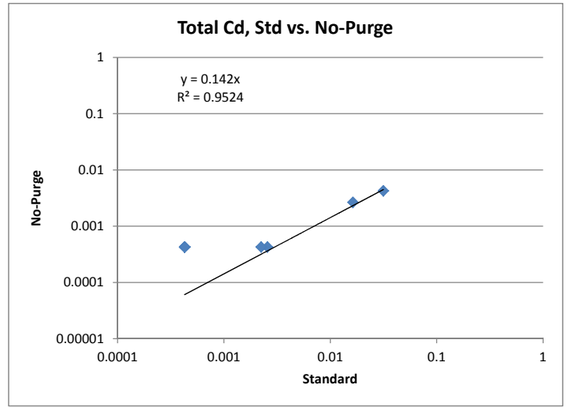
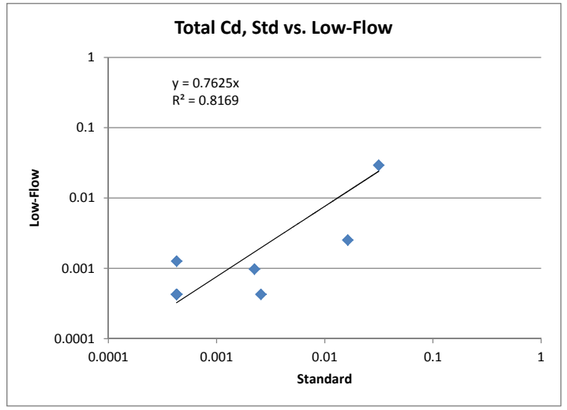


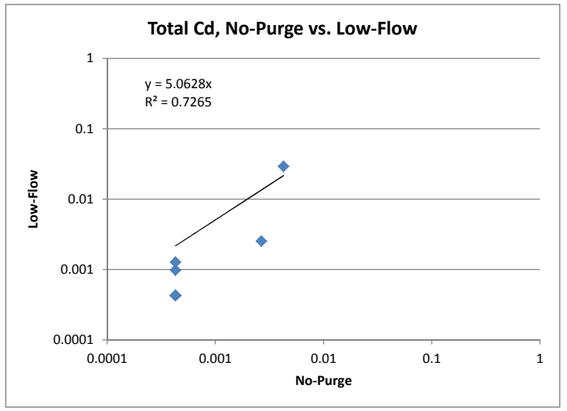
Table A-13
Statistical Differences Between Sampling Methods: Cadmium Concentrations

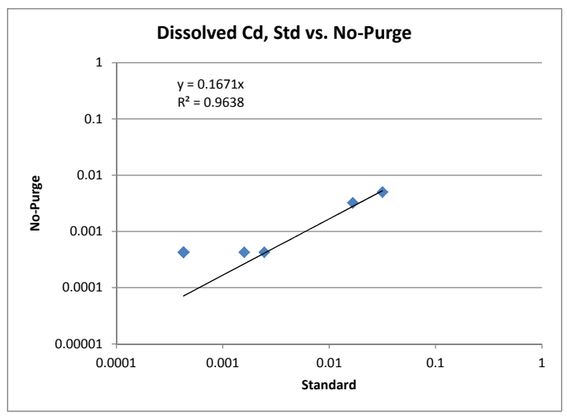
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

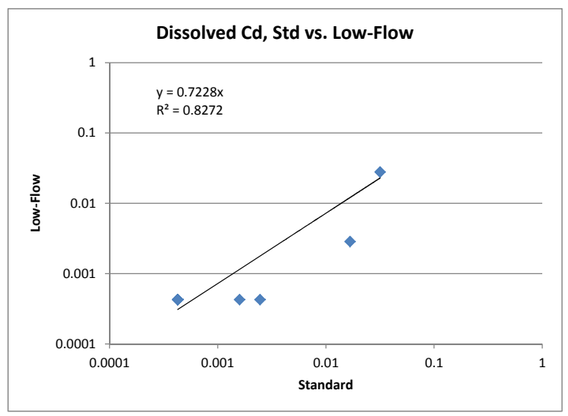
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.00257	0.000427	0.000427
EP-12	0.000427	0.000427	0.000427
EP-131	0.00224	0.000427	0.000979
EP-132	0.000427	0.000427	0.000427
EP-51	0.0315	0.00426	0.0293
EP-58	0.000427	0.000427	0.00127
EP-75	0.0163	0.00266	0.00253
EP-78	0.000427	0.000427	0.000427
Dissolved (mg/L)			
EP-120	0.00246	0.000427	0.000427
EP-12	0.000427	0.000427	0.000427
EP-131	0.00159	0.000427	0.000427
EP-132	0.000427	0.000427	0.000427
EP-51	0.0317	0.00503	0.0279
EP-58	0.000427	0.000427	0.000427
EP-75	0.0167	0.00324	0.00286
EP-78	0.000427	0.000427	0.000427











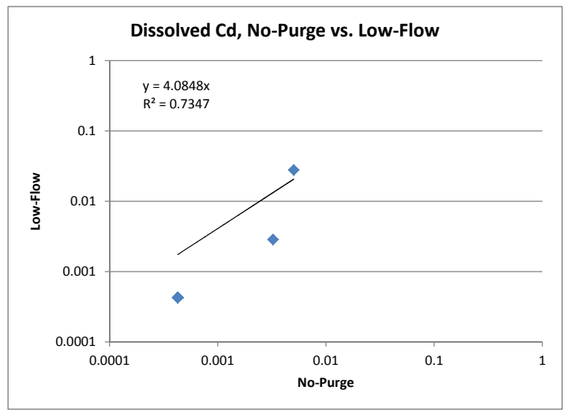
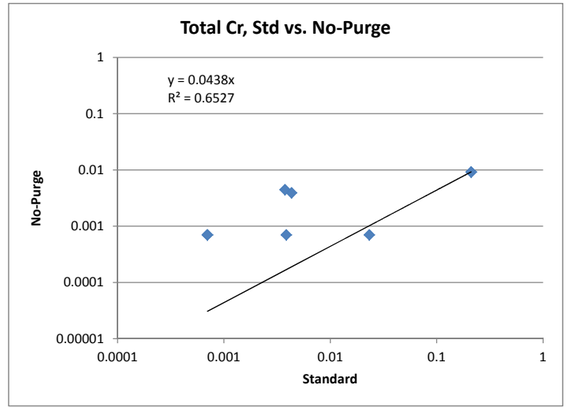
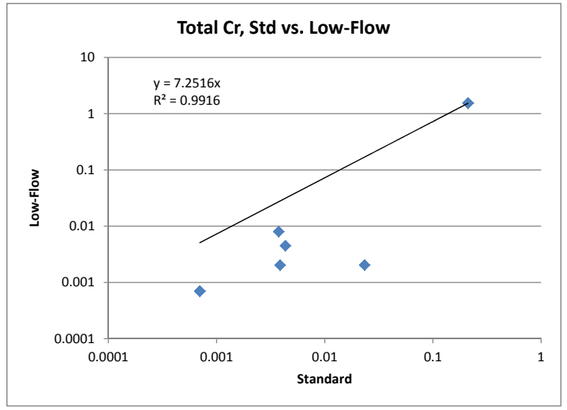


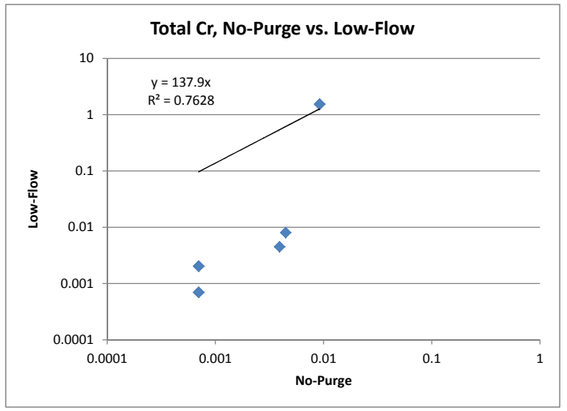
Table A-14
Statistical Differences Between Sampling Methods: Chromium Concentrations

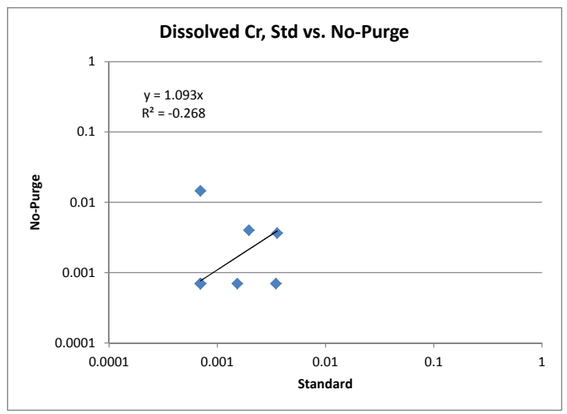
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

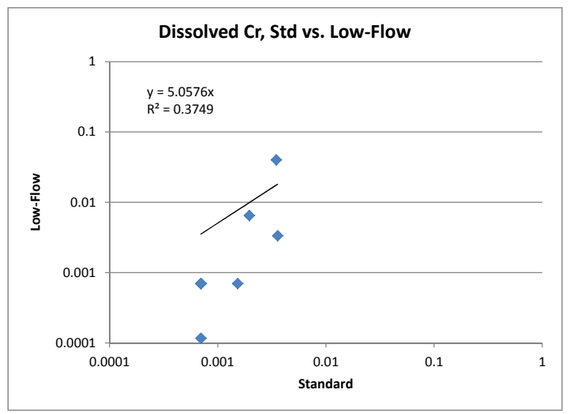
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.00433	0.00391	0.0045
EP-12	0.00375	0.00445	0.00802
EP-131	0.00386	0.0007	0.00203
EP-132	0.0007	0.0007	0.0007
EP-51	0.211	0.00917	1.54
EP-58	0.211	0.00917	1.54
EP-75	0.0233	0.0007	0.00204
EP-78	0.0007	0.0007	0.0007
Dissolved (mg/L)			
EP-120	0.00358	0.00365	0.00335
EP-12	0.00196	0.00402	0.0065
EP-131	0.00153	0.0007	0.0007
EP-132	0.0007	0.0007	0.0007
EP-51	0.00348	0.0007	0.0402
EP-58	0.0007	0.0146	0.000116667
EP-75	0.0007	0.0007	0.0007
EP-78	0.0007	0.0007	0.0007











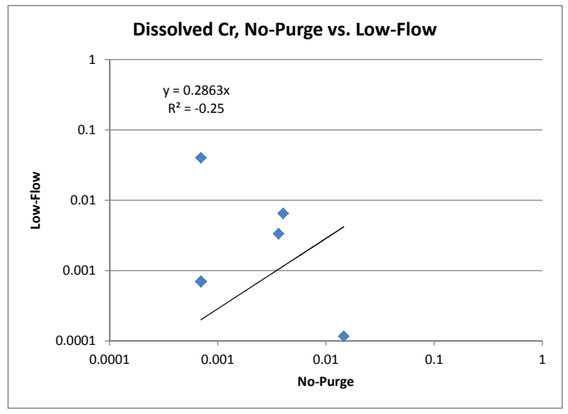
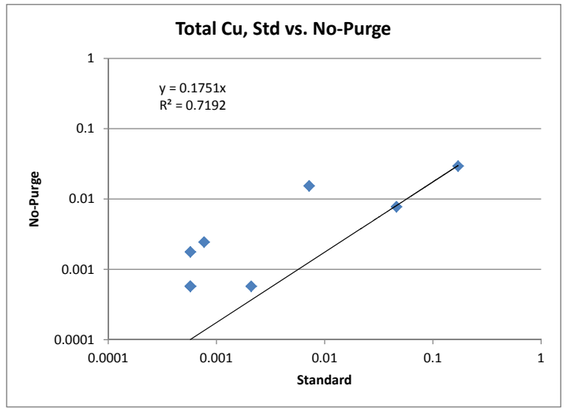
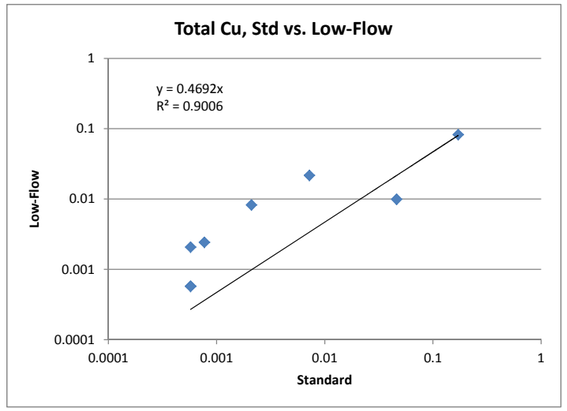


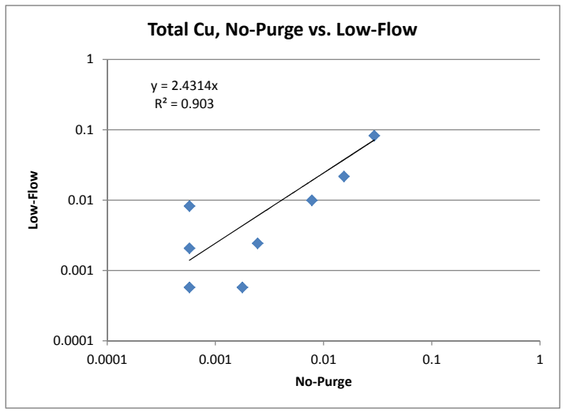
Table A-15
Statistical Differences Between Sampling Methods: Copper Concentrations

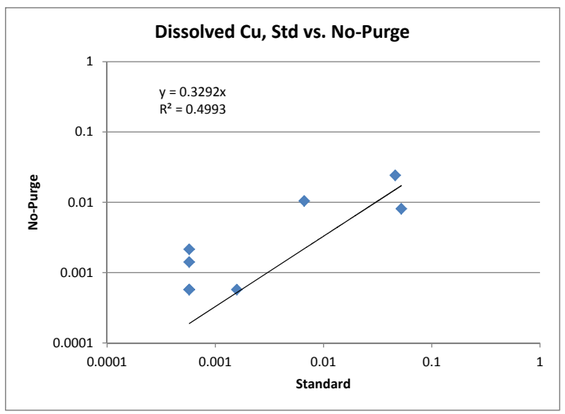
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

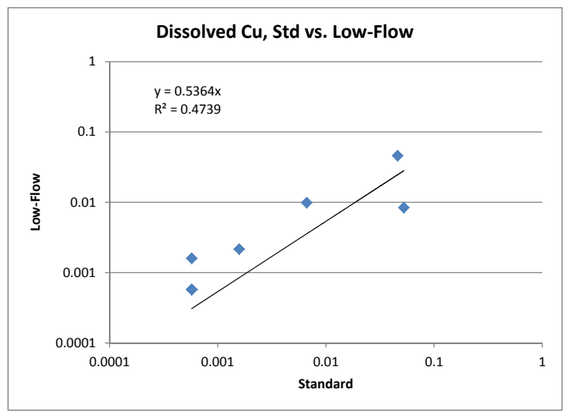
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.0072	0.0154	0.0217
EP-12	0.00077	0.00245	0.00243
EP-131	0.0021	0.000575	0.00823
EP-132	0.000575	0.00177	0.000575
EP-51	0.171	0.0294	0.0825
EP-58	0.000575	0.000575	0.000575
EP-75	0.0461	0.00779	0.00995
EP-78	0.000575	0.000575	0.00207
Dissolved (mg/L)			
EP-120	0.00664	0.0105	0.00989
EP-12	0.000575	0.00215	0.0016
EP-131	0.000575	0.000575	0.000575
EP-132	0.00158	0.000575	0.00216
EP-51	0.046	0.0243	0.0461
EP-58	0.000575	0.000575	0.000575
EP-75	0.0524	0.00811	0.00843
EP-78	0.000575	0.00142	0.000575











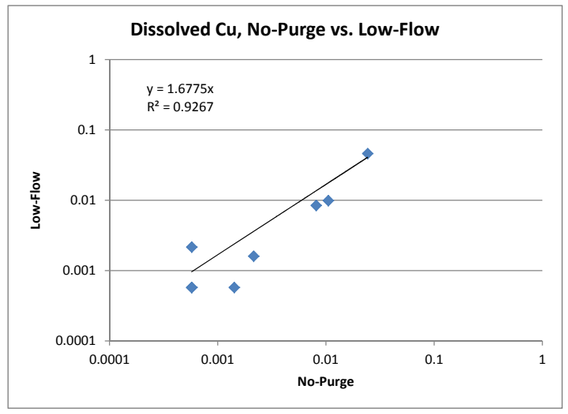
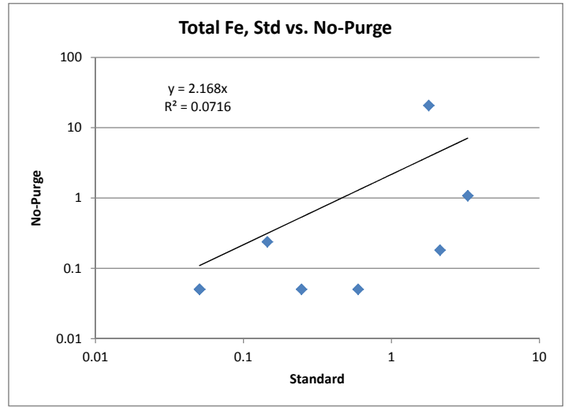
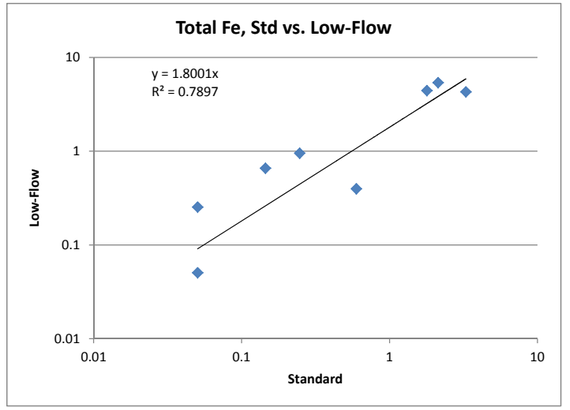


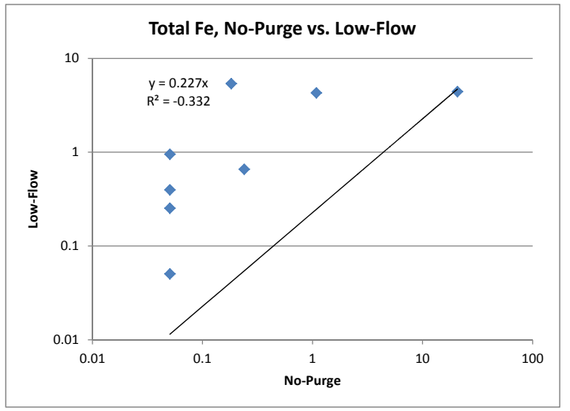
Table A-16
Statistical Differences Between Sampling Methods: Iron Concentrations

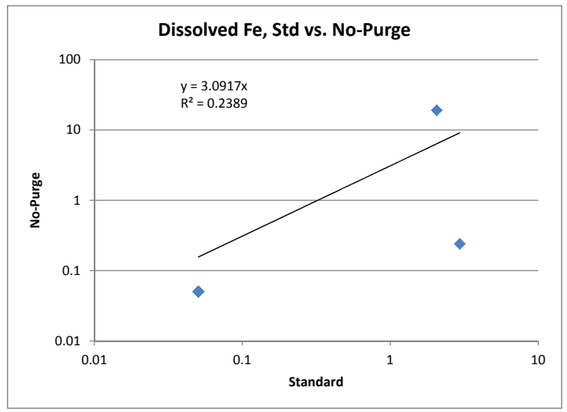
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

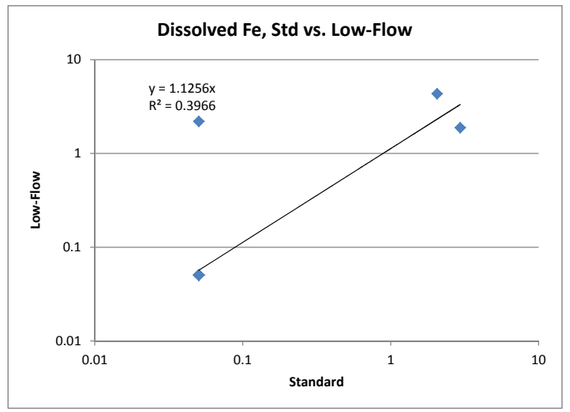
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.145	0.239	0.659
EP-12	3.28	1.08	4.3
EP-131	0.247	0.0505	0.953
EP-132	0.0505	0.0505	0.253
EP-51	2.13	0.182	5.39
EP-58	1.79	20.7	4.43
EP-75	0.596	0.0505	0.397
EP-78	0.0505	0.0505	0.0505
Dissolved (mg/L)			
EP-120	0.0505	0.0505	0.0505
EP-12	2.95	0.241	1.88
EP-131	0.0505	0.0505	0.0505
EP-132	0.0505	0.0505	0.0505
EP-51	0.0505	0.0505	2.2
EP-58	2.06	19.1	4.33
EP-75	0.0505	0.0505	0.0505
EP-78	0.0505	0.0505	0.0505
	100	60	100











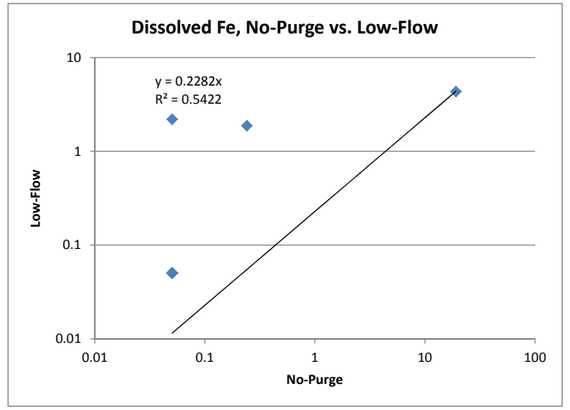
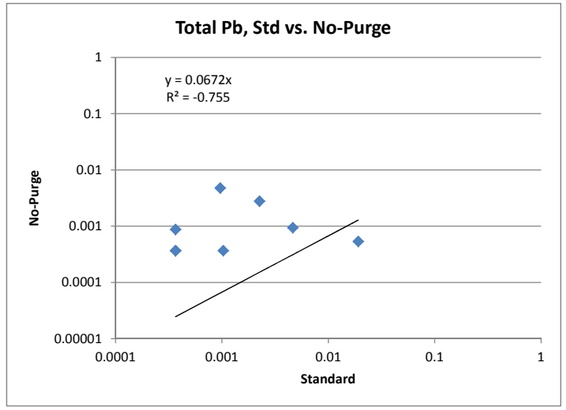
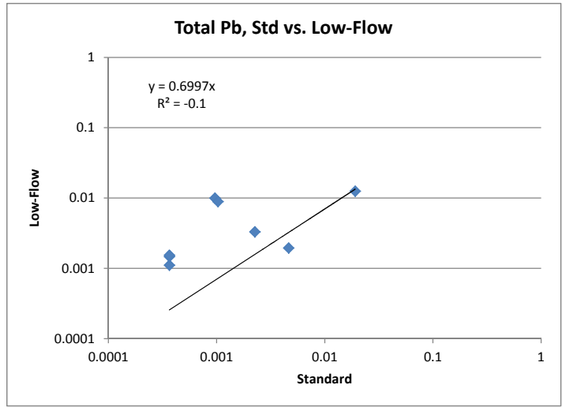


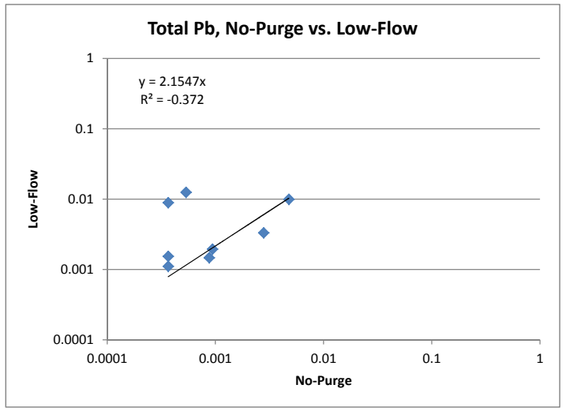
Table A-17
Statistical Differences Between Sampling Methods: Lead Concentrations

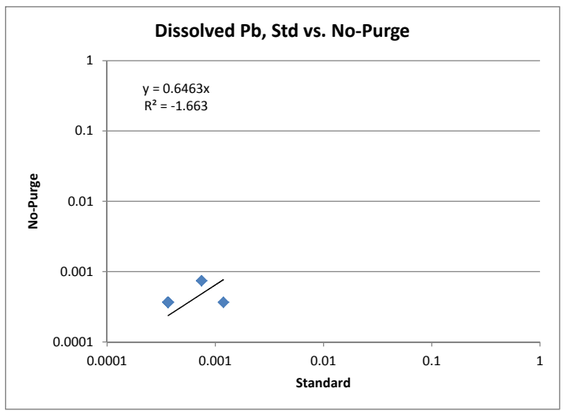
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

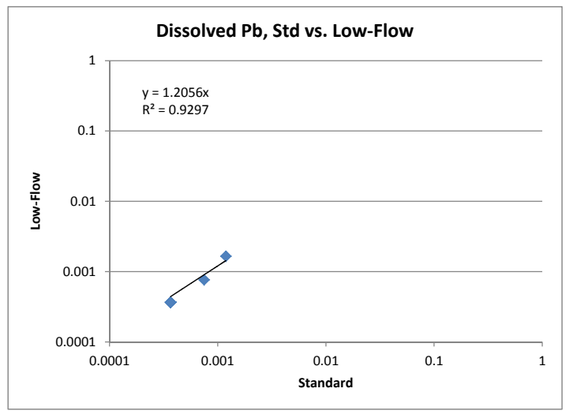
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.000965	0.00477	0.00997
EP-12	0.00226	0.00279	0.00331
EP-131	0.00103	0.0003665	0.00891
EP-132	0.0003665	0.0003665	0.00111
EP-51	0.0191	0.000535	0.0125
EP-58	0.0003665	0.000876	0.00147
EP-75	0.00464	0.000939	0.00195
EP-78	0.0003665	0.0003665	0.00154
Dissolved (mg/L)			
EP-120	0.0003665	0.0003665	0.0003665
EP-12	0.0003665	0.0003665	0.0003665
EP-131	0.0003665	0.0003665	0.0003665
EP-132	0.0003665	0.0003665	0.0003665
EP-51	0.00119	0.0003665	0.00166
EP-58	0.0003665	0.0003665	0.0003665
EP-75	0.000748	0.000743	0.000765
EP-78	0.0003665	0.0003665	0.0003665











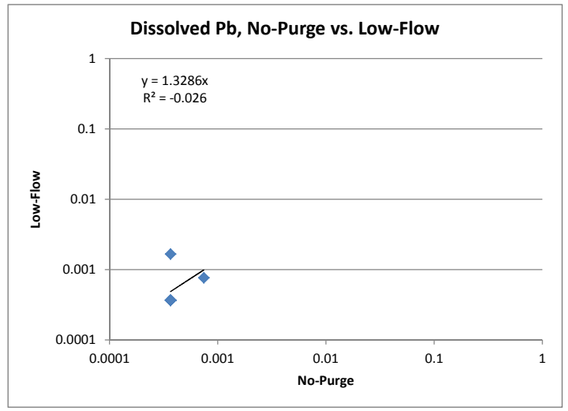
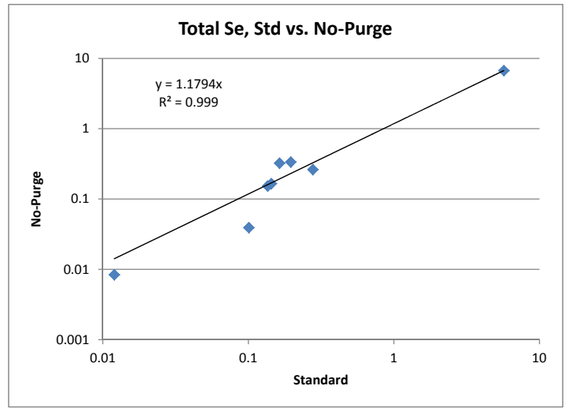
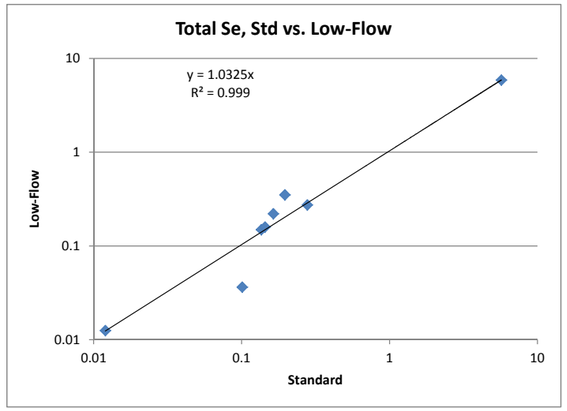


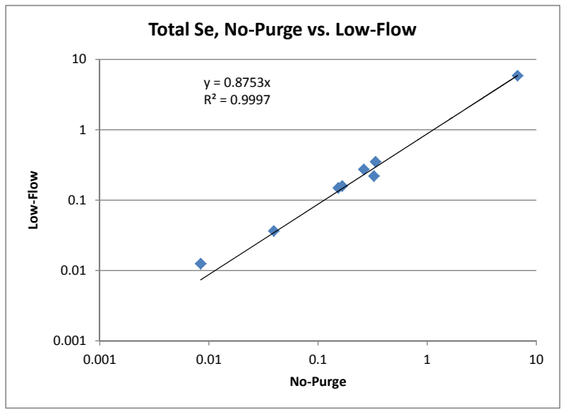
Table A-18
Statistical Differences Between Sampling Methods: Selenium Concentrations

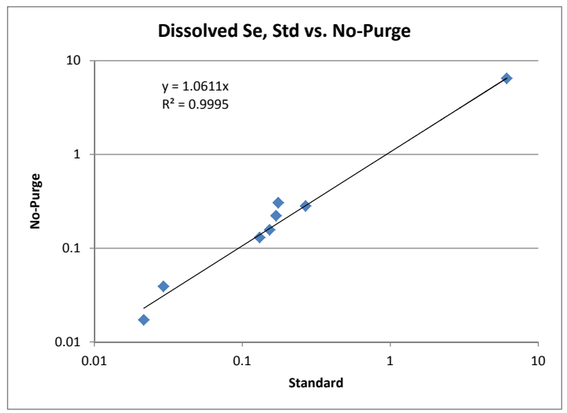
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

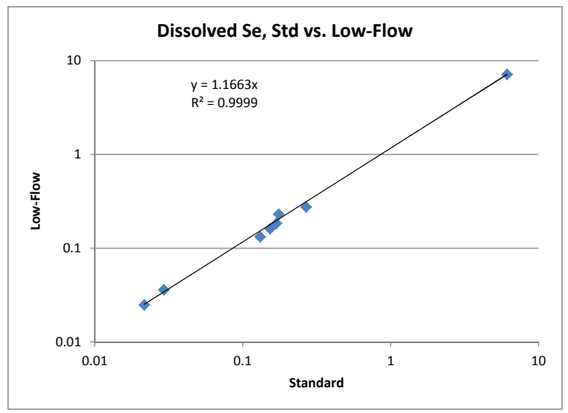
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.101	0.0392	0.0364
EP-12	0.196	0.336	0.351
EP-131	0.136	0.153	0.149
EP-132	0.278	0.262	0.274
EP-51	0.164	0.324	0.22
EP-58	0.012	0.0084	0.0125
EP-75	5.7	6.72	5.88
EP-78	0.144	0.166	0.159
Dissolved (mg/L)			
EP-120	0.0293	0.0392	0.036
EP-12	0.169	0.222	0.184
EP-131	0.131	0.13	0.132
EP-132	0.268	0.282	0.275
EP-51	0.175	0.306	0.231
EP-58	0.0216	0.0172	0.0248
EP-75	6.12	6.49	7.14
EP-78	0.153	0.157	0.161











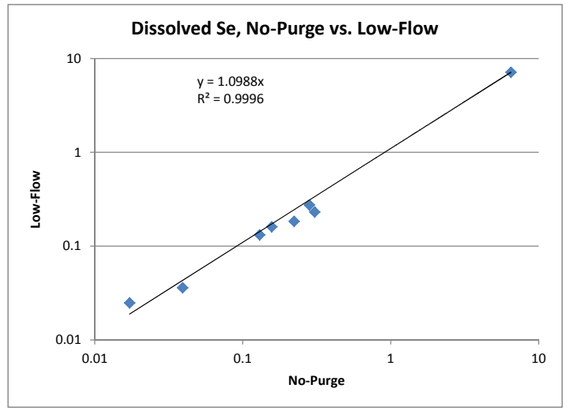
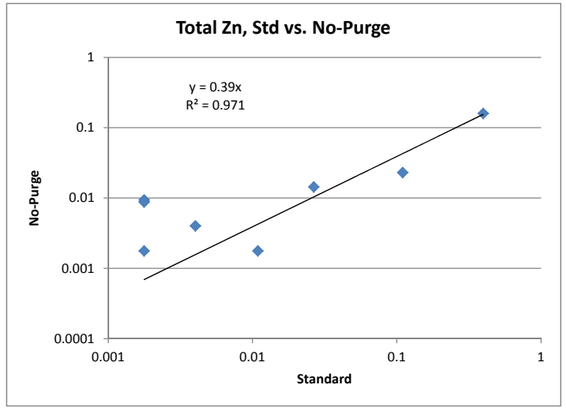
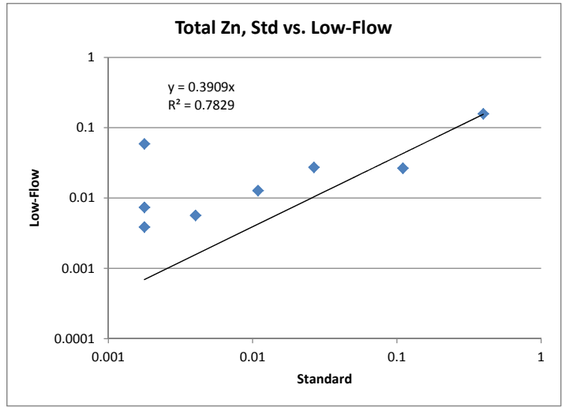


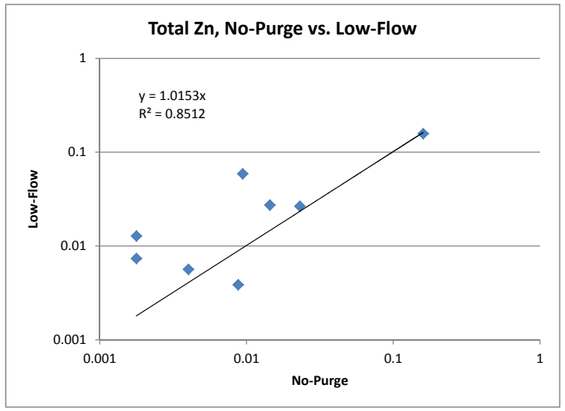
Table A-19
Statistical Differences Between Sampling Methods: Zinc Concentrations

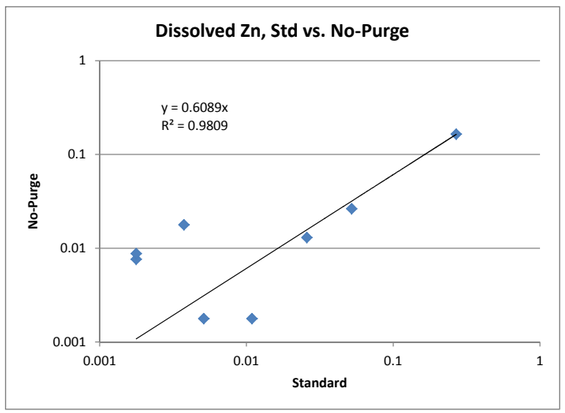
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

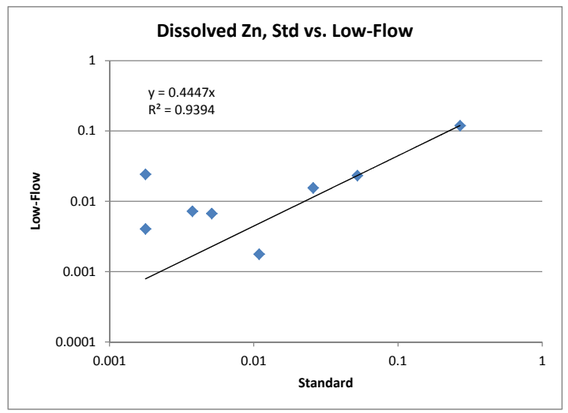
	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	0.0266	0.0144	0.0273
EP-12	0.00402	0.00401	0.00565
EP-131	0.0109	0.001775	0.0128
EP-132	0.001775	0.0094	0.0589
EP-51	0.397	0.16	0.158
EP-58	0.001775	0.00876	0.00387
EP-75	0.11	0.0231	0.0266
EP-78	0.001775	0.001775	0.00737
Dissolved (mg/L)			
EP-120	0.0258	0.013	0.0155
EP-12	0.001775	0.00762	0.0243
EP-131	0.0109	0.001775	0.001775
EP-132	0.00512	0.001775	0.0067
EP-51	0.269	0.165	0.119
EP-58	0.00375	0.0178	0.00721
EP-75	0.0522	0.0264	0.0233
EP-78	0.001775	0.00876	0.00405











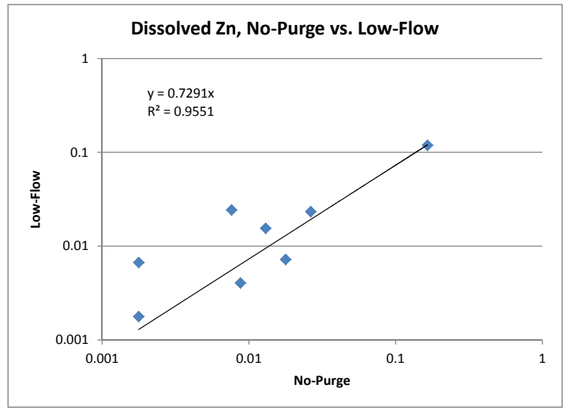
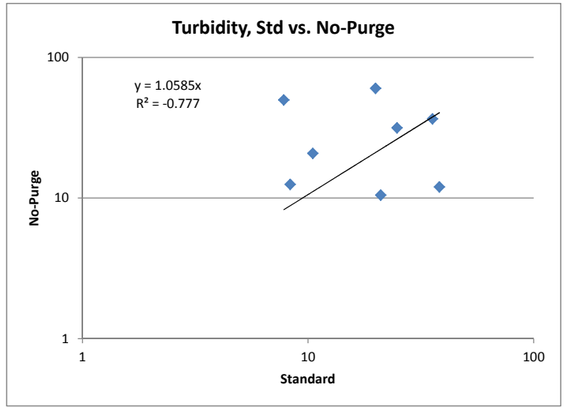
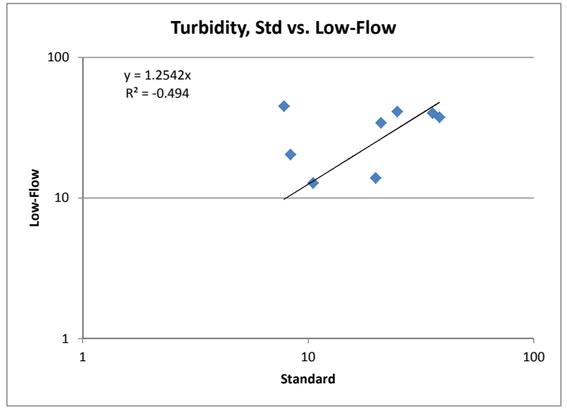


Table A-20
Statistical Differences Between Sampling Methods: Turbidity Concentrations

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

	Standard	No-Purge	Low-Flow
Total (mg/L)			
EP-120	21	10.5	34.3
EP-12	7.81	49.9	45.1
EP-131	24.8	31.6	41.2
EP-132	8.34	12.5	20.4
EP-51	38.2	12	37.6
EP-58	19.9	60.3	13.9
EP-75	35.6	36.6	40.2
EP-78	10.5	20.8	12.8





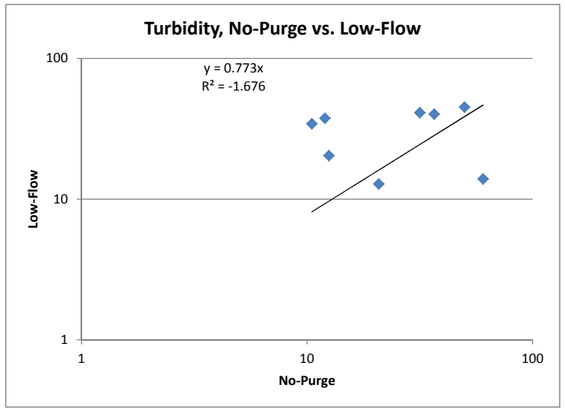
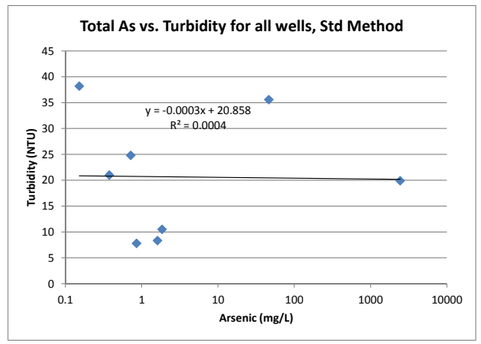
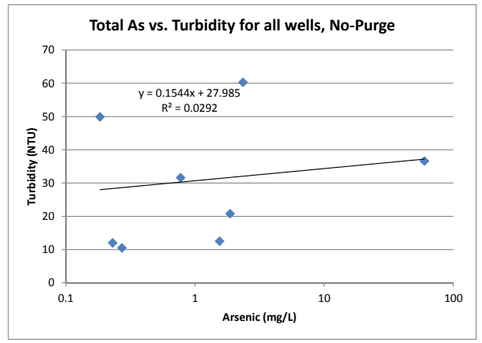


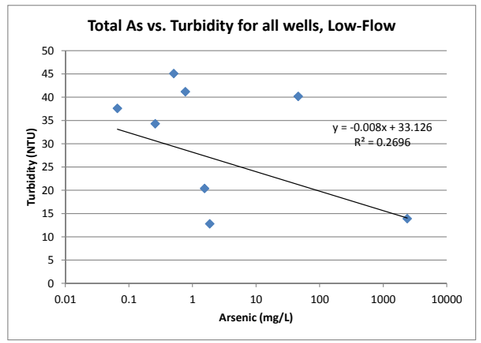
Table A-21
Statistical Differences Between Sampling Methods: Arsenic vs. Turbidity Concentrations

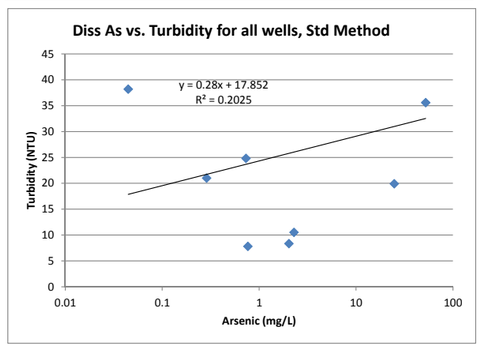
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

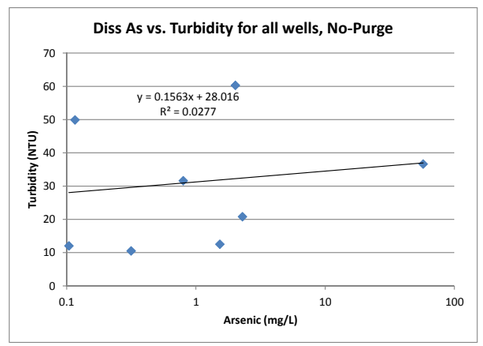
	Arsenic			Turbidity		
	Standard	No-Purge	Low-Flow	Standard	No-Purge	Low-Flow
Total (mg/L)						
EP-120	0.376	0.272	0.26	21	10.5	34.3
EP-12	0.856	0.184	0.51	7.81	49.9	45.1
EP-131	0.718	0.774	0.774	24.8	31.6	41.2
EP-132	1.61	1.55	1.55	8.34	12.5	20.4
EP-51	0.152	0.23	0.066	38.2	12	37.6
EP-58	2450	2.35	2390	19.9	60.3	13.9
EP-75	46.3	59.6	46.2	35.6	36.6	40.2
EP-78	1.85	1.87	1.87	10.5	20.8	12.8
Dissolved (mg/L)						
EP-120	0.287	0.315	0.299			
EP-12	0.765	0.116	0.417			
EP-131	0.732	0.798	0.747			
EP-132	2.03	1.53	1.67			
EP-51	0.0446	0.104	0.00393			
EP-58	24.8	2.02	20.1			
EP-75	52.4	57.3	56.9			
EP-78	2.29	2.29	2.28			











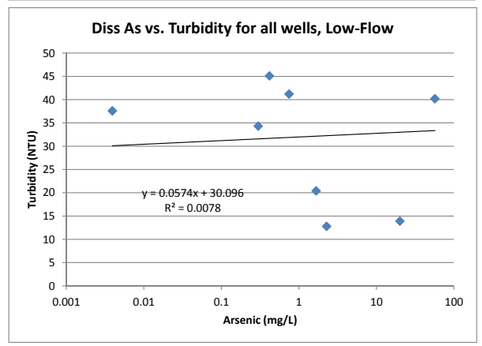
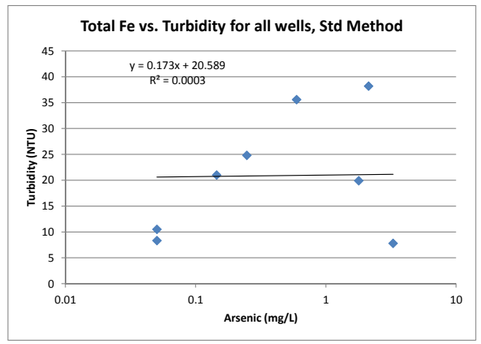
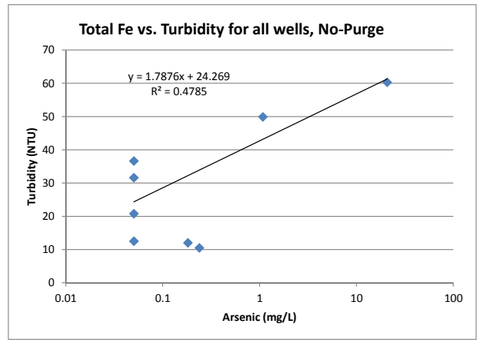


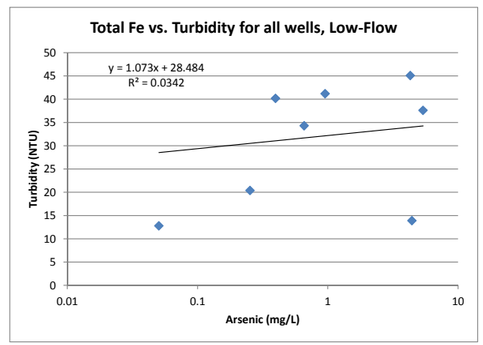
Table A-22
Statistical Differences Between Sampling Methods: Iron vs. Turbidity Concentrations

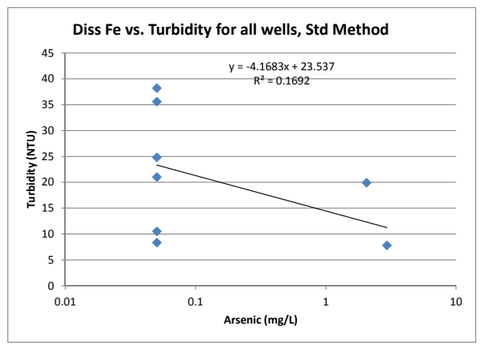
Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

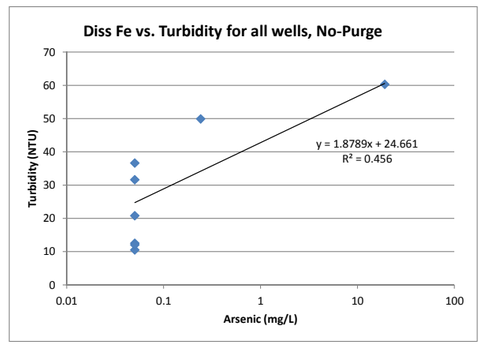
	Arsenic			Turbidity		
	Standard	No-Purge	Low-Flow	Standard	No-Purge	Low-Flow
Total (mg/L)						
EP-120	0.145	0.239	0.659	21	10.5	34.3
EP-12	3.28	1.08	4.3	7.81	49.9	45.1
EP-131	0.247	0.0505	0.953	24.8	31.6	41.2
EP-132	0.0505	0.0505	0.253	8.34	12.5	20.4
EP-51	2.13	0.182	5.39	38.2	12	37.6
EP-58	1.79	20.7	4.43	19.9	60.3	13.9
EP-75	0.596	0.0505	0.397	35.6	36.6	40.2
EP-78	0.0505	0.0505	0.0505	10.5	20.8	12.8
Dissolved (mg/L)						
EP-120	0.0505	0.0505	0.0505			
EP-12	2.95	0.241	1.88			
EP-131	0.0505	0.0505	0.0505			
EP-132	0.0505	0.0505	0.0505			
EP-51	0.0505	0.0505	2.2			
EP-58	2.06	19.1	4.33			
EP-75	0.0505	0.0505	0.0505			
EP-78	0.0505	0.0505	0.0505			











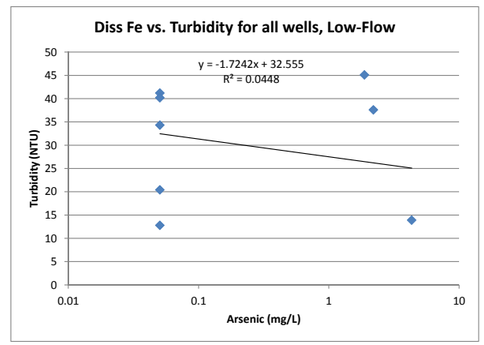


Table A-23
All Data

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

	EP-120						EP-12					
	EP-120 3/1/2011	EP-120HS 3/1/2011	EP-120LF 3/1/2011	Standard	No-Purge	Low-Flow	EP-12 3/3/201	EP-12HS 3/3/201	EP-12LF 3/3/201	Standard	No-Purge	Low-Flow
Total Metals (mg/L)												
Aluminum	0.254	0.173	0.693	0.254	0.173	0.693	<0.0072	<0.0072	0.118	0.0036	0.0036	0.118
Antimony	0.115	0.118	0.113	0.115	0.118	0.113	<0.00161	<0.00161	<0.00161	0.000805	0.000805	0.000805
Arsenic	0.376 J	0.272	0.26	0.376	0.272	0.26	0.856	0.184	0.51	0.856	0.184	0.51
Barium	0.029	0.0452	0.0487	0.029	0.0452	0.0487	0.0588	0.0949	0.0802	0.0588	0.0949	0.0802
Cadmium	0.00257	<0.000854	<0.000854	0.00257	0.000427	0.000427	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Calcium	88.1	87	88.7	88.1	87	88.7	197	161	162	197	161	162
Chromium	0.00433 J	0.00391 J	0.0045 J	0.00433	0.00391	0.0045	0.00375 J	0.00445 J	0.00802	0.00375	0.00445	0.00802
Cobalt	<0.00136	<0.00136	0.00215 J	0.00068	0.00068	0.00215	0.00141 J	<0.00136	<0.00136	0.00141	0.00068	0.00068
Copper	0.0072 J	0.0154	0.0217	0.0072	0.0154	0.0217	<0.00154 UJ	<0.0049 UJ	<0.00486 UJ	0.00077	0.00245	0.00243
Iron	0.145 J	0.239 J	0.659	0.145	0.239	0.659	3.28	1.08	4.3	3.28	1.08	4.3
Lead	0.000965 J	0.00477 J	0.00997	0.000965	0.00477	0.00997	0.00226 J	0.00279 J	0.00331 J	0.00226	0.00279	0.00331
Magnesium	54.5	59.6	59.1	54.5	59.6	59.1	73.9	61.2	60.3	73.9	61.2	60.3
Manganese	0.00965 J	0.0197	0.054	0.00965	0.0197	0.054	0.541	0.112	0.204	0.541	0.112	0.204
Mercury	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065
Molybdenum	0.256 J	0.126	0.123	0.256	0.126	0.123	0.0207	0.00789	0.00944	0.0207	0.00789	0.00944
Nickel	<0.00217	<0.00217	<0.00217	0.001085	0.001085	0.001085	0.0209	0.00752	0.00926	0.0209	0.00752	0.00926
Potassium	21.2	20.3	20.2	21.2	20.3	20.2	11.9 J	11.3 J	10.2 J	11.9	11.3	10.2
Selenium	0.101 J	0.0392	0.0364	0.101	0.0392	0.0364	0.196	0.336	0.351	0.196	0.336	0.351
Sodium	671	687	680	671	687	680	741	669	666	741	669	666
Thallium	0.0144	<0.000693	<0.000693	0.0144	0.0003465	0.0003465	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465
Zinc	0.0266	0.0144 J	0.0273	0.0266	0.0144	0.0273	0.00402 J	0.00401 J	0.00565 J	0.00402	0.00401	0.00565
Dissolved Metals (mg/L)												
Antimony	0.125	0.125	0.115	0.125	0.125	0.115	<0.00161	<0.00161	<0.00161	0.000805	0.000805	0.000805
Arsenic	0.287	0.315	0.299	0.287	0.315	0.299	0.765	0.116	0.417	0.765	0.116	0.417
Barium	0.0301	0.0435	0.0426	0.0301	0.0435	0.0426	0.0596	0.0812	0.0577	0.0596	0.0812	0.0577
Cadmium	0.00246	<0.000854	<0.000854	0.00246	0.000427	0.000427	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Chromium	0.00358 J	0.00365 J	0.00335 J	0.00358	0.00365	0.00335	0.00196 J	0.00402 J	0.0065	0.00196	0.00402	0.0065
Cobalt	<0.00136	<0.00136	<0.00136	0.00068	0.00068	0.00068	0.00147 J	<0.00136	<0.00136	0.00147	0.00068	0.00068
Copper	0.00664 J	0.0105	0.00989 J	0.00664	0.0105	0.00989	<0.00115 UJ	0.00215 J	0.0016 J	0.000575	0.00215	0.0016
Iron	<0.101	<0.101	<0.101	0.0505	0.0505	0.0505	2.95	0.241 J	1.88	2.95	0.241	1.88
Lead	<0.000733	<0.000733	<0.000733	0.0003665	0.0003665	0.0003665	<0.000733	<0.000733	<0.000733	0.0003665	0.0003665	0.0003665
Mercury	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065	0.000134 J	<0.00013	<0.00013	0.000134	0.000065	0.000065
Molybdenum	0.113	0.117	0.109	0.113	0.117	0.109	0.0187	0.00471 J	0.0072	0.0187	0.00471	0.0072
Nickel	<0.00217	<0.00217	<0.00217	0.001085	0.001085	0.001085	0.0195	0.00861	0.00862	0.0195	0.00861	0.00862
Selenium	0.0293	0.0392	0.036	0.0293	0.0392	0.036	0.169	0.222	0.184	0.169	0.222	0.184
Thallium	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465
Zinc	0.0258	0.013 J	0.0155 J	0.0258	0.013	0.0155	<0.00355 UJ	0.00762 J	0.0243 J	0.001775	0.00762	0.0243
Water Quality Parameters (mg/L)												
Chloride	321	307	325	321	307	325	255	119	133	255	119	133
Fluoride	4.38	3.42	3.54	4.38	3.42	3.54	2.94	1.86	1.96	2.94	1.86	1.96
Nitrate	6.91	6.93	6.91	6.91	6.93	6.91	24.6	<0.515	0.995 J	24.6	<0.515	0.995
Nitrate + Nitrite	6.91	6.93	6.91	6.91	6.93	6.91	24.6	<1	<1	24.6	0.5	0.5
Nitrite	<0.4	<0.4	<0.4	0.2	0.2	0.2	<1	<1	<1	0.5	0.5	0.5
Sulfate	916 J	895	928 J	916	895	928	1120	2890	473	1120	2890	473
Sulfide	<0.0131	0.021 J	<0.0131	0.00655	0.021	0.00655	0.027 J	0.269	0.814	0.027	0.269	0.814
Total Alkalinity	382	382	384	382	382	384	825	813	842	825	813	842
Total Dissolved Solids	2310	2450	2460	2310	2450	2460	3130	2630	4900	3130	2630	4900
Total Organic Carbon	56.5	53.6	62.5	56.5	53.6	62.5	120	126	93	120	126	93
Total Suspended Solids	9	8	22.2	9	8	22.2	22	21	25	22	21	25
Purge Parameters												
Conductivity (umhos/cm)	3793	3562	3742	3793	3562	3742	4710	4027	3796	4710	4027	3796
Turbidity (NTU)	21	10.5	34.3	21	10.5	34.3	7.81	49.9	45.1	7.81	49.9	45.1

Table A-23
All Data

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

	EP-131						EP-132					
	EP-131 3/2/2011	EP-131HS 3/2/2011	EP-131LF 3/2/2011	Standard	No-Purge	Low-Flow	EP-132 2/28/201	EP-132HS 2/28/201	EP-132LF 2/28/201	Standard	No-Purge	Low-Flow
Total Metals (mg/L)												
Aluminum	0.448 J	0.161 J	1.67	0.448	0.161	1.67	0.0182 J	0.13	0.465	0.0182	0.13	0.465
Antimony	0.00222 J	0.00182 J	0.00166 J	0.00222	0.00182	0.00166	0.00652	0.00524	0.00639	0.00652	0.00524	0.00639
Arsenic	0.718	0.774	0.774	0.718	0.774	0.774	1.61 J	1.55 J	1.55 J	1.61	1.55	1.55
Barium	0.0203	0.0231	0.049	0.0203	0.0231	0.049	0.019	0.0185	0.0206	0.019	0.0185	0.0206
Cadmium	0.00224	<0.000854	0.000979 J	0.00224	0.000427	0.000979	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Calcium	121	121	126	121	121	126	159 J	155 J	153 J	159	155	153
Chromium	0.00386 J	<0.0014	0.00203 J	0.00386	0.0007	0.00203	<0.0014	<0.0014	<0.0014	0.0007	0.0007	0.0007
Cobalt	0.00326 J	0.00293 J	0.00372 J	0.00326	0.00293	0.00372	<0.00136	<0.00136	<0.00136	0.00068	0.00068	0.00068
Copper	0.0021 J	<0.00115	0.00823 J	0.0021	0.000575	0.00823	<0.00115	0.00177 J	<0.00115	0.000575	0.00177	0.000575
Iron	0.247 J	<0.101	0.953	0.247	0.0505	0.953	<0.101	<0.101	0.253	0.0505	0.0505	0.253
Lead	0.00103 J	<0.000733	0.00891	0.00103	0.0003665	0.00891	<0.000733	<0.000733	0.00111 J	0.0003665	0.0003665	0.00111
Magnesium	42.1	42.4	41.8	42.1	42.4	41.8	38	39.2	38.4	38	39.2	38.4
Manganese	0.661	0.783	0.77	0.661	0.783	0.77	0.0195	0.0589	0.0682	0.0195	0.0589	0.0682
Mercury	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065	<0.00013	<0.00013	0.000172 J	0.000065	0.000065	0.000172
Molybdenum	0.323	0.302	0.302	0.323	0.302	0.302	0.242	0.265	0.256	0.242	0.265	0.256
Nickel	0.00971	0.0108	0.0112	0.00971	0.0108	0.0112	0.0197 J	0.0371 J	0.0228 J	0.0197	0.0371	0.0228
Potassium	19.2	20.5	19.5	19.2	20.5	19.5	42.5	43	41.8	42.5	43	41.8
Selenium	0.136	0.153	0.149	0.136	0.153	0.149	0.278	0.262	0.274	0.278	0.262	0.274
Sodium	715	716	718	715	716	718	609	636	634	609	636	634
Thallium	0.00261	<0.000693	<0.000693	0.00261	0.0003465	0.0003465	<0.000693	0.00123	<0.000693	0.0003465	0.00123	0.0003465
Zinc	0.0109 J	<0.00355	0.0128 J	0.0109	0.001775	0.0128	<0.00355	0.0094 J	0.0589	0.001775	0.0094	0.0589
Dissolved Metals (mg/L)												
Antimony	0.00164 J	0.00171 J	0.00193 J	0.00164	0.00171	0.00193	0.00629	0.00576	0.00506	0.00629	0.00576	0.00506
Arsenic	0.732	0.798	0.747	0.732	0.798	0.747	2.03	1.53	1.67	2.03	1.53	1.67
Barium	0.0149	0.0221	0.0207	0.0149	0.0221	0.0207	0.0192	0.0199	0.0195	0.0192	0.0199	0.0195
Cadmium	0.00159 J	<0.000854	<0.000854	0.00159	0.000427	0.000427	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Chromium	0.00153 J	<0.0014	<0.0014	0.00153	0.0007	0.0007	<0.0014	<0.0014	<0.0014	0.0007	0.0007	0.0007
Cobalt	0.00352 J	0.00319 J	0.00319 J	0.00352	0.00319	0.00319	<0.00136	0.00154 J	<0.00136	0.00068	0.00154	0.00068
Copper	<0.00115	<0.00115	<0.00115	0.000575	0.000575	0.000575	0.00158 J	<0.00115	0.00216 J	0.00158	0.000575	0.00216
Iron	<0.101	<0.101	<0.101	0.0505	0.0505	0.0505	<0.101	<0.101	<0.101	0.0505	0.0505	0.0505
Lead	<0.000733	<0.000733	<0.000733	0.0003665	0.0003665	0.0003665	<0.000733	<0.000733	<0.000733	0.0003665	0.0003665	0.0003665
Mercury	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065
Molybdenum	0.325	0.299	0.29	0.325	0.299	0.29	0.232	0.27	0.276	0.232	0.27	0.276
Nickel	0.0104	0.0105	0.00983	0.0104	0.0105	0.00983	0.0204	0.0222 J	0.0193 J	0.0204	0.0222	0.0193
Selenium	0.131	0.13	0.132	0.131	0.13	0.132	0.268	0.282	0.275	0.268	0.282	0.275
Thallium	0.00244	<0.000693	<0.000693	0.00244	0.0003465	0.0003465	0.00245	<0.000693	0.00106	0.00245	0.0003465	0.00106
Zinc	0.0109 J	<0.00355	<0.00355	0.0109	0.001775	0.001775	0.00512 J	<0.00355	0.0067 J	0.00512	0.001775	0.0067
Water Quality Parameters (mg/L)												
Chloride	290 J	324 J	282 J	290	324	282	284 J	268 J	314 J	284	268	314
Fluoride	11.1	7.2	10.9	11.1	7.2	10.9	3.84	3.62	3.5	3.84	3.62	3.5
Nitrate	6.18	6.78	6.72	6.18	6.78	6.72	9.14 J	5.83 J	7.09 J	9.14	5.83	7.09
Nitrate + Nitrite	6.18	6.78	6.72	6.18	6.78	6.72	9.14	5.83	7.09	9.14	5.83	7.09
Nitrite	<0.4	<0.4	<0.4	0.2	0.2	0.2	<0.4	<0.4	<0.4	0.2	0.2	0.2
Sulfate	1160 J	1780 J	1150 J	1160	1780	1150	1260 J	1100 J	1340 J	1260	1100	1340
Sulfide	<0.0131	<0.0131	<0.0131	0.00655	0.00655	0.00655	<0.0131	<0.0131	<0.0131	0.00655	0.00655	0.00655
Total Alkalinity	346	357	362	346	357	362	307	354	338	307	354	338
Total Dissolved Solids	2600	2490	2500	2600	2490	2500	2600	2620	2620	2600	2620	2620
Total Organic Carbon	65.7	61.6	66.5	65.7	61.6	66.5	32.9	62.9	66.5	32.9	62.9	66.5
Total Suspended Solids	10	4.6	30	10	4.6	30	6	12.8	12.6	6	12.8	12.6
Purge Parameters												
Conductivity (umhos/cm)	4020	2133	3975	4020	2133	3975	3547	3315	3610	3547	3315	3610
Turbidity (NTU)	24.8	31.6	41.2	24.8	31.6	41.2	8.34	12.5	20.4	8.34	12.5	20.4

Table A-23
All Data

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

	EP-51						EP-58					
	EP-51 3/3/201	EP-51HS 3/3/201	EP-51LF 3/3/201	Standard	No-Purge	Low-Flow	EP-58 2/28/201	EP-58HS 2/28/201	EP-58LF 2/28/201	Standard	No-Purge	Low-Flow
Total Metals (mg/L)												
Aluminum	0.912	0.0375 J	0.165	0.912	0.0375	0.165	0.0624 J	0.137	0.407	0.0624	0.137	0.407
Antimony	0.00838	0.00829	0.00301 J	0.00838	0.00829	0.00301	0.00204 J	<0.00161	0.00277 J	0.00204	0.000805	0.00277
Arsenic	0.152	0.23	0.066	0.152	0.23	0.066	2450	2.35 J	2390	2450	2.35	2390
Barium	0.0234	0.0222	0.0212	0.0234	0.0222	0.0212	0.0299	0.0373	0.0329	0.0299	0.0373	0.0329
Cadmium	0.0315	0.00426	0.0293	0.0315	0.00426	0.0293	<0.000854	<0.000854	0.00127 J	0.000427	0.000427	0.00127
Calcium	843	497	693	843	497	693	452 J	371 J	455 J	452	371	455
Chromium	0.211	0.00917	1.54	0.211	0.00917	1.54	0.00791	0.208	0.0353	0.00791	0.208	0.0353
Cobalt	0.00936	0.00172 J	0.0284	0.00936	0.00172	0.0284	0.0193	0.00537	0.0185	0.0193	0.00537	0.0185
Copper	0.171	0.0294	0.0825	0.171	0.0294	0.0825	<0.00115	<0.00115	<0.00115	0.000575	0.000575	0.000575
Iron	2.13	0.182 J	5.39	2.13	0.182	5.39	1.79	20.7	4.43	1.79	20.7	4.43
Lead	0.0191	<0.00107 UJ	0.0125	0.0191	0.000535	0.0125	<0.000733	0.000876 J	0.00147 J	0.0003665	0.000876	0.00147
Magnesium	732	450	613	732	450	613	211	207	208	211	207	208
Manganese	1.68	0.0275	1.14	1.68	0.0275	1.14	11.5	6	11.5	11.5	6	11.5
Mercury	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065	0.00042 J	0.000331 J	0.000294 J	0.00042	0.000331	0.000294
Molybdenum	0.00739	0.0162	0.0211	0.00739	0.0162	0.0211	0.991	0.404	1.06	0.991	0.404	1.06
Nickel	0.314	0.09	2.74	0.314	0.09	2.74	0.128 J	1.07 J	0.109 J	0.128	1.07	0.109
Potassium	56.4 J	39.2 J	49.2 J	56.4	39.2	49.2	225	129	228	225	129	228
Selenium	0.164	0.324	0.22	0.164	0.324	0.22	<0.024 UJ	<0.0168 UJ	<0.025 UJ	0.012	0.0084	0.0125
Sodium	1760	1200	1520	1760	1200	1520	1350	1300	1350	1350	1300	1350
Thallium	0.00287	0.00195	0.00242	0.00287	0.00195	0.00242	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465
Zinc	0.397	0.16 J	0.158	0.397	0.16	0.158	<0.00355	0.00876 J	0.00387 J	0.001775	0.00876	0.00387
Dissolved Metals (mg/L)												
Antimony	0.00593	0.00752	0.00182 J	0.00593	0.00752	0.00182	0.00183 J	<0.00161	0.00256 J	0.00183	0.000805	0.00256
Arsenic	0.0446	0.104	0.00393 J	0.0446	0.104	0.00393	24.8	2.02 J	20.1	24.8	2.02	20.1
Barium	0.0199	0.0202	0.0168	0.0199	0.0202	0.0168	0.0305	0.0406	0.0284	0.0305	0.0406	0.0284
Cadmium	0.0317	0.00503	0.0279	0.0317	0.00503	0.0279	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Chromium	0.00348 J	<0.0014	0.0402	0.00348	0.0007	0.0402	<0.0014	0.0146	<0.0014	0.0007	0.0146	0.000116667
Cobalt	0.00934	0.00564	0.0291	0.00934	0.00564	0.0291	0.018	0.00464 J	0.0169	0.018	0.00464	0.0169
Copper	0.046 J	0.0243	0.0461 J	0.046	0.0243	0.0461	<0.00115	<0.00115	<0.00115	0.000575	0.000575	0.000575
Iron	<0.101	<0.101	2.2	0.0505	0.0505	2.2	2.06	19.1	4.33	2.06	19.1	4.33
Lead	0.00119 J	<0.000733	0.00166 J	0.00119	0.0003665	0.00166	<0.000733	<0.000733	<0.000733	0.0003665	0.0003665	0.0003665
Mercury	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065	0.000396 J	0.00036 J	0.000456 J	0.000396	0.00036	0.000456
Molybdenum	0.00627	0.0175	0.00799	0.00627	0.0175	0.00799	1	0.384	1.1	1	0.384	1.1
Nickel	0.337	0.264	2.83	0.337	0.264	2.83	0.131 J	0.968	0.0976 J	0.131	0.968	0.0976
Selenium	0.175	0.306	0.231	0.175	0.306	0.231	0.0216	0.0172	0.0248	0.0216	0.0172	0.0248
Thallium	0.00288	0.00224	0.00242	0.00288	0.00224	0.00242	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465
Zinc	0.269 J	0.165 J	0.119 J	0.269	0.165	0.119	0.00375 J	0.0178 J	0.00721 J	0.00375	0.0178	0.00721
Water Quality Parameters (mg/L)												
Chloride	5660	2180	3210	5660	2180	3210	588 J	68.4 J	554 J	588	68.4	554
Fluoride	1.01	1.53	1.46	1.01	1.53	1.46	5.13	2.26	5.55	5.13	2.26	5.55
Nitrate	123	222 J	163 J	123	222	163	<0.412	<0.412	<0.412	0.206	0.206	0.206
Nitrate + Nitrite	123	222 J	163 J	123	222	163	<0.8	<0.8	<0.8	0.4	0.4	0.4
Nitrite	<1	<5 UJ	<5 UJ	0.5	2.5	2.5	<0.8	<0.8	<0.8	0.4	0.4	0.4
Sulfate	4590	1860	1880	4590	1860	1880	3270 J	220 J	3090 J	3270	220	3090
Sulfide	0.025 J	<0.0131	<0.0131	0.025	0.00655	0.00655	<0.0131	<0.0131	0.019 J	0.00655	0.00655	0.019
Total Alkalinity	228	106	166	228	106	166	972	648	957	972	648	957
Total Dissolved Solids	11300	7000	9770	11300	7000	9770	7730	6480	7610	7730	6480	7610
Total Organic Carbon	38.3	17	37.2	38.3	17	37.2	213	159	206	213	159	206
Total Suspended Solids	74.8	9	54	74.8	9	54	11.8	84	21.6	11.8	84	21.6
Purge Parameters												
Conductivity (umhos/cm)	16825	6020	14209	16825	6020	14209	9525	9017	9668	9525	9017	9668
Turbidity (NTU)	38.2	12	37.6	38.2	12	37.6	19.9	60.3	13.9	19.9	60.3	13.9

Table A-23
All Data

Attachment 1: Analytical Data and Method Comparison
Groundwater Sampling Method Comparison Memorandum
Former ASARCO Smelter

	EP-75						EP-78					
	EP-75 3/1/2011	EP-75HS 3/1/2011	EP-75LF 3/1/2011	Standard	No-Purge	Low-Flow	EP-78 3/1/2011	EP-78HS 3/1/2011	EP-78LF 3/1/2011	Standard	No-Purge	Low-Flow
Total Metals (mg/L)												
Aluminum	0.443	0.102	0.551	0.443	0.102	0.551	<0.0072	<0.0072	0.0214 J	0.0036	0.0036	0.0214
Antimony	<0.00161	<0.00161	<0.00161	0.000805	0.000805	0.000805	0.0244	0.0259	0.0262	0.0244	0.0259	0.0262
Arsenic	46.3	59.6	46.2	46.3	59.6	46.2	1.85	1.87	1.87	1.85	1.87	1.87
Barium	0.0732	0.0451	0.0512	0.0732	0.0451	0.0512	0.0355	0.0395	0.0391	0.0355	0.0395	0.0391
Cadmium	0.0163	0.00266	0.00253	0.0163	0.00266	0.00253	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Calcium	368	364	365	368	364	365	79	78.5	81.5	79	78.5	81.5
Chromium	0.0233	<0.0014	0.00204 J	0.0233	0.0007	0.00204	<0.0014	<0.0014	<0.0014	0.0007	0.0007	0.0007
Cobalt	0.00629	0.00546	0.00594	0.00629	0.00546	0.00594	<0.00136	<0.00136	<0.00136	0.00068	0.00068	0.00068
Copper	0.0461	0.00779 J	0.00995 J	0.0461	0.00779	0.00995	<0.00115	<0.00115	0.00207 J	0.000575	0.000575	0.00207
Iron	0.596	<0.101	0.397	0.596	0.0505	0.397	<0.101	<0.101	<0.101	0.0505	0.0505	0.0505
Lead	0.00464 J	0.000939 J	0.00195 J	0.00464	0.000939	0.00195	<0.000733	<0.000733	0.00154 J	0.0003665	0.0003665	0.00154
Magnesium	216	209	212	216	209	212	48.8	47.8	49.2	48.8	47.8	49.2
Manganese	1.65	1.64	1.64	1.65	1.64	1.64	<0.0027	<0.0027	0.00301 J	0.00135	0.00135	0.00301
Mercury	0.000208 J	0.00016 J	0.000136 J	0.000208	0.00016	0.000136	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065
Molybdenum	11.8	11.9	11.9	11.8	11.9	11.9	0.356	0.363	0.376	0.356	0.363	0.376
Nickel	0.0281	0.02	0.0214	0.0281	0.02	0.0214	<0.00217	<0.00217	<0.00217	0.001085	0.001085	0.001085
Potassium	954	962	920	954	962	920	44	43.2	44.8	44	43.2	44.8
Selenium	5.7	6.72	5.88	5.7	6.72	5.88	0.144	0.166	0.159	0.144	0.166	0.159
Sodium	7130	6900	7720	7130	6900	7720	620	661	679	620	661	679
Thallium	1.14	1.2	1.24	1.14	1.2	1.24	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465
Zinc	0.11	0.0231 J	0.0266	0.11	0.0231	0.0266	<0.00355	<0.00355	0.00737 J	0.001775	0.001775	0.00737
Dissolved Metals (mg/L)												
Antimony	<0.00161	<0.00161	<0.00161	0.000805	0.000805	0.000805	0.025	0.027	0.0265	0.025	0.027	0.0265
Arsenic	52.4	57.3	56.9	52.4	57.3	56.9	2.29	2.29	2.28	2.29	2.29	2.28
Barium	0.0761	0.0449	0.0433	0.0761	0.0449	0.0433	0.0343	0.0382	0.0379	0.0343	0.0382	0.0379
Cadmium	0.0167	0.00324	0.00286	0.0167	0.00324	0.00286	<0.000854	<0.000854	<0.000854	0.000427	0.000427	0.000427
Chromium	<0.0014	<0.0014	<0.0014	0.0007	0.0007	0.0007	<0.0014	<0.0014	<0.0014	0.0007	0.0007	0.0007
Cobalt	0.00412 J	0.00621	0.00602	0.00412	0.00621	0.00602	<0.00136	<0.00136	<0.00136	0.00068	0.00068	0.00068
Copper	0.0524	0.00811 J	0.00843 J	0.0524	0.00811	0.00843	<0.00115	0.00142 J	<0.00115	0.000575	0.00142	0.000575
Iron	<0.101	<0.101	<0.101	0.0505	0.0505	0.0505	<0.101	<0.101	<0.101	0.0505	0.0505	0.0505
Lead	0.000748 J	0.000743 J	0.000765 J	0.000748	0.000743	0.000765	<0.000733	<0.000733	<0.000733	0.0003665	0.0003665	0.0003665
Mercury	0.000163 J	0.000183 J	0.00018 J	0.000163	0.000183	0.00018	<0.00013	<0.00013	<0.00013	0.000065	0.000065	0.000065
Molybdenum	12.1	11.8	12.2	12.1	11.8	12.2	0.354	0.337	0.364	0.354	0.337	0.364
Nickel	0.0245	0.0207	0.0206	0.0245	0.0207	0.0206	<0.00217	<0.00217	<0.00217	0.001085	0.001085	0.001085
Selenium	6.12	6.49	7.14	6.12	6.49	7.14	0.153	0.157	0.161	0.153	0.157	0.161
Thallium	0.918	1.22	1.24	0.918	1.22	1.24	<0.000693	<0.000693	<0.000693	0.0003465	0.0003465	0.0003465
Zinc	0.0522	0.0264	0.0233 J	0.0522	0.0264	0.0233	<0.00355	0.00876 J	0.00405 J	0.001775	0.00876	0.00405
Water Quality Parameters (mg/L)												
Chloride	227	233	231	227	233	231	306	266	300	306	266	300
Fluoride	16.1	14.8	17.3	16.1	14.8	17.3	3.66	2.82	3.5	3.66	2.82	3.5
Nitrate	113	109	111	113	109	111	7.76	10	7.91	7.76	10	7.91
Nitrate + Nitrite	113	109	111	113	109	111	7.76	10	7.91	7.76	10	7.91
Nitrite	<1	<1	<1	0.5	0.5	0.5	<0.4	<0.4	<0.4	0.2	0.2	0.2
Sulfate	10200 J	10700 J	9620 J	10200	10700	9620	923	813	915	923	813	915
Sulfide	0.045 J	<0.0131	<0.0131	0.045	0.00655	0.00655	0.055	<0.0131	<0.0131	0.055	0.00655	0.00655
Total Alkalinity	502	503	513	502	503	513	350	303	352	350	303	352
Total Dissolved Solids	16300	15800	15800	16300	15800	15800	2350	2160	2460	2350	2160	2460
Total Organic Carbon	66.6	61.6	72.1	66.6	61.6	72.1	46.1	34.9	59.3	46.1	34.9	59.3
Total Suspended Solids	224	15.6	19.2	224	15.6	19.2	3.8	4.2	3.4	3.8	4.2	3.4
Purge Parameters												
Conductivity (umhos/cm)	18554	17346	17480	18554	17346	17480	3691	3250	3602	3691	3250	3602
Turbidity (NTU)	35.6	36.6	40.2	35.6	36.6	40.2	10.5	20.8	12.8	10.5	20.8	12.8