Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Arsenic)
Phase IV RI, El Paso Asarco Smelter

	Total Arsenic					Total Arsenic				
	$X_{(i)}$ [1]	$X_{(n-i+1)}$ [2]	$X_{(n-i+1)} - x_{(i)}$	a_i [3]	b_i [4]					
	EP-95									
X_1	0.006	0.021	0.015	0.5475	0.0082125					
X_2	0.009	0.017	0.008	0.3325	0.00266					
X_3	0.011	0.017	0.006	0.2347	0.0014082					
X_4	0.011	0.015	0.004	0.1586	0.0006344					
X_5	0.012	0.015	0.003	0.0922	0.0002766					
X_6	0.013	0.014	0.001	0.0303	0.0000303					
X_7	0.014	0.013	-0.001	0.024	-0.000024					
X_8	0.015	0.012	-0.003							
X_9	0.015	0.011	-0.004							
X_{10}	0.017	0.011	-0.005							
X_{11}	0.017	0.009	-0.008							
X_{12}	0.021	0.006	-0.015							
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	12									
Minimum	0.006									
Maximum	0.021									
average (x)	0.01									
SD	0.00									
[5] b	0.0132									
[6] W	0.98457									
[7] $W_{0.05, n}$	0.859									
Data	Normal Distributed									

Note: One-half of the laboratory detection limit was used for chemicals not detected during statistical evaluations.

[1] Ordered data (mg/L) from samallest to largest

[2] Ordered data (mg/L) from largest to smallest

[3] Coefficients ai for the Shapiro-Wilk Test for Normality, Table A6.

[4] $b_j = [x_{(n-i+1)} - x_{(i)}] * [a_{n-i+1}]$

[5] Sum of all b_j Numerator of the Shapiro-Wilk Test

[6] Test for Normality (Shapiro-Wilk Test), $W = [b/(SD * sqrt(n-1))]^2$

[7] Quantiles of the Shapiro-Wilk Test for Normality $_{(0.05, n)}$, Table A7.

LN Natural Log

Appendix I

Statistical Summary:(Shapiro Wilk Test of Normality and the Non-Parametric Mann Kendall Test)
Total Arsenic
Phase IV RI, El Paso Asarco Smelter

WELL	Normal	Lognormal	t	Z	$t\ crit_{(\alpha=1,\ alpha=2)}$	Result	+	-	0	Notes
EM-2		X	3.905		1.782	Concentration significantly decreases over time		1		
EM-5	X		9.615		1.782	Concentration significantly decreases over time		1		
EM-7						Only three data points - not tested				
EP-101	X		1.794		1.796	No significant trend detected			1	
EP-106				2.7	1.645	Concentration significantly increases over time	1			
EP-108	X		0.294		1.796	No significant trend detected			1	
EP-111	X		2.124		1.812	Concentration significantly increases over time	1			
EP-114	X		5.63		1.812	Concentration significantly increases over time	1			
EP-115				1.339	1.645	No significant trend detected			1	
EP-116	X		1.813		1.796	Concentration significantly increases over time	1			
EP-117				1.039	1.645	No significant trend detected			1	
EP-118		X	1.808		1.796	No significant trend detected			1	
EP-119	X		0.782		2.015	No significant trend detected			1	
EP-120	X		0.774		2.132	No significant trend detected			1	
EP-121	X		1.914		2.015	No significant trend detected			1	
EP-12	X		4.198		1.782	Concentration significantly decreases over time		1		
EP-122	X		1.123		2.015	No significant trend detected			1	
EP-123				0.922	1.645	No significant trend detected			1	
EP-124	X		0.326		2.132	No significant trend detected			1	
EP-127	X		0.624		2.015	No significant trend detected			1	
EP-129				0.411	1.645	No significant trend detected			1	
EP-13				1.697	1.645	Concentration significantly decreases over time		1		Fails for Seasonality; t= -1.389
EP-131	X		1.514		2.132	No significant trend detected			1	
EP-132	X		2.085		2.015	Concentration significantly increases over time	1			
EP-14				1.847	1.645	Concentration significantly increases over time	1			Fails for Seasonality; t=1.074
EP-20	X		3.6		1.782	Concentration significantly increases over time	1			
EP-22	X		10.797		1.812	Concentration significantly increases over time	1			
EP-23		X	4.3		1.782	Concentration significantly decreases over time		1		
EP-25		X	2.672		1.782	Concentration significantly increases over time	1			
EP-26	X		0.911		1.796	No significant trend detected			1	
EP-29				1.164	1.645	No significant trend detected			1	
EP-43	X		1.196		1.812	No significant trend detected			1	
EP-49				3.566	1.645	Concentration significantly decreases over time		1		Passes test for seasonality; t= -2.75
EP-51		X	4.39		1.782	Concentration significantly decreases over time		1		
EP-52				1.172	1.645	No significant trend detected			1	
EP-53	X		4.015		1.782	Concentration significantly decreases over time		1		
EP-54	X		4.057		1.782	Concentration significantly decreases over time		1		
EP-55	X		4.483		1.895	Concentration significantly increases over time	1			
EP-57	X		1.966		1.796	Concentration significantly decreases over time		1		
EP-56	X		3.291		1.782	Concentration significantly increases over time	1			
EP-58	X		0.675		1.782	No significant trend detected			1	
EP-59	X		4.231		1.782	Concentration significantly decreases over time		1		
EP-62	X		5.043		1.782	Concentration significantly increases over time	1			
EP-66	X		0.253		1.782	No significant trend detected			1	
EP-70	X		2.269		1.796	Concentration significantly increases over time	1			
EP-75	X		2.271		1.782	Concentration significantly increases over time	1			
EP-76	X		3.29		1.812	Concentration significantly decreases over time		1		
EP-77	X		1.198		1.782	No significant trend detected			1	
EP-78	X		3.869		1.782	Concentration significantly decreases over time		1		
EP-83	X		1.196		1.796	No significant trend detected			1	
EP-84				1.408	1.645	No significant trend detected			1	
EP-85	X		3.6		1.782	Concentration significantly decreases over time		1		
EP-93	X		0.854		1.812	No significant trend detected			1	
EP-94	X		0.98		1.812	No significant trend detected			1	
EP-95	X		1.983		1.812	Concentration significantly increases over time	1			
EP-96	X		1.574		1.812	No significant trend detected			1	
EP-97	X		1.043		1.812	No significant trend detected			1	
EP-98	X		0.549		1.796	No significant trend detected			1	
EP-99	X		0.106		2.92	No significant trend detected			1	
							15	14	29	

Note

Normal — Data normal distributed

Lofnormal — Data lognormal distributed

$t\ crit_{(\alpha=2,\ alpha=2)}$ = Look up table

t — r^2 sqrt(n-1)/sqrt(1 n = # of samples

r = Correlation Coefficient

S — Mann-Kendall Statistics S = (Sum # of +) - (Sum # of -)

Z — Statistical Test (Compute)

$Z = S-1/[Var\ (S)]^{1/2}$ If S>0

Z = 0 If S=0

$Z = S+1/[Var\ (S)]^{1/2}$ If S<0

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Cadmium)
Phase IV RI, El Paso Asarco Smelter

	Total Cadmium					Total Cadmium				
n	$x_{(1)}$ [4]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)} - x_{(i)}$	a_i [2]	b_j [1]	LN ($x_{(1)}$) [7]	LN ($x_{(n-i+1)}$) [6]	LN ($x_{(n-i+1)}$) - LN ($x_{(i)}$)	a_i [2]	b_j [1]
	EM-5					EM-5				
X_1	0.0025	0.25	0.2475	0.5251	0.1299623	-5.991464547	-1.386294361	4.605170186	0.5251	2.4181749
X_2	0.0025	0.13	0.1275	0.3318	0.0423045	-5.991464547	-2.040220829	3.951243719	0.3318	1.3110227
X_3	0.006	0.027	0.021	0.246	0.005166	-5.11599581	-3.611918413	1.504077397	0.246	0.370003
X_4	0.006	0.017	0.011	0.1802	0.0019822	-5.11599581	-4.074541935	1.041453875	0.1802	0.18767
X_5	0.006	0.016	0.01	0.124	0.00124	-5.11599581	-4.135166557	0.980829253	0.124	0.1216228
X_6	0.008	0.015	0.007	0.0727	0.0005089	-4.828313737	-4.199705078	0.628608659	0.0727	0.0456998
X_7	0.009	0.009	0	0.024	0	-4.710530702	-4.710530702	0	0.024	0
X_8	0.009	0.009	0	0	0	-4.710530702	-4.710530702	0		
X_9	0.015	0.008	-0.007			-4.199705078	-4.828313737	-0.628608659		
X_{10}	0.016	0.006	-0.01			-4.135166557	-5.11599581	-0.980829253		
X_{11}	0.017	0.006	-0.011			-4.074541935	-5.11599581	-1.041453875		
X_{12}	0.027	0.006	-0.021			-3.611918413	-5.11599581	-1.504077397		
X_{13}	0.13	0.0025	-0.1275			-2.040220829	-5.991464547	-3.951243719		
X_{14}	0.25	0.0025	-0.2475			-1.386294361	-5.991464547	-4.605170186		
X_{15}										
X_{15}										
count (n)	16					14				
Minimum	0.0025					-5.991464547				
Maximum	0.25					-1.386294361				
average (x)	0.04					-4.36				
SD	0.07					1.31				
[5] b	0.1812					4.4542				
[6] W	0.52012					0.88395				
[7] $W_{0.05,n}$	0.866					0.874				
Data	Not-Normal Distributed					Log Normal Distributed				
	$x_{(1)}$ [4]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)} - x_{(i)}$	a_i [2]	b_j [1]	LN ($x_{(1)}$) [7]	LN ($x_{(n-i+1)}$) [6]	LN ($x_{(n-i+1)}$) - LN ($x_{(i)}$)	a_i [2]	b_j [1]
	EP-49					EP-49				
X_1	0.0025	13	12.9975	0.5475	7.1161313	-5.991464547	2.564949357	8.556413905	0.5475	4.5846366
X_2	0.032	0.28	0.248	0.3325	0.08246	-3.442019376	-1.272965676	2.1690537	0.3325	0.7212104
X_3	0.033	0.15	0.117	0.2347	0.0274599	-3.411247718	-1.897119985	1.514127733	0.2347	0.3553658
X_4	0.038	0.088	0.05	0.1586	0.00793	-3.270169119	-2.430418465	0.839750655	0.1586	0.1331845
X_5	0.038	0.066	0.028	0.0922	0.0025816	-3.270169119	-2.718100537	0.552068582	0.0922	0.0509037
X_6	0.053	0.063	0.01	0.0303	0.000303	-2.937463365	-2.764620553	0.172842813	0.0303	0.0052371
X_7	0.063	0.053	-0.01			-2.764620553	-2.937463365	-0.172842813		
X_8	0.066	0.038	-0.028			-2.718100537	-3.270169119	-0.552068582		
X_9	0.088	0.038	-0.05			-2.430418465	-3.270169119	-0.839750655		
X_{10}	0.15	0.033	-0.117			-1.897119985	-3.411247718	-1.514127733		
X_{11}	0.28	0.032	-0.248			-1.272965676	-3.442019376	-2.1690537		
X_{12}	13	0.0025	-12.9975			2.564949357	-5.991464547	-8.556413905		
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	12					12				
Minimum	0.0025					-5.991464547				
Maximum	13					2.564949357				
average (x)	1.15					-2.57				
SD	3.73					1.97				
[5] b	7.2369					5.9505				
[6] W	0.34196					0.82592				
[7] $W_{0.05,n}$	0.859					0.874				
Data	Not-Normal Distributed					Not Log Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Cadmium)
Phase IV RI, El Paso Asarco Smelter

	Total Cadmium					Total Cadmium				
	$x_{(1)}$ (3)	$x_{(n-i+1)}$ (2)	$x_{(n-i+1)} - x(1)$	a_i (5)	b_j (4)	LN ($x_{(1)}$) (3)	LN ($x_{(n-i+1)}$) (2)	LN ($x_{(n-i+1)}$) - LN ($x_{(1)}$)	a_i (5)	b_j (4)
	EP-53					EP-53				
X_1	0.061	1.8	1.739	0.5251	0.9131489	-2.796881415	0.587786665	3.38466808	0.5251	1.7772892
X_2	0.094	1.4	1.306	0.3318	0.4333308	-2.364460497	0.336472237	2.700932733	0.3318	0.8961695
X_3	0.1	1.3	1.2	0.246	0.2952	-2.302585093	0.262364264	2.564949357	0.246	0.6309775
X_4	0.18	1.2	1.02	0.1802	0.183804	-1.714798428	0.182321557	1.897119985	0.1802	0.341861
X_5	0.22	1	0.78	0.124	0.09672	-1.514127733	0	1.514127733	0.124	0.1877518
X_6	0.38	0.47	0.09	0.0727	0.006543	-0.967584026	-0.755022584	0.212561442	0.0727	0.0154532
X_7	0.39	0.46	0.07	0.024	0.00168	-0.94160854	-0.776528789	0.16507975	0.024	0.0039619
X_8	0.46	0.39	-0.07			-0.776528789	-0.94160854	-0.16507975		
X_9	0.47	0.38	-0.09			-0.755022584	-0.967584026	-0.212561442		
X_{10}	1	0.22	-0.78			0	-1.514127733	-1.514127733		
X_{11}	1.2	0.18	-1.02			0.182321557	-1.714798428	-1.897119985		
X_{12}	1.3	0.1	-1.2			0.262364264	-2.302585093	-2.564949357		
X_{13}	1.4	0.094	-1.306			0.336472237	-2.364460497	-2.700932733		
X_{14}	1.8	0.061	-1.739			0.587786665	-2.796881415	-3.38466808		
X_{15}										
X_{16}										
count (n)	14					14				
Minimum	0.061					-2.796881415				
Maximum	1.8					0.587786665				
average (x)	0.65					-0.91				
SD	0.58					1.10				
(5) b	1.9304					3.8535				
(6) W	0.86549					0.93588				
(7) $W_{0.05, n}$	0.866					0.866				
Data	Not-Normal Distributed					Log Normal Distributed				
	$x_{(1)}$ (3)	$x_{(n-i+1)}$ (2)	$x_{(n-i+1)} - x(1)$	a_i (5)	b_j (4)	LN ($x_{(1)}$) (3)	LN ($x_{(n-i+1)}$) (2)	LN ($x_{(n-i+1)}$) - LN ($x_{(1)}$)	a_i (5)	b_j (4)
	EP-55					EP-55				
X_1	0.16	8.7	8.54	0.5888	5.028352	0.83	1.2	0.37	0.5888	0.217856
X_2	0.19	2.3	2.11	0.3244	0.684484	0.91	1.1	0.19	0.3244	0.061636
X_3	0.38	1.3	0.92	0.1976	0.181792	0.93	1.1	0.17	0.1976	0.033592
X_4	0.56	0.84	0.28	0.0947	0.026516	0.95	1.1	0.15	0.0947	0.014205
X_5	0.58	0.58	0			0.95	0.98	0.03		
X_6	0.84	0.56	-0.28			0.97	0.97	0		
X_7	1.3	0.38	-0.92			0.97	0.97	0		
X_8	2.3	0.19	-2.11			0.98	0.95	-0.03		
X_9	8.7	0.16	-8.54			1.1	0.95	-0.15		
X_{10}										
X_{11}										
X_{12}										
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	9					9				
Minimum	0.16					0.83				
Maximum	8.7					1.1				
average (x)	1.67					0.95				
SD	2.72					0.07				
(5) b	5.9211					0.3273				
(6) W	0.59225					2.64998				
(7) $W_{0.05, n}$	0.859					0.859				
Data	Not-Normal Distributed					Log Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Cadmium)
Phase IV RI, El Paso Asarco Smelter

	Total Cadmium					Total Cadmium				
	$x_{(1)}$ [2]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)}-x(i)$	a_i [5]	b_i [4]	$x_{(1)}$ [2]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)}-x(i)$	a_i [5]	b_i [4]
	EP-101					EP-102				
X_1	0.72	1.8	1.08	0.5359	0.578772	0.05	0.18	0.13	0.5475	0.071175
X_2	0.78	1.8	1.02	0.3325	0.33915	0.053	0.17	0.117	0.3325	0.0389025
X_3	1.1	1.7	0.6	0.2412	0.14472	0.075	0.17	0.095	0.2347	0.0222965
X_4	1.2	1.7	0.5	0.1707	0.08535	0.095	0.12	0.025	0.1586	0.003965
X_5	1.3	1.6	0.3	0.1099	0.03297	0.095	0.11	0.015	0.0922	0.001383
X_6	1.4	1.6	0.2	0.0539	0.01078	0.096	0.099	0.003	0.0303	9.09E-05
X_7	1.5	1.5	0			0.099	0.096	-0.003		
X_8	1.6	1.4	-0.2			0.11	0.095	-0.015		
X_9	1.6	1.3	-0.3			0.12	0.095	-0.025		
X_{10}	1.7	1.2	-0.5			0.17	0.075	-0.095		
X_{11}	1.7	1.1	-0.6			0.17	0.053	-0.117		
X_{12}	1.8	0.78	-1.02			0.18	0.05	-0.13		
X_{13}	1.8	0.72	-1.08							
X_{14}										
X_{15}										
X_{16}										
count (n)	13					12				
Minimum	0.72					0.05				
Maximum	1.8					0.18				
average (x)	1.40					0.11				
SD	0.36					0.04				
[5] b	1.1917					0.1378				
[6] W	0.90072					0.90281				
[7] $W_{0.05,n}$	0.866					0.859				
Data	Normal Distributed					Normal Distributed				
	$x_{(1)}$ [2]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)}-x(i)$	a_i [5]	b_i [4]	$x_{(1)}$ [2]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)}-x(i)$	a_i [5]	b_i [4]
	EP-20					EP-51				
X_1	0.03	0.18	0.15	0.5251	0.078765	0.03	0.052	0.022	0.515	0.01133
X_2	0.03	0.13	0.1	0.3318	0.03318	0.031	0.048	0.017	0.3306	0.0056202
X_3	0.047	0.11	0.063	0.246	0.015498	0.031	0.044	0.013	0.2495	0.0032435
X_4	0.068	0.093	0.025	0.1802	0.004505	0.033	0.042	0.009	0.1878	0.0016902
X_5	0.07	0.089	0.019	0.124	0.002356	0.034	0.041	0.007	0.1353	0.0009471
X_6	0.073	0.087	0.014	0.0727	0.0010178	0.034	0.04	0.006	0.088	0.000528
X_7	0.076	0.081	0.005	0.024	0.00012	0.035	0.038	0.003	0.0433	0.0001299
X_8	0.081	0.076	-0.005			0.038	0.038	0		
X_9	0.087	0.073	-0.014			0.038	0.035	-0.003		
X_{10}	0.089	0.07	-0.019			0.04	0.034	-0.006		
X_{11}	0.093	0.068	-0.025			0.041	0.034	-0.007		
X_{12}	0.11	0.047	-0.063			0.042	0.033	-0.009		
X_{13}	0.13	0.03	-0.1			0.044	0.031	-0.013		
X_{14}	0.18	0.03	-0.15			0.048	0.031	-0.017		
X_{15}						0.052	0.03	-0.022		
X_{16}										
count (n)	14					15				
Minimum	0.03					0.03				
Maximum	0.18					0.052				
average (x)	0.08					0.04				
SD	0.04					0.01				
[5] b	0.1354					0.0235				
[6] W	0.91908					0.93683				
[7] $W_{0.05,n}$	0.866					0.881				
Data	Normal Distributed					Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Cadmium)
Phase IV RI, El Paso Asarco Smelter

	Total Cadmium					Total Cadmium				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_i [4]					
	EP-52									
X_1	0.36	0.51	0.15	0.5359	0.080385					
X_2	0.4	0.51	0.11	0.3325	0.036575					
X_3	0.4	0.49	0.09	0.2412	0.021708					
X_4	0.41	0.45	0.04	0.1707	0.006828					
X_5	0.42	0.45	0.03	0.1099	0.003297					
X_6	0.43	0.45	0.02	0.0539	0.001078					
X_7	0.43	0.43	0							
X_8	0.45	0.43	-0.02							
X_9	0.45	0.42	-0.03							
X_{10}	0.45	0.41	-0.04							
X_{11}	0.49	0.4	-0.09							
X_{12}	0.51	0.4	-0.11							
X_{13}	0.51	0.36	-0.15							
X_{14}										
X_{15}										
X_{16}										
count (n)	13									
Minimum	0.36									
Maximum	0.51									
average (x)	0.44									
SD	0.04									
[5] b	0.1499									
[6] W	0.94804									
[7] $W_{0.05,n}$	0.866									
Data	Normal Distributed									

Note: One-half of the laboratory detection limit was used for chemicals not detected during statistical evaluations.

[1] Ordered data (mg/L) from samallest to largest

[2] Ordered data (mg/L) from largest to smallest

[3] Coefficients ai for the Shapiro-Wilk Test for Normality. Table A6.

[4] $b_j = [x_{(n-i+1)} - x_{(i)}] * [a_{n-i+1}]$

[5] Sum of all b_j Numerator of the Shapiro-Wilk Test

[6] Test for Normality (Shapiro-Wilk Test), $W = [b/(SD * sqrt(n-1)]^2$

[7] Quantiles of the Shapiro-Wilk Test for Normality $_{(0.05,n)}$. Table A7.

LN Natural Log

Appendix I

Statistical Summary:(Shapiro Wilk Test of Normality and the Non-Parametric Mann Kendall Test)
Total Cadmium
Phase IV RI, El Paso Asarco Smelter

WELL	Normal	Lognormal	t	Z	$t\ crit_{(\alpha=1,\ alpha=2)}$ =	Result	+	-	0	Notes
EM-5		X	2.442		1.782	Concentration significantly increases over time	1			
EP-101	X		3.818559		1.796	Concentration significantly increases over time	1			
EP-102	X		2.611		1.812	Concentration significantly increases over time	1			
EP-114	X		0.23943		1.812	No significant trend detected			1	
EP-115	X		1.415		2.132	No significant trend detected			1	
EP-116		X	1.498		1.796	No significant trend detected			1	
EP-117	X		0.616		1.796	No significant trend detected			1	
EP-118		X	1.073		1.796	No significant trend detected			1	
EP-13	X		0.031		1.782	No significant trend detected			1	
EP-20	X		3.918		1.782	Concentration significantly increases over time	1			
EP-26				-1.041	1.645	No significant trend detected			1	
EP-49				-2.2	1.645	Concentration significantly decreases over time		1		Dissolved!!!
EP-51	X		6.343		1.771	Concentration significantly increases over time	1			
EP-52	X		1.819		1.796	Concentration significantly decreases over time		1		
EP-53		X	3.4		1.782	Concentration significantly decreases over time		1		
EP-54	X		0.996		1.782	No significant trend detected			1	
EP-55		X	3.18		1.895	Concentration significantly increases over time	1			
							6	3	8	

Note

Normal Data normal distributed

Lofnormal Data lognormal distributed

$t\ crit_{(\alpha=1,\ alpha=2)}$ = Look up table

$$t = r^2 \cdot \mathrm{sqrt}(n-1)/\mathrm{sqrt}(1-r^2)$$

n = # of samples

r = Correlation Coefficient

S Mann-Kendall Statistics S = (Sum # of +) - (Sum # of -)

Z Statistical Test (Compute)

$Z = S-1/[Var(S)]^{1/2}$ If S>0

$Z = 0$ If S=0

$Z = S+1/[Var(S)]^{1/2}$ If S<0

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Lead)
Phase IV RI, El Paso Asarco Smelter

	Total Lead					Total Lead				
n	$x_{(i)}$ [3]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)} - x(i)$	a_i [3]	b_j [4]	LN ($x_{(i)}$) [3]	LN ($x_{(n-i+1)}$) [3]	LN ($x_{(n-i+1)}$) - LN (x (i))	a_i [3]	D_j [4]
	EP-105					EP-105				
X_1	0.005	0.34	0.335	0.5359	0.1795265	-5.298317367	-1.078809661	4.219507705	0.5359	2.2612342
X_2	0.008	0.16	0.152	0.3325	0.05054	-4.828313737	-1.832581464	2.995732274	0.3325	0.996081
X_3	0.011	0.1	0.089	0.2412	0.0214668	-4.509860006	-2.302585093	2.207274913	0.2412	0.5323947
X_4	0.012	0.094	0.082	0.1707	0.0139974	-4.422848629	-2.364460497	2.058388132	0.1707	0.3513669
X_5	0.012	0.076	0.064	0.1099	0.0070336	-4.422848629	-2.577021939	1.84582669	0.1099	0.2028564
X_6	0.018	0.034	0.016	0.0539	0.0008624	-4.017383521	-3.381394754	0.635988767	0.0539	0.0342798
X_7	0.018	0.018	0	0	0	-4.017383521	-4.017383521	0	0	0
X_8	0.034	0.018	-0.016			-3.381394754	-4.017383521	-0.635988767		
X_9	0.076	0.012	-0.064			-2.577021939	-4.422848629	-1.84582669		
X_{10}	0.094	0.012	-0.082			-2.364460497	-4.422848629	-2.058388132		
X_{11}	0.1	0.011	-0.089			-2.302585093	-4.509860006	-2.207274913		
X_{12}	0.16	0.008	-0.152			-1.832581464	-4.828313737	-2.995732274		
X_{13}	0.34	0.005	-0.335			-1.078809661	-5.298317367	-4.219507705		
X_{14}										
X_{15}										
X_{16}										
count (n)	13					13				
Minimum	0.005					-5.298317367				
Maximum	0.34					-1.078809661				
average (x)	0.07					-3.47				
SD	0.09					1.31				
[5] b	0.2734					4.3782				
[6] W	0.69574					0.93629				
[7] $W_{0.05,n}$	0.866					0.874				
Data	Not-Normal Distributed					Log Normal Distributed				
	$x_{(i)}$ [3]	$x_{(n-i+1)}$ [3]	$x_{(n-i+1)} - x(i)$	a_i [3]	b_j [4]	LN ($x_{(i)}$) [3]	LN ($x_{(n-i+1)}$) [3]	LN ($x_{(n-i+1)}$) - LN (x (i))	a_i [3]	D_j [4]
	EP-114					EP-49				
X_1	0.02	6.6	6.58	0.5475	3.60255	-3.912023005	1.887069649	5.799092654	0.5475	3.1750032
X_2	0.065	2.1	2.035	0.3325	0.6766375	-2.733368009	0.741937345	3.475305354	0.3325	1.155539
X_3	0.12	1.1	0.98	0.2347	0.230006	-2.120263536	0.09531018	2.215573716	0.2347	0.5199952
X_4	0.16	0.87	0.71	0.1586	0.112606	-1.832581464	-0.139262067	1.693319396	0.1586	0.2685605
X_5	0.23	0.53	0.3	0.0922	0.02766	-1.46967597	-0.634878272	0.834797698	0.0922	0.0769683
X_6	0.24	0.41	0.17	0.0303	0.005151	-1.427116356	-0.891598119	0.535518236	0.0303	0.0162262
X_7	0.41	0.24	-0.17			-0.891598119	-1.427116356	-0.535518236		
X_8	0.53	0.23	-0.3			-0.634878272	-1.46967597	-0.834797698		
X_9	0.87	0.16	-0.71			-0.139262067	-1.832581464	-1.693319396		
X_{10}	1.1	0.12	-0.98			0.09531018	-2.120263536	-2.215573716		
X_{11}	2.1	0.065	-2.035			0.741937345	-2.733368009	-3.475305354		
X_{12}	6.6	0.02	-6.58			1.887069649	-3.912023005	-5.799092654		
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	12					12				
Minimum	0.02					-3.912023005				
Maximum	6.6					1.887069649				
average (x)	1.04					-1.04				
SD	1.85					1.57				
[5] b	4.6546					5.2123				
[6] W	0.57568					0.99608				
[7] $W_{0.05,n}$	0.859					0.874				
Data	Not-Normal Distributed					Log Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Lead)
Phase IV RI, El Paso Asarco Smelter

	Total Lead					Total Lead				
	$x_{(1)}$ (1)	$x_{(n-i+1)}$ (2)	$x_{(n-i+1)} - x(i)$	a_i (3)	b_j (4)	LN ($x_{(1)}$) (1)	LN ($x_{(n-i+1)}$) (2)	LN ($x_{(n-i+1)}$) - LN (x(1))	a_i (3)	b_j (4)
	EP-115					EP-115				
X_1	0.02	0.19	0.17	0.6431	0.109327	-3.912023005	-1.660731207	2.251291799	0.6431	1.4478058
X_2	0.037	0.18	0.143	0.2806	0.0401258	-3.296837366	-1.714798428	1.582038938	0.2806	0.4439201
X_3	0.077	0.084	0.007	0.0875	0.0006125	-2.563949857	-2.47693848	0.087011377	0.0875	0.0076135
X_4	0.084	0.077	-0.007			-2.47693848	-2.563949857	-0.087011377		
X_5	0.18	0.037	-0.143			-1.714798428	-3.296837366	-1.582038938		
X_6	0.19	0.02	-0.17			-1.660731207	-3.912023005	-2.251291799		
X_7										
X_8										
X_9										
X_{10}										
X_{11}										
X_{12}										
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	6					6				
Minimum	0.02					-3.912023005				
Maximum	0.19					-1.660731207				
average (x)	0.10					-2.60				
SD	0.07					0.88				
(5) b	0.1501					1.8993				
(6) W	0.87864					0.92758				
(7) $W_{0.05,n}$	0.874					0.874				
Data	Normal Distributed					Log Normal Distributed				
	$x_{(1)}$ (1)	$x_{(n-i+1)}$ (2)	$x_{(n-i+1)} - x(i)$	a_i (3)	b_j (4)	LN ($x_{(1)}$) (1)	LN ($x_{(n-i+1)}$) (2)	LN ($x_{(n-i+1)}$) - LN (x(1))	a_i (3)	b_j (4)
	EP-55					EP-55				
X_1	0.028	1.1	1.072	0.5888	0.6311936	-3.575550769	0.09531018	3.670860949	0.5888	2.1614029
X_2	0.031	0.6	0.569	0.3244	0.1845836	-3.473768074	-0.510825624	2.962942451	0.3244	0.9611785
X_3	0.08	0.44	0.36	0.1976	0.071136	-2.525728644	-0.820980552	1.704748092	0.1976	0.3368582
X_4	0.13	0.29	0.16	0.0947	0.015152	-2.040220829	-1.237874356	0.802346473	0.0947	0.0759822
X_5	0.14	0.14	0	0	0	-1.966112856	-1.966112856	0	0	0
X_6	0.29	0.13	-0.16			-1.237874356	-2.040220829	-0.802346473		
X_7	0.44	0.08	-0.36			-0.820980552	-2.525728644	-1.704748092		
X_8	0.6	0.031	-0.569			-0.510825624	-3.473768074	-2.962942451		
X_9	1.1	0.028	-1.072			0.09531018	-3.575550769	-3.670860949		
X_{10}										
X_{11}										
X_{12}										
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	9					9				
Minimum	0.028					-3.575550769				
Maximum	1.1					0.09531018				
average (x)	0.32					-1.78				
SD	0.35					1.28				
(5) b	0.9021					3.5354				
(6) W	0.81634					0.95469				
(7) $W_{0.05,n}$	0.829					0.829				
Data	Not-Normal Distributed					Log Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Lead)
Phase IV RI, El Paso Asarco Smelter

	Total Lead					Total Lead				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_i [3]	b_j [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_i [3]	b_j [4]
	EP-116					EP-117				
X_1	0.55	9.9	9.35	0.5359	5.010665	0.28	10	9.72	0.5359	5.208948
X_2	1.1	9.5	8.4	0.3325	2.793	0.41	10	9.59	0.3325	3.188675
X_3	1.4	8.6	7.2	0.2412	1.73664	0.7	6.9	6.2	0.2412	1.49544
X_4	2	6.2	4.2	0.1707	0.71694	1.8	4.5	2.7	0.1707	0.46089
X_5	2.3	4.2	1.9	0.1099	0.20881	2	4.1	2.1	0.1099	0.23079
X_6	2.7	4.1	1.4	0.0539	0.07546	2.4	3.5	1.1	0.0539	0.05929
X_7	3.7	3.7	0			3.3	3.3	0		
X_8	4.1	2.7	-1.4			3.5	2.4	-1.1		
X_9	4.2	2.3	-1.9			4.1	2	-2.1		
X_{10}	6.2	2	-4.2			4.5	1.8	-2.7		
X_{11}	8.6	1.4	-7.2			6.9	0.7	-6.2		
X_{12}	9.5	1.1	-8.4			10	0.41	-9.59		
X_{13}	9.9	0.55	-9.35			10	0.28	-9.72		
X_{14}										
X_{15}										
X_{16}										
count (n)	13					13				
Minimum	0.55					0.28				
Maximum	9.9					10				
average (x)	4.33					3.84				
SD	3.23					3.29				
[5] b	10.5415					10.6440				
[6] W	0.88571					0.87094				
[7] $W_{0.05,n}$	0.859					0.866				
Data	Normal Distributed					Normal Distributed				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_i [3]	b_j [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_i [3]	b_j [4]
	EP-118					EP-124				
X_1	0.12	2.5	2.38	0.5359	1.275442	0.018	0.19	0.172	0.6431	0.1106132
X_2	0.17	1.9	1.73	0.3325	0.575225	0.039	0.15	0.111	0.2806	0.0311466
X_3	0.36	1.9	1.54	0.2412	0.371448	0.067	0.068	0.001	0.0875	8.75E-05
X_4	0.36	1.4	1.04	0.1707	0.177528	0.068	0.067	-0.001		
X_5	0.41	1.1	0.69	0.1099	0.075831	0.15	0.039	-0.111		
X_6	0.49	0.88	0.39	0.0539	0.021021	0.19	0.018	-0.172		
X_7	0.66	0.66	0							
X_8	0.88	0.49	-0.39							
X_9	1.1	0.41	-0.69							
X_{10}	1.4	0.36	-1.04							
X_{11}	1.9	0.36	-1.54							
X_{12}	1.9	0.17	-1.73							
X_{13}	2.5	0.12	-2.38							
X_{14}										
X_{15}										
X_{16}										
count (n)	13					6				
Minimum	0.12					0.018				
Maximum	2.5					0.19				
average (x)	0.94					0.09				
SD	0.76					0.07				
[5] b	2.4965					0.1418				
[6] W	0.88814					0.89875				
[7] $W_{0.05,n}$	0.866					0.788				
Data	Normal Distributed					Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Lead)
Phase IV RI, El Paso Asarco Smelter

	Total Lead					Total Lead				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_j [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_j [4]
	EP-125					EP-52				
X_1	0.0015	0.18	0.1785	0.6431	0.1147934	0.44	1.6	1.16	0.5359	0.621644
X_2	0.014	0.11	0.096	0.2806	0.0269376	0.51	1.5	0.99	0.3325	0.329175
X_3	0.033	0.035	0.002	0.0875	0.000175	0.58	1.4	0.82	0.2412	0.197784
X_4	0.035	0.033	-0.002			0.66	0.96	0.3	0.1707	0.05121
X_5	0.11	0.014	-0.096			0.67	0.9	0.23	0.1099	0.025277
X_6	0.18	0.0015	-0.1785			0.68	0.83	0.15	0.0539	0.008085
X_7						0.75	0.75	0	0	0
X_8						0.83	0.68	-0.15		
X_9						0.9	0.67	-0.23		
X_{10}						0.96	0.66	-0.3		
X_{11}						1.4	0.58	-0.82		
X_{12}						1.5	0.51	-0.99		
X_{13}						1.6	0.44	-1.16		
X_{14}										
X_{15}										
X_{16}										
count (n)	6					13				
Minimum	0.0015					0.44				
Maximum	0.18					1.6				
average (x)	0.06					0.88				
SD	0.07					0.38				
[5] b	0.1419					1.2332				
[6] W	0.84745					0.86785				
[7] $W_{0.05,n}$	0.788					0.866				
Data	Normal Distributed					Normal Distributed				

Note: One-half of the laboratory detection limit was used for chemicals not detected during statistical evaluations.

[1] Ordered data (mg/L) from samallest to largest

[2] Ordered data (mg/L) from largest to smallest

[3] Coefficients ai for the Shapiro-Wilk Test for Normality. Table A6.

[4] $b_j = [x_{(n-i+1)} - x_{(i)}] * [a_{n-i+1}]$

[5] Sum of all b_j Numerator of the Shapiro-Wilk Test

[6] Test for Normality (Shapiro-Wilk Test), $W = [b/(SD) * \text{sqrt}(n-1)]^2$

[7] Quantiles of the Shapiro-Wilk Test for Normality $_{(0.05,\,n)}$ Table A7.

LN Natural Log

Appendix I

Statistical Summary:(Shapiro Wilk Test of Normality and the Non-Parametric Mann Kendall Test)
Total Lead
Phase IV RI, El Paso Asarco Smelter

WELL	Normal	Lognormal	t	Z	$t\ crit_{(n-2,\ alpha=.2)}$	Result	+	-	0	Notes
EP-52	X		0.288		1.796	No significant trend detected			1	
EP-55		X	2.815		1.895	Concentration significantly increases over time	1			
EP-105		X	1.444		1.796	No significant trend detected			1	
EP-114		X	1.414		1.812	No significant trend detected			1	
EP-115	X		0.090		2.353	No significant trend detected			1	
EP-116	X		2.606		1.796	Concentration significantly increases over time	1			
EP-117	X		0.343		1.796	No significant trend detected			1	
EP-118			0.485		1.796	No significant trend detected			1	
EP-124	X		0.907		2.132	No significant trend detected			1	
EP-125	X		0.550		2.132	No significant trend detected			1	
							2		7	
							4	0	14	

Note

Normal Data normal distributed

Lofnormal Data lognormal distributed

$t\ crit_{(n-2,\ alpha=.2)}$ = Look up table

t $r^2 \text{ sqrt}(n-1)/\text{sqrt}(1_{n-\#\text{ of samples}}$

r = Correlation Coefficient

S Mann-Kendall Statistics S = (Sum # of +) - (Sum # of -)

Z Statistical Test (Compute)

$Z = S-1/[\text{Var }(S)]^{1/2}$ If S>0

Z = 0 If S=0

$Z = S+1/[\text{Var }(S)]^{1/2}$ If S<0

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Selenium)
Phase IV RI, El Paso Asarco Smelter

	Total Selenium					Total Selenium				
n	$x_{(1)}$ [3]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [2]	b_j [4]	LN $(x_{(1)})$ [8]	LN $(x_{(n-i+1)})$ [8]	LN $(x_{(n-i+1)})$ - LN $(x_{(i)})$	a_i [2]	b_j [4]
	EP-101					EP-105				
X_1	1	3.5	2.5	0.5359	1.33975	0	1.252762968	1.252762968	0.5359	0.6713557
X_2	1.1	3.4	2.3	0.3325	0.76475	0.09531018	1.223775432	1.128465252	0.3325	0.3752147
X_3	1.4	3.3	1.9	0.2412	0.45828	0.336472237	1.193922468	0.857450232	0.2412	0.206817
X_4	1.4	2.8	1.4	0.1707	0.23898	0.336472237	1.029619417	0.693147181	0.1707	0.1183202
X_5	1.5	2.4	0.9	0.1099	0.09891	0.405465108	0.875468737	0.470003629	0.1099	0.0516534
X_6	1.7	2.3	0.6	0.0539	0.03234	0.530628251	0.832909123	0.302280872	0.0539	0.0162929
X_7	1.9	1.9	0	0	0	0.641853886	0.641853886	0		
X_8	2.3	1.7	-0.6			0.832909123	0.530628251	-0.302280872		
X_9	2.4	1.5	-0.9			0.875468737	0.405465108	-0.470003629		
X_{10}	2.8	1.4	-1.4			1.029619417	0.336472237	-0.693147181		
X_{11}	3.3	1.4	-1.9			1.193922468	0.336472237	-0.857450232		
X_{12}	3.4	1.1	-2.3			1.223775432	0.09531018	-1.128465252		
X_{13}	3.5	1	-2.5			1.252762968	0	-1.252762968		
X_{14}										
X_{15}										
X_{16}										
count (n)	13					13				
Minimum	1					0				
Maximum	3.5					1.252762968				
average (x)	2.13					0.67				
SD	0.89					0.43				
[5] b	2.9330					1.4397				
[6] W	0.91054					0.93760				
[7] $W_{0.05,n}$	0.866					0.874				
Data	Normal Distributed					Log Normal Distributed				
	$x_{(1)}$ [3]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [2]	b_j [4]	LN $(x_{(1)})$ [8]	LN $(x_{(n-i+1)})$ [8]	LN $(x_{(n-i+1)})$ - LN $(x_{(i)})$	a_i [2]	b_j [4]
	EP-12					EP-12				
X_1	0.045	0.71	0.665	0.5251	0.3491915	-3.101092789	-0.342490309	2.75860248	0.5251	1.4485422
X_2	0.069	0.61	0.541	0.3318	0.1795038	-2.673648774	-0.494296322	2.179352453	0.3318	0.7231091
X_3	0.087	0.48	0.393	0.246	0.096678	-2.44184716	-0.733969175	1.707877985	0.246	0.420138
X_4	0.097	0.43	0.333	0.1802	0.0600066	-2.3330443	-0.84397007	1.48907423	0.1802	0.2683312
X_5	0.1	0.42	0.32	0.124	0.03968	-2.302585093	-0.867500568	1.435084525	0.124	0.1779505
X_6	0.11	0.26	0.15	0.0727	0.010905	-2.207274913	-1.347073648	0.860201265	0.0727	0.0625366
X_7	0.12	0.14	0.02	0.24	0.0048	-2.120263536	-1.966112856	0.15415068	0.24	0.0369962
X_8	0.14	0.12	-0.02			-1.966112856	-2.120263536	-0.15415068		
X_9	0.26	0.11	-0.15			-1.347073648	-2.207274913	-0.860201265		
X_{10}	0.42	0.1	-0.32			-0.867500568	-2.302585093	-1.435084525		
X_{11}	0.43	0.097	-0.333			-0.84397007	-2.3330443	-1.48907423		
X_{12}	0.48	0.087	-0.393			-0.733969175	-2.44184716	-1.707877985		
X_{13}	0.61	0.069	-0.541			-0.494296322	-2.673648774	-2.179352453		
X_{14}	0.71	0.045	-0.665							
X_{15}										
X_{16}										
count (n)	14					13				
Minimum	0.045					-3.101092789				
Maximum	0.71					-0.494296322				
average (x)	0.26					-1.80				
SD	0.22					0.84				
[5] b	0.7408					3.1375				
[6] W	0.84537					1.15401				
[7] $W_{0.05,n}$	0.874					0.874				
Data	Not-Normal Distributed					Log Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Selenium)
Phase IV RI, El Paso Asarco Smelter

	Total Selenium					Total Selenium				
	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_j [4]	LN ($x_{(1)}$) [1]	LN ($x_{(n-i+1)}$) [2]	LN ($x_{(n-i+1)}$) - LN ($x_{(i)}$)	a_i [3]	b_j [4]
	EP-14					EP-14				
X_1	0.19	4.1	3.91	0.5251	2.053141	-1.660731207	1.410986974	3.071718181	0.5251	1.6129592
X_2	0.19	0.33	0.14	0.3318	0.046452	-1.660731207	-1.108662625	0.552068582	0.3318	0.1831764
X_3	0.19	0.32	0.13	0.246	0.03198	-1.660731207	-1.139434283	0.521296924	0.246	0.128239
X_4	0.2	0.31	0.11	0.1802	0.019822	-1.609437912	-1.171182982	0.438254931	0.1802	0.0789735
X_5	0.2	0.28	0.08	0.124	0.00992	-1.609437912	-1.272965676	0.336472237	0.124	0.0417226
X_6	0.21	0.28	0.07	0.0727	0.005089	-1.560647748	-1.272965676	0.287682072	0.0727	0.0209145
X_7	0.21	0.26	0.05	0.24	0.012	-1.560647748	-1.347073648	0.2135741	0.24	0.0512578
X_8	0.26	0.21	-0.05			-1.347073648	-1.560647748	-0.2135741		
X_9	0.28	0.21	-0.07			-1.272965676	-1.560647748	-0.287682072		
X_{10}	0.28	0.2	-0.08			-1.272965676	-1.609437912	-0.336472237		
X_{11}	0.31	0.2	-0.11			-1.171182982	-1.609437912	-0.438254931		
X_{12}	0.32	0.19	-0.13			-1.139434283	-1.660731207	-0.521296924		
X_{13}	0.33	0.19	-0.14			-1.108662625	-1.660731207	-0.552068582		
X_{14}	4.1	0.19	-3.91							
X_{15}										
X_{16}										
count (n)	14					13				
Minimum	0.19					-1.560731207				
Maximum	4.1					-1.108662625				
average (x)	0.52					-1.43				
SD	1.03					0.22				
[5] b	2.1784					2.1172				
[6] W	0.34280					7.87880				
[7] $W_{0.05, n}$	0.874					0.874				
Data	Not-Normal Distributed					Log Normal Distributed				
	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_j [4]	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_j [4]
	EP-102					EP-109				
X_1	2.4	8.3	5.9	0.5475	3.23025	0.047	0.078	0.031	0.5475	0.0169725
X_2	3.6	7.5	3.9	0.3325	1.29675	0.048	0.072	0.024	0.3325	0.00798
X_3	3.7	6.4	2.7	0.2347	0.63369	0.048	0.07	0.022	0.2347	0.0051634
X_4	4	6.4	2.4	0.1586	0.38064	0.056	0.064	0.008	0.1586	0.0012688
X_5	4.7	5.7	1	0.0922	0.0922	0.056	0.064	0.008	0.0922	0.0007376
X_6	4.8	5	0.2	0.0303	0.00606	0.063	0.063	0	0.0303	0
X_7	5	4.8	-0.2			0.063	0.063	0		
X_8	5.7	4.7	-1			0.064	0.056	-0.008		
X_9	6.4	4	-2.4			0.064	0.056	-0.008		
X_{10}	6.4	3.7	-2.7			0.07	0.048	-0.022		
X_{11}	7.5	3.6	-3.9			0.072	0.048	-0.024		
X_{12}	8.3	2.4	-5.9			0.078	0.047	-0.031		
X_{13}										
X_{14}										
X_{15}										
X_{16}										
count (n)	12					12				
Minimum	2.4					0.047				
Maximum	8.3					0.078				
average (x)	5.21					0.06				
SD	1.72					0.01				
[5] b	5.6396					0.0321				
[6] W	0.97654					0.93783				
[7] $W_{0.05, n}$	0.859					0.859				
Data	Normal Distributed					Normal Distributed				

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Selenium)
Phase IV RI, El Paso Asarco Smelter

	Total Selenium					Total Selenium				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_i [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_i [4]
	EP-119					EP-26				
X_1	0.16	0.28	0.12	0.6233	0.074796	0.56	1.3	0.74	0.5359	0.396566
X_2	0.16	0.26	0.1	0.3031	0.03031	0.74	1.1	0.36	0.3325	0.1197
X_3	0.18	0.24	0.06	0.1401	0.008406	0.91	1.1	0.19	0.2412	0.045828
X_4	0.2	0.2	0	0	0	0.92	1.1	0.18	0.1707	0.030726
X_5	0.24	0.18	-0.06			0.94	1.1	0.16	0.1099	0.017584
X_6	0.26	0.16	-0.1			0.95	1.1	0.15	0.0539	0.008085
X_7	0.28	0.16	-0.12			0.98	1.1	0.12	0	0
X_8						1.1	0.95	-0.15		
X_9						1.1	0.94	-0.16		
X_{10}						1.1	0.92	-0.18		
X_{11}						1.1	0.91	-0.19		
X_{12}						1.1	0.74	-0.36		
X_{13}						1.3	0.56	-0.74		
X_{14}										
X_{15}										
X_{16}										
count (n)	7					13				
Minimum	0.16					0.56				
Maximum	0.28					1.3				
average (x)	0.21					0.98				
SD	0.05					0.19				
[5] b	0.1135					0.6185				
[6] W	0.90195					0.91269				
[7] $W_{0.05,n}$	0.803					0.866				
Data	Normal Distributed					Normal Distributed				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_i [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)} - x_{(i)}$	a_i [3]	b_i [4]
	EP-35					EP-51				
X_1	0.56	1.7	1.14	0.5251	0.598614	0.15	0.29	0.14	0.5251	0.073514
X_2	0.57	1.3	0.73	0.3318	0.242214	0.17	0.27	0.1	0.3318	0.03318
X_3	0.63	1.2	0.57	0.246	0.14022	0.18	0.27	0.09	0.246	0.02214
X_4	0.68	1.2	0.52	0.1802	0.093704	0.18	0.24	0.06	0.1802	0.010812
X_5	0.73	1.1	0.37	0.124	0.04588	0.19	0.23	0.04	0.124	0.00496
X_6	0.86	0.96	0.1	0.0727	0.00727	0.2	0.22	0.02	0.0727	0.001454
X_7	0.92	0.96	0.04	0.24	0.0096	0.2	0.22	0.02	0.24	0.0048
X_8	0.96	0.92	-0.04			0.22	0.2	-0.02		
X_9	0.96	0.86	-0.1			0.22	0.2	-0.02		
X_{10}	1.1	0.73	-0.37			0.23	0.19	-0.04		
X_{11}	1.2	0.68	-0.52			0.24	0.18	-0.06		
X_{12}	1.2	0.63	-0.57			0.27	0.18	-0.09		
X_{13}	1.3	0.57	-0.73			0.27	0.17	-0.1		
X_{14}	1.7	0.56	-1.14			0.29	0.15	-0.14		
X_{15}										
X_{16}										
count (n)	14					14				
Minimum	0.56					0.15				
Maximum	1.7					0.29				
average (x)	0.96					0.22				
SD	0.32					0.04				
[5] b	1.1375					0.1509				
[6] W	0.95032					1.01829				
[7] $W_{0.05,n}$	0.874					0.874				
Data	Normal Distributed					Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Selenium)
Phase IV RI, El Paso Asarco Smelter

	Total Selenium					Total Selenium				
	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_j [3]	b_j [4]	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_j [3]	b_j [4]
	EP-52					EP-55				
X_1	0.15	0.29	0.14	0.5359	0.075026	0.052	0.43	0.378	0.5888	0.2225664
X_2	0.17	0.25	0.08	0.3325	0.0266	0.11	0.36	0.25	0.3244	0.0811
X_3	0.17	0.24	0.07	0.2412	0.016884	0.12	0.27	0.15	0.1976	0.02964
X_4	0.17	0.23	0.06	0.1707	0.010242	0.15	0.2	0.05	0.0947	0.004735
X_5	0.18	0.21	0.03	0.1099	0.003297	0.17	0.17	0		
X_6	0.18	0.2	0.02	0.0539	0.001078	0.2	0.15	-0.05		
X_7	0.19	0.19	0			0.27	0.12	-0.15		
X_8	0.2	0.18	-0.02			0.36	0.11	-0.25		
X_9	0.21	0.18	-0.03			0.43	0.052	-0.378		
X_{10}	0.23	0.17	-0.06							
X_{11}	0.24	0.17	-0.07							
X_{12}	0.25	0.17	-0.08							
X_{13}	0.29	0.15	-0.14							
X_{14}										
X_{15}										
X_{16}										
count (n)	13					9				
Minimum	0.15					0.052				
Maximum	0.29					0.43				
average (x)	0.20					0.21				
SD	0.04					0.12				
[5] b	0.1331					0.3380				
[6] W	0.92159					0.93073				
[7] $W_{0.05,n}$	0.866					0.829				
Data	Normal Distributed					Normal Distributed				
	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_j [3]	b_j [4]	$x_{(1)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x_{(i)}$	a_j [3]	b_j [4]
	EP-59					EP-63				
X_1	0.19	0.31	0.12	0.5251	0.063012	0.073	0.24	0.167	0.5359	0.0894953
X_2	0.19	0.28	0.09	0.3318	0.029862	0.076	0.2	0.124	0.3325	0.04123
X_3	0.2	0.28	0.08	0.246	0.01968	0.077	0.18	0.103	0.2412	0.0248436
X_4	0.21	0.26	0.05	0.1802	0.00901	0.084	0.17	0.086	0.1707	0.0146802
X_5	0.22	0.25	0.03	0.124	0.00372	0.099	0.14	0.041	0.1099	0.0045059
X_6	0.23	0.25	0.02	0.0727	0.001454	0.099	0.14	0.041	0.0539	0.0022099
X_7	0.25	0.25	0	0.24	0	0.12	0.12	0	0	0
X_8	0.25	0.25	0			0.14	0.099	-0.041		
X_9	0.25	0.23	-0.02			0.14	0.099	-0.041		
X_{10}	0.25	0.22	-0.03			0.17	0.084	-0.086		
X_{11}	0.26	0.21	-0.05			0.18	0.077	-0.103		
X_{12}	0.28	0.2	-0.08			0.2	0.076	-0.124		
X_{13}	0.28	0.19	-0.09			0.24	0.073	-0.167		
X_{14}	0.31	0.19	-0.12							
X_{15}										
X_{16}										
count (n)	14					13				
Minimum	0.19					0.073				
Maximum	0.31					0.24				
average (x)	0.24					0.13				
SD	0.04					0.05				
[5] b	0.1267					0.1770				
[6] W	0.95085					0.91018				
[7] $W_{0.05,n}$	0.874					0.866				
Data	Normal Distributed					Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Selenium)
Phase IV RI, El Paso Asarco Smelter

	Total Selenium					Total Selenium				
	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x(i)$	a_i [3]	b_j [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x(i)$	a_i [3]	b_j [4]
	EP-65					EP-72				
X_1	0.18	0.27	0.09	0.5359	0.048231	1.8	15	13.2	0.5601	7.39332
X_2	0.19	0.25	0.06	0.3325	0.01995	4.1	13	8.9	0.3315	2.95035
X_3	0.2	0.25	0.05	0.2412	0.01206	5.2	10	4.8	0.226	1.0848
X_4	0.21	0.25	0.04	0.1707	0.006828	6	9.4	3.4	0.1429	0.48586
X_5	0.22	0.24	0.02	0.1099	0.002198	6	7.4	1.4	0.0695	0.0973
X_6	0.22	0.23	0.01	0.0539	0.000539	7.2	7.2	0	0	0
X_7	0.22	0.22	0	0	0	7.4	6	-1.4		
X_8	0.23	0.22	-0.01			9.4	6	-3.4		
X_9	0.24	0.22	-0.02			10	5.2	-4.8		
X_{10}	0.25	0.21	-0.04			13	4.1	-8.9		
X_{11}	0.25	0.2	-0.05			15	1.8	-13.2		
X_{12}	0.25	0.19	-0.06							
X_{13}	0.27	0.18	-0.09							
X_{14}										
X_{15}										
X_{16}										
count (n)	13					11				
Minimum	0.18					1.8				
Maximum	0.27					15				
average (x)	0.23					7.74				
SD	0.03					3.87				
[5] b	0.0898					12.0116				
[6] W	0.96901					0.96388				
[7] $W_{0.05,n}$	0.866					0.85				
Data	Normal Distributed					Normal Distributed				

	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x(i)$	a_i [3]	b_j [4]	$x_{(i)}$ [1]	$x_{(n-i+1)}$ [2]	$x_{(n-i+1)}-x(i)$	a_i [3]	b_j [4]
	EP-73					EP-81				
X_1	0.74	1.1	0.36	0.5359	0.192924	0.21	0.3	0.09	0.5359	0.048231
X_2	0.81	1	0.19	0.3325	0.063175	0.23	0.3	0.07	0.3325	0.023275
X_3	0.84	0.96	0.12	0.2412	0.028944	0.26	0.29	0.03	0.2412	0.007236
X_4	0.87	0.95	0.08	0.1707	0.013656	0.26	0.29	0.03	0.1707	0.005121
X_5	0.89	0.93	0.04	0.1099	0.004396	0.26	0.28	0.02	0.1099	0.002198
X_6	0.9	0.92	0.02	0.0539	0.001078	0.27	0.28	0.01	0.0539	0.000539
X_7	0.91	0.91	0	0	0	0.28	0.28	0	0	0
X_8	0.92	0.9	-0.02			0.28	0.27	-0.01		
X_9	0.93	0.89	-0.04			0.28	0.26	-0.02		
X_{10}	0.95	0.87	-0.08			0.29	0.26	-0.03		
X_{11}	0.96	0.84	-0.12			0.29	0.26	-0.03		
X_{12}	1	0.81	-0.19			0.3	0.23	-0.07		
X_{13}	1.1	0.74	-0.36			0.3	0.21	-0.09		
X_{14}										
X_{15}										
X_{16}										
count (n)	13					13				
Minimum	0.74					0.21				
Maximum	1.1					0.3				
average (x)	0.91					0.27				
SD	0.09					0.03				
[5] b	0.3042					0.0866				
[6] W	0.97707					0.89280				
[7] $W_{0.95,n}$	0.866					0.866				
Data	Normal Distributed					Normal Distributed				

Appendix I

Statistical Evaluation: Shapiro Wilk Test of Normality (Total Selenium)
Phase IV RI, El Paso Asarco Smelter

	Total Selenium					Total Selenium				
	$x_{(i)}$ (1)	$x_{(n-i+1)}$ (2)	$x_{(n-i+1)} - x_{(i)}$	a_i (3)	b_j (4)					
	EP-90									
X_1	0.37	1.5	1.13	0.5359	0.605567					
X_2	0.52	1.4	0.88	0.3325	0.2926					
X_3	0.56	1.2	0.64	0.2412	0.154368					
X_4	0.69	1.2	0.51	0.1707	0.087057					
X_5	1	1.2	0.2	0.1099	0.02198					
X_6	1.1	1.2	0.1	0.0539	0.00539					
X_7	1.1	1.1	0	0	0					
X_8	1.2	1.1	-0.1							
X_9	1.2	1	-0.2							
X_{10}	1.2	0.69	-0.51							
X_{11}	1.2	0.56	-0.64							
X_{12}	1.4	0.52	-0.88							
X_{13}	1.5	0.37	-1.13							
X_{14}										
X_{15}										
X_{16}										
count (n)	13									
Minimum	0.37									
Maximum	1.5									
average (x)	1.00									
SD	0.35									
(5) b	1.1670									
(6) W	0.90372									
(7) $W_{0.05,n}$	0.866									
Data	Normal Distributed									

Note: One-half of the laboratory detection limit was used for chemicals not detected during statistical evaluations.

(1) Ordered data (mg/L) from samallest to largest

(2) Ordered data (mg/L) from largest to smallest

(3) Coefficients ai for the Shapiro-Wilk Test for Normality, Table A6.

(4) $b_j = [x_{(n-i+1)} - x_{(i)}] * [a_{n-i+1}]$

(5) Sum of all b_j Numerator of the Shapiro-Wilk Test

(6) Test for Normality (Shapiro-Wilk Test), $W = [b/(SD * sqrt(n-1)]^2$

(7) Quantiles of the Shapiro-Wilk Test for Normality $_{(0.05, n)}$, Table A7.

LN Natural Log

Appendix I

Statistical Summary:(Shapiro Wilk Test of Normality and the Non-Parametric Mann Kendall Test)
Total Selenium
Phase IV RI, El Paso Asarco Smelter

WELL	Normal	Lognormal	t	Z	$t_{crit(0.1,alt=2)}$	Result	+	-	0	Notes
EP-100				1.11	1.645	No significant trend detected			1	
EP-101	X		4.823		1.796	Concentration significantly decreases over time		1		
EP-102	X		2.559		1.812	Concentration significantly increases over time	1			
EP-109	X		1.893		1.812	Concentration significantly decreases over time		1		
EP-114	X		0.528		1.812	No significant trend detected			1	
EP-115		X	0.418		2.132	No significant trend detected			1	
EP-116	X		1.084		1.796	No significant trend detected			1	
EP-117	X		0.047		1.796	No significant trend detected			1	
EP-118				1.041	1.645	No significant trend detected			1	
EP-119	X		3.772		2.015	Concentration significantly decreases over time		1		
EP-12		X	4.465		1.782	Concentration significantly decreases over time		1		
EP-120	X		1.326		2.132	No significant trend detected			1	
EP-122	X		0.339		2.015	No significant trend detected			1	
EP-125		X	0.894		2.132	No significant trend detected			1	
EP-126	X		1.946		2.132	No significant trend detected			1	
EP-13				-0.773	1.645	No significant trend detected			1	
EP-130	X		1.549		2.132	No significant trend detected			1	
EP-131				1.588	1.645	No significant trend detected			1	
EP-132	X		0.233		2.015	No significant trend detected			1	
EP-14				1.659	1.645	Concentration significantly increases over time	1			Graph shown with outlier removed
EP-20	X		0.839		1.761	No significant trend detected			1	
EP-22	X		1.33		1.812	No significant trend detected			1	
EP-25		X	0.615		1.782	No significant trend detected			1	
EP-26	X		1.988		1.796	Concentration significantly increases over time	1			
EP-29	X		1.255		1.761	No significant trend detected			1	
EP-35	X		7.223		1.782	Concentration significantly decreases over time		1		
EP-51	X		5.756		1.782	Concentration significantly decreases over time		1		
EP-52	X		3.295		1.796	Concentration significantly decreases over time		1		
EP-53		X	0.102		1.782	No significant trend detected			1	
EP-55	X		2.784		1.895	Concentration significantly increases over time	1			
EP-58	X		0.211		1.761	No significant trend detected			1	
EP-59	X		1.914		1.782	Concentration significantly decreases over time		1		
EP-60				0.939	1.645	No significant trend detected			1	
EP-61	X		0.338		1.782	No significant trend detected			1	
EP-62	X		0.427		1.796	No significant trend detected			1	
EP-63	X		3.103		1.796	Concentration significantly decreases over time		1		
EP-64	X		0.465		1.761	No significant trend detected			1	
EP-65	X		3.187		1.796	Concentration significantly increases over time	1			
EP-66	X		0.677		1.761	No significant trend detected			1	
EP-68	X		0.296		1.796	No significant trend detected			1	
EP-70	X		0.614		1.796	No significant trend detected			1	
EP-71	X		0.023		1.796	No significant trend detected			1	
EP-72	X		2.167		1.833	Concentration significantly increases over time	1			
EP-73	X		2.402		1.796	Concentration significantly decreases over time		1		
EP-75	X		1.117		1.796	No significant trend detected			1	
EP-76	X		1.612		1.812	No significant trend detected			1	
EP-78				-1.208	1.645	No significant trend detected			1	
EP-81	X		1.809		1.796	Concentration significantly increases over time	1			
EP-82	X		1.239		1.796	No significant trend detected			1	
EP-85	X		0.13		1.782	No significant trend detected			1	
EP-90	X		2.952		1.796	Concentration significantly decreases over time		1		
EP-98	X		1.715		1.812	No significant trend detected			1	
							7	11	34	

Note

Normal — Data normal distributed

Lofnormal — Data lognormal distributed

$t\ crit_{(0.1,alt=2)}$ = Look up table

t — r^2 sqrt(n-1)/sqrt(1 n = # of samples

r = Correlation Coefficient

S — Mann-Kendall Statistics S = (Sum # of +) - (Sum # of -)

Z — Statistical Test (Compute)

$Z = S-1/[Var\ (S)]^{1/2}$ If S>0

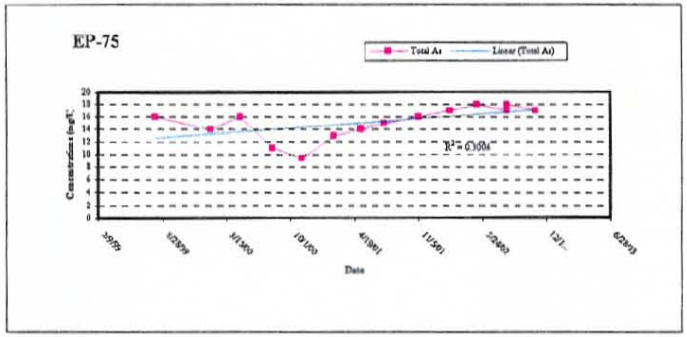
Z = 0 If S=0

$Z = S+1/[Var\ (S)]^{1/2}$ If S<0

APPENDIX J

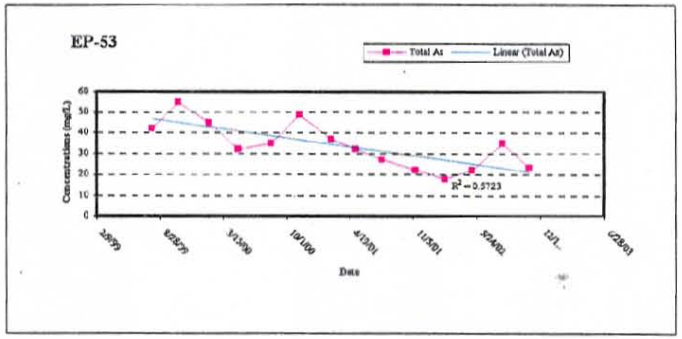
TIME SERIES PLOTS: ARSENIC, CADMIUM, LEAD AND SELENIUM

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



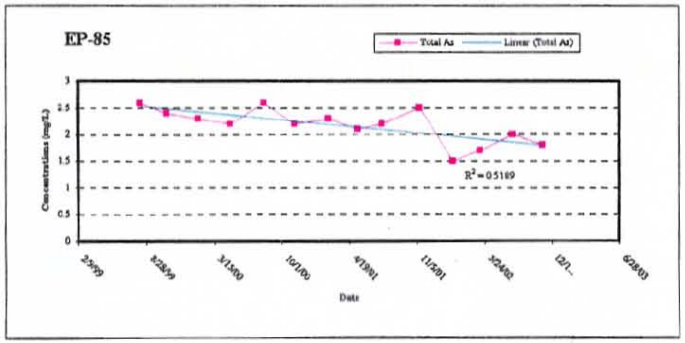
r2	3.01E-01	r = Correlation Coefficient	0.548270006
n = # of samples	14	$t\ crit_{(n-1,\ alpha/2)}$ =	1.782
t =	2.271026998		

Since t > t crit, ***The concentration change as a function of time***



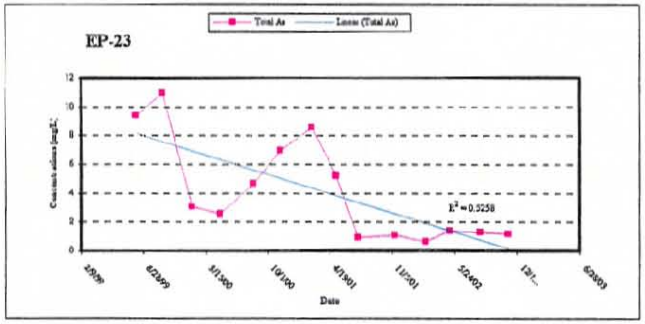
r2	5.73E-01	r = Correlation Coefficient	0.757099729
n = Number of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	4.014500428		

Since t > t crit, ***The concentration change as a function of time***



r2	5.19E-01	r = Correlation Coefficient:	0.720347139
n = Number of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	3.597615784		

Since t > t crit, ***The concentration change as a function of time***



r2	5.26E-01	r = Correlation Coefficient	0.72512068
n = Number of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	3.647708617		

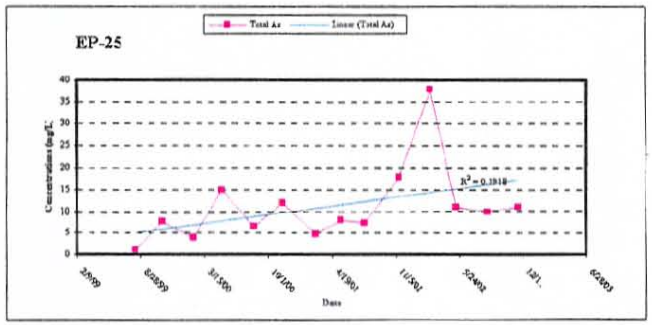
Since t > t crit, ***The concentration change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

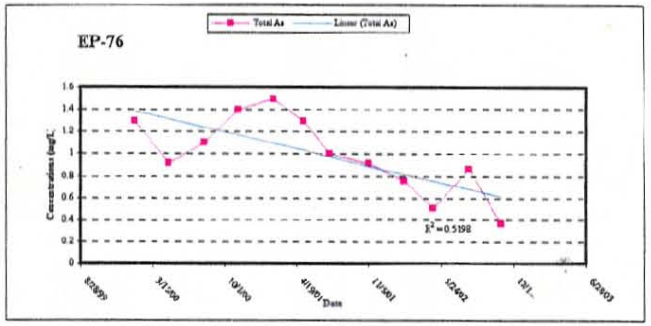
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if t > t crit.

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



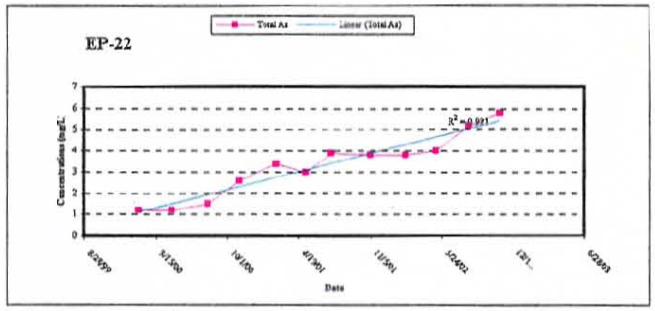
r2	1.92E-01	r = Correlation Coefficient	0.437949769
n = # of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	1.68754554		

Since t < t crit, ***The concentration does not change as a function of time***



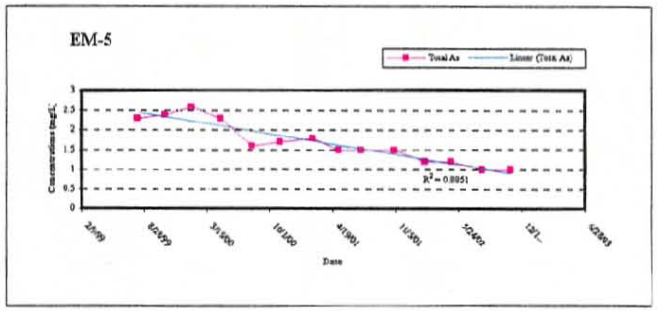
r2	5.20E-01	r = Correlation Coefficient	0.720971567
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	3.290084557		

Since t > t crit, ***The concentration change as a function of time***



r2	9.21E-01	r = Correlation Coefficient	0.959687449
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	10.79732738		

Since t > t crit, ***The concentration change as a function of time***



r2	8.85E-01	r = Correlation Coefficient	0.940797534
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	9.614501667		

Since t > t crit, ***The concentration change as a function of time***

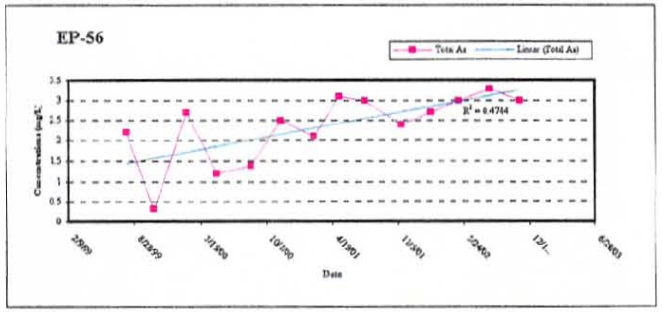
Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

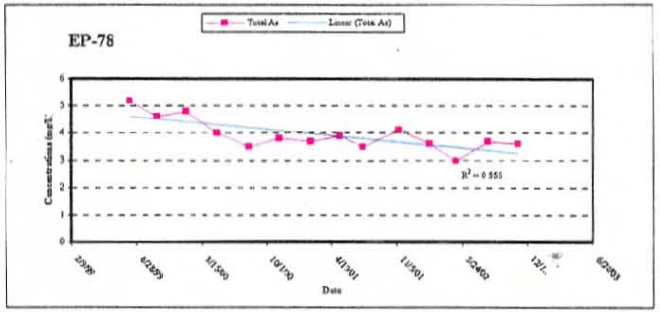
Appendix J

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



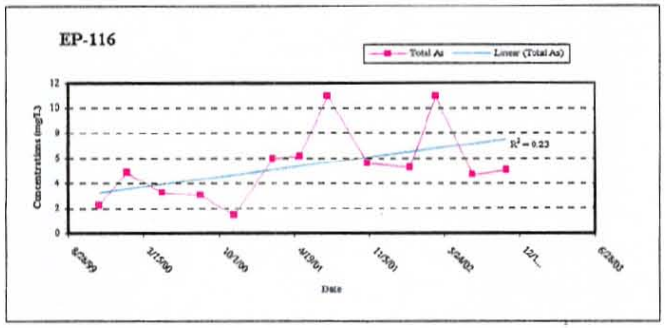
r2	4.74E-01	r = Correlation Coefficient	0.688767014
n = Number of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	3.291056096		

Since t > t crit, ***The concentration change as a function of time***



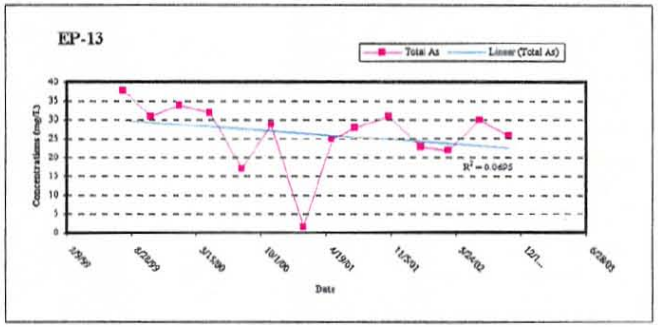
r2	5.55E-01	r = Correlation Coefficient	0.744983221
n = # of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	3.868629232		

Since t > t crit, ***The concentration change as a function of time***



r2	2.30E-01	r = Correlation Coefficient	0.479583152
n = # of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	1.812653934		

Since t > t crit, ***The concentration change as a function of time***



r2	6.95E-02	r = Correlation Coefficient	0.263628527
n = Number of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	0.94672716		

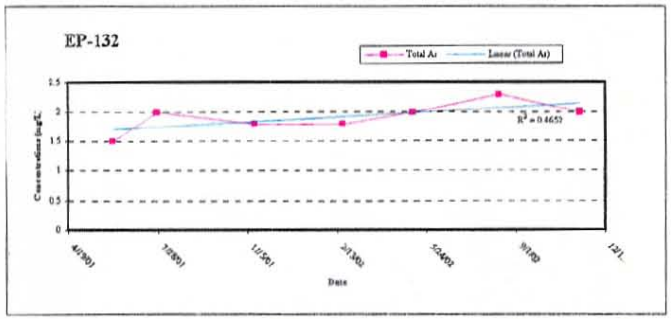
Since t < t crit, ***The concentration does not change as a function of time***

Note

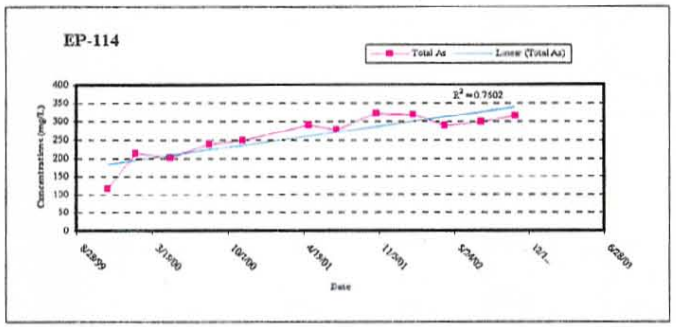
t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

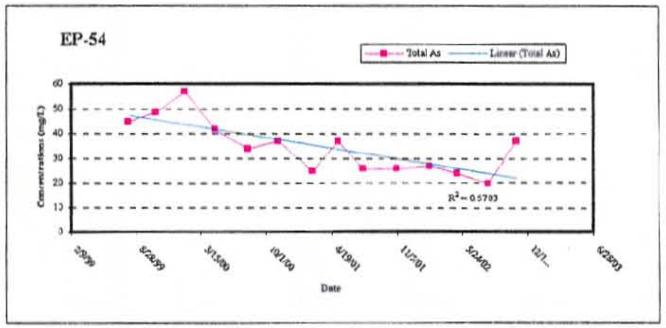
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit.**

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



r2	4.65E-01	r = Correlation Coefficient	0.682055716	**r2**	5.95E-01	r = Correlation Coefficient	0.771297608
n = Number of samples	7	**t crit** $_{(n-2,\ alpha/2)}$ =	2.015	n = # of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	2.085495014			**t** =	4.197894172		
Since t > t crit,	***The concentration change as a function of time***			Since t > t crit,	***The concentration change as a function of time***		





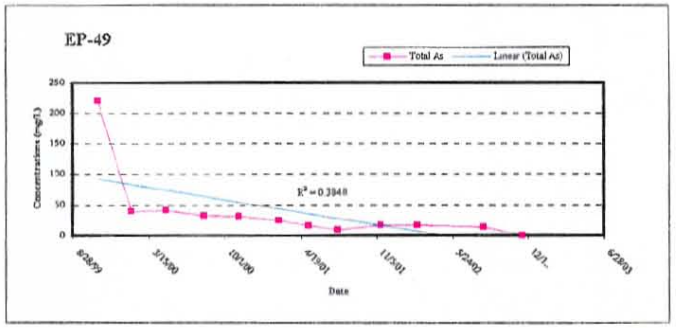
r2	7.60E-01	r = Correlation Coefficient	0.871894489	**r2**	5.78E-01	r = Correlation Coefficient	0.760460387
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812	n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	5.630401216			**t** =	4.056630192		
Since t > t crit,	***The concentration change as a function of time***			Since t > t crit,	***The concentration change as a function of time***		

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

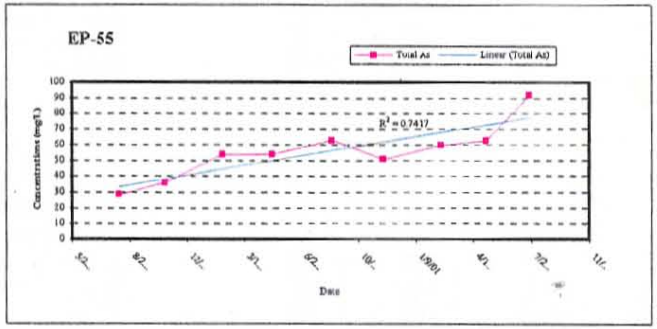
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if t > t crit.

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



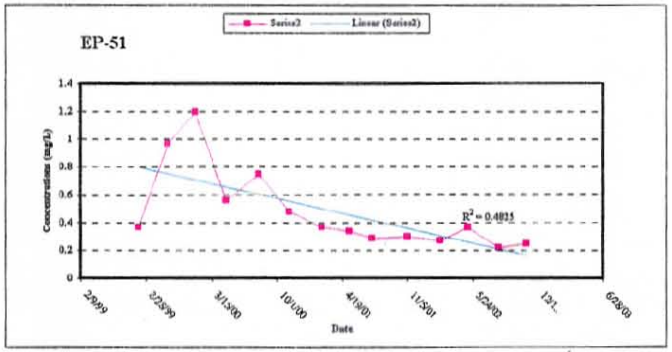
r2	3.85E-01	r = Correlation Coefficient	0.620322497
n = Number of samples	11	t crit $_{(n-2,\ alpha/2)}$ =	1.833
t =	2.372633309		

Since t > t crit, ***The concentration change as a function of time***



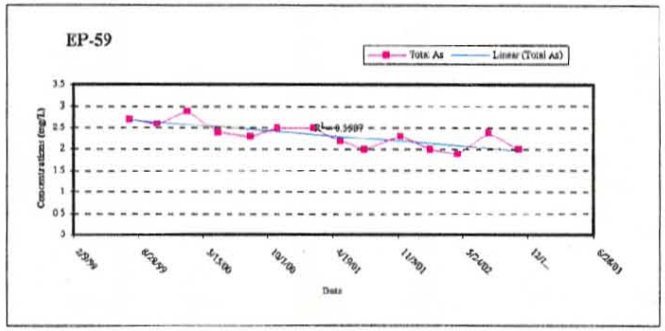
r2	7.42E-01	r = Correlation Coefficient	0.861220065
n = Number of samples	9	t crit $_{(n-2,\ alpha/2)}$ =	1.895
t =	4.483332578		

Since t > t crit, ***The concentration change as a function of time***



r2	4.83E-01	r = Correlation Coefficient	0.694622199
n = # of samples	13	t crit $_{(n-2,\ alpha/2)}$ =	1.796
t =	3.202505058		

Since t < t crit, ***The concentration change as a function of time***



r2	5.99E-01	r = Correlation Coefficient	0.773757068
n = Number of samples	14	t crit $_{(n-2,\ alpha/2)}$ =	1.782
t =	4.231171924		

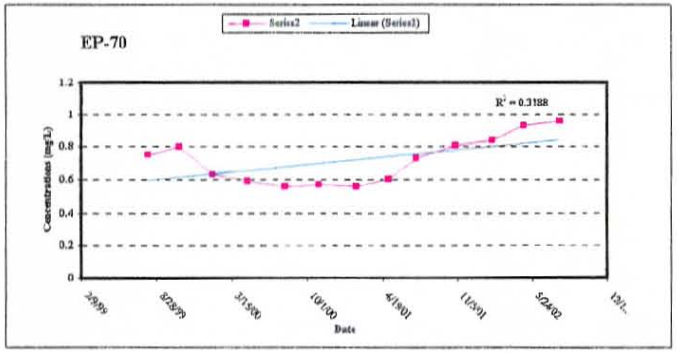
Since t > t crit, ***The concentration change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

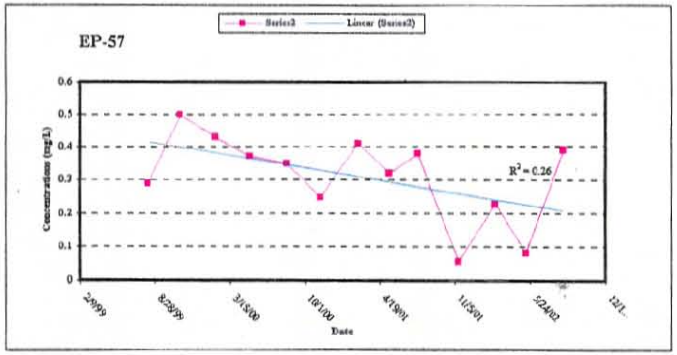
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if t > t crit.

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



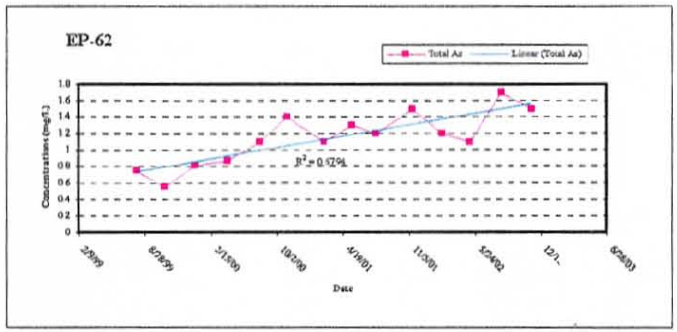
r2	3.19E-01	r = Correlation Coefficient	0.564623769
n = # of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	2.268914755		

Since t > t crit, ***The concentration change as a function of time***



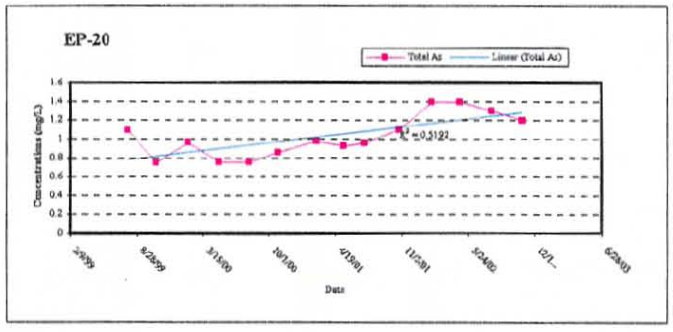
r2	2.60E-01	r = Correlation Coefficient	0.509901951
n = # of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	1.965925956		

Since t > t crit, ***The concentration change as a function of time***



r2	6.79E-01	r = Correlation Coefficient	0.824257241
n = Number of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	5.042798736		

Since t > t crit, ***The concentration change as a function of time***



r2	5.19E-01	r = Correlation Coefficient	0.720555341
n = # of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	3.599778141		

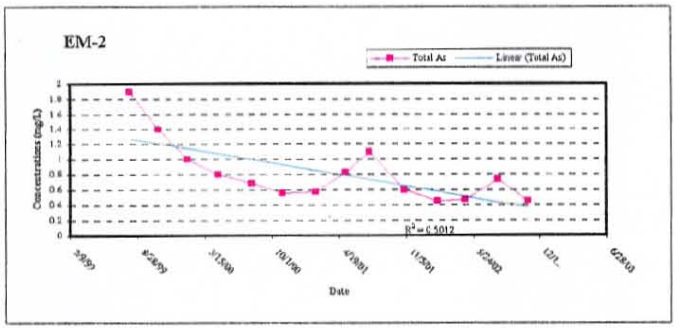
Since t > t crit, ***The concentration change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

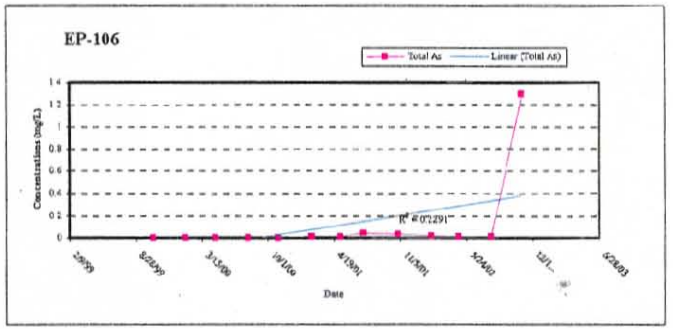
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit.**

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



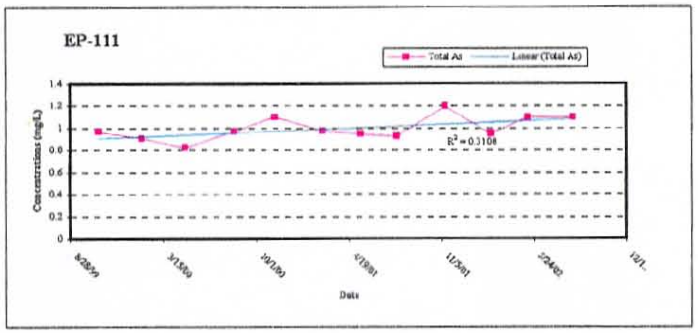
r2	5.01E-01	r = Correlation Coefficient	0.707954801
n = # of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	3.47242546		

Since t > t crit, ***The concentration change as a function of time***



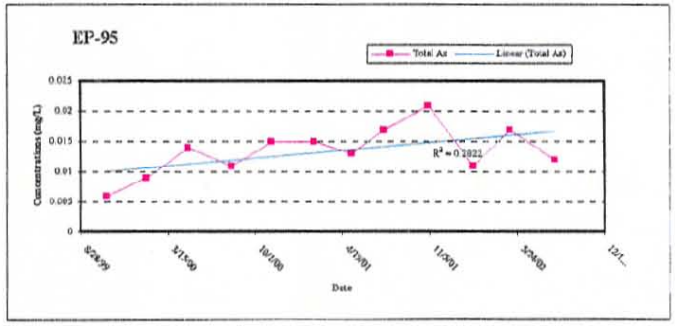
r2	2.29E-01	r = Correlation Coefficient	0.478643918
n = # of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	1.808047619		

Since t > t crit, ***The concentration change as a function of time***



r2	3.11E-01	r = Correlation Coefficient	0.557494395
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	2.123576304		

Since t > t crit, ***The concentration change as a function of time***



r2	2.82E-01	r = Correlation Coefficient	0.531224599
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	1.982790264		

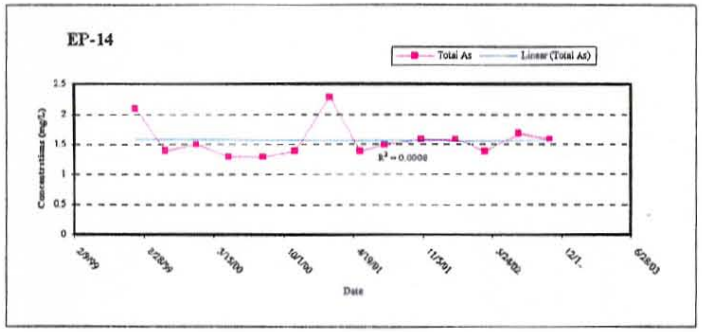
Since t > t crit, ***The concentration change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

Time Series Plots: Total Arsenic Concentrations vs Time
Phase IV Remedial Investigation
Asarco El Paso Smelter



r2	8.00E-04	r = Correlation Coefficient	0.028284271
n = # of samples	14	$t\ crit_{(n-2,\ alpha/2)}$ =	1.782
t =	0.098018805		

Since t < t crit, ***The concentration does not change as a function of time***

Note

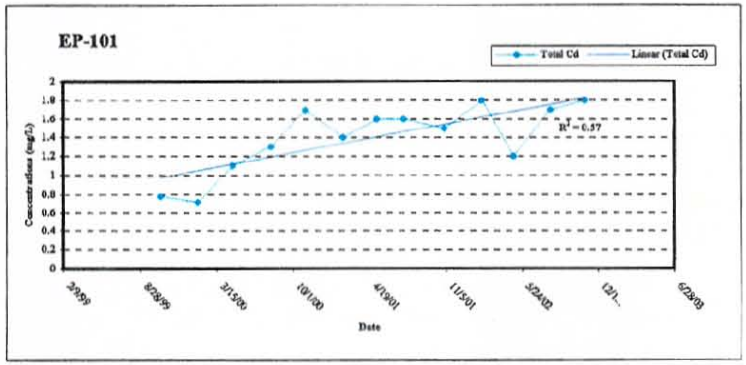
t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if t > t crit.

TIME SERIES PLOTS

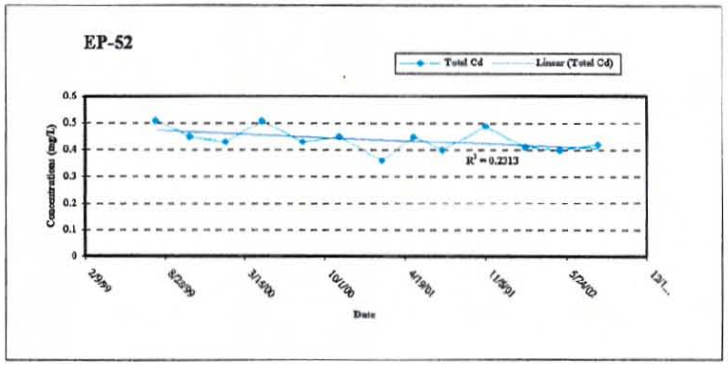
TOTAL CADMIUM CONCENTRATION VERSUS TIME (POND 5 AND 6 ARROYO)

Time Series Plots: Total Cadmium Concentrations vs Time
Pond 5 and 6 Area
Phase IV, Remedial Investigation



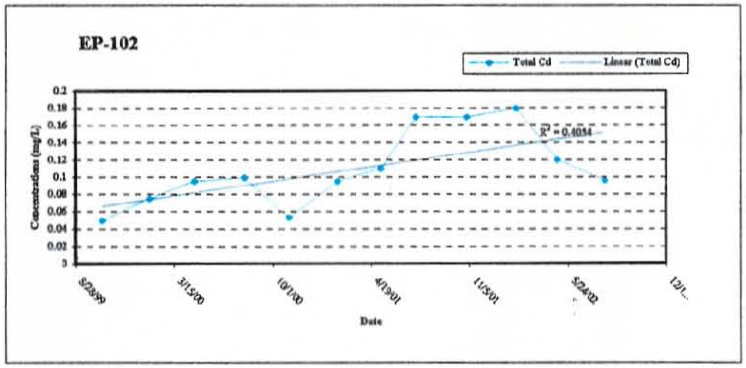
r2	5.70E-01	r = Correlation Coefficient	0.754983444
n = # of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	3.818559329		

Since t > t crit, The concentration change as a function of time



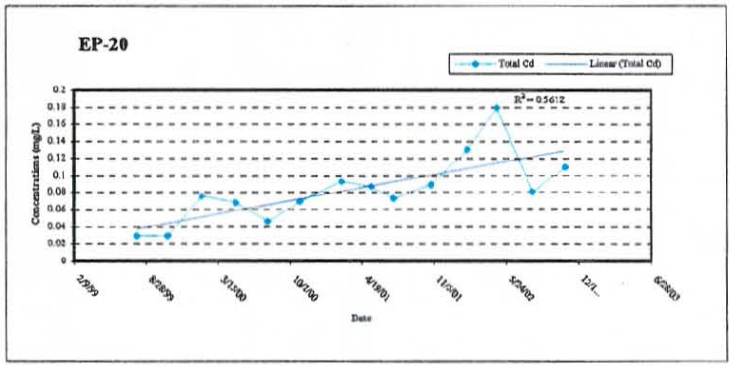
r2	2.31E-01	r = Correlation Coefficient	0.480936586
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	1.81930586		

Since t > t crit, *The concentration change as a function of time*



r2	4.05E-01	r = Correlation Coefficient	0.636710295
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	2.611135563		

Since t <> t crit, *The concentration change as a function of time*



r2	5.61E-01	r = Correlation Coefficient	0.749132832
n = # of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	3.917564403		

Since t <> t crit, *The concentration change as a function of time*

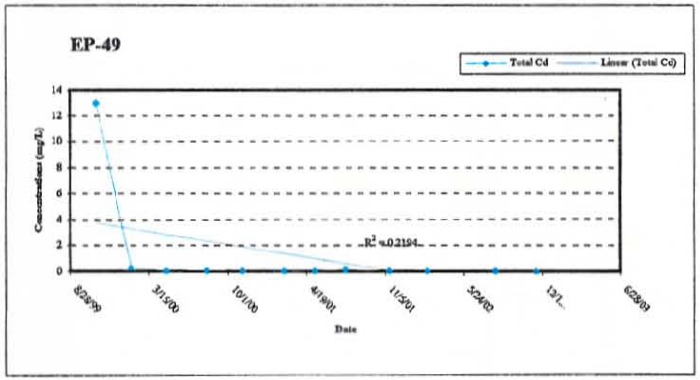
Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

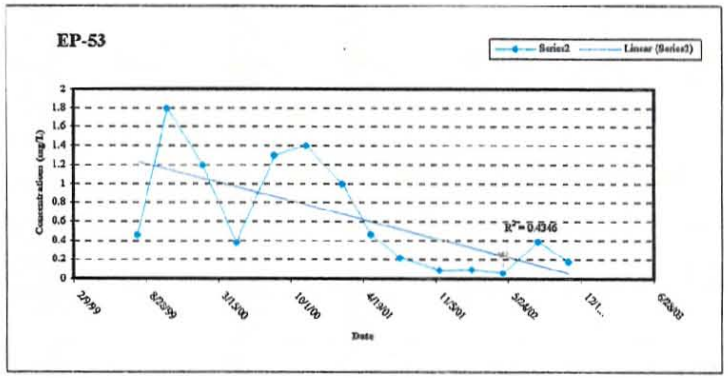
Appendix J

Time Series Plots: Total Cadmium Concentrations vs Time
Pond 5 and 6 Area
Phase IV, Remedial Investigation



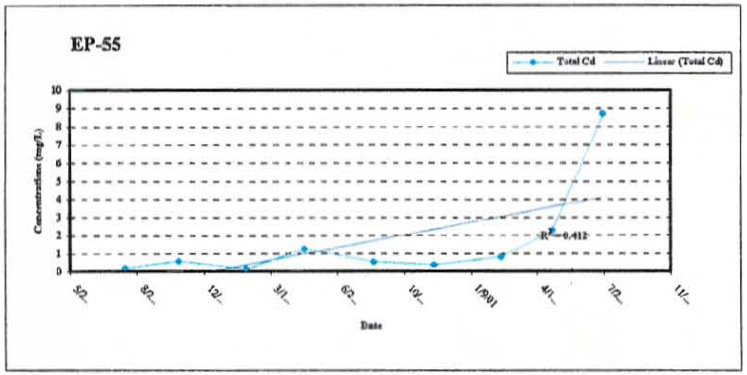
r2	2.19E-01	r = Correlation Coefficient	0.468401537
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	1.676501854		

Since t <> t crit, ***The concentration does not change as a function of time***



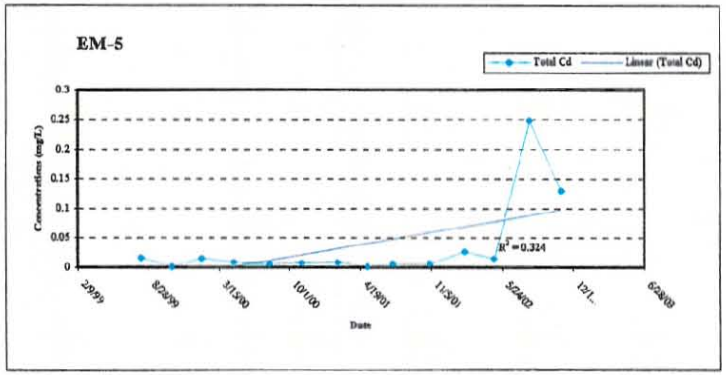
r2	4.35E-01	r = Correlation Coefficient	0.659241989
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	3.037089441		

Since t < t crit, ***The concentration change as a function of time***



r2	4.12E-01	r = Correlation Coefficient	0.641872251
n = # of samples	9	**t crit** $_{(n-2,\ alpha/2)}$ =	1.895
t =	2.214669706		

Since t <> t crit, ***The concentration change as a function of time***



r2	3.24E-01	r = Correlation Coefficient	0.569209979
n = # of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	2.398224195		

Since t <> t crit, ***The concentration change as a function of time***

Note

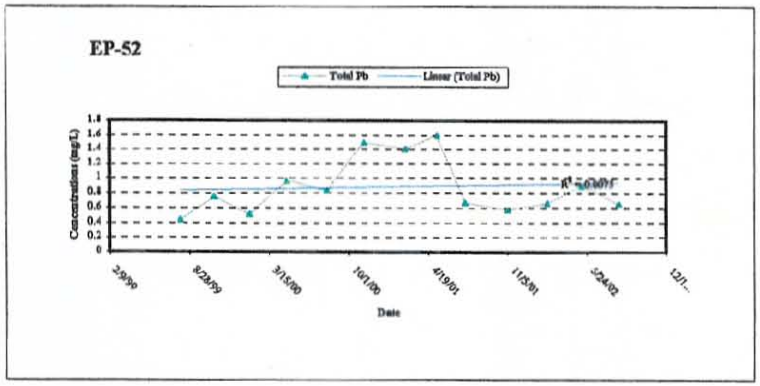
t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit.**

TIME SERIES PLOTS

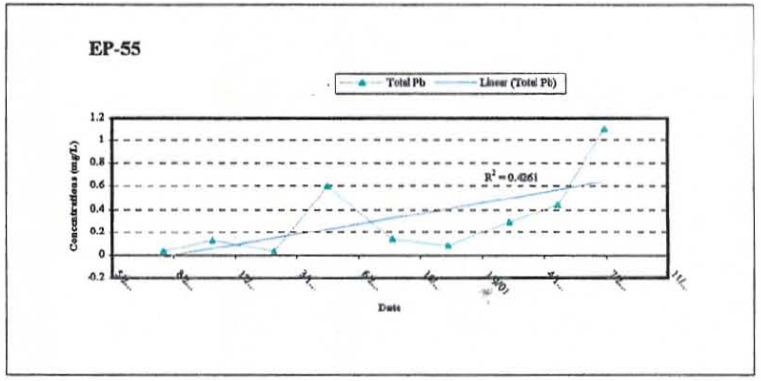
TOTAL LEAD CONCENTRATION VERSUS TIME
(PATH OF ACID PLANT ARROYO)

Time Series Plots: Total Lead Concentrations vs Time
Path of Acid Plant Arroyo
Phase IV, Remedial Investigation



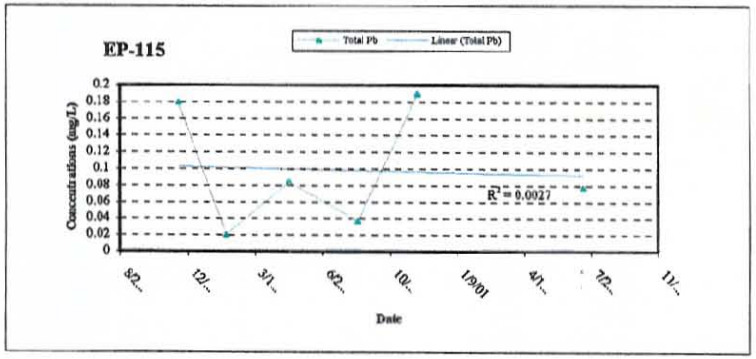
r2	7.50E-03	r = Correlation Coefficient	0.08660254
n = # of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	0.288311335		

*Since t < t crit, **The concentration does not change as a function of time***



r2	4.26E-01	r = Correlation Coefficient	0.652763357
n = Number of samples	9	$t\ crit_{(n-2,\ alpha/2)}$ =	1.895
t =	2.279747115		

Since t < t crit, ***The concentration change as a function of time***



r2	2.70E-03	r = Correlation Coefficient	0.051961524
n = Number of samples	5	$t\ crit_{(n-2,\ alpha/2)}$ =	2.353
t =	0.090121747		

Since t < t crit, ***The concentration does not change as a function of time***

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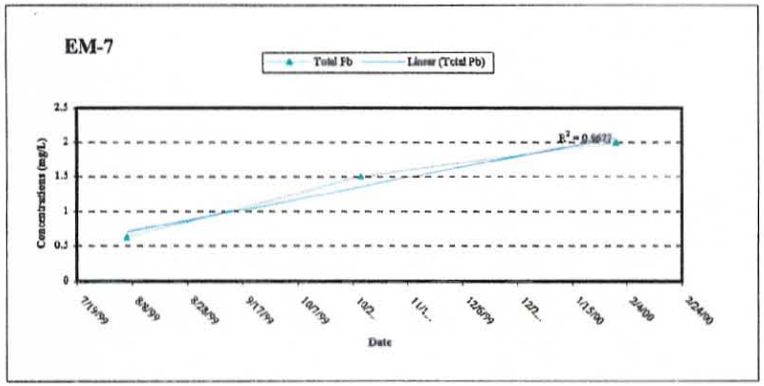
Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

TIME SERIES PLOTS

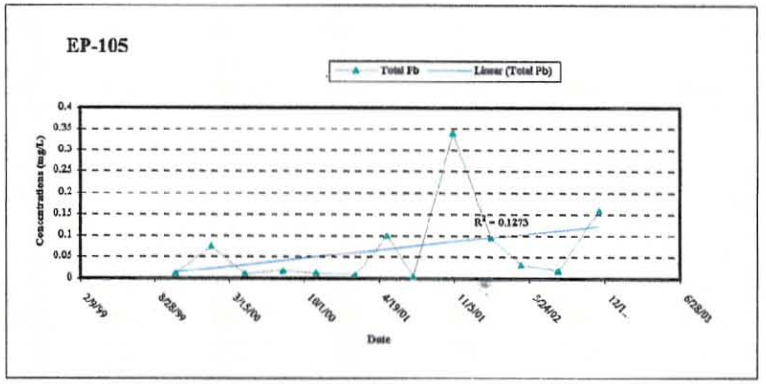
TOTAL LEAD CONCENTRATION VERSUS TIME
(POND 5 AND 6 ARROYO)

Time Series Plots: Total Lead Concentrations vs Time
Path of Ponds 5 and 6 Arroyo
Phase IV, Remedial Investigation



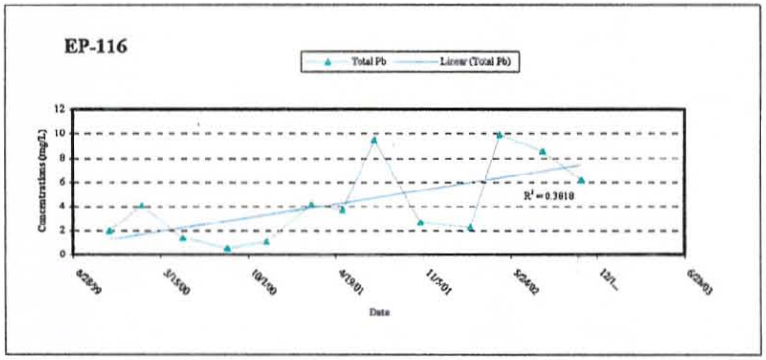
r2	9.68E-01	r = Correlation Coefficient	0.983717439
n = # of samples	3	**t crit** $_{(n-2,\ alpha/2)}$ =	6.314
t =	5.473550248		

*Since t > t crit, **The concentration does not change as a function of time***



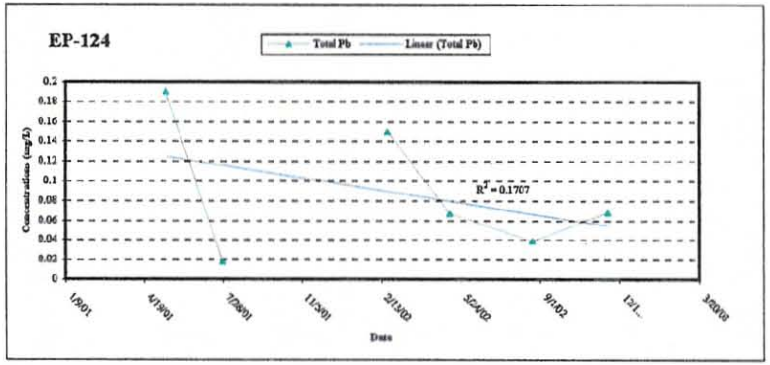
r2	1.27E-01	r = Correlation Coefficient	0.356791255
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	1.323038057		

Since t < t crit, ***The concentration does not change as a function of time***



r2	3.82E-01	r = Correlation Coefficient	0.617899568
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	2.606452437		

Since t < t crit, ***The concentration change as a function of time***



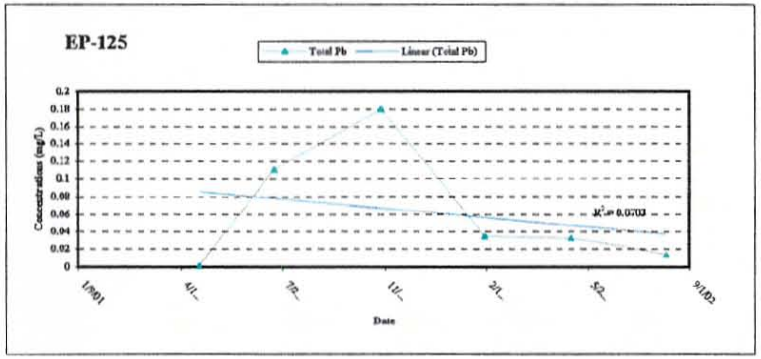
r2	1.71E-01	r = Correlation Coefficient	0.413158565
n = Number of samples	6	**t crit** $_{(n-2,\ alpha/2)}$ =	2.132
t =	0.907383596		

Since t < t crit, ***The concentration does not change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

Time Series Plots: Total Lead Concentrations vs Time
Path of Ponds 5 and 6 Arroyo
Phase IV, Remedial Investigation



r2	7.03E-02	r = Correlation Coefficient	0.265141472
n = Number of samples	6	**t crit** $_{(n-2,\ alpha/2)}$ =	2.132
t =	0.549966508		

Since t > t crit, ***The concentration does not change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

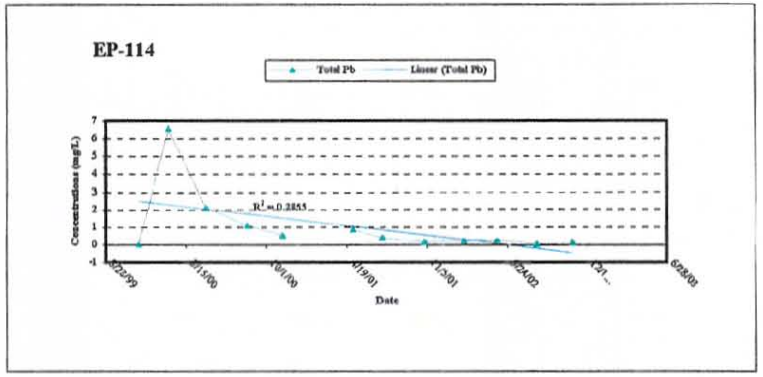
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected **if t > t crit.**

TIME SERIES PLOTS

TOTAL LEAD CONCENTRATION VERSUS TIME
(RIO GRANDE ALLUVIUM AREA)

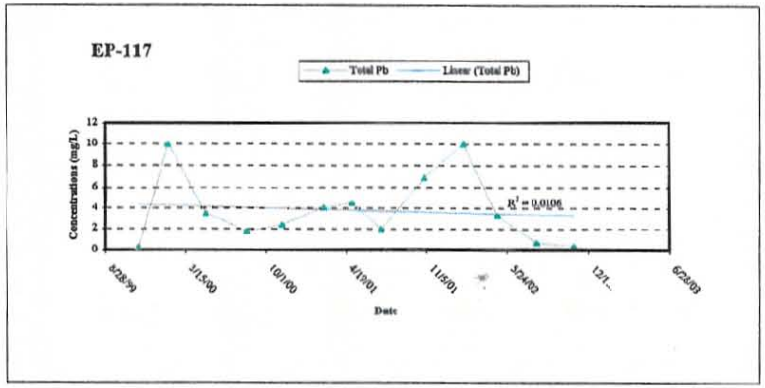
Appendix J

Time Series Plots: Total Lead Concentrations vs Time
Rio Grande Alluvium Area
Phase IV, Remedial Investigation



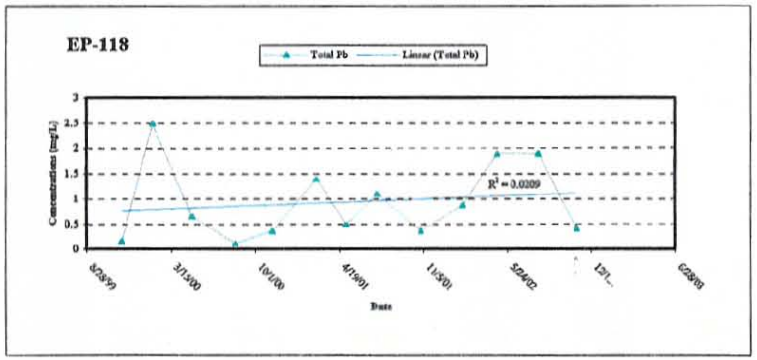
r2	2.86E-01	r = Correlation Coefficient	0.534322
n = Number of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	1.998950039		

Since t > t crit, ***The concentration change as a function of time***



r2	1.06E-02	r = Correlation Coefficient	0.102956301
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	0.343291715		

Since t < t crit, ***The concentration does not change as a function of time***



r2	2.09E-02	r = Correlation Coefficient	0.144568323
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	0.484569372		

Since t < t crit, ***The concentration does not change as a function of time***

Note

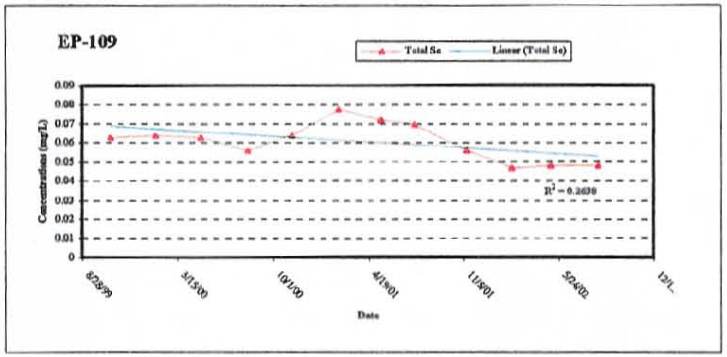
t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

TIME SERIES PLOTS

TOTAL SELENIUM CONCENTRATION VERSUS TIME (PATH OF PARKER'S BROTHER ARROYO

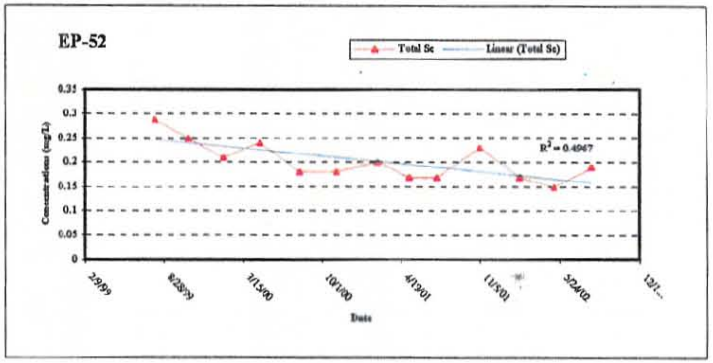
Appendix J

Time Series Plots: Total Selenium Concentrations vs Time
Path of Parker's Brother Arroyo
Phase IV, Remedial Investigation



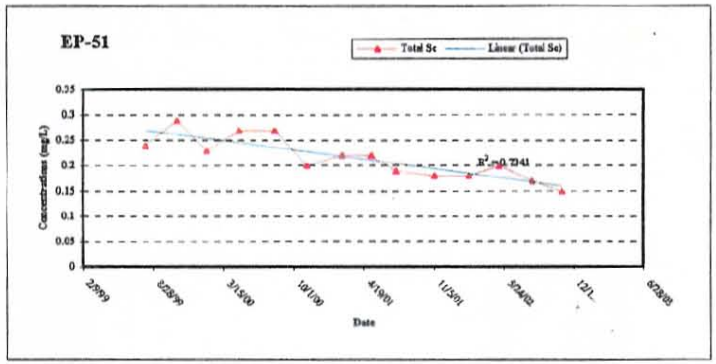
r2	2.64E-01	r = Correlation Coefficient	0.513614642
n = # of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	1.892951509		

Since t > t crit, The concentration change as a function of time



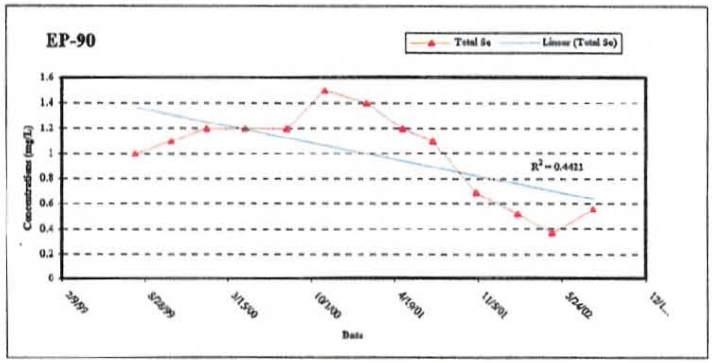
r2	4.97E-01	r = Correlation Coefficient	0.704769466
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	3.294805828		

Since t > t crit, *The concentration change as a function of time*



r2	7.34E-01	r = Correlation Coefficient	0.856796359
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	5.755844684		

Since t > t crit, *The concentration change as a function of time*



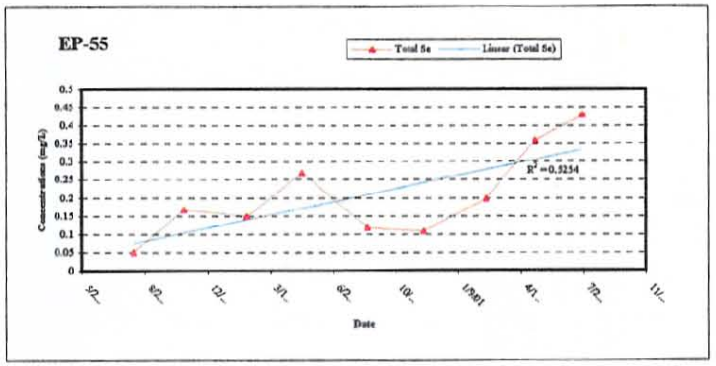
r2	4.42E-01	r = Correlation Coefficient	0.664906008
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	2.952421908		

Since t > t crit, *The concentration change as a function of time*

Note
t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit.**

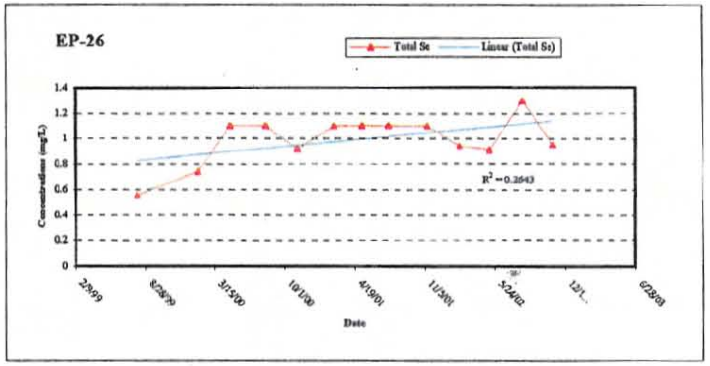
Appendix J

Time Series Plots: Total Selenium Concentrations vs Time
Path of Parker's Brother Arroyo
Phase IV, Remedial Investigation



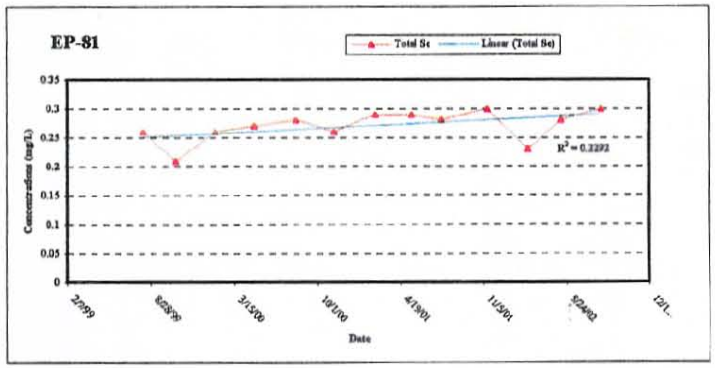
r2	5.25E-01	r = Correlation Coefficient	0.724844811
n = Number of samples	9	$t\ crit_{(n-2,\ alpha/2)}$ =	1.895
t =	2.783749726		

Since t > t crit, ***The concentration change as a function of time***



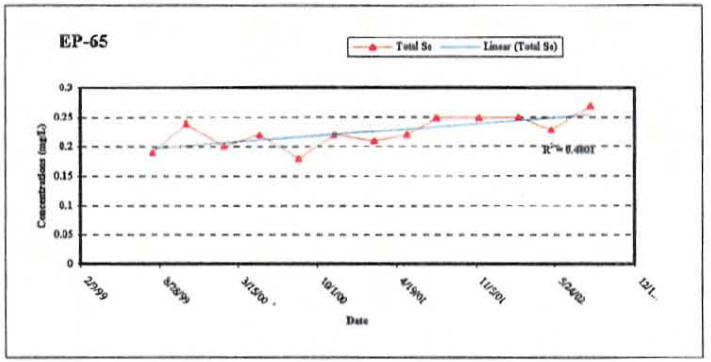
r2	2.64E-01	r = Correlation Coefficient	0.514101157
n = Number of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	1.987900057		

Since t < t crit, ***The concentration change as a function of time***



r2	2.29E-01	r = Correlation Coefficient	0.478748368
n = Number of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	1.808559479		

Since t > t crit, ***The concentration change as a function of time***



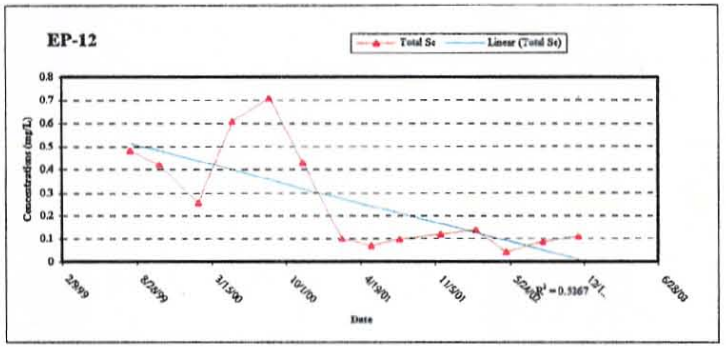
r2	4.80E-01	r = Correlation Coefficient	0.692892488
n = Number of samples	13	$t\ crit_{(n-2,\ alpha/2)}$ =	1.796
t =	3.187148409		

Since t < t crit, ***The concentration change as a function of time***

Note

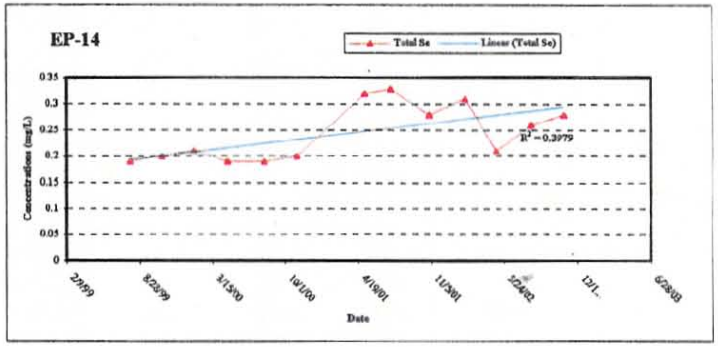
t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)
The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

Time Series Plots: Total Selenium Concentrations vs Time
Path of Parker's Brother Arroyo
Phase IV, Remedial Investigation



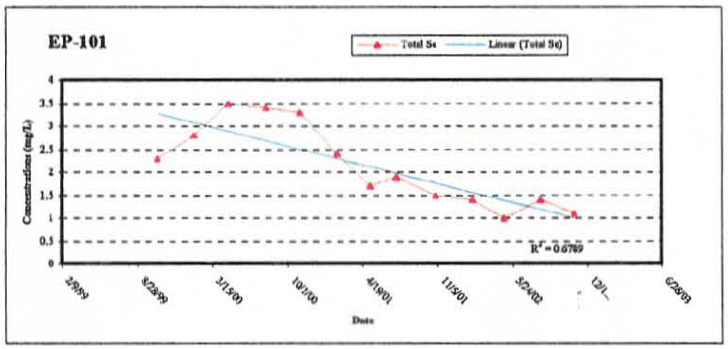
r2	5.27E-01	r = Correlation Coefficient	0.725741001
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	3.654298587		

Since t > t crit, ***The concentration change as a function of time***



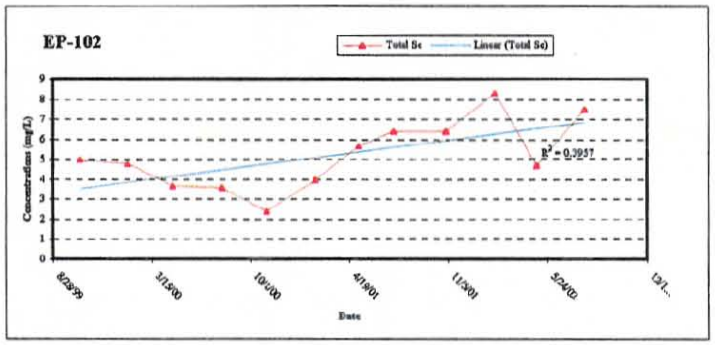
r2	3.98E-01	r = Correlation Coefficient	0.630793152
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	2.816068917		

Since t > t crit, ***The concentration change as a function of time***



r2	6.79E-01	r = Correlation Coefficient	0.823953882
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	4.822576151		

Since t > t crit, ***The concentration change as a function of time***



r2	3.96E-01	r = Correlation Coefficient	0.629046898
n = Number of samples	12	**t crit** $_{(n-2,\ alpha/2)}$ =	1.812
t =	2.558920114		

Since t > t crit, ***The concentration change as a function of time***

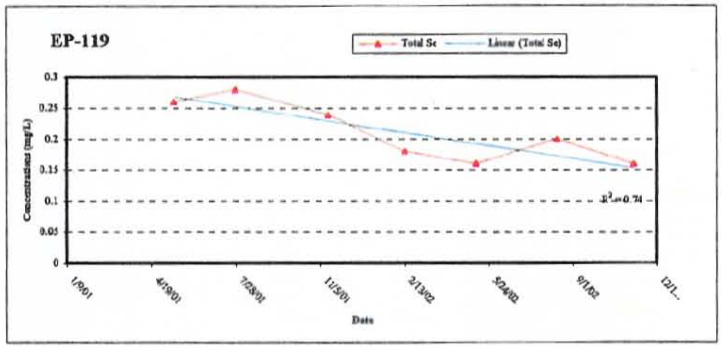
Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit**.

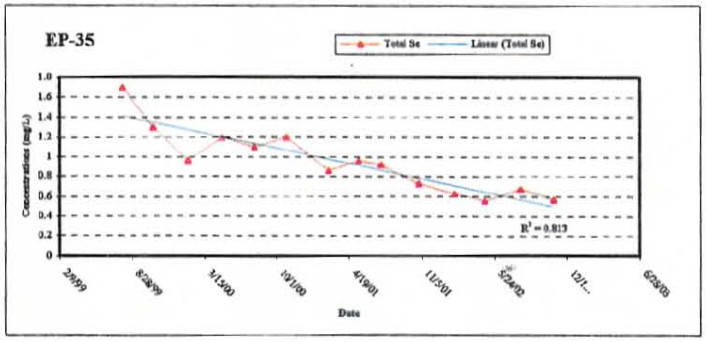
Appendix J

Time Series Plots: Total Selenium Concentrations vs Time
Path of Parker's Brother Arroyo
Phase IV, Remedial Investigation



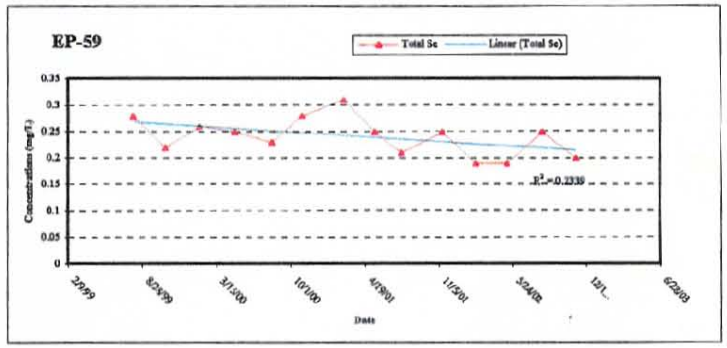
r2	7.40E-01	r = Correlation Coefficient	0.860232527
n = Number of samples	7	**t crit** $_{(n-2,\ alpha/2)}$ =	2.015
t =	3.77236918		

Since t > t crit, ***The concentration change as a function of time***



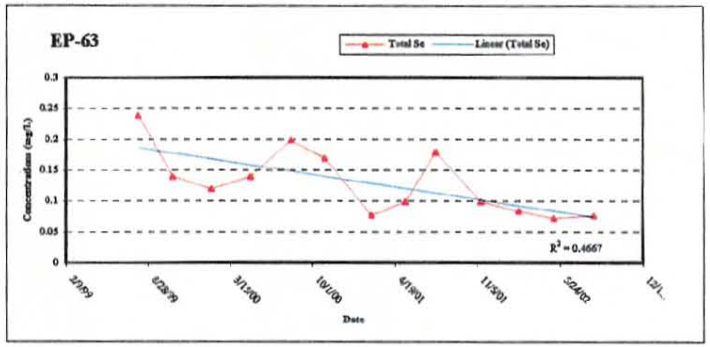
r2	8.13E-01	r = Correlation Coefficient	0.901665126
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	7.22295805		

Since t > t crit, ***The concentration change as a function of time***



r2	2.34E-01	r = Correlation Coefficient	0.483632092
n = Number of samples	14	**t crit** $_{(n-2,\ alpha/2)}$ =	1.782
t =	1.914092858		

Since t > t crit, ***The concentration change as a function of time***



r2	4.67E-01	r = Correlation Coefficient	0.683154448
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	3.102626169		

Since t > t crit, ***The concentration change as a function of time***

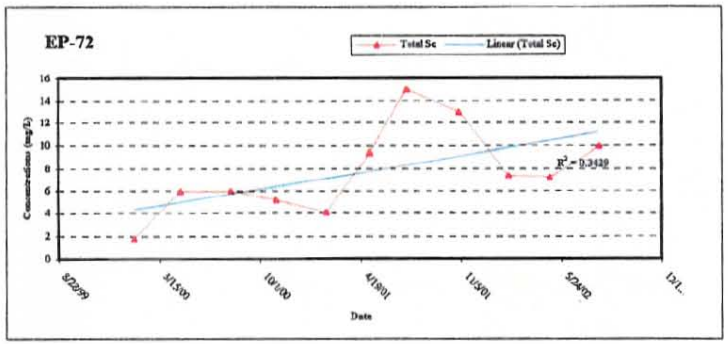
Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit.**

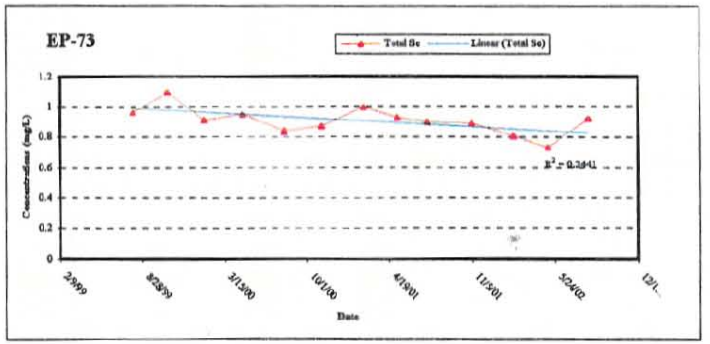
Appendix J

Time Series Plots: Total Selenium Concentrations vs Time
Path of Parker's Brother Arroyo
Phase IV, Remedial Investigation



r2	3.43E-01	r = Correlation Coefficient	0.585576639
n = Number of samples	11	**t crit** $_{(n-2,\ alpha/2)}$ =	1.833
t =	2.167151455		

Since t > t crit, ***The concentration change as a function of time***



r2	3.44E-01	r = Correlation Coefficient	0.586600375
n = Number of samples	13	**t crit** $_{(n-2,\ alpha/2)}$ =	1.796
t =	2.40225919		

Since t > t crit, ***The concentration change as a function of time***

Note

t crit is the t value for n-2 degrees of freedom and a probability of alpha/2 (alpha = 0.05)

The Null Hypothesis (H_0) that the concentration does not change as a function of time is rejected if **t > t crit.**

APPENDIX K

APPENDIX K

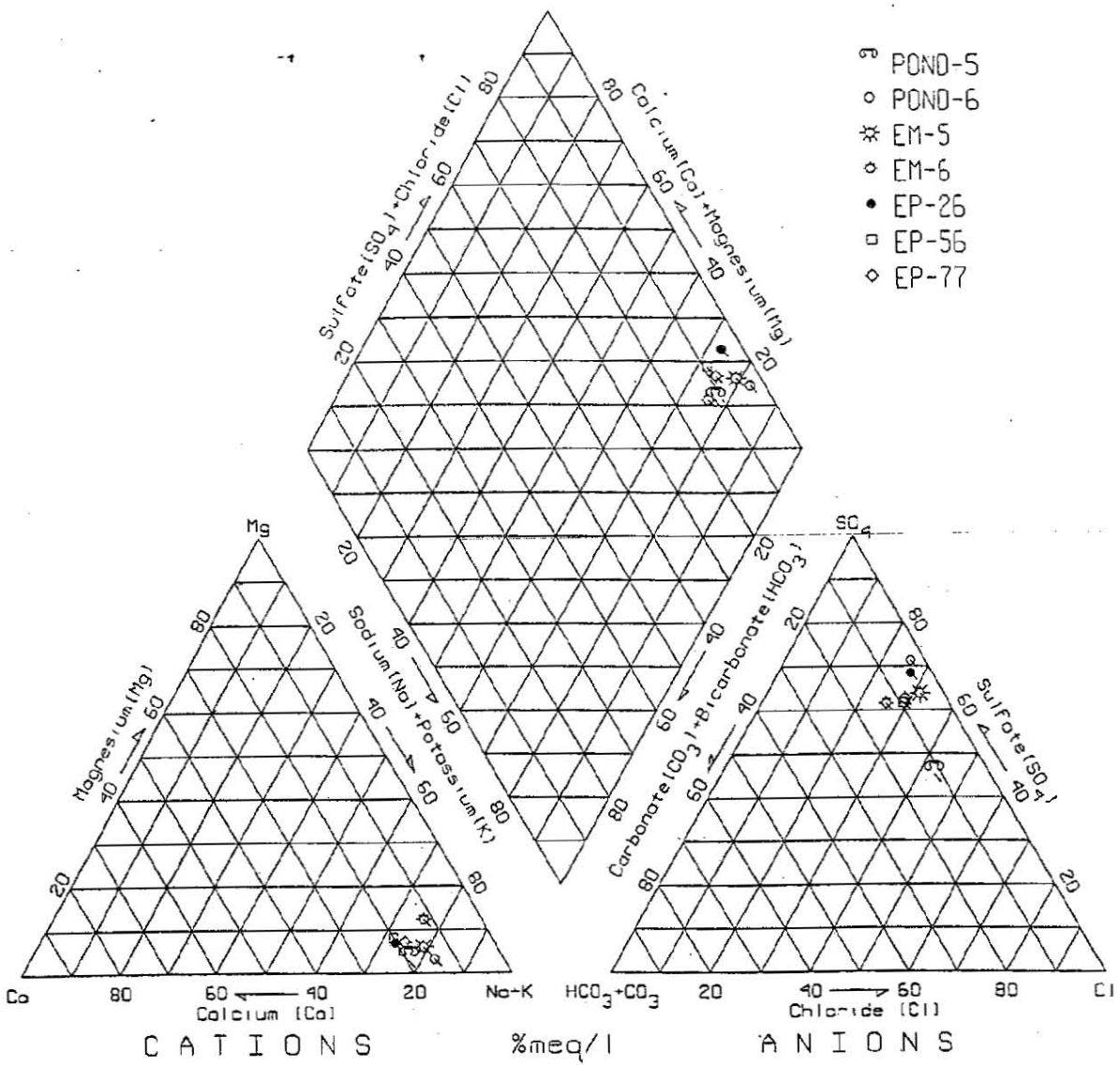
APPENDIX K

APPENDIX K

APPENDIX K

APPENDIX K

PIPER DIAGRAMS FOR WATER/GROUNDWATER SAMPLES COLLECTED AT PONDS 5 AND 6 ARROYO, POND 1 ARROYO, AND AT ACID PLANT ARROYO (PHASE I RI).



SEE EXHIBIT 1 FOR SAMPLING LOCATIONS

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	PIPER DIAGRAM FOR WATER SAMPLES COLLECTED AT PONDS 5 AND 6 ARROYO LOCATIONS, FEBRUARY 1997	FIGURE 2-18

UPDATE TIME: 9:00
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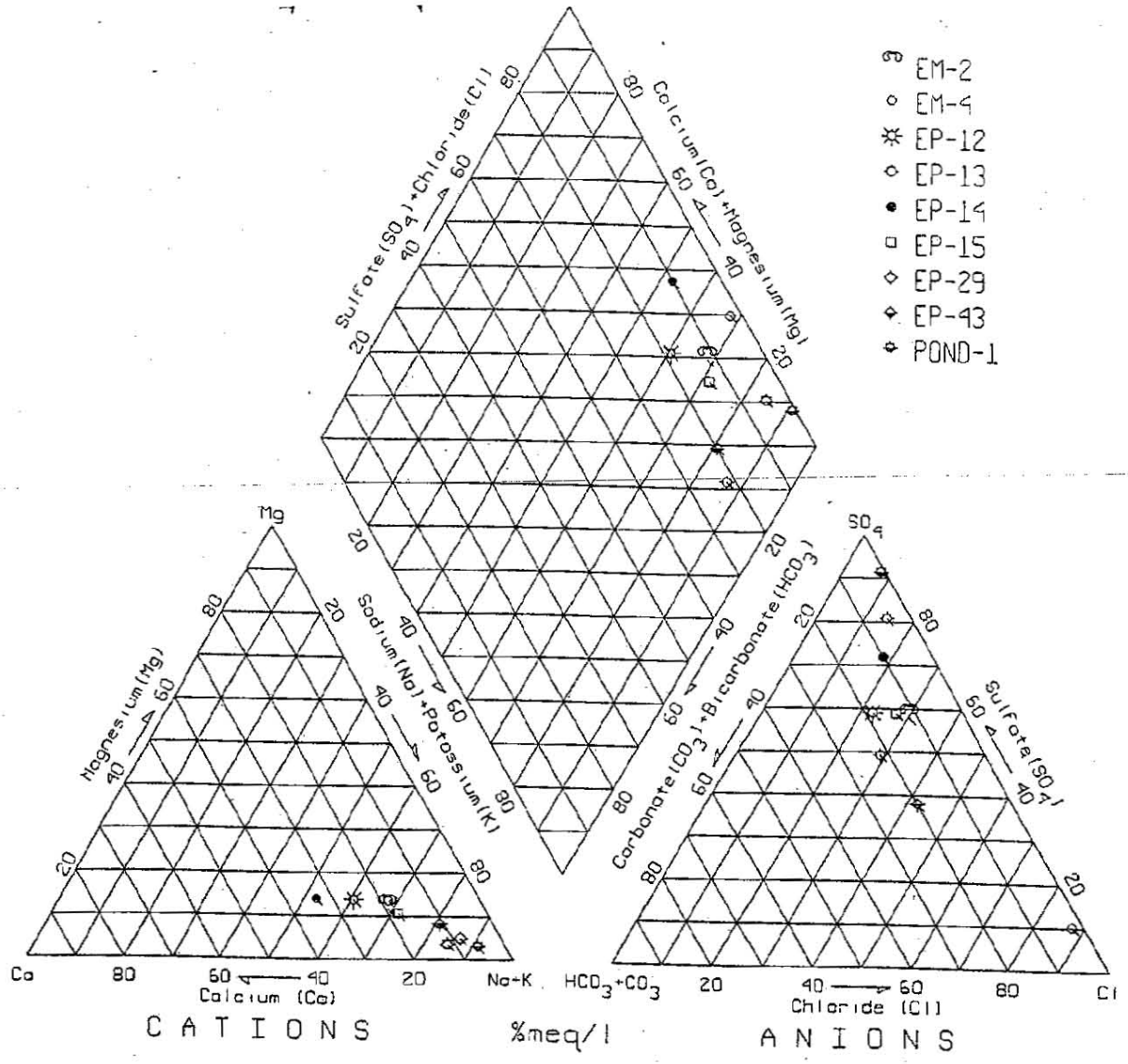
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



SEE EXHIBIT 1 FOR SAMPLING LOCATIONS

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	**PIPER DIAGRAM FOR WATER SAMPLES COLLECTED AT POND 1 ARROYO LOCATIONS, FEBRUARY 1997**	FIGURE **2-19**

UPDATE TIME: 9:00
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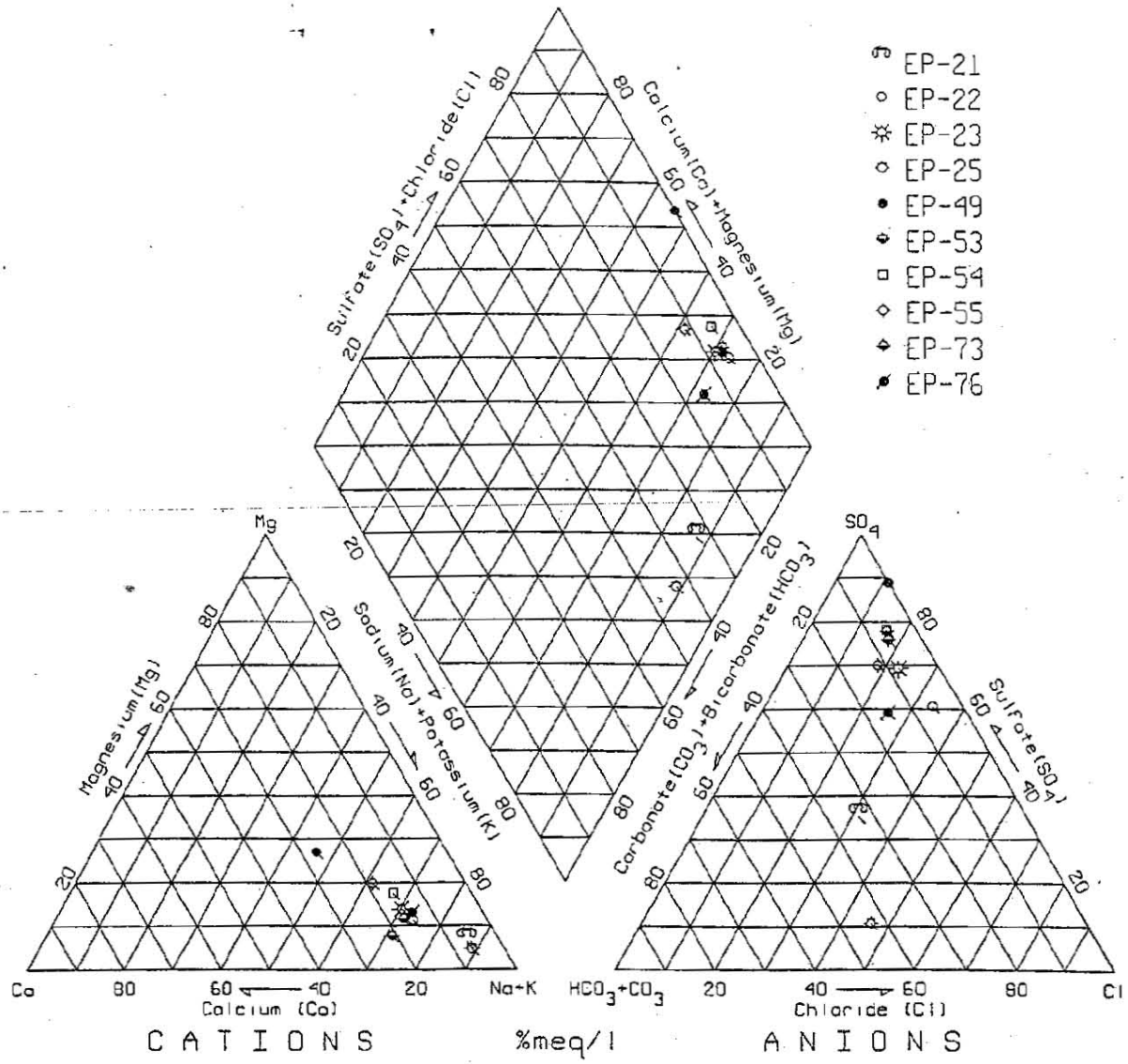
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



SEE EXHIBIT 1 FOR WELL LOCATIONS

ASARCO INCORPORATED EL PASO COPPER SMELTER REMEDIAL INVESTIGATION REPORT EL PASO, TEXAS	PIPER DIAGRAM FOR GROUNDWATER SAMPLES COLLECTED AT ACID PLANT ARROYO LOCATIONS, FEBRUARY 1997	FIGURE 2-21

UPDATE TIME: 9:00
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