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"Roper, Ralph"
<Ralph.Roper@heritage-enviro.com>

11/25/2003 12:20 PM

To: Juan Parra/DC/USEPA/US@EPA
cc: "Opell, Doug" <Doug.Opell@heritage-enviro.com>, "Roberts, Tom" <Tom.Roberts@heritage-enviro.com>
Subject: Heritage Se Variance Application Supplement

Juan - Attached are the backup documents for the supplemental tests I summarized in my e-mail to your yesterday. It includes our 11-24-03 e-mail letter to you, my lab test protocol and summary, and the ICP metals data from the analytical lab.

Ralph

<<2003-11-25 Heritage Supplement to Se Variance.pdf>>

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Roper, Ralph

From: Roper, Ralph
Sent: Monday, November 24, 2003 6:35 PM
To: 'parra.juan@epamail.epa.gov'
Cc: Opell, Doug; Roberts, Tom; Price, Ken; Kriech, Tony; Hamrick, Winde
Subject: Heritage Variance Petition -Supplemental Stabilization Tests (Confidential Business Information)

Juan:
Per our discussion last Wednesday, we tested two additional stabilization recipes using the same 5 selenium waste samples that were originally used for our petition. The recipes were tested in an attempt to further optimize selenium stabilization using cementitious reagents. You will recall that the stabilization tests we submitted for our variance petition employed a 2:1 cement ratio and a 0.7:1 FSH ratio; and the TCLP selenium concentrations averaged 37.8 mg/l.

I set the new tests up last Thursday (11/20/03) using the same cure time (24 hours) as was done previously. Round "A" used a recipe of 1:1 cement, 1:1 cement kiln dust, and 0.7:1 FSH. Round "B" used a recipe of 1:1 cement, 1:1 cement kiln dust, and 0.35:1 FSH. I obtained the "CKD" from one of our suppliers (Mintek Resources) and it reportedly was "very cementitious" and had a high free lime content. After adding the stabilization reagents, curing for 24 hours, and then extracting for 18 hours, I then filtered the TCLP leachate using 0.45u autovial filters. The filtrates from the Round A tests that used 0.7:1 FSH were unusual in that after filtration, amorphous selenium (elemental) post precipitated. Accordingly, I refiltered all 5 the Round A filtrates. Had I not done this, the true TCLP test results for the Round A tests would have undoubtedly been much higher. Post precipitation of amorphous selenium was not a significant problem with the Round B tests that used the 0.35:1 FSH dose.

As it turned out, the average of the TCLP selenium concentrations (by ICP analysis) for the double filtered Round A tests was about the same as that for the Round B tests: 28.8 mg/l Se vs. 29.3 mg/l Se. However, I am reluctant to submit the results from the Round A tests because the double filtered selenium concentrations are misleading and the recipe, in my opinion, was not optimum. The individual results for the Round B samples that used 1:1 cement, 1:1 CKD, and 0.35:1 FSH were as follows:

Round B TCLP Selenium Test Results (1:1 cement, 1:1 CDK, 0.35:1 FSH):
- Sample 1 (No. 1183982) = 30.4 mg/l TCLP selenium
- Sample 2 (No. 1183983) = 35.6 mg/l
- Sample 3 (No. 1184103) = 25.6 mg/l
- Sample 4 (No. 1184104) = 26.7 mg/l
- Sample 5 (No. 1184340) = 28.4 mg/l

In all cases, the TCLP chrome concentration was removed to below the detection level.

Tomorrow I will submit for your files an electronic copy of the lab sheets, the MSD for the CKD, etc. for this most recent round of tests. I presume this will give you and your staff all the information needed to finalize your conclusions about our variance petition submitted last May. Doug Opell and I will call tomorrow to discuss this with you.

Sincerely,
Ralph Roper, Ph.D., PE
Heritage Environmental Services, LLC

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Roper / Heritage **Test Date: Thursday, November 20, 2003**

Supplemental Testing for Heritage's Petition to EPA for Se Variance

1.0 Background:

The stabilization recipe used in the Heritage Se variance petition was the same as previously approved by EPA for a similar waste. The recipe consisted of a 200% dose of portland cement and a 70% dose of FSH. Water was also added to make a thick paste that upon curing, solidified into a hard cementitious material. Optimization was performed in which cement doses of 1:1, 2:1 and 3:1 were tested. FSH doses up to 0.70:1 were also tested for removal of TCLP chrome.

Additional testing was requested by US EPA to determine if replacing half the cement dose with cement kiln dust (CKD) and reducing the FSH dose by half might give better results for selenium stabilization.

2.0 Objective:

The objective of this supplemental series of tests was to determine if a 1:1 cement plus 1:1 CKD stabilization recipe would be more effective than the 2:1 cement recipe used for the variance petition. It was also of interest to see if lower TCLP selenium would result if the 0.70:1 dose of FSH was reduced to 0.35:1.

3.0 Waste Materials Tested:

The same 5 samples of Guardian raw waste were used as were previously used for the EPA Se variance petition. The samples used and the TCLP results for the raw and cement/FSH stabilized samples were as follows:

Sample No.	Batch No.	Sample Date	Lab ID No.	Selenium content
1	No. 1183982	3/6/2003	H143746	Se = 6.7% (est.)
2	No. 1183983	3/7/2003	H143745	Se = 5.8% (est.)
3	No. 1184103	3/7/2003	H143748	Se = 6.0% (est.)
4	No. 1184104	3/8/2003	H143749	Se = 7.2% (est.)
5	No. 1184304	3/6/2003	H143747	Se = 6.3% (est.)

4.0 Protocol:

1. For this series of tests, Heritage used a research-oriented scaled-down version of the TCLP test protocol. The method only differed from the standard TCLP protocol in that the mass of sample and volume of extraction fluid were scaled down to 1/4th the standard amount.

2. Each test was set up the same way. 10-gram aliquots of the raw wastes were weighed out and placed in plastic cups. Next, 10.0 grams of portlant cement (Type I) were added and then 10.0 grams of CKD were added. The CDK was obtained on Nov. 20th from a local representative of Mintek Resources. It was said to be very cementitious and have a free lime content of about 25%. For "Round A" tests, the FSH dose was 0.70:1 and for "Round B" tests, the FSH dose was 0.35:1. After adding the dry materials, water was added in increments and mixed until a paste was formed. The paste was then transferred to a new plastic cup that had been preweighed. The net weight was recorded and then a watch glass was placed over the top of the cup during the cure time. The compacted volumes were measured by level comparison.

3. After a cure time of 24.0 hours, the samples were tested for TCLP Se and Chrome. The TCLP tests were performed using 25 gram samples placed in 500 ml of TCLP leach solution No. 2. The TCLP sample containers were placed on the tumbler at 6:00 pm Fridaym Nov. 21st, and removed18.0 hours later at 12:00 noon on Saturday, Nov. 22nd.

4. After extraction, the pHs and ORP were measured. Aliquots were filtered with 0.45 u autovial membrane filters before submitting to the lab for ICP metals analysis.

5.0 Test Formulations:

	No. 1183982	No. 1183983	No. 1184103	No. 1184104	No. 1184304
Round A Tests (grams)	**Test 1A**	**Test 2A**	**Test 3A**	**Test 4A**	**Test 5A**
Guardian Raw Sample	10.0	10.0	10.0	10.0	10.0
Portland Cement (Type 1)	10.0	10.0	10.0	10.0	10.0
Cement Kiln Dust (CKD)	10.0	10.0	10.0	10.0	10.0
Ferrous Sulfate Heptahydrate	7.0	7.0	7.0	7.0	7.0
Water (gms)	21.0	23.0	23.0	23.0	24.0
Total Weight:	58.0	60.0	60.0	60	61
Grams raw waste in 25 gms mix:	4.3	4.2	4.2	4.2	4.1
Cement to Waste Ratio:	1:1	1:1	1:1	1:1	1:1
CKD to Waste Ratio:	1:1	1:1	1:1	1:1	1:1

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FSH to Waste Ratio:	0.70:1	0.70:1	0.70:1	0.70:1	0.70:1
Time mix was prepared on 11/20/03:	5:10 PM	5:20 PM	5:25 PM	5:30 PM	5:35 PM
Empty cup tare wt (gms):	14.08	14.09	14.47	14.14	14.05
Total Weight after mix added:	68.18	69.38	72.04	71.19	71.74
Initial wt. of wet mix placed in cup:	54.10	55.29	57.57	57.05	57.69
Approx. volume (ml):	40	40	40	40	40
Wet Density (gms/ml):	1.35	1.38	1.44	1.43	1.44
Total weight after 24 hours (gms):	67.52	68.92	71.41	70.79	71.22

	No. 1183982	No. 1183983	No. 1184103	No. 1184104	No. 1184304
Round B Tests (grams)	**Test 1B**	**Test 2B**	**Test 3B**	**Test 4B**	**Test 5B**
Guardian Raw Sample	10.0	10.0	10.0	10.0	10.0
Portland Cement (Type 1)	10.0	10.0	10.0	10.0	10.0
Cement Kiln Dust (CKD)	10.0	10.0	10.0	10.0	10.0
Ferrous Sulfate Heptahydrate	3.5	3.5	3.5	3.5	3.5
Water (gms)	20.0	21.0	21.0	22.0	21.0
Total Weight:	53.5	54.5	54.5	55.5	54.5
Grams raw waste in 25 gms mix:	4.7	4.6	4.6	4.5	4.6
Cement to Waste Ratio:	1:1	1:1	1:1	1:1	1:1
CKD to Waste Ratio:	1:1	1:1	1:1	1:1	1:1
FSH to Waste Ratio:	0.35:1	0.35:1	0.35:1	0.35:1	0.35:1
Time mix was prepared on 11/20/03:	5:40 PM	5:45 PM	5:50 PM	5:55 PM	6:00 PM
Empty cup tare wt (gms):	13.88	14.16	14.16	14.11	13.89
Total Weight after mix added:	64.83	63.64	65.17	66.47	64.73
Initial wt. of wet mix placed in cup:	50.95	49.48	51.01	52.36	50.84
Approx. volume (ml):	35	35	35	35	35
Wet Density (gms/ml):	1.46	1.41	1.46	1.50	1.45
Total weight after 24 hours (gms):	64.30	63.21	64.68	66.07	64.33

6.0 TCLP Test Results

	Test 1A	Test 2A	Test 3A	Test 4A	Test 5A
pH	11.85	11.91	11.86	11.86	11.94
ORP	-448	-464	-462	-515	-481
Se (mg/l)	**	**	**	**	**
Cr (mg/l)	BDL	BDL	BDL	BDL	BDL

** In all of the Round A TCLP filtrates, a precipitant formed after 0.45u filtration that looked like amorphous selenium (elemental). The filtrates were refiltered to remove the precipitant. Thus the final results did not reflect the true TCLP concentrations. The double filtered results averaged 28.8 mg/l
(27.7 + 28.1 + 30.2 + 30.5 + 27.3)/5 = 28.8 mg/l average TCLP Se)
The average was about the same as that for the Round B tests that used 1/2 the amount of FSH.

	Test 1B	Test 2B	Test 3B	Test 4B	Test 5B
pH	11.96	12.03	12.07	12.05	12.11
ORP	-478	-501	-461	-472	-487
Se (mg/l)	30.4	35.6	25.6	26.7	28.4
Cr (mg/l)	BDL	BDL	BDL	BDL	BDL

(The TCLP Se average for the Round B tests was 29.3 mg/l)

Sn 189.927 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		0.88447	0.000000	0.000000	-	-
Standard 4		7363.9	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 736.297 x + 0.884475

Sr 216.596 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		-1.6205	0.000000	0.000000	-	-
Standard 2		56021	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 5602.28 x + -1.62045

Ti 322.284 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		100.06	0.000000	0.000000	-	-
Standard 4		88692	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 8859.14 x + 100.058

Tl 190.794 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		-0.88046	0.000000	0.000000	-	-
Standard 2		4423.6	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 442.451 x + -0.880457

V 289.164 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		0.23270	0.000000	0.000000	-	-
Standard 2		76921	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 7692.12 x + 0.232696

Zn 206.200 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		1.0160	0.000000	0.000000	-	-
Standard 2		7109.5	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 710.851 x + 1.016

Zr 257.147 Calibration (ppm) 11/23/03, 11:44:21 AM **Correlation Coefficient: 1.000000**

Label	Flags	Int. (c/s)	Std Conc.	Calc Conc.	Error	%Error
Blank		13.398	0.000000	0.000000	-	-
Standard 2		114239	10.000	10.000	0.000000	0.0

Curve Type: Linear Equation: y = 11422.6 x + 13.3985

CCV (CCV) 11/23/03, 4:24:30 PM **Rack 2, Tube 2**

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	36023	36341	36390
Al	237.312	2714.5	2778.9	2780.4
As	188.980	1585.7	1603.3	1606.3
B	249.772	23934	24566	24581
Ba	233.527	189431	193190	193334
Be	234.861	291781	297862	298021
Ca	315.887	316208	323056	323224
Cd	228.802	41094	42078	41995
Co	231.160	27088	27612	27687
Cr	267.716	163969	168416	168793
Cu	324.754	189078	192999	193607
Fe	261.382	8787.5	8979.9	9001.6
K	728.181	79478	80337	80058
Li	610.365	212028	215407	215419
Mg	279.078	47677	48713	48791
Mn	293.305	71293	72793	72908
Mo	202.032	4257.4	4361.7	4375.5
Na	589.592	8183283	8297843	8297238
Na	568.821	13611	13809	13802
Ni	221.648	7160.2	7259.0	7261.5
Pb	220.353	8079.1	8262.9	8255.6
Sb	217.582	601.40	622.09	613.77
Se	196.026	1217.5	1229.5	1228.2
Si	251.611	10856	11059	11146
Sn	189.927	3464.3	3609.0	3616.0
Sr	216.596	26678	27346	27682
Ti	322.284	43045	43994	44052
Tl	190.794	2084.2	2134.7	2147.3
V	289.164	37562	38385	38410
Y	361.104	217259	217684	218043
Zn	206.200	3296.8	3377.9	3385.1
Zr	257.147	56234	57533	57621

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
Ag	328.068	0.97467	ppm	0.005435	0.6	36251	0.97467 ppm	Y 361.104	97.46725
Al	237.312	4.9243	ppm	0.067629	1.4	2757.9	4.9243 ppm	Y 361.104	98.48660
As	188.980	4.9647	ppm	0.034599	0.7	1598.4	4.9647 ppm	Y 361.104	99.29462
B	249.772	2.0171	ppm	0.030602	1.5	24361	2.0171 ppm	Y 361.104	100.85566

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El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
Ba	233.527	4.9008	ppm	0.056537	1.2	191985	4.9008 ppm	Y 361.104	98.01678
Be	234.861	5.0882	ppm	0.061170	1.2	295888	5.0882 ppm	Y 361.104	101.76360
Ca	315.887	49.391	ppm	0.61630	1.2	320829	49.391 ppm	Y 361.104	98.78258
Cd	228.802	5.0033	ppm	0.065390	1.3	41722	5.0033 ppm	Y 361.104	100.06610
Co	231.160	4.8697	ppm	0.057752	1.2	27462	4.8697 ppm	Y 361.104	97.39433
Cr	267.716	4.9325	ppm	0.079229	1.6	167059	4.9325 ppm	Y 361.104	98.64967
Cu	324.754	4.9656	ppm	0.063591	1.3	191895	4.9656 ppm	Y 361.104	99.31237
Fe	261.382	4.8967	ppm	0.064285	1.3	8923.0	4.8967 ppm	Y 361.104	97.93417
K	728.181	52.814	ppm	0.28485	0.5	79958	52.814 ppm	Y 361.104	105.62835
Li	610.365	4.9681	ppm	0.045318	0.9	214284	4.9681 ppm	Y 361.104	99.36298
Mg	279.078	48.010	ppm	0.61683	1.3	48394	48.010 ppm	Y 361.104	96.01902
Mn	293.305	4.8735	ppm	0.060735	1.2	72331	4.8735 ppm	Y 361.104	97.46998
Mo	202.032	0.99378	ppm	0.014835	1.5	4331.6	0.99378 ppm	Y 361.104	99.37762
Na	589.592	50.878	ppm	0.40416	0.8	8259455	50.878 ppm	Y 361.104	101.75507
Ni	221.648	4.8562	ppm	0.038858	0.8	7226.9	4.8562 ppm	Y 361.104	97.12474
Pb	220.353	4.8314	ppm	0.061269	1.3	8199.2	4.8314 ppm	Y 361.104	96.62794
Sb	217.582	1.0217	ppm	0.017126	1.7	612.42	1.0217 ppm	Y 361.104	102.16725
Se	196.026	4.8812	ppm	0.026355	0.5	1225.1	4.8812 ppm	Y 361.104	97.62391
Si	251.611	4.9871	ppm	0.067355	1.4	11020	4.9871 ppm	Y 361.104	99.74106
Sn	189.927	4.8356	ppm	0.11632	2.4	3563.1	4.8356 ppm	Y 361.104	96.71226
Sr	216.596	4.8601	ppm	0.091258	1.9	27235	4.8601 ppm	Y 361.104	97.20123
Ti	322.284	4.9192	ppm	0.063856	1.3	43697	4.9192 ppm	Y 361.104	98.38446
Tl	190.794	4.7623	ppm	0.075581	1.6	2122.1	4.7623 ppm	Y 361.104	95.24585
V	289.164	4.9753	ppm	0.062738	1.3	38119	4.9753 ppm	Y 361.104	99.50642
Zn	206.200	4.7038	ppm	0.069030	1.5	3353.3	4.7038 ppm	Y 361.104	94.07528
Zr	257.147	5.0024	ppm	0.067965	1.4	57129	5.0024 ppm	Y 361.104	100.04796

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.97370	217662	392.259	0.2

BLA01 (CCB) **11/23/03, 4:27:43 PM** **Rack 2, Tube 3**

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-13.261	-1.2768	-3.4057
Al	237.312	1.0155	0.47574	1.3605
As	188.980	0.080190	-0.033102	-0.46227
B	249.772	264.68	262.66	257.01
Ba	233.527	106.97	106.57	108.48
Be	234.861	11.139	7.6340	12.588
Ca	315.887	127.54	117.88	130.16

El	Wavelen.	Replicates Intensity (c/s)		
Cd	228.802	0.42967	0.70559	2.0723
Co	231.160	8.4045	7.5031	6.0489
Cr	267.716	29.120	21.948	18.402
Cu	324.754	15.086	10.525	16.291
Fe	261.382	4.9044	5.2987	4.2457
K	728.181	105.20	101.87	97.627
Li	610.365	489.27	460.47	475.30
Mg	279.078	6.1468	4.5378	5.7254
Mn	293.305	9.9341	9.9502	10.840
Mo	202.032	2.6794	0.64558	2.1703
Na	589.592	640.58	563.38	692.46
Na	568.821	-223.01	-200.57	-220.37
Ni	221.648	-0.44723	0.014221	-0.011996
Pb	220.353	0.61871	0.63534	-1.0949
Sb	217.582	-2.5103	-0.64351	-2.6281
Se	196.026	0.14920	0.98277	1.0476
Si	251.611	29.271	22.010	21.105
Sn	189.927	-0.065724	0.46082	0.10344
Sr	216.596	2.7359	1.4079	2.0390
Ti	322.284	43.013	46.503	43.402
Tl	190.794	0.24587	0.010004	-0.054294
V	289.164	-3.1040	2.3993	3.5778
Y	361.104	474468	479824	483477
Zn	206.200	0.58606	-0.16292	1.2402
Zr	257.147	8.9757	9.0377	9.3034

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
Ag	328.068	0.000264	ppm	0.000175	66.1	-5.9813	0.000264 ppm	Y 361.104	0.00026
Al	237.312	0.009122	ppm	0.000802	8.8	0.95060	0.009122 ppm	Y 361.104	0.00912
As	188.980	-0.000060u	ppm	0.000889	1486.6	-0.13839	-0.000060 ppm	Y 361.104	-0.00006
B	249.772	0.017946	ppm	0.000329	1.8	261.45	0.017946 ppm	Y 361.104	0.01795
Ba	233.527	0.000116	ppm	0.000026	22.1	107.34	0.000116 ppm	Y 361.104	0.00012
Be	234.861	0.000278	ppm	0.000044	15.7	10.454	0.000278 ppm	Y 361.104	0.00028
Ca	315.887	0.000141u	ppm	0.000996	708.2	125.19	0.000141 ppm	Y 361.104	0.00014
Cd	228.802	0.000040u	ppm	0.000105	262.2	1.0692	0.000040 ppm	Y 361.104	0.00004
Co	231.160	-0.000244u	ppm	0.000211	86.2	7.3188	-0.000244 ppm	Y 361.104	-0.00024
Cr	267.716	-0.000402u	ppm	0.000161	40.1	23.157	-0.000402 ppm	Y 361.104	-0.00040
Cu	324.754	-0.002144u	ppm	0.000079	3.7	13.967	-0.002144 ppm	Y 361.104	-0.00214
Fe	261.382	-0.001323u	ppm	0.000290	21.9	4.8163	-0.001323 ppm	Y 361.104	-0.00132

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El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
K	728.181	-0.011233u	ppm	0.002558	22.8	101.57	-0.011233 ppm	Y 361.104	-0.01123
Li	610.365	-0.007376u	ppm	0.000334	4.5	475.01	-0.007376 ppm	Y 361.104	-0.00738
Mg	279.078	0.003771	ppm	0.000828	21.9	5.4700	0.003771 ppm	Y 361.104	0.00377
Mn	293.305	-0.000015u	ppm	0.000035	231.4	10.242	-0.000015 ppm	Y 361.104	-0.00002
Mo	202.032	-0.001071u	ppm	0.000243	22.7	1.8318	-0.001071 ppm	Y 361.104	-0.00107
Na	589.592	-0.002127u	ppm	0.000403	18.9	632.14	-0.002127 ppm	Y 361.104	-0.00213
Ni	221.648	0.000932	ppm	0.000174	18.7	-0.14833	0.000932 ppm	Y 361.104	0.00093
Pb	220.353	0.001762	ppm	0.000585	33.2	0.053059	0.001762 ppm	Y 361.104	0.00176
Sb	217.582	0.002990	ppm	0.001831	61.2	-1.9273	0.002990 ppm	Y 361.104	0.00299
Se	196.026	-0.001013u	ppm	0.001998	197.2	0.72654	-0.001013 ppm	Y 361.104	-0.00101
Si	251.611	0.000772u	ppm	0.002030	263.0	24.129	0.000772 ppm	Y 361.104	0.00077
Sn	189.927	-0.000973u	ppm	0.000365	37.5	0.16618	-0.000973 ppm	Y 361.104	-0.00097
Sr	216.596	0.000658	ppm	0.000119	18.0	2.0609	0.000658 ppm	Y 361.104	0.00066
Ti	322.284	-0.006293u	ppm	0.000216	3.4	44.306	-0.006293 ppm	Y 361.104	-0.00629
Tl	190.794	0.002161	ppm	0.000357	16.5	0.067193	0.002161 ppm	Y 361.104	0.00216
V	289.164	0.000094u	ppm	0.000464	494.3	0.95769	0.000094 ppm	Y 361.104	0.00009
Zn	206.200	-0.000651u	ppm	0.000988	151.7	0.55443	-0.000651 ppm	Y 361.104	-0.00065
Zr	257.147	-0.000381u	ppm	0.000015	4.0	9.1056	-0.000381 ppm	Y 361.104	-0.00038

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	2.1439	479256	4531.320	0.9

R. Roper 1A (Samp) **11/23/03, 4:30:56 PM** **Rack 2, Tube 4**

Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-120.42	-129.88	-128.19
Al	237.312	13.762	5.1821	6.7430
As	188.980	-0.78573	-4.3818	-1.6603
B	249.772	4303.8	4492.7	4526.4
Ba	233.527	12666	12913	13003
Be	234.861	1.6412	3.8809	-3.2528
Ca	315.887	13630303	13854140	13844866
Cd	228.802	1.2305	-4.9120	3.5444
Co	231.160	5.2702	17.558	12.377
Cr	267.716	5.3139	13.895	2.0563
Cu	324.754	859.80	873.27	856.30
Fe	261.382	94.996	92.809	73.700
K	728.181	431967	434742	433760
Li	610.365	-46702	-47714	-47568

El	Wavelen.	Replicates Intensity (c/s)		
Mg	279.078	54.078	62.129	74.688
Mn	293.305	33.533	34.476	35.091
Mo	202.032	320.32	301.73	289.52
Na	589.592	29958624	30007506	29858598
Na	568.821	109531	110235	110529
Ni	221.648	19.545	23.290	16.658
Pb	220.353	-3.3482	-3.3616	-1.4419
Sb	217.582	40.558	34.902	33.784
Se	196.026	6723.3	7030.4	7101.2
Si	251.611	2511.7	2523.9	2501.0
Sn	189.927	6.5749	4.3603	5.3639
Sr	216.596	10914	11065	11060
Ti	322.284	2.6790	-15.497	-5.7332
Tl	190.794	-16.412	-17.127	-10.433
V	289.164	-0.73364	-12.546	-14.891
Y	361.104	196697	196588	197018
Zn	206.200	12.216	9.6722	11.805
Zr	257.147	3668.6	3563.4	2588.5

1A

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.004073u	ppm	0.000138	3.4	-126.16	-0.004073 ppm	Y 361.104	1.0000
Al	237.312	0.019529	ppm	0.008221	42.1	8.5623	0.019529 ppm	Y 361.104	1.0000
As	188.980	-0.006754u	ppm	0.005827	86.3	-2.2760	-0.006754 ppm	Y 361.104	1.0000
B	249.772	0.36415	ppm	0.009935	2.7	4441.0	0.36415 ppm	Y 361.104	1.0000
Ba	233.527	0.32590	ppm	0.004463	1.4	12861	0.32590 ppm	Y 361.104	1.0000
Be	234.861	0.000120	ppm	0.000063	52.3	0.75644	0.000120 ppm	Y 361.104	1.0000
Ca	315.887	2120.8b	ppm	19.495	0.9	13776436	2120.8 ppm	Y 361.104	1.0000
Cd	228.802	-0.000102u	ppm	0.000524	514.2	-0.045673	-0.000102 ppm	Y 361.104	1.0000
Co	231.160	-0.002750ub	ppm	0.001093	39.7	11.735	-0.002750 ppm	Y 361.104	1.0000
Cr	267.716	-0.000876u	ppm	0.000181	20.6	7.0885	-0.000876 ppm	Y 361.104	1.0000
Cu	324.754	0.019814	ppm	0.000232	1.2	863.12	0.019814 ppm	Y 361.104	1.0000
Fe	261.382	0.043587	ppm	0.006390	14.7	87.169	0.043587 ppm	Y 361.104	1.0000
K	728.181	276.43b	ppm	0.88707	0.3	433490	276.43 ppm	Y 361.104	1.0000
Li	610.365	-0.35556ub	ppm	0.012687	3.6	-47328	-0.35556 ppm	Y 361.104	1.0000
Mg	279.078	0.061472	ppm	0.010305	16.8	63.632	0.061472 ppm	Y 361.104	1.0000
Mn	293.305	0.001611	ppm	0.000053	3.3	34.367	0.001611 ppm	Y 361.104	1.0000
Mo	202.032	0.068326	ppm	0.003564	5.2	303.86	0.068326 ppm	Y 361.104	1.0000
Na	589.592	182.48o	ppm	0.45961	0.3	29941576	182.48 ppm	Y 361.104	1.0000
Na	568.821	344.94b	ppm	1.6791	0.5	110098	344.94 ppm	Y 361.104	1.0000

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El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ni	221.648	0.012274	ppm	0.002236	18.2	19.831	0.012274 ppm	Y 361.104	1.0000
Pb	220.353	0.000314u	ppm	0.000650	207.0	-2.7172	0.000314 ppm	Y 361.104	1.0000
Sb	217.582	0.066083	ppm	0.005974	9.0	36.415	0.066083 ppm	Y 361.104	1.0000
Se	196.026	27.717	ppm	0.80116	2.9	6951.6	27.717 ppm	Y 361.104	1.0000
Si	251.611	1.1290	ppm	0.005186	0.5	2512.2	1.1290 ppm	Y 361.104	1.0000
Sn	189.927	0.006066	ppm	0.001506	24.8	5.4330	0.006066 ppm	Y 361.104	1.0000
Sr	216.596	1.9661	ppm	0.015283	0.8	11013	1.9661 ppm	Y 361.104	1.0000
Ti	322.284	-0.012178u	ppm	0.001027	8.4	-6.1838	-0.012178 ppm	Y 361.104	1.0000
Tl	190.794	-0.030964u	ppm	0.008308	26.8	-14.658	-0.030964 ppm	Y 361.104	1.0000
V	289.164	-0.001693u	ppm	0.000986	58.3	-9.3901	-0.001693 ppm	Y 361.104	1.0000
Zn	206.200	0.014342	ppm	0.001921	13.4	11.231	0.014342 ppm	Y 361.104	1.0000
Zr	257.147	0.28541	ppm	0.052136	18.3	3273.5	0.28541 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88023	196768	223.901	0.1

R. Roper 2A (Samp) **11/23/03, 4:34:10 PM** **Rack 2, Tube 5**

Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-129.24	-112.54	-125.72
Al	237.312	5.8709	5.3496	9.0486
As	188.980	-2.1209	-2.6309	1.1408
B	249.772	8283.9	8696.0	8665.3
Ba	233.527	12309	12683	12614
Be	234.861	2.2001	7.4426	-0.93485
Ca	315.887	13612540	13831737	13884563
Cd	228.802	0.12982	-1.6799	-2.5221
Co	231.160	7.0402	11.910	5.8991
Cr	267.716	3.7309	8.7370	10.386
Cu	324.754	857.65	869.15	871.78
Fe	261.382	26.087	24.282	18.170
K	728.181	420632	419557	421164
Li	610.365	-47025	-47636	-47792
Mg	279.078	58.544	58.862	63.668
Mn	293.305	39.065	31.109	40.236
Mo	202.032	288.34	285.09	287.45
Na	589.592	29886690	29899610	29838818
Na	568.821	107365	108017	108223
Ni	221.648	5.4749	5.2538	3.4537

El	Wavelen.	Replicates Intensity (c/s)		
Pb	220.353	-1.9337	1.4850	0.14964
Sb	217.582	24.262	29.158	19.735
Se	196.026	6854.1	7123.2	7159.9
Si	251.611	2400.9	2430.4	2389.2
Sn	189.927	6.0157	5.5001	5.5294
Sr	216.596	10862	11229	11047
Ti	322.284	3.8389	4.0071	1.3316
Tl	190.794	-11.291	-10.585	-7.7629
V	289.164	-12.034	0.37125	0.65340
Y	361.104	196094	196835	196849
Zn	206.200	13.874	16.825	12.242
Zr	257.147	393.96	356.05	336.28

2A

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.003030u	ppm	0.000240	7.9	-122.50	-0.003030 ppm	Y 361.104	1.0000
Al	237.312	0.018017	ppm	0.003601	20.0	6.7564	0.018017 ppm	Y 361.104	1.0000
As	188.980	-0.003420u	ppm	0.006358	185.9	-1.2036	-0.003420 ppm	Y 361.104	1.0000
B	249.772	0.70438	ppm	0.019016	2.7	8548.4	0.70438 ppm	Y 361.104	1.0000
Ba	233.527	0.31759	ppm	0.005076	1.6	12536	0.31759 ppm	Y 361.104	1.0000
Be	234.861	0.000150	ppm	0.000073	48.4	2.9026	0.000150 ppm	Y 361.104	1.0000
Ca	315.887	2120.8b	ppm	22.205	1.0	13776280	2120.8 ppm	Y 361.104	1.0000
Cd	228.802	-0.000255u	ppm	0.000162	63.8	-1.3574	-0.000255 ppm	Y 361.104	1.0000
Co	231.160	-0.003227ub	ppm	0.000566	17.5	8.2831	-0.003227 ppm	Y 361.104	1.0000
Cr	267.716	-0.000861u	ppm	0.000102	11.9	7.6179	-0.000861 ppm	Y 361.104	1.0000
Cu	324.754	0.019890	ppm	0.000194	1.0	866.19	0.019890 ppm	Y 361.104	1.0000
Fe	261.382	0.008514	ppm	0.002263	26.6	22.846	0.008514 ppm	Y 361.104	1.0000
K	728.181	268.21b	ppm	0.51605	0.2	420451	268.21 ppm	Y 361.104	1.0000
Li	610.365	-0.35918ub	ppm	0.009400	2.6	-47484	-0.35918 ppm	Y 361.104	1.0000
Mg	279.078	0.058224	ppm	0.002848	4.9	60.358	0.058224 ppm	Y 361.104	1.0000
Mn	293.305	0.001775	ppm	0.000335	18.9	36.803	0.001775 ppm	Y 361.104	1.0000
Mo	202.032	0.064444	ppm	0.000386	0.6	286.96	0.064444 ppm	Y 361.104	1.0000
Na	589.592	182.08o	ppm	0.19394	0.1	29875040	182.08 ppm	Y 361.104	1.0000
Na	568.821	337.65b	ppm	1.4667	0.4	107868	337.65 ppm	Y 361.104	1.0000
Ni	221.648	0.002205	ppm	0.000746	33.8	4.7275	0.002205 ppm	Y 361.104	1.0000
Pb	220.353	0.001844	ppm	0.001014	55.0	-0.099715	0.001844 ppm	Y 361.104	1.0000
Sb	217.582	0.046279	ppm	0.007753	16.8	24.385	0.046279 ppm	Y 361.104	1.0000
Se	196.026	28.092	ppm	0.66578	2.4	7045.7	28.092 ppm	Y 361.104	1.0000
Si	251.611	1.0812	ppm	0.009619	0.9	2406.8	1.0812 ppm	Y 361.104	1.0000
Sn	189.927	0.006507	ppm	0.000393	6.0	5.6817	0.006507 ppm	Y 361.104	1.0000

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El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Sr	216.596	1.9719	ppm	0.032711	1.7	11046	1.9719 ppm	Y 361.104	1.0000
Ti	322.284	-0.011047u	ppm	0.000169	1.5	3.0592	-0.011047 ppm	Y 361.104	1.0000
Tl	190.794	-0.020175u	ppm	0.004220	20.9	-9.8797	-0.020175 ppm	Y 361.104	1.0000
V	289.164	-0.000505u	ppm	0.000942	186.6	-3.6699	-0.000505 ppm	Y 361.104	1.0000
Zn	206.200	0.018678	ppm	0.003268	17.5	14.314	0.018678 ppm	Y 361.104	1.0000
Zr	257.147	0.030514	ppm	0.002566	8.4	362.10	0.030514 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.87945	196593	431.860	0.2

R. Roper 3A (Samp) **11/23/03, 4:37:23 PM** **Rack 2, Tube 6**
Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)			
Ag	328.068	-119.49	-128.36	-125.38	
Al	237.312	10.349	8.3143	4.2290	
As	188.980	-1.0258	-0.41736	0.88016	
B	249.772	5955.7	6267.8	6290.4	
Ba	233.527	12089	12608	12514	
Be	234.861	-1.8382	7.3516	-1.8582	
Ca	315.887	13283122	13507041	13485775	
Cd	228.802	3.0497	-1.5652	-1.1529	
Co	231.160	7.2410	6.5385	3.4544	
Cr	267.716	15.707	9.5493	6.9564	
Cu	324.754	835.90	865.25	837.31	
Fe	261.382	21.556	22.985	19.561	
K	728.181	424462	426093	425671	
Li	610.365	-44217	-44967	-45171	
Mg	279.078	69.440	75.868	77.625	
Mn	293.305	34.108	40.723	34.496	
Mo	202.032	330.36	325.83	319.08	
Na	589.592	30142250	30235414	30291276	
Na	568.821	118148	118851	119064	
Ni	221.648	5.3135	4.7831	5.0366	
Pb	220.353	-1.6601	-2.8509	-1.6676	
Sb	217.582	21.331	15.721	15.917	
Se	196.026	7404.6	7679.8	7672.9	
Si	251.611	2870.5	2921.1	2882.4	
Sn	189.927	2.0448	4.7148	4.5570	
Sr	216.596	10831	11117	11084	

El	Wavelen.	Replicates Intensity (c/s)			
Ti	322.284	-7.8419	0.91858	2.3677	
Tl	190.794	-7.1161	-10.277	-11.570	
V	289.164	4.8185	-2.9454	3.5848	
Y	361.104	197666	197906	197426	
Zn	206.200	12.588	11.406	11.294	
Zr	257.147	164.00	160.78	162.02	

3A

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.003019u	ppm	0.000123	4.1	-124.41	-0.003019 ppm	Y 361.104	1.0000
Al	237.312	0.019719	ppm	0.005606	28.4	7.6306	0.019719 ppm	Y 361.104	1.0000
As	188.980	-0.000267u	ppm	0.003025	1132.8	-0.18766	-0.000267 ppm	Y 361.104	1.0000
B	249.772	0.50748	ppm	0.015493	3.1	6171.3	0.50748 ppm	Y 361.104	1.0000
Ba	233.527	0.31422	ppm	0.007052	2.2	12404	0.31422 ppm	Y 361.104	1.0000
Be	234.861	0.000121	ppm	0.000091	75.3	1.2184	0.000121 ppm	Y 361.104	1.0000
Ca	315.887	2066.7b	ppm	19.027	0.9	13425312	2066.7 ppm	Y 361.104	1.0000
Cd	228.802	-0.000075u	ppm	0.000306	408.0	0.11049	-0.000075 ppm	Y 361.104	1.0000
Co	231.160	-0.003533ub	ppm	0.000357	10.1	5.7446	-0.003533 ppm	Y 361.104	1.0000
Cr	267.716	-0.000768u	ppm	0.000133	17.3	10.738	-0.000768 ppm	Y 361.104	1.0000
Cu	324.754	0.019369	ppm	0.000428	2.2	846.15	0.019369 ppm	Y 361.104	1.0000
Fe	261.382	0.007701	ppm	0.000938	12.2	21.367	0.007701 ppm	Y 361.104	1.0000
K	728.181	271.33b	ppm	0.53347	0.2	425409	271.33 ppm	Y 361.104	1.0000
Li	610.365	-0.31596ub	ppm	0.011656	3.7	-44785	-0.31596 ppm	Y 361.104	1.0000
Mg	279.078	0.072067	ppm	0.004275	5.9	74.311	0.072067 ppm	Y 361.104	1.0000
Mn	293.305	0.001750	ppm	0.000250	14.3	36.443	0.001750 ppm	Y 361.104	1.0000
Mo	202.032	0.073205	ppm	0.001304	1.8	325.09	0.073205 ppm	Y 361.104	1.0000
Na	589.592	184.19o	ppm	0.45587	0.2	30222982	184.19 ppm	Y 361.104	1.0000
Na	568.821	373.52b	ppm	1.5703	0.4	118688	373.52 ppm	Y 361.104	1.0000
Ni	221.648	0.002009	ppm	0.000178	8.9	5.0444	0.002009 ppm	Y 361.104	1.0000
Pb	220.353	0.000712	ppm	0.000404	56.7	-2.0595	0.000712 ppm	Y 361.104	1.0000
Sb	217.582	0.035210	ppm	0.005237	14.9	17.656	0.035210 ppm	Y 361.104	1.0000
Se	196.026	30.246	ppm	0.62580	2.1	7585.8	30.246 ppm	Y 361.104	1.0000
Si	251.611	1.3009	ppm	0.012009	0.9	2891.3	1.3009 ppm	Y 361.104	1.0000
Sn	189.927	0.003921	ppm	0.002035	51.9	3.7722	0.003921 ppm	Y 361.104	1.0000
Sr	216.596	1.9656	ppm	0.027852	1.4	11010	1.9656 ppm	Y 361.104	1.0000
Ti	322.284	-0.011571u	ppm	0.000624	5.4	-1.5185	-0.011571 ppm	Y 361.104	1.0000
Tl	190.794	-0.019647u	ppm	0.005179	26.4	-9.6543	-0.019647 ppm	Y 361.104	1.0000
V	289.164	0.000246u	ppm	0.000542	220.4	1.8193	0.000246 ppm	Y 361.104	1.0000
Zn	206.200	0.015085	ppm	0.001008	6.7	11.763	0.015085 ppm	Y 361.104	1.0000
Zr	257.147	0.013020	ppm	0.000142	1.1	162.27	0.013020 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88425	197666	240.000	0.1

R. Roper 4A (Samp) **11/23/03, 4:40:36 PM** **Rack 2, Tube 7**

Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-114.81	-129.34	-126.93
Al	237.312	14.478	10.619	10.869
As	188.980	-2.7876	-5.1839	-1.4656
B	249.772	6351.8	6592.0	6607.2
Ba	233.527	11602	12029	12041
Be	234.861	0.98262	8.7447	7.3044
Ca	315.887	12993026	13299813	13364945
Cd	228.802	-2.1299	2.3114	-3.8451
Co	231.160	10.597	6.4538	2.6599
Cr	267.716	5.1239	9.9582	4.0538
Cu	324.754	834.33	847.34	831.85
Fe	261.382	18.503	20.577	19.300
K	728.181	419483	421993	423872
Li	610.365	-43000	-44256	-44557
Mg	279.078	92.427	100.96	102.72
Mn	293.305	38.508	33.300	29.858
Mo	202.032	352.12	350.04	353.22
Na	589.592	30821474	30753544	31035640
Na	568.821	137516	138600	138186
Ni	221.648	2.9126	2.8231	5.0706
Pb	220.353	-2.8197	-2.7729	-3.6242
Sb	217.582	21.991	23.044	16.275
Se	196.026	7470.0	7723.7	7740.8
Si	251.611	3182.7	3163.0	3102.0
Sn	189.927	3.1992	5.9820	4.4991
Sr	216.596	10918	11245	11187
Ti	322.284	4.3697	-4.1660	13.342
Tl	190.794	-6.2714	-9.1978	-10.287
V	289.164	6.0265	5.7137	2.8499
Y	361.104	198034	198109	196659
Zn	206.200	19.273	17.351	19.161
Zr	257.147	123.12	117.02	117.06

4A

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002984u	ppm	0.000213	7.1	-123.69	-0.002984 ppm	Y 361.104	1.0000
Al	237.312	0.027641	ppm	0.003884	14.1	11.989	0.027641 ppm	Y 361.104	1.0000
As	188.980	-0.009459u	ppm	0.005856	61.9	-3.1457	-0.009459 ppm	Y 361.104	1.0000
B	249.772	0.53611	ppm	0.011867	2.2	6517.0	0.53611 ppm	Y 361.104	1.0000
Ba	233.527	0.30112	ppm	0.006396	2.1	11891	0.30112 ppm	Y 361.104	1.0000
Be	234.861	0.000198	ppm	0.000071	35.9	5.6772	0.000198 ppm	Y 361.104	1.0000
Ca	315.887	2035.0b	ppm	30.575	1.5	13219261	2035.0 ppm	Y 361.104	1.0000
Cd	228.802	-0.000245u	ppm	0.000381	155.3	-1.2212	-0.000245 ppm	Y 361.104	1.0000
Co	231.160	-0.003372ub	ppm	0.000703	20.9	6.5701	-0.003372 ppm	Y 361.104	1.0000
Cr	267.716	-0.000897u	ppm	0.000093	10.4	6.3787	-0.000897 ppm	Y 361.104	1.0000
Cu	324.754	0.019152	ppm	0.000215	1.1	837.84	0.019152 ppm	Y 361.104	1.0000
Fe	261.382	0.006660	ppm	0.000571	8.6	19.460	0.006660 ppm	Y 361.104	1.0000
K	728.181	269.05b	ppm	1.3883	0.5	421782	269.05 ppm	Y 361.104	1.0000
Li	610.365	-0.30769ub	ppm	0.019151	6.2	-43938	-0.30769 ppm	Y 361.104	1.0000
Mg	279.078	0.096267	ppm	0.005463	5.7	98.704	0.096267 ppm	Y 361.104	1.0000
Mn	293.305	0.001578	ppm	0.000293	18.6	33.889	0.001578 ppm	Y 361.104	1.0000
Mo	202.032	0.079340	ppm	0.000370	0.5	351.79	0.079340 ppm	Y 361.104	1.0000
Na	589.592	188.11o	ppm	0.89150	0.5	30870218	188.11 ppm	Y 361.104	1.0000
Na	568.821	437.32b	ppm	1.7912	0.4	138101	437.32 ppm	Y 361.104	1.0000
Ni	221.648	0.000821	ppm	0.000856	104.3	3.6021	0.000821 ppm	Y 361.104	1.0000
Pb	220.353	0.000131u	ppm	0.000282	215.3	-3.0723	0.000131 ppm	Y 361.104	1.0000
Sb	217.582	0.039779	ppm	0.005992	15.1	20.436	0.039779 ppm	Y 361.104	1.0000
Se	196.026	30.481	ppm	0.60468	2.0	7644.9	30.481 ppm	Y 361.104	1.0000
Si	251.611	1.4179	ppm	0.019093	1.3	3149.3	1.4179 ppm	Y 361.104	1.0000
Sn	189.927	0.004992	ppm	0.001891	37.9	4.5601	0.004992 ppm	Y 361.104	1.0000
Sr	216.596	1.9846	ppm	0.031138	1.6	11116	1.9846 ppm	Y 361.104	1.0000
Ti	322.284	-0.010897u	ppm	0.000988	9.1	4.5152	-0.010897 ppm	Y 361.104	1.0000
Tl	190.794	-0.017220u	ppm	0.004694	27.3	-8.5855	-0.017220 ppm	Y 361.104	1.0000
V	289.164	0.000654	ppm	0.000228	34.8	4.8634	0.000654 ppm	Y 361.104	1.0000
Zn	206.200	0.024694	ppm	0.001517	6.1	18.595	0.024694 ppm	Y 361.104	1.0000
Zr	257.147	0.009238	ppm	0.000307	3.3	119.06	0.009238 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88396	197600	816.426	0.4

R. Roper 5A (Samp) **11/23/03, 4:43:50 PM** **Rack 2, Tube 8**
Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-121.84	-117.86	-133.34
Al	237.312	6.3907	6.9253	11.197
As	188.980	-3.8044	-2.6398	-1.2054
B	249.772	4959.9	5256.3	5266.3
Ba	233.527	11965	12258	12475
Be	234.861	-0.79125	2.7560	1.2244
Ca	315.887	13509821	13647572	13759035
Cd	228.802	-2.4884	-4.1728	-0.79532
Co	231.160	11.595	9.2357	13.502
Cr	267.716	8.3441	-6.3645	7.4060
Cu	324.754	863.34	838.21	846.16
Fe	261.382	15.241	11.877	11.155
K	728.181	418612	421309	420684
Li	610.365	-46553	-47545	-47494
Mg	279.078	57.664	69.338	71.031
Mn	293.305	37.444	29.401	29.181
Mo	202.032	274.01	269.91	275.10
Na	589.592	29784202	29424186	29187528
Na	568.821	102169	102864	103441
Ni	221.648	5.8582	4.7637	4.1514
Pb	220.353	-4.1519	-2.9351	-5.4939
Sb	217.582	20.717	20.696	15.255
Se	196.026	6641.0	6935.3	6980.1
Si	251.611	2644.1	2677.5	2652.6
Sn	189.927	4.8057	3.9530	5.5755
Sr	216.596	10828	11074	11095
Ti	322.284	-4.6937	-8.5373	-1.6723
Tl	190.794	-9.0473	-7.2284	-8.3546
V	289.164	-0.35368	0.65029	-9.9044
Y	361.104	197060	198388	199199
Zn	206.200	9.4945	5.2114	7.2661
Zr	257.147	113.57	112.78	107.27

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002999u	ppm	0.000219	7.3	-124.35	-0.002999 ppm	Y 361.104	1.0000
Al	237.312	0.020740	ppm	0.004738	22.8	8.1710	0.020740 ppm	Y 361.104	1.0000
As	188.980	-0.007601u	ppm	0.004045	53.2	-2.5499	-0.007601 ppm	Y 361.104	1.0000

5A

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
B	249.772	0.42378	ppm	0.014421	3.4	5160.8	0.42378 ppm	Y 361.104	1.0000
Ba	233.527	0.30986	ppm	0.006549	2.1	12233	0.30986 ppm	Y 361.104	1.0000
Be	234.861	0.000118	ppm	0.000031	26.0	1.0630	0.000118 ppm	Y 361.104	1.0000
Ca	315.887	2099.6b	ppm	19.218	0.9	13638809	2099.6 ppm	Y 361.104	1.0000
Cd	228.802	-0.000395u	ppm	0.000202	51.3	-2.4855	-0.000395 ppm	Y 361.104	1.0000
Co	231.160	-0.002580b	ppm	0.000379	14.7	11.444	-0.002580 ppm	Y 361.104	1.0000
Cr	267.716	-0.000993u	ppm	0.000243	24.5	3.1285	-0.000993 ppm	Y 361.104	1.0000
Cu	324.754	0.019451	ppm	0.000332	1.7	849.23	0.019451 ppm	Y 361.104	1.0000
Fe	261.382	0.002995	ppm	0.001189	39.7	12.758	0.002995 ppm	Y 361.104	1.0000
K	728.181	268.05b	ppm	0.88999	0.3	420201	268.05 ppm	Y 361.104	1.0000
Li	610.365	-0.36012ub	ppm	0.012944	3.6	-47197	-0.36012 ppm	Y 361.104	1.0000
Mg	279.078	0.063832	ppm	0.007220	11.3	66.011	0.063832 ppm	Y 361.104	1.0000
Mn	293.305	0.001452	ppm	0.000317	21.9	32.009	0.001452 ppm	Y 361.104	1.0000
Mo	202.032	0.061238	ppm	0.000628	1.0	273.01	0.061238 ppm	Y 361.104	1.0000
Na	589.592	179.60o	ppm	1.8193	1.0	29465306	179.60 ppm	Y 361.104	1.0000
Na	568.821	321.32b	ppm	2.0844	0.6	102825	321.32 ppm	Y 361.104	1.0000
Ni	221.648	0.002125	ppm	0.000582	27.4	4.9244	0.002125 ppm	Y 361.104	1.0000
Pb	220.353	-0.000576u	ppm	0.000754	130.7	-4.1936	-0.000576 ppm	Y 361.104	1.0000
Sb	217.582	0.037234	ppm	0.005177	13.9	18.889	0.037234 ppm	Y 361.104	1.0000
Se	196.026	27.320	ppm	0.73453	2.7	6852.1	27.320 ppm	Y 361.104	1.0000
Si	251.611	1.1952	ppm	0.007859	0.7	2658.0	1.1952 ppm	Y 361.104	1.0000
Sn	189.927	0.005289	ppm	0.001102	20.8	4.7781	0.005289 ppm	Y 361.104	1.0000
Sr	216.596	1.9637	ppm	0.026494	1.3	10999	1.9637 ppm	Y 361.104	1.0000
Ti	322.284	-0.011942u	ppm	0.000388	3.3	-4.9677	-0.011942 ppm	Y 361.104	1.0000
Tl	190.794	-0.016408u	ppm	0.002075	12.6	-8.2101	-0.016408 ppm	Y 361.104	1.0000
V	289.164	-0.000409u	ppm	0.000757	185.0	-3.2026	-0.000409 ppm	Y 361.104	1.0000
Zn	206.200	0.008846	ppm	0.003013	34.1	7.3240	0.008846 ppm	Y 361.104	1.0000
Zr	257.147	0.008550	ppm	0.000300	3.5	111.21	0.008550 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88671	198216	1080.244	0.5

R. Roper 1B (Samp) **11/23/03, 4:47:04 PM** **Rack 2, Tube 9**
Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-135.43	-123.83	-113.02
Al	237.312	2.5364	0.21600	8.3013
As	188.980	-3.0400	-0.41948	-0.91324
B	249.772	4679.3	4859.5	4896.1

11

El	Wavelen.	Replicates Intensity (c/s)		
Ba	233.527	14418	14696	14686
Be	234.861	-0.34241	2.9284	1.9873
Ca	315.887	14563511	14683667	14731041
Cd	228.802	3.1819	3.9373	-3.8980
Co	231.160	10.508	7.5039	5.8663
Cr	267.716	3.0339	8.4149	7.1255
Cu	324.754	867.53	906.73	904.03
Fe	261.382	3.0455	3.6646	0.31325
K	728.181	445234	445502	446746
Li	610.365	-51349	-52322	-52611
Mg	279.078	43.976	45.101	49.120
Mn	293.305	29.952	40.343	40.136
Mo	202.032	267.47	267.05	267.79
Na	589.592	30041918	29979410	29847492
Na	568.821	109341	109526	109307
Ni	221.648	5.0551	1.7953	1.0178
Pb	220.353	-0.78643	-1.4821	-7.8104
Sb	217.582	22.532	15.307	22.305
Se	196.026	7455.2	7668.7	7729.1
Si	251.611	1217.7	1256.3	1250.9
Sn	189.927	4.0320	5.2260	3.4940
Sr	216.596	10527	10709	10649
Ti	322.284	-5.7110	-19.219	-6.3072
Tl	190.794	-9.6656	-6.0814	-6.9768
V	289.164	2.0227	-9.9181	-1.1349
Y	361.104	196322	197080	196412
Zn	206.200	18.208	19.648	20.727
Zr	257.147	115.22	124.88	124.64

1B

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002995u	ppm	0.000306	10.2	-124.10	-0.002995 ppm	Y 361.104	1.0000
Al	237.312	0.012409	ppm	0.007489	60.3	3.6846	0.012409 ppm	Y 361.104	1.0000
As	188.980	-0.004211u	ppm	0.004326	102.7	-1.4576	-0.004211 ppm	Y 361.104	1.0000
B	249.772	0.39485	ppm	0.009616	2.4	4811.6	0.39485 ppm	Y 361.104	1.0000
Ba	233.527	0.37033	ppm	0.004030	1.1	14600	0.37033 ppm	Y 361.104	1.0000
Be	234.861	0.000125	ppm	0.000029	23.2	1.5244	0.000125 ppm	Y 361.104	1.0000
Ca	315.887	2256.7b	ppm	13.295	0.6	14659407	2256.7 ppm	Y 361.104	1.0000
Cd	228.802	0.000036u	ppm	0.000518	1442.4	1.0737	0.000036 ppm	Y 361.104	1.0000
Co	231.160	-0.003422ub	ppm	0.000417	12.2	7.9594	-0.003422 ppm	Y 361.104	1.0000

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Cr	267.716	-0.000903u	ppm	0.000083	9.2	6.1914	-0.000903 ppm	Y 361.104	1.0000
Cu	324.754	0.020577	ppm	0.000566	2.8	892.77	0.020577 ppm	Y 361.104	1.0000
Fe	261.382	-0.002684u	ppm	0.000973	36.2	2.3411	-0.002684 ppm	Y 361.104	1.0000
K	728.181	284.21b	ppm	0.50867	0.2	445827	284.21 ppm	Y 361.104	1.0000
Li	610.365	-0.41734ub	ppm	0.015328	3.7	-52094	-0.41734 ppm	Y 361.104	1.0000
Mg	279.078	0.044045	ppm	0.002683	6.1	46.066	0.044045 ppm	Y 361.104	1.0000
Mn	293.305	0.001775	ppm	0.000400	22.5	36.810	0.001775 ppm	Y 361.104	1.0000
Mo	202.032	0.059957	ppm	0.000085	0.1	267.43	0.059957 ppm	Y 361.104	1.0000
Na	589.592	182.57o	ppm	0.60101	0.3	29956272	182.57 ppm	Y 361.104	1.0000
Na	568.821	341.48b	ppm	0.38577	0.1	109391	341.48 ppm	Y 361.104	1.0000
Ni	221.648	0.001773	ppm	0.001441	81.3	2.6227	0.001773 ppm	Y 361.104	1.0000
Pb	220.353	-0.000086u	ppm	0.002279	2653.0	-3.3596	-0.000086 ppm	Y 361.104	1.0000
Sb	217.582	0.039140	ppm	0.006757	17.3	20.048	0.039140 ppm	Y 361.104	1.0000
Se	196.026	30.373	ppm	0.57382	1.9	7617.7	30.373 ppm	Y 361.104	1.0000
Si	251.611	0.55286	ppm	0.009466	1.7	1241.6	0.55286 ppm	Y 361.104	1.0000
Sn	189.927	0.004573	ppm	0.001204	26.3	4.2507	0.004573 ppm	Y 361.104	1.0000
Sr	216.596	1.8975	ppm	0.016570	0.9	10628	1.8975 ppm	Y 361.104	1.0000
Ti	322.284	-0.012555u	ppm	0.000862	6.9	-10.413	-0.012555 ppm	Y 361.104	1.0000
Tl	190.794	-0.014972u	ppm	0.004216	28.2	-7.5746	-0.014972 ppm	Y 361.104	1.0000
V	289.164	-0.000386u	ppm	0.000804	208.5	-3.0101	-0.000386 ppm	Y 361.104	1.0000
Zn	206.200	0.026014	ppm	0.001777	6.8	19.528	0.026014 ppm	Y 361.104	1.0000
Zr	257.147	0.009458	ppm	0.000482	5.1	121.58	0.009458 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.87951	196605	414.261	0.2

R. Roper 2B (Samp) **11/23/03, 4:50:18 PM** **Rack 2, Tube 10**

Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-109.68	-108.85	-119.79
Al	237.312	4.0652	7.6908	3.4759
As	188.980	-2.8819	-0.12546	1.1900
B	249.772	6430.9	6686.2	6745.1
Ba	233.527	14095	14478	14527
Be	234.861	3.5289	1.5365	5.2326
Ca	315.887	14262606	14605946	14607969
Cd	228.802	0.75284	2.4894	1.4656
Co	231.160	6.1236	14.665	7.4032
Cr	267.716	8.1743	1.8668	8.5752

12

El	Wavelen.	Replicates Intensity (c/s)		
Cu	324.754	873.95	883.54	888.77
Fe	261.382	5.5964	5.7141	-1.3046
K	728.181	444556	443891	443896
Li	610.365	-50736	-51556	-51602
Mg	279.078	31.361	34.974	42.337
Mn	293.305	36.660	39.868	31.886
Mo	202.032	285.51	292.03	287.22
Na	589.592	29861720	30014264	29845420
Na	568.821	116080	116710	116644
Ni	221.648	3.0340	-1.0493	0.87048
Pb	220.353	-4.4768	3.6222	-3.0778
Sb	217.582	23.283	24.438	24.860
Se	196.026	8648.3	9021.8	9085.7
Si	251.611	1313.8	1357.3	1345.2
Sn	189.927	5.7580	4.0192	5.3195
Sr	216.596	10136	10324	10341
Ti	322.284	5.1372	-0.18411	-1.2439
Tl	190.794	-9.5308	-9.6939	-11.941
V	289.164	-3.0545	-4.1556	-3.9876
Y	361.104	197127	197534	197899
Zn	206.200	7.9053	7.8878	10.736
Zr	257.147	102.96	124.12	119.82

2B

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002685u	ppm	0.000166	6.2	-112.78	-0.002685 ppm	Y 361.104	1.0000
Al	237.312	0.014940	ppm	0.004106	27.5	5.0773	0.014940 ppm	Y 361.104	1.0000
As	188.980	-0.001566u	ppm	0.006456	412.2	-0.60579	-0.001566 ppm	Y 361.104	1.0000
B	249.772	0.54471	ppm	0.013832	2.5	6620.7	0.54471 ppm	Y 361.104	1.0000
Ba	233.527	0.36437	ppm	0.006049	1.7	14367	0.36437 ppm	Y 361.104	1.0000
Be	234.861	0.000158	ppm	0.000032	20.2	3.4327	0.000158 ppm	Y 361.104	1.0000
Ca	315.887	2231.0b	ppm	30.606	1.4	14492173	2231.0 ppm	Y 361.104	1.0000
Cd	228.802	0.000098	ppm	0.000105	106.3	1.5693	0.000098 ppm	Y 361.104	1.0000
Co	231.160	-0.003176ub	ppm	0.000816	25.7	9.3974	-0.003176 ppm	Y 361.104	1.0000
Cr	267.716	-0.000902u	ppm	0.000111	12.3	6.2055	-0.000902 ppm	Y 361.104	1.0000
Cu	324.754	0.020300	ppm	0.000194	1.0	882.09	0.020300 ppm	Y 361.104	1.0000
Fe	261.382	-0.002132u	ppm	0.002192	102.8	3.3353	-0.002132 ppm	Y 361.104	1.0000
K	728.181	283.13b	ppm	0.24113	0.1	444114	283.13 ppm	Y 361.104	1.0000
Li	610.365	-0.40811ub	ppm	0.011302	2.8	-51298	-0.40811 ppm	Y 361.104	1.0000
Mg	279.078	0.034281	ppm	0.005549	16.2	36.224	0.034281 ppm	Y 361.104	1.0000

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Mn	293.305	0.001730	ppm	0.000271	15.6	36.138	0.001730 ppm	Y 361.104	1.0000
Mo	202.032	0.064741	ppm	0.000777	1.2	288.25	0.064741 ppm	Y 361.104	1.0000
Na	589.592	182.27o	ppm	0.56394	0.3	29907136	182.27 ppm	Y 361.104	1.0000
Na	568.821	364.89b	ppm	1.1331	0.3	116478	364.89 ppm	Y 361.104	1.0000
Ni	221.648	0.000567	ppm	0.001374	242.4	0.95172	0.000567 ppm	Y 361.104	1.0000
Pb	220.353	0.001131u	ppm	0.002549	225.3	-1.3108	0.001131 ppm	Y 361.104	1.0000
Sb	217.582	0.045960	ppm	0.001343	2.9	24.194	0.045960 ppm	Y 361.104	1.0000
Se	196.026	35.561	ppm	0.94206	2.6	8918.6	35.561 ppm	Y 361.104	1.0000
Si	251.611	0.59691	ppm	0.010196	1.7	1338.8	0.59691 ppm	Y 361.104	1.0000
Sn	189.927	0.005634	ppm	0.001228	21.8	5.0322	0.005634 ppm	Y 361.104	1.0000
Sr	216.596	1.8330	ppm	0.020301	1.1	10267	1.8330 ppm	Y 361.104	1.0000
Ti	322.284	-0.011247u	ppm	0.000386	3.4	1.2364	-0.011247 ppm	Y 361.104	1.0000
Tl	190.794	-0.021325u	ppm	0.003044	14.3	-10.388	-0.021325 ppm	Y 361.104	1.0000
V	289.164	-0.000475u	ppm	0.000077	16.2	-3.7326	-0.000475 ppm	Y 361.104	1.0000
Zn	206.200	0.010981	ppm	0.002307	21.0	8.8432	0.010981 ppm	Y 361.104	1.0000
Zr	257.147	0.008938	ppm	0.000979	11.0	115.63	0.008938 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88360	197520	386.465	0.2

R. Roper 3B (Samp) **11/23/03, 4:53:32 PM** **Rack 2, Tube 11**
Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-127.28	-130.10	-113.73
Al	237.312	7.7904	6.6284	9.1503
As	188.980	0.23036	-1.6451	-2.5554
B	249.772	5721.6	5783.0	5950.4
Ba	233.527	15796	15699	15968
Be	234.861	2.3224	9.9206	4.2653
Ca	315.887	14321969	14028771	14407564
Cd	228.802	-2.5735	-6.8859	-2.1534
Co	231.160	8.4382	13.539	6.0253
Cr	267.716	4.4253	4.4362	7.5012
Cu	324.754	896.82	889.72	880.00
Fe	261.382	4.8590	5.3604	3.9759
K	728.181	452700	441560	453527
Li	610.365	-49961	-49425	-51259
Mg	279.078	32.548	37.646	40.173
Mn	293.305	30.661	41.375	44.263

13.

El	Wavelen.	Replicates Intensity (c/s)		
Mo	202.032	285.23	277.23	286.28
Na	589.592	30575264	29769132	30245432
Na	568.821	128377	125366	128845
Ni	221.648	1.6851	3.3490	-0.32461
Pb	220.353	-1.8492	1.4646	-4.2580
Sb	217.582	15.362	28.717	11.716
Se	196.026	6264.1	6379.8	6617.9
Si	251.611	1230.9	1228.4	1271.1
Sn	189.927	4.6199	1.4992	5.8678
Sr	216.596	10842	10778	10913
Ti	322.284	-15.190	-14.687	-31.295
Tl	190.794	-10.138	-4.0356	-9.2960
V	289.164	-1.6242	-2.6776	0.29303
Y	361.104	196305	201313	197790
Zn	206.200	9.3408	11.324	9.3676
Zr	257.147	100.51	109.54	123.57

3B

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002981u	ppm	0.000239	8.0	-123.70	-0.002981 ppm	Y 361.104	1.0000
Al	237.312	0.019785	ppm	0.002271	11.5	7.8564	0.019785 ppm	Y 361.104	1.0000
As	188.980	-0.003798u	ppm	0.004413	116.2	-1.3234	-0.003798 ppm	Y 361.104	1.0000
B	249.772	0.47824	ppm	0.009806	2.1	5818.3	0.47824 ppm	Y 361.104	1.0000
Ba	233.527	0.40152	ppm	0.003476	0.9	15821	0.40152 ppm	Y 361.104	1.0000
Be	234.861	0.000193	ppm	0.000068	35.1	5.5028	0.000193 ppm	Y 361.104	1.0000
Ca	315.887	2194.1b	ppm	30.581	1.4	14252768	2194.1 ppm	Y 361.104	1.0000
Cd	228.802	-0.000556u	ppm	0.000314	56.4	-3.8709	-0.000556 ppm	Y 361.104	1.0000
Co	231.160	-0.003079ub	ppm	0.000680	22.1	9.3341	-0.003079 ppm	Y 361.104	1.0000
Cr	267.716	-0.000924u	ppm	0.000052	5.7	5.4543	-0.000924 ppm	Y 361.104	1.0000
Cu	324.754	0.020475	ppm	0.000219	1.1	888.85	0.020475 ppm	Y 361.104	1.0000
Fe	261.382	-0.001376u	ppm	0.000382	27.8	4.7317	-0.001376 ppm	Y 361.104	1.0000
K	728.181	286.37b	ppm	4.2137	1.5	449262	286.37 ppm	Y 361.104	1.0000
Li	610.365	-0.39621ub	ppm	0.021868	5.5	-50215	-0.39621 ppm	Y 361.104	1.0000
Mg	279.078	0.034841	ppm	0.003854	11.1	36.789	0.034841 ppm	Y 361.104	1.0000
Mn	293.305	0.001907	ppm	0.000483	25.3	38.766	0.001907 ppm	Y 361.104	1.0000
Mo	202.032	0.063514	ppm	0.001137	1.8	282.91	0.063514 ppm	Y 361.104	1.0000
Na	589.592	184.03o	ppm	2.4540	1.3	30196608	184.03 ppm	Y 361.104	1.0000
Na	568.821	401.37b	ppm	6.1784	1.5	127529	401.37 ppm	Y 361.104	1.0000
Ni	221.648	0.001063	ppm	0.001237	116.4	1.5698	0.001063 ppm	Y 361.104	1.0000
Pb	220.353	0.000988u	ppm	0.001692	171.2	-1.5475	0.000988 ppm	Y 361.104	1.0000

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Sb	217.582	0.036755	ppm	0.014724	40.1	18.598	0.036755 ppm	Y 361.104	1.0000
Se	196.026	25.599	ppm	0.71935	2.8	6420.6	25.599 ppm	Y 361.104	1.0000
Si	251.611	0.55369	ppm	0.010883	2.0	1243.5	0.55369 ppm	Y 361.104	1.0000
Sn	189.927	0.004227	ppm	0.003056	72.3	3.9956	0.004227 ppm	Y 361.104	1.0000
Sr	216.596	1.9360	ppm	0.011975	0.6	10844	1.9360 ppm	Y 361.104	1.0000
Ti	322.284	-0.013686u	ppm	0.001066	7.8	-20.391	-0.013686 ppm	Y 361.104	1.0000
Tl	190.794	-0.015525u	ppm	0.007474	48.1	-7.8232	-0.015525 ppm	Y 361.104	1.0000
V	289.164	-0.000164u	ppm	0.000196	119.5	-1.3362	-0.000164 ppm	Y 361.104	1.0000
Zn	206.200	0.012624	ppm	0.001600	12.7	10.011	0.012624 ppm	Y 361.104	1.0000
Zr	257.147	0.008549	ppm	0.001017	11.9	111.21	0.008549 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88785	198469	2572.295	1.3

R. Roper 4B (Samp) **11/23/03, 4:56:46 PM** **Rack 2, Tube 12**

Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-108.16	-106.70	-115.87
Al	237.312	9.8013	5.9163	6.6911
As	188.980	-1.4202	-0.52684	0.12216
B	249.772	4431.2	4644.9	4694.0
Ba	233.527	15014	15371	15508
Be	234.861	2.6761	4.7860	4.1862
Ca	315.887	13848566	13965241	14117311
Cd	228.802	1.6922	-1.6112	-2.4633
Co	231.160	5.3971	11.678	6.0659
Cr	267.716	1.9417	7.8583	6.3567
Cu	324.754	861.69	871.88	865.20
Fe	261.382	3.1069	2.9502	8.1686
K	728.181	459204	459875	458028
Li	610.365	-48090	-48578	-48556
Mg	279.078	32.905	39.510	44.066
Mn	293.305	28.977	40.852	49.591
Mo	202.032	322.03	325.45	329.15
Na	589.592	31063194	31338716	31757780
Na	568.821	152572	153607	152819
Ni	221.648	5.4052	4.7275	5.0804
Pb	220.353	1.1048	-5.3060	-4.5827
Sb	217.582	19.922	19.822	18.275

El	Wavelen.	Replicates Intensity (c/s)		
Se	196.026	6496.3	6792.3	6830.7
Si	251.611	1648.2	1700.7	1714.3
Sn	189.927	5.0775	3.9821	4.1870
Sr	216.596	10253	10488	10534
Ti	322.284	9.2966	-6.7300	-9.9502
Tl	190.794	-9.8926	-6.4522	-11.456
V	289.164	0.56628	9.2165	-7.7648
Y	361.104	196504	197706	197198
Zn	206.200	15.784	14.748	16.528
Zr	257.147	83.681	99.255	94.170

4B

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002608u	ppm	0.000134	5.2	-110.24	-0.002608 ppm	Y 361.104	1.0000
Al	237.312	0.019157	ppm	0.003699	19.3	7.4696	0.019157 ppm	Y 361.104	1.0000
As	188.980	-0.001579u	ppm	0.002406	152.3	-0.60829	-0.001579 ppm	Y 361.104	1.0000
B	249.772	0.37650	ppm	0.011577	3.1	4590.0	0.37650 ppm	Y 361.104	1.0000
Ba	233.527	0.38816	ppm	0.006513	1.7	15298	0.38816 ppm	Y 361.104	1.0000
Be	234.861	0.000165	ppm	0.000019	11.3	3.8828	0.000165 ppm	Y 361.104	1.0000
Ca	315.887	2151.7b	ppm	20.746	1.0	13977040	2151.7 ppm	Y 361.104	1.0000
Cd	228.802	-0.000185u	ppm	0.000263	142.2	-0.79408	-0.000185 ppm	Y 361.104	1.0000
Co	231.160	-0.003317ub	ppm	0.000611	18.4	7.7136	-0.003317 ppm	Y 361.104	1.0000
Cr	267.716	-0.000926u	ppm	0.000091	9.8	5.3855	-0.000926 ppm	Y 361.104	1.0000
Cu	324.754	0.019888	ppm	0.000134	0.7	866.26	0.019888 ppm	Y 361.104	1.0000
Fe	261.382	-0.001370u	ppm	0.001619	118.2	4.7419	-0.001370 ppm	Y 361.104	1.0000
K	728.181	292.54b	ppm	0.58954	0.2	459036	292.54 ppm	Y 361.104	1.0000
Li	610.365	-0.36953ub	ppm	0.006387	1.7	-48408	-0.36953 ppm	Y 361.104	1.0000
Mg	279.078	0.036864	ppm	0.005567	15.1	38.827	0.036864 ppm	Y 361.104	1.0000
Mn	293.305	0.001977	ppm	0.000697	35.3	39.807	0.001977 ppm	Y 361.104	1.0000
Mo	202.032	0.073309	ppm	0.000817	1.1	325.54	0.073309 ppm	Y 361.104	1.0000
Na	589.592	191.23o	ppm	2.1178	1.1	31386562	191.23 ppm	Y 361.104	1.0000
Na	568.821	485.10b	ppm	1.7693	0.4	152999	485.10 ppm	Y 361.104	1.0000
Ni	221.648	0.003043	ppm	0.000228	7.5	5.0711	0.003043 ppm	Y 361.104	1.0000
Pb	220.353	0.000201u	ppm	0.002067	1026.4	-2.9280	0.000201 ppm	Y 361.104	1.0000
Sb	217.582	0.037975	ppm	0.001519	4.0	19.340	0.037975 ppm	Y 361.104	1.0000
Se	196.026	26.739	ppm	0.72977	2.7	6706.4	26.739 ppm	Y 361.104	1.0000
Si	251.611	0.75514	ppm	0.015834	2.1	1687.7	0.75514 ppm	Y 361.104	1.0000
Sn	189.927	0.004797	ppm	0.000791	16.5	4.4155	0.004797 ppm	Y 361.104	1.0000
Sr	216.596	1.8611	ppm	0.026888	1.4	10425	1.8611 ppm	Y 361.104	1.0000
Ti	322.284	-0.011675u	ppm	0.001164	10.0	-2.4612	-0.011675 ppm	Y 361.104	1.0000

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Tl	190.794	-0.018771u	ppm	0.005786	30.8	-9.2669	-0.018771 ppm	Y 361.104	1.0000
V	289.164	0.000109u	ppm	0.001104	1015.6	0.67266	0.000109 ppm	Y 361.104	1.0000
Zn	206.200	0.020605	ppm	0.001257	6.1	15.687	0.020605 ppm	Y 361.104	1.0000
Zr	257.147	0.006902	ppm	0.000695	10.1	92.368	0.006902 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88188	197136	603.693	0.3

R. Roper 5B (Samp) **11/23/03, 5:00:01 PM** **Rack 2, Tube 13**

Weight: 1 Volume: 1 Dilution: 1

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-121.56	-122.36	-121.48
Al	237.312	6.6393	3.3604	5.5155
As	188.980	-1.4065	-1.2779	-0.85667
B	249.772	7743.9	7990.6	8103.6
Ba	233.527	14554	14734	14805
Be	234.861	-0.74362	-0.92591	4.6254
Ca	315.887	14222023	14419442	14512643
Cd	228.802	2.3772	2.5162	-1.7635
Co	231.160	0.83662	4.6535	11.327
Cr	267.716	5.3914	-1.6315	10.588
Cu	324.754	870.75	892.91	878.99
Fe	261.382	5.9501	13.368	-1.9418
K	728.181	451869	454230	454453
Li	610.365	-50812	-51744	-52227
Mg	279.078	30.091	35.074	36.864
Mn	293.305	38.074	49.848	29.178
Mo	202.032	272.35	276.19	275.29
Na	589.592	29898244	29981398	29745938
Na	568.821	117146	117981	118435
Ni	221.648	4.7165	4.6246	5.3837
Pb	220.353	-1.3604	-1.1626	-2.4988
Sb	217.582	13.151	19.200	22.393
Se	196.026	6865.7	7200.1	7294.0
Si	251.611	1187.4	1154.7	1177.6
Sn	189.927	5.3875	6.3180	4.8257
Sr	216.596	10231	10314	10335
Ti	322.284	-3.1706	-10.366	-6.0986
Tl	190.794	-6.1531	-11.089	-7.8153

El	Wavelen.	Replicates Intensity (c/s)		
V	289.164	0.83754	-3.5940	1.7700
Y	361.104	198353	198681	198732
Zn	206.200	11.288	7.7677	11.165
Zr	257.147	85.142	92.295	94.316

5B

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	DF
Ag	328.068	-0.002922u	ppm	0.000013	0.5	-121.80	-0.002922 ppm	Y 361.104	1.0000
Al	237.312	0.015092	ppm	0.002997	19.9	5.1717	0.015092 ppm	Y 361.104	1.0000
As	188.980	-0.003351u	ppm	0.000894	26.7	-1.1804	-0.003351 ppm	Y 361.104	1.0000
B	249.772	0.65449	ppm	0.015237	2.3	7946.0	0.65449 ppm	Y 361.104	1.0000
Ba	233.527	0.37282	ppm	0.003302	0.9	14698	0.37282 ppm	Y 361.104	1.0000
Be	234.861	0.000116	ppm	0.000054	46.8	0.98527	0.000116 ppm	Y 361.104	1.0000
Ca	315.887	2214.4b	ppm	22.844	1.0	14384703	2214.4 ppm	Y 361.104	1.0000
Cd	228.802	0.000033u	ppm	0.000291	877.3	1.0433	0.000033 ppm	Y 361.104	1.0000
Co	231.160	-0.003764ub	ppm	0.000941	25.0	5.6057	-0.003764 ppm	Y 361.104	1.0000
Cr	267.716	-0.000944u	ppm	0.000181	19.2	4.7825	-0.000944 ppm	Y 361.104	1.0000
Cu	324.754	0.020269	ppm	0.000290	1.4	880.88	0.020269 ppm	Y 361.104	1.0000
Fe	261.382	-0.000795u	ppm	0.004176	525.1	5.7921	-0.000795 ppm	Y 361.104	1.0000
K	728.181	289.06b	ppm	0.90258	0.3	453517	289.06 ppm	Y 361.104	1.0000
Li	610.365	-0.42091ub	ppm	0.016683	4.0	-51594	-0.42091 ppm	Y 361.104	1.0000
Mg	279.078	0.032084	ppm	0.003482	10.9	34.010	0.032084 ppm	Y 361.104	1.0000
Mn	293.305	0.001925	ppm	0.000699	36.3	39.033	0.001925 ppm	Y 361.104	1.0000
Mo	202.032	0.061606	ppm	0.000462	0.7	274.61	0.061606 ppm	Y 361.104	1.0000
Na	589.592	182.08o	ppm	0.72305	0.4	29875194	182.08 ppm	Y 361.104	1.0000
Na	568.821	369.54b	ppm	2.1398	0.6	117854	369.54 ppm	Y 361.104	1.0000
Ni	221.648	0.003367	ppm	0.000279	8.3	4.9083	0.003367 ppm	Y 361.104	1.0000
Pb	220.353	0.000909	ppm	0.000425	46.7	-1.6740	0.000909 ppm	Y 361.104	1.0000
Sb	217.582	0.036182	ppm	0.007722	21.3	18.248	0.036182 ppm	Y 361.104	1.0000
Se	196.026	28.388	ppm	0.89773	3.2	7120.0	28.388 ppm	Y 361.104	1.0000
Si	251.611	0.52186	ppm	0.007610	1.5	1173.3	0.52186 ppm	Y 361.104	1.0000
Sn	189.927	0.006285	ppm	0.001024	16.3	5.5104	0.006285 ppm	Y 361.104	1.0000
Sr	216.596	1.8376	ppm	0.009797	0.5	10293	1.8376 ppm	Y 361.104	1.0000
Ti	322.284	-0.012120u	ppm	0.000408	3.4	-6.5451	-0.012120 ppm	Y 361.104	1.0000
Tl	190.794	-0.016727u	ppm	0.005676	33.9	-8.3525	-0.016727 ppm	Y 361.104	1.0000
V	289.164	-0.000031u	ppm	0.000373	1213.0	-0.32880	-0.000031 ppm	Y 361.104	1.0000
Zn	206.200	0.012714	ppm	0.002811	22.1	10.074	0.012714 ppm	Y 361.104	1.0000
Zr	257.147	0.006744	ppm	0.000422	6.3	90.584	0.006744 ppm	Y 361.104	1.0000

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.88838	198589	205.368	0.1

CCV (CCV) **11/23/03, 5:03:15 PM** **Rack 2, Tube 14**

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	35823	36248	36172
Al	237.312	2682.8	2764.8	2758.7
As	188.980	1582.1	1609.0	1612.2
B	249.772	23917	24541	24477
Ba	233.527	186358	190623	191062
Be	234.861	289295	295823	296737
Ca	315.887	314812	321429	321501
Cd	228.802	40535	41568	41426
Co	231.160	26647	27252	27336
Cr	267.716	161291	165845	166472
Cu	324.754	189160	194137	194331
Fe	261.382	8643.0	8864.8	8892.0
K	728.181	79951	80994	80948
Li	610.365	211062	214791	214946
Mg	279.078	46884	48007	48135
Mn	293.305	70392	72097	72389
Mo	202.032	4149.3	4276.2	4310.0
Na	589.592	8132508	8262688	8246909
Na	568.821	13651	13829	13862
Ni	221.648	7076.7	7250.5	7185.1
Pb	220.353	7916.9	8084.0	8120.2
Sb	217.582	605.85	616.47	605.85
Se	196.026	1243.1	1254.9	1266.7
Si	251.611	11598	11923	12071
Sn	189.927	3425.3	3560.6	3562.2
Sr	216.596	26094	26849	27365
Ti	322.284	42642	43668	43804
Tl	190.794	2030.1	2108.7	2126.3
V	289.164	37028	37981	38076
Y	361.104	218310	218019	218881
Zn	206.200	3206.8	3274.9	3301.0
Zr	257.147	55290	56708	56915

16

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
Ag	328.068	0.97023	ppm	0.006186	0.6	36081	0.97023 ppm	Y 361.104	97.02256
Al	237.312	4.8845	ppm	0.082137	1.7	2735.4	4.8845 ppm	Y 361.104	97.69037
As	188.980	4.9731	ppm	0.051438	1.0	1601.1	4.9731 ppm	Y 361.104	99.46204
B	249.772	2.0130	ppm	0.028442	1.4	24312	2.0130 ppm	Y 361.104	100.65072
Ba	233.527	4.8335	ppm	0.066370	1.4	189347	4.8335 ppm	Y 361.104	96.66956
Be	234.861	5.0549	ppm	0.069786	1.4	293952	5.0549 ppm	Y 361.104	101.09761
Ca	315.887	49.147	ppm	0.59139	1.2	319247	49.147 ppm	Y 361.104	98.29487
Cd	228.802	4.9379	ppm	0.067093	1.4	41176	4.9379 ppm	Y 361.104	98.75779
Co	231.160	4.8016	ppm	0.066666	1.4	27078	4.8016 ppm	Y 361.104	96.03281
Cr	267.716	4.8580	ppm	0.083515	1.7	164536	4.8580 ppm	Y 361.104	97.15942
Cu	324.754	4.9823	ppm	0.075829	1.5	192543	4.9823 ppm	Y 361.104	99.64690
Fe	261.382	4.8290	ppm	0.074482	1.5	8799.9	4.8290 ppm	Y 361.104	96.58077
K	728.181	53.252	ppm	0.38314	0.7	80631	53.252 ppm	Y 361.104	106.50467
Li	610.365	4.9522	ppm	0.050990	1.0	213600	4.9522 ppm	Y 361.104	99.04362
Mg	279.078	47.297	ppm	0.68283	1.4	47676	47.297 ppm	Y 361.104	94.59377
Mn	293.305	4.8260	ppm	0.072697	1.5	71626	4.8260 ppm	Y 361.104	96.51912
Mo	202.032	0.97392	ppm	0.019474	2.0	4245.1	0.97392 ppm	Y 361.104	97.39198
Na	589.592	50.600	ppm	0.43530	0.9	8214035	50.600 ppm	Y 361.104	101.19933
Ni	221.648	4.8177	ppm	0.059067	1.2	7170.8	4.8177 ppm	Y 361.104	96.35484
Pb	220.353	4.7378	ppm	0.063864	1.3	8040.4	4.7378 ppm	Y 361.104	94.75651
Sb	217.582	1.0166	ppm	0.010083	1.0	609.39	1.0166 ppm	Y 361.104	101.65981
Se	196.026	5.0002	ppm	0.047142	0.9	1254.9	5.0002 ppm	Y 361.104	100.00385
Si	251.611	5.3699	ppm	0.10972	2.0	11864	5.3699 ppm	Y 361.104	107.39806
Sn	189.927	4.7717	ppm	0.10674	2.2	3516.0	4.7717 ppm	Y 361.104	95.43367
Sr	216.596	4.7769	ppm	0.11416	2.4	26770	4.7769 ppm	Y 361.104	95.53879
Ti	322.284	4.8825	ppm	0.071706	1.5	43371	4.8825 ppm	Y 361.104	97.65016
Tl	190.794	4.6864	ppm	0.11579	2.5	2088.3	4.6864 ppm	Y 361.104	93.72845
V	289.164	4.9199	ppm	0.075388	1.5	37695	4.9199 ppm	Y 361.104	98.39855
Zn	206.200	4.5740	ppm	0.068451	1.5	3260.9	4.5740 ppm	Y 361.104	91.47958
Zr	257.147	4.9302	ppm	0.077428	1.6	56305	4.9302 ppm	Y 361.104	98.60396

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	0.97702	218403	438.690	0.2

BLA01 (CCB) **11/23/03, 5:06:30 PM** **Rack 2, Tube 15**

El	Wavelen.	Replicates Intensity (c/s)		
Ag	328.068	-1.4741	-0.63842	-14.365
Al	237.312	-2.5229	-2.8953	-0.71399
As	188.980	1.3710	0.30170	-0.11112

El	Wavelen.	Replicates Intensity (c/s)		
B	249.772	447.14	417.62	395.59
Ba	233.527	110.11	107.26	107.22
Be	234.861	12.251	2.7948	-0.89684
Ca	315.887	1568.5	1503.1	1263.6
Cd	228.802	3.9261	0.58887	-0.86853
Co	231.160	12.285	11.134	11.447
Cr	267.716	138.37	122.57	128.03
Cu	324.754	101.40	116.58	103.23
Fe	261.382	6.9526	5.8530	6.9823
K	728.181	111.41	107.93	107.33
Li	610.365	749.86	762.02	743.53
Mg	279.078	6.0598	0.81807	1.1691
Mn	293.305	9.6231	5.1972	2.4031
Mo	202.032	29.464	28.845	18.434
Na	589.592	1710.1	1447.4	1351.4
Na	568.821	-353.44	-402.03	-396.35
Ni	221.648	-1.4591	-1.8012	-2.5056
Pb	220.353	-2.5004	-4.3806	-4.0151
Sb	217.582	-3.1671	0.074985	-4.4523
Se	196.026	19.191	19.832	17.154
Si	251.611	94.661	94.985	89.317
Sn	189.927	-0.26705	1.7031	-0.052045
Sr	216.596	3.0293	-0.64990	2.5726
Ti	322.284	111.95	108.64	107.62
Tl	190.794	11.986	9.4934	7.4890
V	289.164	1.8533	4.2085	6.2649
Y	361.104	226979	227854	227631
Zn	206.200	1.4269	0.98085	1.0339
Zr	257.147	83.874	66.658	53.809

El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
Ag	328.068	0.000262	ppm	0.000210	80.3	-5.4925	0.000262 ppm	Y 361.104	0.00026
Al	237.312	0.003706	ppm	0.002099	56.6	-2.0441	0.003706 ppm	Y 361.104	0.00371
As	188.980	0.001985	ppm	0.002376	119.7	0.52052	0.001985 ppm	Y 361.104	0.00198
B	249.772	0.031091	ppm	0.002142	6.9	420.12	0.031091 ppm	Y 361.104	0.03109
Ba	233.527	0.000138	ppm	0.000042	30.6	108.20	0.000138 ppm	Y 361.104	0.00014
Be	234.861	0.000180	ppm	0.000117	64.8	4.7162	0.000180 ppm	Y 361.104	0.00018
Ca	315.887	0.20337	ppm	0.024712	12.2	1445.1	0.20337 ppm	Y 361.104	0.20337Z
Cd	228.802	0.000060u	ppm	0.000294	490.3	1.2155	0.000060 ppm	Y 361.104	0.00006

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El	Wavelen.	Sol'n Conc.	Units	SD	%RSD	Int. (c/s)	Calc Conc.	IS	QC Value
Co	231.160	0.000524	ppm	0.000105	20.1	11.622	0.000524 ppm	Y 361.104	0.00052
Cr	267.716	0.002743	ppm	0.000237	8.6	129.66	0.002743 ppm	Y 361.104	0.00274
Cu	324.754	0.000264	ppm	0.000214	81.2	107.07	0.000264 ppm	Y 361.104	0.00026
Fe	261.382	-0.000353u	ppm	0.000351	99.4	6.5960	-0.000353 ppm	Y 361.104	-0.00035
K	728.181	-0.006325u	ppm	0.001487	23.5	108.89	-0.006325 ppm	Y 361.104	-0.00632
Li	610.365	-0.000885u	ppm	0.000218	24.6	751.80	-0.000885 ppm	Y 361.104	-0.00088
Mg	279.078	0.001005u	ppm	0.002907	289.2	2.6823	0.001005 ppm	Y 361.104	0.00101
Mn	293.305	-0.000318u	ppm	0.000245	77.1	5.7411	-0.000318 ppm	Y 361.104	-0.00032
Mo	202.032	0.004386	ppm	0.001424	32.5	25.581	0.004386 ppm	Y 361.104	0.00439
Na	589.592	0.003274	ppm	0.001152	35.2	1503.0	0.003274 ppm	Y 361.104	0.00327
Ni	221.648	-0.000317u	ppm	0.000359	113.3	-1.9220	-0.000317 ppm	Y 361.104	-0.00032
Pb	220.353	-0.000392u	ppm	0.000587	149.9	-3.6320	-0.000392 ppm	Y 361.104	-0.00039
Sb	217.582	0.002022u	ppm	0.003838	189.8	-2.5148	0.002022 ppm	Y 361.104	0.00202
Se	196.026	0.070762	ppm	0.005575	7.9	18.726	0.070762 ppm	Y 361.104	0.07076Z
Si	251.611	0.031997	ppm	0.001443	4.5	92.988	0.031997 ppm	Y 361.104	0.03200
Sn	189.927	-0.000576u	ppm	0.001468	254.8	0.46135	-0.000576 ppm	Y 361.104	-0.00058
Sr	216.596	0.000585	ppm	0.000358	61.2	1.6507	0.000585 ppm	Y 361.104	0.00058
Ti	322.284	0.001046	ppm	0.000256	24.5	109.40	0.001046 ppm	Y 361.104	0.00105
Tl	190.794	0.023828	ppm	0.005092	21.4	9.6563	0.023828 ppm	Y 361.104	0.02383Z
V	289.164	0.000510	ppm	0.000287	56.3	4.1089	0.000510 ppm	Y 361.104	0.00051
Zn	206.200	0.000173u	ppm	0.000343	197.9	1.1472	0.000173 ppm	Y 361.104	0.00017
Zr	257.147	0.004791	ppm	0.001321	27.6	68.114	0.004791 ppm	Y 361.104	0.00479

El	Wavelen.	Ratio	Int. (c/s)	SD(Int)	%RSD
Y	361.104	1.0177	227488	454.419	0.2

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