Tennessee Valley Authority
Cumberland Fossil Plant
Dry Ash and Gypsum Disposal Areas (IDL 81-102-0086)

GROUNDWATER ASSESSMENT MONITORING REPORT JULY 2015

Prepared by

Anna B. Fisher, P.E.

Chattanooga, Tennessee

August 17, 2015

DOCUMENT CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information.

Print Name:_____ Signature:_____ Date:_____

Cumberland Fossil Plant Manager

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INTRODUCTION

This report contains quarterly *Groundwater Assessment Monitoring* results for samples collected July 20-21, 2015, from the six designated monitoring stations associated with the Class II Dry Ash and Gypsum Disposal Areas at Cumberland Fossil Plant (CUF) under landfill permit number IDL 81-102-0086. Water samples were analyzed by ESC Lab Sciences in Mount Juliet, TN (ESC) for all constituents. Sample collection and statistical evaluation of monitoring data were performed by TVA staff in accordance with Tennessee Department of Environment and Conservation (TDEC) Rule 0400-11-01-.04 (7) and the current facility Groundwater Detection Monitoring Program Plan approved by TDEC via letter from Alan Spear dated March 10, 2010.

GROUNDWATER SAMPLING

Unfiltered water samples were collected by M.W. Starks (TVA) from downgradient monitoring wells 93-1, 93-2R, 93-3 and 93-4 and from off-site background sampling stations at Rye Spring (CUF-RS) and Wells Creek (CUF-WCUP). A map showing monitoring well locations is presented on Figure 1. Purging/sampling methods used at each well were largely dictated by well yield characteristics, e.g., well 93-2R is a moderately productive well and can be sampled using a conventional submersible pump; whereas, wells 93-1 and 93-4 are poor producers and must be purged dry and allowed to recover prior to sample collection with disposable bailers. Yield of well 93-3 is typically low but was sufficient to allow using a bladder pump for this event. Grab samples were obtained from CUF-RS and CUF-WCUP. Field quality control (QC) duplicate samples were collected from well 93-3. Equipment rinsate blanks and matrix spikes were collected before sampling well 93-2R. Field parameters (i.e., temperature, specific conductance, pH, dissolved oxygen, oxidation-reduction potential, and turbidity) were monitored during well purging using a flow-through cell and calibrated instruments. Each well was considered properly evacuated when field parameters remained stable after purging a minimum of two well volumes or the well was purged to dryness. Filtered samples were also collected at well 93-1 and at Rye Spring due to high turbidity readings and in order to assess dissolved metals concentrations which may be more representative of groundwater quality under turbid well conditions. Field data sheets are included in Appendix A.

Immediately following collection, samples were transferred to new sample bottles provided by the laboratory with appropriate preservatives, where applicable. Samples were then sealed, labeled, recorded on the custody form, and placed in an iced cooler for transport. Samples were received by ESC laboratory on July 23, 2015 and copies of the sample custody records are provided in Appendix B.

ANALYTICAL RESULTS

The July 20-21, 2015 water samples were analyzed for the 0400-11-01-.04 (7) Appendix I inorganic constituents. As indicated in our first quarterly *Groundwater Assessment Monitoring* report (dated May 20, 2009), laboratory analysis of the April 2009 groundwater samples for the complete 0400-11-01-.04 (7) Appendix II parameter list indicated no detections of any of the Appendix II organic constituents in any sample. Furthermore, no new inorganic constituents beyond those listed in Appendix I (0400-11-01-.04(7)) were detected. In accordance with *the current facility Groundwater Detection Monitoring Program Plan approved by TDEC via letter from Alan Spear dated March 10, 2010, events have been limited to Appendix I* inorganic constituents.

Appendix B also presents ESC's laboratory reports including complete analytical results, laboratory methods, detection limits and result qualifiers (where applicable) for each water sample. Analysis of all samples was completed by approved EPA methods per EPA Publication SW-846 as appropriate to obtain the laboratory reporting limits at the lowest PQL that can be reliably achieved within specified limits of precision and accuracy. All analytical testing was conducted within recommended sample holding times. The equipment rinsate blank showed no detectable levels of most Appendix I constituents, though small amounts of chromium were detected. Chromium was not detected in the groundwater well samples.

EVALUATION OF ASSESSMENT MONITORING DATA

GWPSs used in evaluating compliance monitoring data are based on constituent MCLs listed in Appendix III of Rule 0400-11-01-.04 (7), where available. The July 20-21, 2015 groundwater monitoring results are summarized in Table 1. No GWPS exceedance was indicated for the July 2015 sampling event. Time-series graphs of monitoring data collected since January

TABLE 1. July 20-21, 2014 Groundwater Assessment Monitoring Results

Constituent	Units	CUF-93-1	CUF-93-2R	CUF-93-3	CUF-93-4	CUF-RS	CUF-WCUP	GWPS based on TDEC MCL
Antimony, total	ug/L	<2	<2	<2	<2	<2	<2	6
Arsenic, total	ug/L	<2	<2	<2	<2	<2	<2	10
Barium, total	ug/L	193	42.7	158	52.5	38.3	32.9	2,000
Beryllium, total	ug/L	<2	<2	<2	<2	<2	<2	4
Cadmium, total	ug/L	<1	1.52	<1	<1	<1	<1	5
Chromium, total	ug/L	<2	<2	<2	<2	<2	<2	100
Cobalt, total	ug/L	<2	2.02	<2	<2	<2	<2	N/A
Copper, total	ug/L	<5	<5	<5	<5	<5	<5	N/A
Fluoride, total	mg/L	<0.1	<0.1	0.400	<0.1	0.256	<0.1	4
Lead, total	ug/L	<2	<2	<2	<2	<2	<2	15
Mercury, total	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2
Nickel, total	ug/L	3.24	5.32	<2	2.51	<2	<2	100
Selenium, total	ug/L	<2	<2	<2	<2	<2	<2	50
Silver, total	ug/L	<2	<2	<2	<2	<2	<2	100
Thallium, total	ug/L	<2	<2	<2	<2	<2	<2	2
Vanadium, total	ug/L	<5	<5	<5	<5	<5	<5	N/A
Zinc, total	ug/L	<25	<25	<25	<25	<25	<25	N/A
Turbidity, field	NTU	33.9	5.2	3.6	5.1	8.7	1.9	

N/A - Not Applicable, as no TDEC MCLs exist for cobalt, copper, vanadium, or zinc.

2000 are presented in Appendix C. Field turbidity measurements are included as qualitative indicators of potential sampling bias.

Dissolved metals were also collected at the sampling points that exhibited a turbidity higher than 5 ntu. Suspended solids in groundwater samples often consist of particles of geologic material containing naturally-occurring metals, some of which may be the same as Appendix I inorganic constituents. Consequently, the measured total suspended solids (TSS) content of water samples is one factor considered in screening data outliers. The filtered samples can sometimes provide a more accurate representation of groundwater at the site, without sediment or colloidal particle interference. Regional soils are known to contain naturally-occurring arsenic, and could potentially be a source for other metals.

Accordingly, as can be seen in the time-series graphs in Appendix C, historic sporadic concentrations for some constituents over time may also be due to analytical interferences and/or bias produced by suspended solids containing naturally-occurring metals in unfiltered groundwater samples. Even through the sporadic data, arsenic and nickel appear to be stabilizing or even declining over the past few years. The stabilizing trends may be influenced by changes in hydraulic loading as a result of modified ash and gypsum management operations since 2010 timeframe. Removing ponding water and lining the gypsum management channels decreased infiltration through the waste disposal areas.

GROUNDWATER CONDITIONS

Groundwater and surface water level measurements on July 20, 2015 prior to sample collection are given in Table 2. The groundwater potentiometric surface derived from these measurements is presented on Figure 1. Westward and southwestward flow of groundwater beneath the Dry Fly Ash and Gypsum Disposal Areas toward Wells Creek is indicated by the potentiometric contours with an average horizontal hydraulic gradient of approximately 0.0046. The estimated groundwater gradient may not be representative of overall gradients in the disposal site vicinity because potentiometric level data are spatially limited and the influence of impoundments (e.g., the Ash Pond) on shallow groundwater levels cannot be adequately represented with existing monitoring wells.

TABLE 2. July 20, 2015 Water Level Measurements

Sampling Point	Reference Elevation (feet)	Depth to Water (feet)	Water Elevation (feet)	Bottom Depth (feet)
CUF-93-1	397.51	33.76	363.75	62.07
CUF-93-2	397.34	11.52	385.82	45.18
CUF-93-2R	397.93	37.37	360.56	72.57
CUF-93-3	397.83	30.15	367.68	55.02
CUF-93-4	397.34	26.64	370.70	36.38
Wells Creek	387.40	27.03	360.37	--

The Dry Fly Ash and Gypsum Disposal Areas are underlain (in descending order) by some 40 feet of fly ash and bottom ash deposits, approximately 15 to 20 feet of residual and/or alluvial soils, and by limestone bedrock. The older ash deposits, which represent the shallowest water-bearing unit, exhibit a mean hydraulic conductivity of approximately $2.5x10^{-5}$ cm/s (or 0.072 ft/d) and a porosity of 0.48. Using these data and the current groundwater gradient given above, the local groundwater seepage velocity through the ash deposits is estimated from Darcy's Law to be approximately $6.8x10^{-4}$ ft/day.

CONCLUSIONS

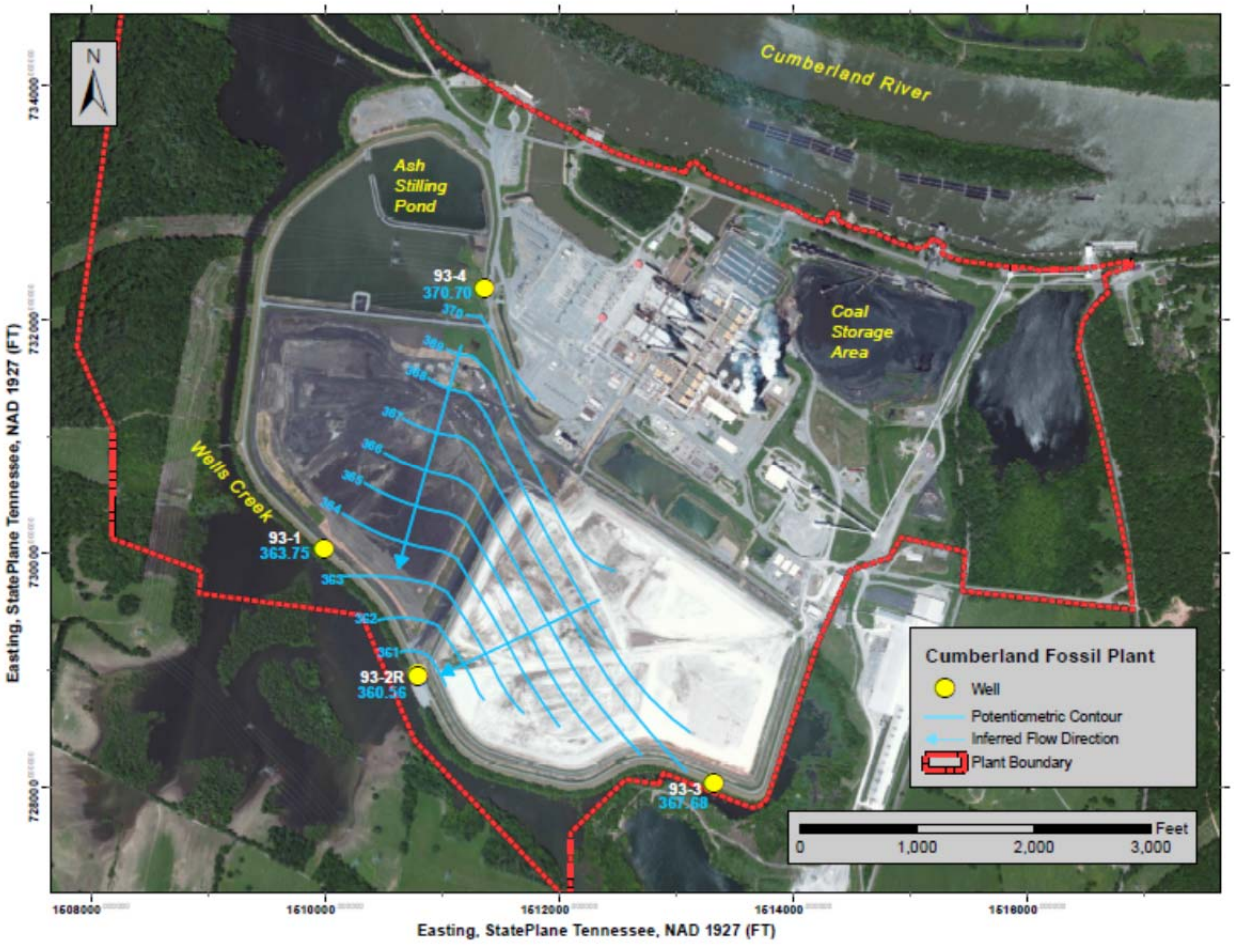
The July 20-21, 2015 groundwater monitoring results indicate no GWPS exceedances. Sporadic concentrations for some constituents over time may be due to analytical interferences and/or bias produced by suspended solids containing naturally-occurring metals in unfiltered groundwater samples. Even through the sporadic data, arsenic and nickel appear to be stabilizing or even declining over the past few years.

These stabilizing trends may be influenced by changes in hydraulic loading as a result of modified ash and gypsum management operations since 2010 timeframe. Concurrent with the initiation of assessment monitoring, operational changes were implemented regarding the Gypsum Disposal Area ash handling in order to mitigate stability risks on the stack. The gypsum sluice water was temporarily diverted in 2009 from the normal handling area on top of the Gypsum Disposal Area until a new handling operation was configured that would prevent an increase of phreatic levels in the Gypsum Disposal Area. To achieve this, in spring 2013, new lined gypsum slurry settling channels and a gypsum dewatering pad went into operation on the northwest side of the Gypsum Disposal Area. The channels included a flexible membrane liner to minimize infiltration of water into the stack. As a result

of diverting the routine sluicing operations from the top of the stack, infiltration of transport water into the gypsum byproduct was eliminated. After a period of attenuation, groundwater quality has improved and is expected to continue improving with the use of the lined channel sluicing operation. TVA plans to partially close perimeter portions of both stacks, which should help mitigate groundwater impacts from these areas of the stacks. This and other future projects will further prevent stormwater infiltration, including closure at the end of landfill life.

Several groundwater constituents demonstrate stable or decreasing trends. The past nine consecutive sampling events have shown no GWPS exceedances for arsenic and no other GWPS have been exceeded for the past four years. TVA will continue quarterly monitoring until approval to reduce monitoring frequency. The next regularly scheduled facility sampling is in October 2015.

FIGURE 1. Groundwater Potentiometric Surface on July 20, 2015



APPENDIX A

FIELD DATA SHEETS

Preliminary Groundwater Data Field Worksheet

Sheet 1 of 1

Project/Site	Well Number	Purge Date	Year	Month	Day
CUMBERLAND	93-1 84068		15	07	20

Depth to Water (m)	Bottom of Well (m)	Well Diameter (mm)	Survey Leader	Field Crew
10.29 4195	18.92 4194	51 4188	M. STARKS	J. EUBANKS

☐ Depth of Screen ☐ Open Bore Hole

(m)	To	(m)	Sample Label	Filter
15.80 4191	To	18.83 4190	CUF-93-1-0715	☐ Unfiltered ☐ Filtered ☑ Both Filter Type and Size:

[Bottom of Well - Depth to Water]	x	Volume Factor	=	Well Volume	Target Purge Volume	Actual Purge Volume
[(18.92)m - (10.29)m]	x	(2.027)L/m	=	17.49 (L)	52.47 (L)	22.0 (L) 4186

Purge Pump: ☐ Bladder ☑ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Sample Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list): BAIL

Notes and WQ Observations	Time ET CT	Pump Rate (L/min)	Depth to Water (m)	Pump Depth (m)	Temp °C	pH (s.u.)	DO (mg/L)	COND (umhos/cm)	(+/-) ORP (mV)	Turbidity (NTU)
Begin Purge →	1110		10.29	18.9	24.2	7.9	0.2	3027	-7	564
Pumped 13L	1115	2.6			21.4	11.0	2.1	2817	124	371
9L	1119		DRY		22.8	10.4	1.9	2409	161	399
					ALLOWED WELL TO RECOVER AND					
					SETTLE OVERNIGHT					
7-21-15	0920		10.32							

Remarks:

Reviewed By: M. W. Starks 7-21-15 Survey Leader Date — Becky Seaton 7/29/15 Project Leader Date

Sample Collector: MWS/JLE	
Sample Date	Time
Year 15 Month 07 Day 21	0920 ET CT
Pump Duration: 9 min	72004

"999" = 2 days

Sample Readings

0920	BAIL	N/A	22.1	7.4 / 9.7	3.4	2363	228	33.9
	4193	4192	10	400	300	94	90	
Analysis Time ET CT	Pump Rate (L/min)	Pump Depth (m)	Temp °C EPA 170.1	pH (s.u.) EPA 150.1	DO (mg/L) EPA 360.1	COND (umhos/cm) EPA 120.1	(+/-) ORP (mv) SM 2580B	Turbidity (NTU) EPA 180.1

Additional Sample Data

Analyst: JLE		102		112	Well Diameter (mm)	Vol. Factor (L/m)
Date Analyzed	415	431	436	437	12.7 (0.5 in)	0.127
Year 15 Month 07 Day 21	Phenol Alkalinity mg/L (EPA 310.1)	Total Alk. mg/L (EPA 310.1)	Mineral Acidity mg/L (EPA 305.1)	CO_2 Acidity mg/L (EPA 305.1)	51 (2 in)	2.027
Turbidity 1350 ☑ Clear					76 (3 in)	4.560
☐ Slightly Turbid					102 (4 in)	8.107
☐ Turbid	Time:	Time: 1342	Time:	Time: 1334	127 (5 in)	12.668
☐ Highly Turbid	Initial:	Initial: JLE	Initial:	Initial: JLE	153 (6 in)	18.228

Color: CLEAR

Odor: NONE

Bottles Required: ☐ BOD ☐ TOC ☐ COD ☐ TIC ☐ Ferrous ☐ Metals ☐ Dis. Metals ☐ Mineral ☐ Dis. Mineral ☐ Nutrient ☐ Phenol ☐ Filt TIC ☐ TSS/TDS

Others (list):

Preliminary Groundwater Data Field Worksheet

Sheet 1 of 1

Project/Site	Well Number	Purge Date	Year	Month	Day
CUMBERLAND	93-2R 84068		15	07	21

Depth to Water (m)	Bottom of Well (m)	Well Diameter (mm)	Survey Leader	Field Crew
11.43 4195	22.12 4194	51 4188	M. STARKS	

☐ Depth of Screen ☐ Open Bore Hole

(m)	To	(m)	Sample Label	
19.05 4191		22.09 4190	CUF-93-2R-0715	☑ Unfiltered ☐ Filtered ☐ Both; Filter Type and Size:

[Bottom of Well - Depth to Water]	x	Volume Factor	=	Well Volume	Target Purge Volume	Actual Purge Volume
[(22.12)m - (11.43)m]	x	(2.027)L/m	=	21.66 (L)	65.00 (L)	91.0 (L) 4186

Purge Pump: ☐ Bladder ☑ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Sample Pump: ☐ Bladder ☑ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Notes and WQ Observations	Time ET CT	Pump Rate (L/min)	Depth to Water (m)	Pump Depth (m)	Temp °C	pH (s.u.)	DO (mg/L)	COND (umhos/cm)	(+/-) ORP (mV)	Turbidity (NTU)
Begin Purge →	1030		11.43	15.0	25.6	6.4	1.2	5302	306	23.8
Pumped 13L	1035	2.6			22.7	6.3	0.3	5300	197	17.9
13L	1040	2.6			22.8	6.2	0.3	5299	189	23.5
13L	1045	2.6	11.45		22.5	6.2	0.2	5286	186	11.5
13L	1050	2.6			22.1	6.2	0.2	5240	181	7.6
13L	1055	2.6			21.8	6.2	0.1	5218	181	7.0
13L	1100	2.6	~~11.46~~ MWS		21.9	6.2	0.1	5248	186	6.1
13L	1105	2.6	11.46		21.9	6.2	0.1	5241	188	5.2

Remarks: COLLECT ~~DUPS~~ MWS MS + MSD

ESC LAB SUPPLIED D.I. H_2O / EQ BLANKS BEFORE (1000)

Reviewed By: M. Stone 7-22-15 Survey Leader Date

Becky Seaton (THIS WELL) 7/29/15 Project Leader Date

Sample Collector: MWS / JLE

Sample Date			Time
Year	Month	Day	1105 ET CT
15	07	21	

Pump Duration: 35 min 72004

"999" = 2 days

Sample Readings

Analysis Time ET CT	Pump Rate (L/min)	Pump Depth (m)	Temp °C EPA 170.1	pH (s.u.) EPA 150.1	DO (mg/L) EPA 360.1	COND (umhos/cm) EPA 120.1	(+/-) ORP (mv) SM 2580B	Turbidity (NTU) EPA 180.1
1105	1.0	15.0	21.9	6.2	0.1	5241	188	5.2
	4193	4192	10	400	300	94	90	

Additional Sample Data

Analyst: JLE

Date Analyzed		
Year	Month	Day
15	07	21

Turbidity 1350: ☑ Clear ☐ Slightly Turbid ☐ Turbid ☐ Highly Turbid

Color: CLEAR

Odor: NONE

415	431	436	437
	64		124
Phenol Alkalinity mg/L (EPA 310.1)	Total Alk. mg/L (EPA 310.1)	Mineral Acidity mg/L (EPA 305.1)	CO_2 Acidity mg/L (EPA 305.1)
Time:	Time: 1359	Time:	Time: 1355
Initial:	Initial: JLE	Initial:	Initial: JLE

Well Diameter (mm)		Vol. Factor (L/m)
12.7	(0.5 in)	0.127
51	(2 in)	2.027
76	(3 in)	4.560
102	(4 in)	8.107
127	(5 in)	12.668
153	(6 in)	18.228

Bottles Required: ☐ BOD ☐ TOC ☐ COD ☐ TIC ☐ Ferrous ☐ Metals ☐ Dis. Metals ☐ Mineral ☐ Dis. Mineral ☐ Nutrient ☐ Phenol ☐ Filt TIC ☐ TSS/TDS

Others (list):

Preliminary Groundwater Data Field Worksheet

Sheet 1 of 1

Project/Site	Well Number	Purge Date	Year	Month	Day
CUMBERLAND	93-3 84068		15	07	21

Depth to Water (m)	Bottom of Well (m)	Well Diameter (mm)	Survey Leader	Field Crew
9.11 4195	16.77 4194	51 4188	M. STARKS	J. EUBANKS

☐ Depth of Screen ☐ Open Bore Hole

(m)	To	(m)	Sample Label	
13.65 4191		16.70 4190	CUF-93-3-0715	☑ Unfiltered ☐ Filtered ☐ Both Filter Type and Size:

[Bottom of Well - Depth to Water]	x Volume Factor =	Well Volume	Target Purge Volume	Actual Purge Volume
[(16.77)m - (9.11)m]	x (2.027)L/m =	15.52 (L)	46.58 (L)	51.0 (L) 4186

Purge Pump: ☑ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Sample Pump: ☑ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Notes and WQ Observations	Time ET CT	Pump Rate (L/min)	Depth to Water (m)	Pump Depth (m)	Temp °C	pH (s.u.)	DO (mg/L)	COND (umhos/cm)	(+/-) ORP (mV)	Turbidity (NTU)
Begin Purge →	1155		9.11	10.5	28.6	6.7	2.8	1683	172	2.8
PUMPED 3L	1200	0.6			24.7	6.7	1.7	1693	133	9.2
3L	1205	0.6			24.9	6.7	1.7	1696	131	9.1
3L	1210	0.6	9.52		25.8	6.7	1.5	1685	121	10.1
6L SAMPLES	1220	0.6			25.2	6.6	1.3	1625	108	7.2
6L	1230	0.6			25.8	6.6	0.9	1522	101	9.8
6L	1240	0.6			25.8	6.6	0.7	1431	102	8.4
6L	1250	0.6	9.62		24.2	6.6	0.5	1381	102	7.5
6L	1300	0.6			25.3	6.6	0.4	1357	101	5.4
6L	1310	0.6			26.0	6.6	0.4	1350	99	4.4
6L	1320	0.6	9.65		25.7	6.6	0.3	1339	98	3.6

Remarks: COLLECT DUPLICATES

Reviewed By: M. Towe, Stark 7-22-15 Survey Leader Date

Becky Seaton 7/29/15 Project Leader Date

Sample Collector: MWS/JLV

Sample Date			Time
Year	Month	Day	1320 ET CT
15	07	21	

Pump Duration: 85 min 72004

"999" = 2 days

Sample Readings

Analysis Time ET CT	Pump Rate (L/min) 4193	Pump Depth (m) 4192	Temp °C EPA 170.1 10	pH (s.u.) EPA 150.1 400	DO (mg/L) EPA 360.1 300	COND (umhos/cm) EPA 120.1 94	(+/-) ORP (mv) SM 2580B 90	Turbidity (NTU) EPA 180.1
1320	0.6	10.5	25.7	6.6	0.3	1339	98	3.6

Additional Sample Data

Analyst: JLE

Date Analyzed			415	448/460 431	436	148/160 437
Year	Month	Day	Phenol Alkalinity mg/L (EPA 310.1)	Total Alk. mg/L (EPA 310.1)	Mineral Acidity mg/L (EPA 305.1)	CO_2 Acidity mg/L (EPA 305.1)
15	07	21				
Turbidity 1350 ☑ Clear			Time:	Time: 1411/1414	Time:	Time: 1405/1415
☐ Slightly Turbid			Initial:	Initial: JLE	Initial:	Initial: JLE
☐ Turbid						
☐ Highly Turbid						

Well Diameter (mm)		Vol. Factor (L/m)
12.7	(0.5 in)	0.127
51	(2 in)	2.027
76	(3 in)	4.560
102	(4 in)	8.107
127	(5 in)	12.668
153	(6 in)	18.228

Color: CLEAR

Odor: NONE

Bottles Required: ☐ BOD ☐ TOC ☐ COD ☐ TIC ☐ Ferrous ☐ Metals ☐ Dis. Metals ☐ Mineral ☐ Dis. Mineral ☐ Nutrient ☐ Phenol ☐ Filt TIC ☐ TSS/TDS

Others (list):

Preliminary Groundwater Data Field Worksheet

Sheet 1 of 1

Project/Site	Well Number	Purge Date	Year	Month	Day
CUMBERLAND	93-4 84068		15	07	20

Depth to Water (m)	Bottom of Well (m)	Well Diameter (mm)	Survey Leader	Field Crew
8.12 4195	11.09 4194	51 4188	M. STARKS	J. EUBANKS

☐ Depth of Screen ☐ Open Bore Hole

(m)	To	(m)	Sample Label	
7.87 4191		10.92 4190	CUF-93-4-0715	☑ Unfiltered ☐ Filtered ☐ Both Filter Type and Size:

[Bottom of Well - Depth to Water]	x	Volume Factor	=	Well Volume	Target Purge Volume	Actual Purge Volume
[(11.09)m - (8.12)m]	x	(2.027)L/m	=	6.02 (L)	18.06 (L)	8.0 (L) 4186

Purge Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list): BAIL
Sample Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list): BAIL

Notes and WQ Observations	Time ET CT	Pump Rate (L/min)	Depth to Water (m)	Pump Depth (m)	Temp °C	pH (s.u.)	DO (mg/L)	COND (umhos/cm)	(+/-) ORP (mV)	Turbidity (NTU)
Begin Purge →	1041		8.12							
	1050		DRY		BAILED	8.0L				
					ALLOWED WELL TO RECOVER					
					OVERNIGHT					
	0845		8.15		COLLECT	SAMPLES				

Remarks: _____

Reviewed By: M. W. Starks 7-22-15 Becky Seaton 7/29/15
Survey Leader Date Project Leader Date

Sample Collector: MWS/JLE			
Sample Date			Time
Year 15	Month 07	Day 21	0845 ET CT
Pump Duration: N/A min 72004			

"999" = 2 days

Sample Readings

Analysis Time ET CT	Pump Rate (L/min)	Pump Depth (m)	Temp °C EPA 170.1	pH (s.u.) EPA 150.1	DO (mg/L) EPA 360.1	COND (umhos/cm) EPA 120.1	(+/-) ORP (mv) SM 2580B	Turbidity (NTU) EPA 180.1
0845	BAIL	N/A	20.7	6.4	2.0	3409	386	5.1
	4193	4192	10	400	300	94	90	

Additional Sample Data

Analyst: JLE		320		136	Well Diameter (mm)	Vol. Factor (L/m)
Date Analyzed	415	431	436	437	12.7 (0.5 in)	0.127
Year 15 Month 07 Day 21	Phenol Alkalinity mg/L (EPA 310.1)	Total Alk. mg/L (EPA 310.1)	Mineral Acidity mg/L (EPA 305.1)	CO_2 Acidity mg/L (EPA 305.1)	51 (2 in)	2.027
Turbidity 1350 ☑ Clear					76 (3 in)	4.560
☐ Slightly Turbid	Time:	Time: 1430	Time:	Time: 1423	102 (4 in)	8.107
☐ Turbid	Initial:	Initial: JLE	Initial:	Initial: JLE	127 (5 in)	12.668
☐ Highly Turbid					153 (6 in)	18.228

Color: CLEAR
Odor: NONE

Bottles Required: ☐ BOD ☐ TOC ☐ COD ☐ TIC ☐ Ferrous ☐ Metals ☐ Dis. Metals ☐ Mineral ☐ Dis. Mineral ☐ Nutrient ☐ Phenol ☐ Filt TIC ☐ TSS/TDS
Others (list): _____

Preliminary Groundwater Data Field Worksheet

Sheet 1 of 1

Project/Site	Well Number	Purge Date	Year	Month	Day
CUMBERLAND	RS 84068		15	07	21

Depth to Water (m)	Bottom of Well (m)	Well Diameter (mm)	Survey Leader	Field Crew
N/A 4195	N/A 4194	N/A 4188	M. STARKS	

☐ Depth of Screen ☐ Open Bore Hole

(m)	To	(m)	Sample Label	Filter
N/A 4191		N/A 4190	CUF-RS-0715	☐ Unfiltered ☐ Filtered ☐ Both Filter Type and Size:

[Bottom of Well - Depth to Water] x Volume Factor =	Well Volume	Target Purge Volume	Actual Purge Volume
[(N/A)m - (N/A)m] x (N/A)L/m =	N/A (L)	N/A (L)	N/A (L) 4186

Purge Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Sample Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list): GRAB

Notes and WQ Observations	Time ET CT	Pump Rate (L/min)	Depth to Water (m)	Pump Depth (m)	Temp °C	pH (s.u.)	DO (mg/L)	COND (umhos/cm)	(+/-) ORP (mV)	Turbidity (NTU)
Begin Purge →										

Remarks: COLLECTED DISS. METALS DUE TO TURBIDITY 75.0

Reviewed By: M.t W. Stark 7-22-15 Survey Leader / Date

Becky Seaton 7/29/15 Project Leader / Date

Sample Collector: MWS

Sample Date			Time
Year	Month	Day	1443 ET CT
15	07	21	

Pump Duration: N/A min 72004

"999" = 2 days

Sample Readings

Analysis Time ET CT	Pump Rate (L/min)
1443	GRAB
	4193

Pump Depth (m)	Temp °C EPA 170.1	pH (s.u.) EPA 150.1	DO (mg/L) EPA 360.1	COND (umhos/cm) EPA 120.1	(+/-) ORP (mv) SM 2580B	Turbidity (NTU) EPA 180.1
N/A	28.3	7.0	5.1	616	285	8.7
4192	10	400	300	94	90	

Additional Sample Data

Analyst: JLE

Date Analyzed		
Year	Month	Day
15	07	21

Turbidity 1350: ☑ Clear ☐ Slightly Turbid ☐ Turbid ☐ Highly Turbid

Color: CLEAR

Odor: NONE

415 Phenol Alkalinity mg/L (EPA 310.1)	431 Total Alk. mg/L (EPA 310.1)	436 Mineral Acidity mg/L (EPA 305.1)	437 CO_2 Acidity mg/L (EPA 305.1)
	284		38
Time:	Time: 1514	Time:	Time: 1511
Initial:	Initial: JLE	Initial:	Initial: JLE

Bottles Required: ☐ BOD ☐ TOC ☐ COD ☐ TIC ☐ Ferrous ☐ Metals ☐ Dis. Metals ☐ Mineral ☐ Dis. Mineral ☐ Nutrient ☐ Phenol ☐ Filt TIC ☐ TSS/TDS

Others (list):

Well Diameter (mm)		Vol. Factor (L/m)
12.7	(0.5 in)	0.127
51	(2 in)	2.027
76	(3 in)	4.560
102	(4 in)	8.107
127	(5 in)	12.668
153	(6 in)	18.228

Preliminary Groundwater Data Field Worksheet

Sheet 1 of 1

Project/Site	Well Number	Purge Date	Year	Month	Day
CUMBERLAND	WCUP 84068		15	07	21

Depth to Water (m)	Bottom of Well (m)	Well Diameter (mm)	Survey Leader	Field Crew
N/A 4195	N/A 4194	N/A 4188	M. STARKS	J. EUBANKS

☐ Depth of Screen ☐ Open Bore Hole

(m)	To	(m)	Sample Label	Filter
N/A 4191		N/A 4190	CUF-WCUP-0715	☑ Unfiltered ☐ Filtered ☐ Both; Filter Type and Size:

[Bottom of Well - Depth to Water] x Volume Factor =	Well Volume	Target Purge Volume	Actual Purge Volume
[(N/A)m - (N/A)m] x (N/A)L/m =	N/A (L)	N/A (L)	N/A (L) 4186

Purge Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list):

Sample Pump: ☐ Bladder ☐ Centrifugal ☐ Peristaltic ☐ Dedicated Other (list): GRAB

Notes and WQ Observations	Time ET	Time CT	Pump Rate (L/min)	Depth to Water (m)	Pump Depth (m)	Temp °C	pH (s.u.)	DO (mg/L)	COND (umhos/cm)	(+/-) ORP (mV)	Turbidity (NTU)
Begin Purge →											

Remarks:

Reviewed By: M.T.W. ~~Stark~~ Survey Leader 7-22-15 Date — Becky Seaton Project Leader 7/29/15 Date

Sample Collector: MWS / JLE			
Sample Date			Time
Year	Month	Day	1515 ET CT
15	07	21	
Pump Duration: N/A min 72004			

"999" = 2 days

Sample Readings

Analysis Time ET CT	Pump Rate (L/min)	Pump Depth (m)	Temp °C EPA 170.1	pH (s.u.) EPA 150.1	DO (mg/L) EPA 360.1	COND (umhos/cm) EPA 120.1	(+/-) ORP (mv) SM 2580B	Turbidity (NTU) EPA 180.1
1515	GRAB	N/A	27.8	7.5	8.6	321	294	1.9
	4193	4192	10	400	300	94	90	

Additional Sample Data

Analyst: JLE

Date Analyzed		
Year	Month	Day
15	07	21

Turbidity 1350: ☑ Clear ☐ Slightly Turbid ☐ Turbid ☐ Highly Turbid

Color: CLEAR

Odor: NONE

415 Phenol Alkalinity mg/L (EPA 310.1)	431 Total Alk. mg/L (EPA 310.1)	436 Mineral Acidity mg/L (EPA 305.1)	437 CO_2 Acidity mg/L (EPA 305.1)
	164		22
Time:	Time: 1521	Time:	Time: 1517
Initial:	Initial: JLE	Initial:	Initial: JLE

Well Diameter (mm)		Vol. Factor (L/m)
12.7	(0.5 in)	0.127
51	(2 in)	2.027
76	(3 in)	4.560
102	(4 in)	8.107
127	(5 in)	12.668
153	(6 in)	18.228

Bottles Required: ☐ BOD ☐ TOC ☐ COD ☐ TIC ☐ Ferrous ☐ Metals ☐ Dis. Metals ☐ Mineral ☐ Dis. Mineral ☐ Nutrient ☐ Phenol ☐ Filt TIC ☐ TSS/TDS

Others (list):

TVA 30066A [2-2008]

APPENDIX B

LABORATORY REPORTS AND SAMPLE CUSTODY RECORD

ANALYTICAL REPORT

August 04, 2015

TVA-Environmental Affairs

Sample Delivery Group:	L778714
Samples Received:	07/23/2015
Project Number:	CUF-93-2R
Description:	Cumberland Groundwater

Report To: Anna Fisher
400 W. Summit Hill Mailstop TVA WT 9D-K
Knoxville, TN 37902

Entire Report Reviewed By:

Pam Langford

Pam Langford
Technical Service Representative

CUF-93-1-0715 L778714-01 GW

Collected by: Monte Starks | Collected date/time: 07/21/15 09:20 | Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:05	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:33	CHM
Mercury by Method 7470A	WG805296	1	07/29/15 10:49	07/29/15 22:50	CHM
Metals (ICPMS) by Method 6020	WG805024	1	07/28/15 08:19	07/28/15 22:11	ST
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 20:33	JD
Metals (ICPMS) by Method 6020	WG805551	1	07/29/15 12:45	07/31/15 18:02	ST
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 12:45	07/27/15 12:45	NJM

CUF-93-2R-0715 L778714-02 GW

Collected by: Monte Starks | Collected date/time: 07/21/15 11:05 | Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:06	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 08:59	CHM
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 20:24	JD
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 12:59	07/27/15 12:59	NJM

CUF-93-3-0715 L778714-03 GW

Collected by: Monte Starks | Collected date/time: 07/21/15 13:20 | Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:05	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:35	CHM
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 20:36	JD
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 13:13	07/27/15 13:13	NJM

CUF-93-3-0715-DUP L778714-04 GW

Collected by: Monte Starks | Collected date/time: 07/21/15 13:20 | Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:05	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:37	CHM
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 21:18	JD
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 13:27	07/27/15 13:27	NJM

CUF-93-4-0715 L778714-05 GW

Collected by: Monte Starks | Collected date/time: 07/21/15 08:45 | Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:05	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:39	CHM
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 21:20	JD
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 13:41	07/27/15 13:41	NJM

CUF-RS-0715 L778714-06 GW

Collected by: Monte Starks | Collected date/time: 07/21/15 14:43 | Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:07	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:46	CHM
Mercury by Method 7470A	WG805296	1	07/29/15 10:49	07/29/15 22:52	CHM

CUF-RS-0715 L778714-06 GW

Collected by: Monte Starks
Collected date/time: 07/21/15 14:43
Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Metals (ICPMS) by Method 6020	WG805024	1	07/28/15 08:19	07/28/15 22:13	ST
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 21:23	JD
Metals (ICPMS) by Method 6020	WG805551	1	07/29/15 12:45	07/31/15 18:11	ST
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 14:23	07/27/15 14:23	NJM

CUF-WCUP-0715 L778714-07 GW

Collected by: Monte Starks
Collected date/time: 07/21/15 15:15
Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:06	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:48	CHM
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 21:25	JD
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 15:05	07/27/15 15:05	NJM

CUF-EQ BLANK-0715 L778714-08 GW

Collected by: Monte Starks
Collected date/time: 07/21/15 10:00
Received date/time: 07/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG805048	1	07/27/15 15:07	07/28/15 09:08	MF
Mercury by Method 7470A	WG804650	1	07/25/15 10:43	07/27/15 09:50	CHM
Mercury by Method 7470A	WG805296	1	07/29/15 10:49	07/29/15 22:54	CHM
Metals (ICPMS) by Method 6020	WG805024	1	07/28/15 08:19	07/28/15 22:16	ST
Metals (ICPMS) by Method 6020	WG805232	1	07/27/15 17:42	07/28/15 21:27	JD
Metals (ICPMS) by Method 6020	WG805551	1	07/29/15 12:45	07/31/15 18:13	ST
Wet Chemistry by Method 9056MOD	WG804825	1	07/27/15 15:18	07/27/15 15:18	NJM

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Pamela A. Langford

Pam Langford

Pam Langford
Technical Service Representative

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	65.6		2.50	1	07/28/2015 09:05	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	ND		0.100	1	07/27/2015 12:45	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:33	WG804650
Mercury,Dissolved	ND		0.000200	1	07/29/2015 22:50	WG805296

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 20:33	WG805232
Antimony,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Arsenic	ND		0.00200	1	07/28/2015 20:33	WG805232
Arsenic,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Barium	0.193		0.00500	1	07/28/2015 20:33	WG805232
Barium,Dissolved	0.207		0.00500	1	07/28/2015 22:11	WG805024
Beryllium	ND		0.00200	1	07/28/2015 20:33	WG805232
Beryllium,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Cadmium	ND		0.00100	1	07/28/2015 20:33	WG805232
Cadmium,Dissolved	ND		0.00100	1	07/28/2015 22:11	WG805024
Chromium	ND		0.00200	1	07/28/2015 20:33	WG805232
Chromium,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Copper	ND		0.00500	1	07/28/2015 20:33	WG805232
Copper,Dissolved	ND		0.00500	1	07/28/2015 22:11	WG805024
Cobalt	ND		0.00200	1	07/28/2015 20:33	WG805232
Cobalt,Dissolved	0.00240		0.00200	1	07/31/2015 18:02	WG805551
Lead	ND		0.00200	1	07/28/2015 20:33	WG805232
Lead,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Nickel	0.00324		0.00200	1	07/28/2015 20:33	WG805232
Nickel,Dissolved	0.00367		0.00200	1	07/28/2015 22:11	WG805024
Selenium	ND		0.00200	1	07/28/2015 20:33	WG805232
Selenium,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Silver	ND		0.00200	1	07/28/2015 20:33	WG805232
Silver,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Thallium	ND		0.00200	1	07/28/2015 20:33	WG805232
Thallium,Dissolved	ND		0.00200	1	07/28/2015 22:11	WG805024
Vanadium	ND		0.00500	1	07/28/2015 20:33	WG805232
Vanadium,Dissolved	ND		0.00500	1	07/28/2015 22:11	WG805024
Zinc	ND		0.0250	1	07/28/2015 20:33	WG805232
Zinc,Dissolved	ND		0.0250	1	07/28/2015 22:11	WG805024

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	ND		2.50	1	07/28/2015 09:06	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	ND		0.100	1	07/27/2015 12:59	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 08:59	WG804650

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 20:24	WG805232
Arsenic	ND		0.00200	1	07/28/2015 20:24	WG805232
Barium	0.0427		0.00500	1	07/28/2015 20:24	WG805232
Beryllium	ND		0.00200	1	07/28/2015 20:24	WG805232
Cadmium	0.00152		0.00100	1	07/28/2015 20:24	WG805232
Chromium	ND		0.00200	1	07/28/2015 20:24	WG805232
Copper	ND		0.00500	1	07/28/2015 20:24	WG805232
Cobalt	0.00202		0.00200	1	07/28/2015 20:24	WG805232
Lead	ND		0.00200	1	07/28/2015 20:24	WG805232
Nickel	0.00532		0.00200	1	07/28/2015 20:24	WG805232
Selenium	ND		0.00200	1	07/28/2015 20:24	WG805232
Silver	ND		0.00200	1	07/28/2015 20:24	WG805232
Thallium	ND		0.00200	1	07/28/2015 20:24	WG805232
Vanadium	ND		0.00500	1	07/28/2015 20:24	WG805232
Zinc	ND		0.0250	1	07/28/2015 20:24	WG805232

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	11.1		2.50	1	07/28/2015 09:05	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	0.418		0.100	1	07/27/2015 13:13	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:35	WG804650

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 20:36	WG805232
Arsenic	ND		0.00200	1	07/28/2015 20:36	WG805232
Barium	0.158		0.00500	1	07/28/2015 20:36	WG805232
Beryllium	ND		0.00200	1	07/28/2015 20:36	WG805232
Cadmium	ND		0.00100	1	07/28/2015 20:36	WG805232
Chromium	ND		0.00200	1	07/28/2015 20:36	WG805232
Copper	ND		0.00500	1	07/28/2015 20:36	WG805232
Cobalt	ND		0.00200	1	07/28/2015 20:36	WG805232
Lead	ND		0.00200	1	07/28/2015 20:36	WG805232
Nickel	ND		0.00200	1	07/28/2015 20:36	WG805232
Selenium	ND		0.00200	1	07/28/2015 20:36	WG805232
Silver	ND		0.00200	1	07/28/2015 20:36	WG805232
Thallium	ND		0.00200	1	07/28/2015 20:36	WG805232
Vanadium	ND		0.00500	1	07/28/2015 20:36	WG805232
Zinc	ND		0.0250	1	07/28/2015 20:36	WG805232

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	11.0		2.50	1	07/28/2015 09:05	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	0.382		0.100	1	07/27/2015 13:27	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:37	WG804650

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 21:18	WG805232
Arsenic	ND		0.00200	1	07/28/2015 21:18	WG805232
Barium	0.158		0.00500	1	07/28/2015 21:18	WG805232
Beryllium	ND		0.00200	1	07/28/2015 21:18	WG805232
Cadmium	ND		0.00100	1	07/28/2015 21:18	WG805232
Chromium	ND		0.00200	1	07/28/2015 21:18	WG805232
Copper	ND		0.00500	1	07/28/2015 21:18	WG805232
Cobalt	ND		0.00200	1	07/28/2015 21:18	WG805232
Lead	ND		0.00200	1	07/28/2015 21:18	WG805232
Nickel	ND		0.00200	1	07/28/2015 21:18	WG805232
Selenium	ND		0.00200	1	07/28/2015 21:18	WG805232
Silver	ND		0.00200	1	07/28/2015 21:18	WG805232
Thallium	ND		0.00200	1	07/28/2015 21:18	WG805232
Vanadium	ND		0.00500	1	07/28/2015 21:18	WG805232
Zinc	ND		0.0250	1	07/28/2015 21:18	WG805232

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	8.44		2.50	1	07/28/2015 09:05	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	ND		0.100	1	07/27/2015 13:41	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:39	WG804650

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 21:20	WG805232
Arsenic	ND		0.00200	1	07/28/2015 21:20	WG805232
Barium	0.0525		0.00500	1	07/28/2015 21:20	WG805232
Beryllium	ND		0.00200	1	07/28/2015 21:20	WG805232
Cadmium	ND		0.00100	1	07/28/2015 21:20	WG805232
Chromium	ND		0.00200	1	07/28/2015 21:20	WG805232
Copper	ND		0.00500	1	07/28/2015 21:20	WG805232
Cobalt	ND		0.00200	1	07/28/2015 21:20	WG805232
Lead	ND		0.00200	1	07/28/2015 21:20	WG805232
Nickel	0.00251		0.00200	1	07/28/2015 21:20	WG805232
Selenium	ND		0.00200	1	07/28/2015 21:20	WG805232
Silver	ND		0.00200	1	07/28/2015 21:20	WG805232
Thallium	ND		0.00200	1	07/28/2015 21:20	WG805232
Vanadium	ND		0.00500	1	07/28/2015 21:20	WG805232
Zinc	ND		0.0250	1	07/28/2015 21:20	WG805232

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	7.70		2.50	1	07/28/2015 09:07	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	0.256		0.100	1	07/27/2015 14:23	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:46	WG804650
Mercury,Dissolved	ND		0.000200	1	07/29/2015 22:52	WG805296

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 21:23	WG805232
Antimony,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Arsenic	ND		0.00200	1	07/28/2015 21:23	WG805232
Arsenic,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Barium	0.0383		0.00500	1	07/28/2015 21:23	WG805232
Barium,Dissolved	0.0351		0.00500	1	07/28/2015 22:13	WG805024
Beryllium	ND		0.00200	1	07/28/2015 21:23	WG805232
Beryllium,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Cadmium	ND		0.00100	1	07/28/2015 21:23	WG805232
Cadmium,Dissolved	ND		0.00100	1	07/28/2015 22:13	WG805024
Chromium	ND		0.00200	1	07/28/2015 21:23	WG805232
Chromium,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Copper	ND		0.00500	1	07/28/2015 21:23	WG805232
Copper,Dissolved	0.00511		0.00500	1	07/28/2015 22:13	WG805024
Cobalt	ND		0.00200	1	07/28/2015 21:23	WG805232
Cobalt,Dissolved	ND		0.00200	1	07/31/2015 18:11	WG805551
Lead	ND		0.00200	1	07/28/2015 21:23	WG805232
Lead,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Nickel	ND		0.00200	1	07/28/2015 21:23	WG805232
Nickel,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Selenium	ND		0.00200	1	07/28/2015 21:23	WG805232
Selenium,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Silver	ND		0.00200	1	07/28/2015 21:23	WG805232
Silver,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Thallium	ND		0.00200	1	07/28/2015 21:23	WG805232
Thallium,Dissolved	ND		0.00200	1	07/28/2015 22:13	WG805024
Vanadium	ND		0.00500	1	07/28/2015 21:23	WG805232
Vanadium,Dissolved	ND		0.00500	1	07/28/2015 22:13	WG805024
Zinc	ND		0.0250	1	07/28/2015 21:23	WG805232
Zinc,Dissolved	ND		0.0250	1	07/28/2015 22:13	WG805024

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	ND		2.50	1	07/28/2015 09:06	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	ND		0.100	1	07/27/2015 15:05	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:48	WG804650

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 21:25	WG805232
Arsenic	ND		0.00200	1	07/28/2015 21:25	WG805232
Barium	0.0329		0.00500	1	07/28/2015 21:25	WG805232
Beryllium	ND		0.00200	1	07/28/2015 21:25	WG805232
Cadmium	ND		0.00100	1	07/28/2015 21:25	WG805232
Chromium	ND		0.00200	1	07/28/2015 21:25	WG805232
Copper	ND		0.00500	1	07/28/2015 21:25	WG805232
Cobalt	ND		0.00200	1	07/28/2015 21:25	WG805232
Lead	ND		0.00200	1	07/28/2015 21:25	WG805232
Nickel	ND		0.00200	1	07/28/2015 21:25	WG805232
Selenium	ND		0.00200	1	07/28/2015 21:25	WG805232
Silver	ND		0.00200	1	07/28/2015 21:25	WG805232
Thallium	ND		0.00200	1	07/28/2015 21:25	WG805232
Vanadium	ND		0.00500	1	07/28/2015 21:25	WG805232
Zinc	ND		0.0250	1	07/28/2015 21:25	WG805232

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	ND		2.50	1	07/28/2015 09:08	WG805048

Wet Chemistry by Method 9056MOD

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Fluoride	ND		0.100	1	07/27/2015 15:18	WG804825

Mercury by Method 7470A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	07/27/2015 09:50	WG804650
Mercury,Dissolved	ND		0.000200	1	07/29/2015 22:54	WG805296

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Antimony	ND		0.00200	1	07/28/2015 21:27	WG805232
Antimony,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Arsenic	ND		0.00200	1	07/28/2015 21:27	WG805232
Arsenic,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Barium	ND		0.00500	1	07/28/2015 21:27	WG805232
Barium,Dissolved	ND		0.00500	1	07/28/2015 22:16	WG805024
Beryllium	ND		0.00200	1	07/28/2015 21:27	WG805232
Beryllium,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Cadmium	ND		0.00100	1	07/28/2015 21:27	WG805232
Cadmium,Dissolved	ND		0.00100	1	07/28/2015 22:16	WG805024
Chromium	0.00223		0.00200	1	07/28/2015 21:27	WG805232
Chromium,Dissolved	0.00931		0.00200	1	07/28/2015 22:16	WG805024
Copper	ND		0.00500	1	07/28/2015 21:27	WG805232
Copper,Dissolved	ND		0.00500	1	07/28/2015 22:16	WG805024
Cobalt	ND		0.00200	1	07/28/2015 21:27	WG805232
Cobalt,Dissolved	ND		0.00200	1	07/31/2015 18:13	WG805551
Lead	ND		0.00200	1	07/28/2015 21:27	WG805232
Lead,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Nickel	ND		0.00200	1	07/28/2015 21:27	WG805232
Nickel,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Selenium	ND		0.00200	1	07/28/2015 21:27	WG805232
Selenium,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Silver	ND		0.00200	1	07/28/2015 21:27	WG805232
Silver,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Thallium	ND		0.00200	1	07/28/2015 21:27	WG805232
Thallium,Dissolved	ND		0.00200	1	07/28/2015 22:16	WG805024
Vanadium	ND		0.00500	1	07/28/2015 21:27	WG805232
Vanadium,Dissolved	ND		0.00500	1	07/28/2015 22:16	WG805024
Zinc	ND		0.0250	1	07/28/2015 21:27	WG805232
Zinc,Dissolved	ND		0.0250	1	07/28/2015 22:16	WG805024

Method Blank (MB)

(MB) 07/28/15 09:04

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Suspended Solids	ND		2.50

L778713-01 Original Sample (OS) • Duplicate (DUP)

(OS) 07/28/15 09:04 • (DUP) 07/28/15 09:04

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	7.78	8.00	1	2.82		5

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/28/15 09:03 • (LCSD) 07/28/15 09:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Suspended Solids	773	784	788	101	102	85.0-115			0.509	5

Method Blank (MB)

(MB) 07/27/15 10:26

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Fluoride	ND		0.100

L778510-04 Original Sample (OS) • Duplicate (DUP)

(OS) 07/27/15 11:36 • (DUP) 07/27/15 11:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Fluoride	0.121	0.109	1	10		20

L778874-01 Original Sample (OS) • Duplicate (DUP)

(OS) 07/27/15 16:28 • (DUP) 07/27/15 16:42

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Fluoride	ND	-0.0515	10	0		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/27/15 10:40 • (LCSD) 07/27/15 10:54

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Fluoride	8.00	7.94	7.95	99	99	90-110			0	20

L778714-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 07/27/15 13:41 • (MS) 07/27/15 13:55 • (MSD) 07/27/15 14:09

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Fluoride	5.00	0.0553	4.80	5.07	95	100	1	80-120			6	20

Method Blank (MB)

(MB) 07/27/15 08:52

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Mercury	ND		0.000200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/27/15 08:55 • (LCSD) 07/27/15 08:57

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	0.00264	0.00274	88	91	80-120			4	20

L778714-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 07/27/15 08:59 • (MS) 07/27/15 09:01 • (MSD) 07/27/15 09:03

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	0.0000186	0.00235	0.00227	78	75	1	75-125			3	20

Method Blank (MB)

(MB) 07/29/15 22:30

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Mercury,Dissolved	ND		0.000200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/29/15 22:32 • (LCSD) 07/29/15 22:34

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury,Dissolved	0.00300	0.00325	0.00304	108	101	80-120			7	20

L779291-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 07/29/15 22:37 • (MS) 07/29/15 22:39 • (MSD) 07/29/15 22:41

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury,Dissolved	0.00300	ND	0.000601	0.00325	20	108	1	75-125	J6	J3	137	20

Method Blank (MB)

(MB) 07/28/15 21:55

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Antimony,Dissolved	ND		0.00200
Arsenic,Dissolved	ND		0.00200
Barium,Dissolved	ND		0.00500
Beryllium,Dissolved	ND		0.00200
Cadmium,Dissolved	ND		0.00100
Chromium,Dissolved	ND		0.00200
Copper,Dissolved	ND		0.00500
Lead,Dissolved	ND		0.00200
Nickel,Dissolved	ND		0.00200
Selenium,Dissolved	ND		0.00200
Silver,Dissolved	ND		0.00200
Thallium,Dissolved	ND		0.00200
Vanadium,Dissolved	ND		0.00500
Zinc,Dissolved	ND		0.0250

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/28/15 23:22 • (LCSD) 07/28/15 23:25

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Antimony,Dissolved	0.0500	0.0544	0.0539	109	108	80-120			1	20
Arsenic,Dissolved	0.0500	0.0517	0.0521	103	104	80-120			1	20
Barium,Dissolved	0.0500	0.0491	0.0486	98	97	80-120			1	20
Beryllium,Dissolved	0.0500	0.0525	0.0522	105	104	80-120			0	20
Cadmium,Dissolved	0.0500	0.0529	0.0531	106	106	80-120			0	20
Chromium,Dissolved	0.0500	0.0502	0.0499	100	100	80-120			0	20
Copper,Dissolved	0.0500	0.0533	0.0526	107	105	80-120			1	20
Lead,Dissolved	0.0500	0.0506	0.0503	101	101	80-120			1	20
Nickel,Dissolved	0.0500	0.0521	0.0513	104	103	80-120			2	20
Selenium,Dissolved	0.0500	0.0499	0.0503	100	101	80-120			1	20
Silver,Dissolved	0.0500	0.0561	0.0550	112	110	80-120			2	20
Thallium,Dissolved	0.0500	0.0493	0.0498	99	100	80-120			1	20
Vanadium,Dissolved	0.0500	0.0499	0.0497	100	99	80-120			0	20
Zinc,Dissolved	0.0500	0.0512	0.0478	102	96	80-120			7	20

L778726-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 07/28/15 22:02 • (MS) 07/28/15 22:07 • (MSD) 07/28/15 22:09

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony,Dissolved	0.0500	0.000597	0.0539	0.0535	107	106	1	75-125			1	20
Arsenic,Dissolved	0.0500	0.00321	0.0546	0.0554	103	104	1	75-125			2	20
Barium,Dissolved	0.0500	0.0267	0.0765	0.0762	100	99	1	75-125			0	20
Beryllium,Dissolved	0.0500	0.0000159	0.0527	0.0517	105	103	1	75-125			2	20
Cadmium,Dissolved	0.0500	0.0000200	0.0528	0.0538	106	108	1	75-125			2	20
Chromium,Dissolved	0.0500	0.00102	0.0525	0.0487	103	95	1	75-125			7	20
Copper,Dissolved	0.0500	0.000889	0.0552	0.0511	109	100	1	75-125			8	20
Lead,Dissolved	0.0500	0.000307	0.0521	0.0504	104	100	1	75-125			3	20
Nickel,Dissolved	0.0500	0.00144	0.0535	0.0502	104	98	1	75-125			6	20
Selenium,Dissolved	0.0500	0.000229	0.0525	0.0499	104	99	1	75-125			5	20
Silver,Dissolved	0.0500	0.0000465	0.0569	0.0560	114	112	1	75-125			2	20
Thallium,Dissolved	0.0500	0.0000206	0.0514	0.0495	103	99	1	75-125			4	20
Vanadium,Dissolved	0.0500	0.00161	0.0537	0.0494	104	96	1	75-125			8	20
Zinc,Dissolved	0.0500	0.00346	0.0513	0.0483	96	90	1	75-125			6	20

Method Blank (MB)

(MB) 07/28/15 20:17

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Antimony	ND		0.00200
Arsenic	ND		0.00200
Barium	ND		0.00500
Beryllium	ND		0.00200
Cadmium	ND		0.00100
Chromium	ND		0.00200
Copper	ND		0.00500
Cobalt	ND		0.00200
Lead	ND		0.00200
Nickel	ND		0.00200
Selenium	ND		0.00200
Silver	ND		0.00200
Thallium	ND		0.00200
Vanadium	ND		0.00500
Zinc	ND		0.0250

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/28/15 20:20 • (LCSD) 07/28/15 20:22

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Antimony	0.0500	0.0551	0.0548	110	110	80-120			1	20
Arsenic	0.0500	0.0483	0.0481	97	96	80-120			0	20
Barium	0.0500	0.0504	0.0516	101	103	80-120			2	20
Beryllium	0.0500	0.0471	0.0481	94	96	80-120			2	20
Cadmium	0.0500	0.0495	0.0489	99	98	80-120			1	20
Chromium	0.0500	0.0487	0.0511	97	102	80-120			5	20
Copper	0.0500	0.0514	0.0527	103	105	80-120			2	20
Cobalt	0.0500	0.0489	0.0505	98	101	80-120			3	20
Lead	0.0500	0.0499	0.0503	100	101	80-120			1	20
Nickel	0.0500	0.0502	0.0523	100	105	80-120			4	20
Selenium	0.0500	0.0483	0.0488	97	98	80-120			1	20
Silver	0.0500	0.0547	0.0550	109	110	80-120			1	20
Thallium	0.0500	0.0493	0.0502	99	100	80-120			2	20
Vanadium	0.0500	0.0477	0.0495	95	99	80-120			4	20
Zinc	0.0500	0.0501	0.0512	100	102	80-120			2	20

L778714-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 07/28/15 20:24 • (MS) 07/28/15 20:29 • (MSD) 07/28/15 20:31

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Antimony	0.0500	0.00119	0.0540	0.0538	106	105	1	75-125			0	20
Arsenic	0.0500	0.000968	0.0548	0.0521	108	102	1	75-125			5	20
Barium	0.0500	0.0427	0.0928	0.0911	100	97	1	75-125			2	20
Beryllium	0.0500	0.00000238	0.0470	0.0466	94	93	1	75-125			1	20
Cadmium	0.0500	0.00152	0.0558	0.0518	108	101	1	75-125			7	20
Chromium	0.0500	0.00147	0.0495	0.0481	96	93	1	75-125			3	20
Copper	0.0500	0.000384	0.0479	0.0474	95	94	1	75-125			1	20
Cobalt	0.0500	0.00202	0.0479	0.0489	92	94	1	75-125			2	20
Lead	0.0500	0.000374	0.0488	0.0494	97	98	1	75-125			1	20
Nickel	0.0500	0.00532	0.0525	0.0519	94	93	1	75-125			1	20
Selenium	0.0500	0.000203	0.0502	0.0509	100	101	1	75-125			1	20
Silver	0.0500	0.000103	0.0533	0.0538	106	107	1	75-125			1	20
Thallium	0.0500	0.000170	0.0481	0.0484	96	96	1	75-125			1	20
Vanadium	0.0500	0.000243	0.0489	0.0482	97	96	1	75-125			2	20
Zinc	0.0500	0.00391	0.0480	0.0486	88	89	1	75-125			1	20

Method Blank (MB)

(MB) 07/31/15 17:53

Analyte	MB Result mg/l	MB Qualifier	MB RDL mg/l
Cobalt,Dissolved	ND		0.00200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 07/31/15 17:57 • (LCSD) 07/31/15 17:59

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Cobalt,Dissolved	0.0500	0.0507	0.0509	101	102	80-120			0	20

L778714-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 07/31/15 18:02 • (MS) 07/31/15 18:06 • (MSD) 07/31/15 18:08

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cobalt,Dissolved	0.0500	0.00240	0.0499	0.0514	95	98	1	75-125			3	20

Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND,U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.
SDL	Sample Detection Limit.
MQL	Method Quantitation Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.

Qualifier	Description
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.

ACCREDITATIONS & LOCATIONS

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE.**

State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Conneticut	PH-0197	North Carolina [1]	DW21704
Florida	E87487	North Carolina [2]	41
Georgia	NELAP	North Dakota	R-140
Georgia [1]	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky [1]	90010	South Dakota	n/a
Kentucky [2]	16	Tennessee [1 4]	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

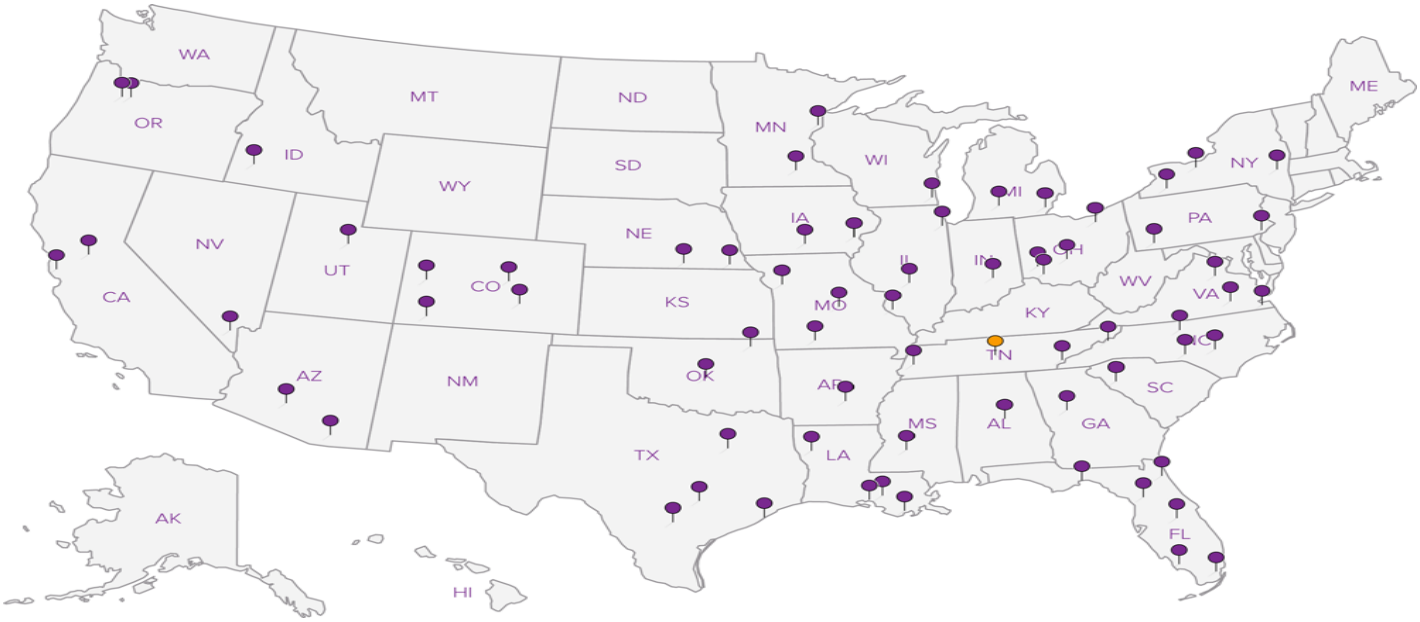
[1.] Drinking Water [2.] Underground Storage Tanks [3.] Aquatic Toxicity [4.] Chemical/Microbiological [5.] Mold [n/a] Accreditation not applicable

Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
Canada	1461.01	DOD	1461.01
EPA–Crypto	TN00003	USDA	S-67674

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



TVA-Environmental Affairs

400 W. Summit Hill Mailstop TVA WT 9D-K
Knoxville, TN 37902

Billing Information:
Accounts Payable
1101 Market St. Mailstop: LP-5D-C
Chattanooga, TN 37402

Report to: Anna Fisher

Email To: TVA_GW_Analytical@tva.gov;acbrodi0@tva.gov;m

Project Description: Cumberland Groundwater

City/State Collected: CUMBERLAND City TN

Phone: 865-632-6941
Fax:

Client Project # CUF GW

Lab Project # TVAENVAFF-CUFGW

Collected by (print): MONTE STARKS

Site/Facility ID #

P.O. # 727573

Collected by (signature): Monte W. Starks

Immediately Packed on Ice N___ Y✓

Rush? (Lab MUST Be Notified)
___ Same Day 200%
___ Next Day 100%
___ Two Day 50%
___ Three Day 25%

Date Results Needed: STD

Email? ___No X_Yes
FAX? ___No ___Yes

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	FLUORIDE 125mlHDPE-NoPres	METALS 500mlHDPE-HNO3	Metals 500mlHDPE-HNO3 (DISSOLVED METALS)	TSS 1L-HDPE NoPres	Rem./Contaminant	Sample # (lab only)
CUF-93-1-0715	GRAB	GW		7-21-15	0920	4	X	X	X	X		-01
CUF-93-2R-0715	↑	GW		↑	1105	3	X	X		X		02
CUF-93-3-0715		GW			1320	3	X	X		X		03
CUF-93-3R-0715-DUP		GW			1320	3	X	X		X		04
CUF-93-4-0715		GW			0845	3	X	X	X	X		05
CUF-RS-0715		GW			1443	4	X	X	X	X		06
CUF-WCUP-0715		GW			1515	3	X	X		X		07
CUF-EQ BLANK-0715		GW			1000	4	X	X	X	X		08
CUF-93-2R-0715-MS		GW			1105	1	X	X		X		01
CUF-93-2R-0715-MSD	GRAB	GW		7-21-15	1105	1	X	X		X		02

* Matrix: SS - Soil GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other

Remarks: 6361020059716 5960

pH ____ Temp ____
Flow ____ Other ____

Chain of Custody Page ___ of ___

ESC LABORATORY SCIENCES
YOUR LAB OF CHOICE
12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L778714
Table E140
Acctnum: TVAENVAFF
Template: T72458
Prelogin: P513943
TSR: 633 - Pam Langford
PB: 6.11 7/18
Shipped Via: FedEX Ground

Hold #

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Monte W. Starks	7-22-15	1300	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ ____
Temp: 3.2 °C Bottles Received: 29
Date: 7/23/15 Time: 0900

Condition: (lab use only) GOOD
COC Seal Intact: ✓Y ___N ___NA
pH Checked: 42 NCF: YES

Andy Vann

ESC Lab Sciences
Non-Conformance Form

Login #:L788714	Client:TVAENVAFF	Date:07/23/15	Evaluated by:Nikki Slaon

Non-Conformance (check applicable items)

	Sample Integrity		Chain of Custody Clarification		
	Parameter(s) past holding time	x	Login Clarification Needed		**If Broken Container:**
	Improper temperature		Chain of custody is incomplete		Insufficient packing material around container
	Improper container type		Please specify Metals requested.		Insufficient packing material inside cooler
	Improper preservation		Please specify TCLP requested.		Improper handling by carrier (FedEx / UPS / Couri
	Insufficient sample volume.		Received additional samples not listed on coc.		Sample was frozen
	Sample is biphasic.		Sample ids on containers do not match ids on coc		Container lid not intact
	Vials received with headspace.		Trip Blank not received.		**If no Chain of Custody:**
	Broken container		Client did not "X" analysis.		Received by:
	Broken container:		Chain of Custody is missing		Date/Time:
	Sufficient sample remains				Temp./Cont. Rec./pH:
					Carrier:
					Tracking#

Login Comments:Dissolved metals have been field filtered & preserved. Received total metals container unpreserved & dissolved metal container preserved for sample id CUF-RS-0715. Did client switch the labels? Need to know which contianer was filtered.

Client informed by:		Call		Email		Voice Mail		Date:	Time:
TSR Initials:	Client Contact:								

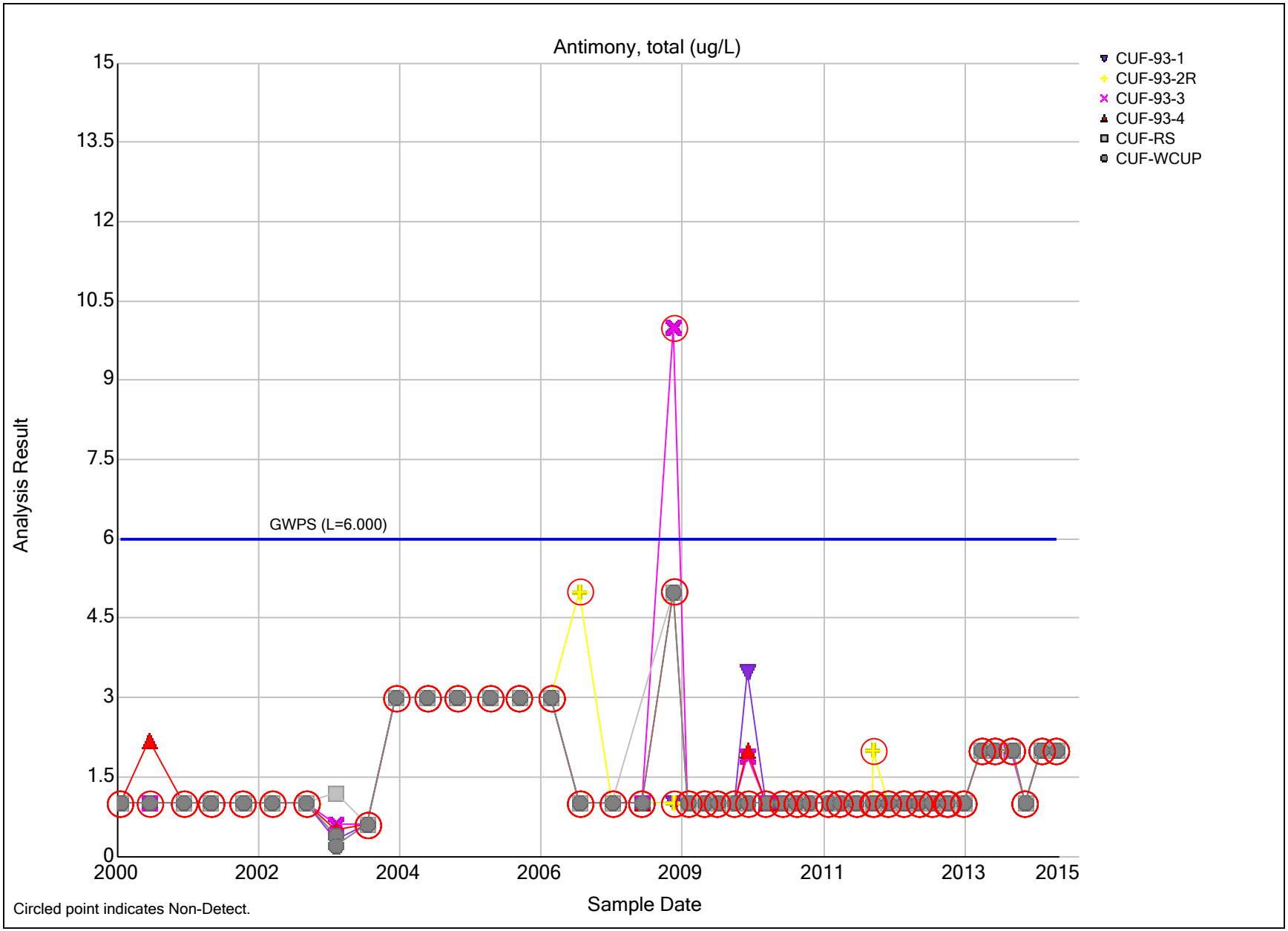
Login Instructions:

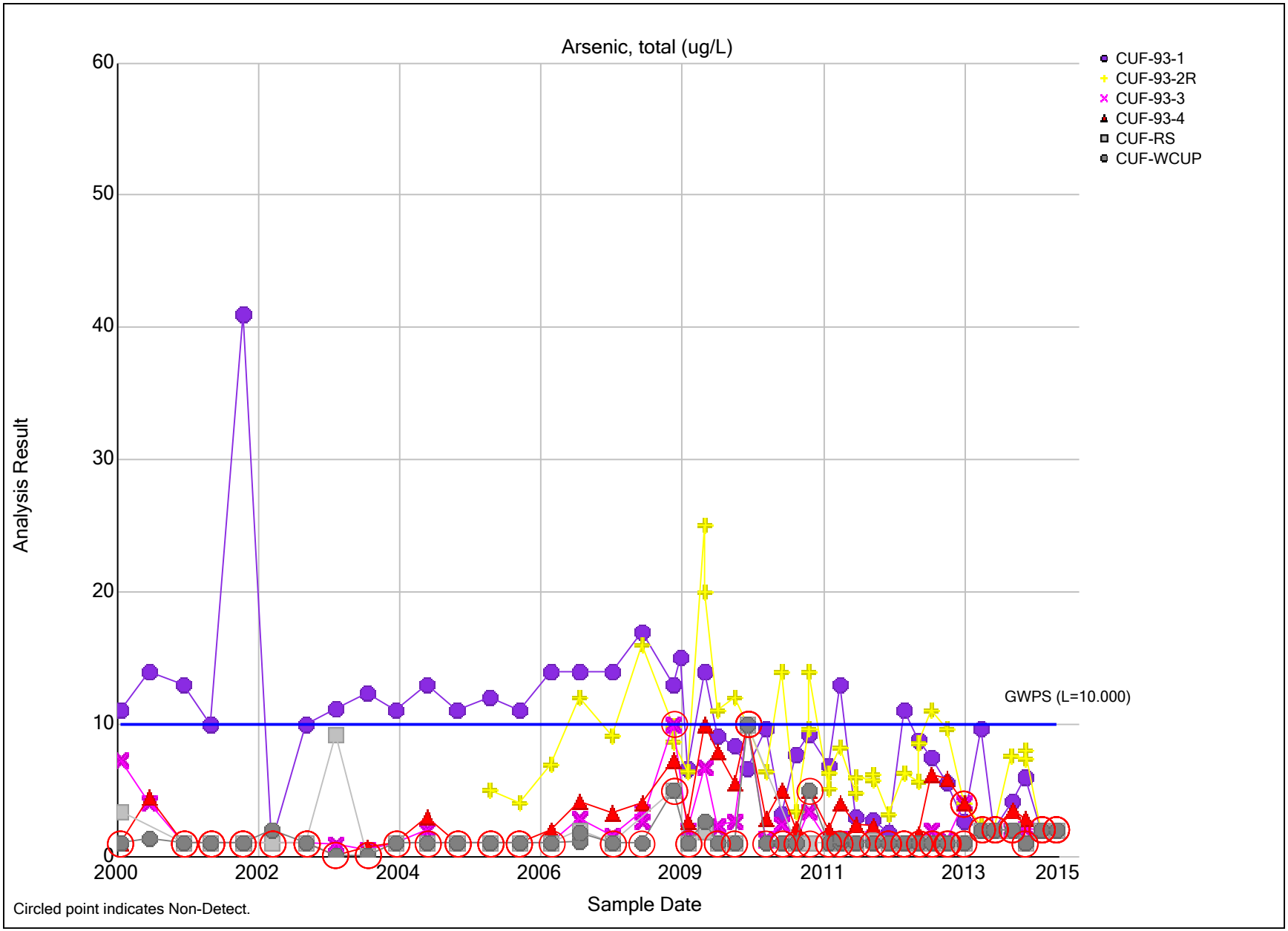
Total and dissolved metals are needed for sample CUF-RS-0715. The additional of nitric acid in the field was not performed for the total metals container. Please preserve and analyze per Monte Starks.

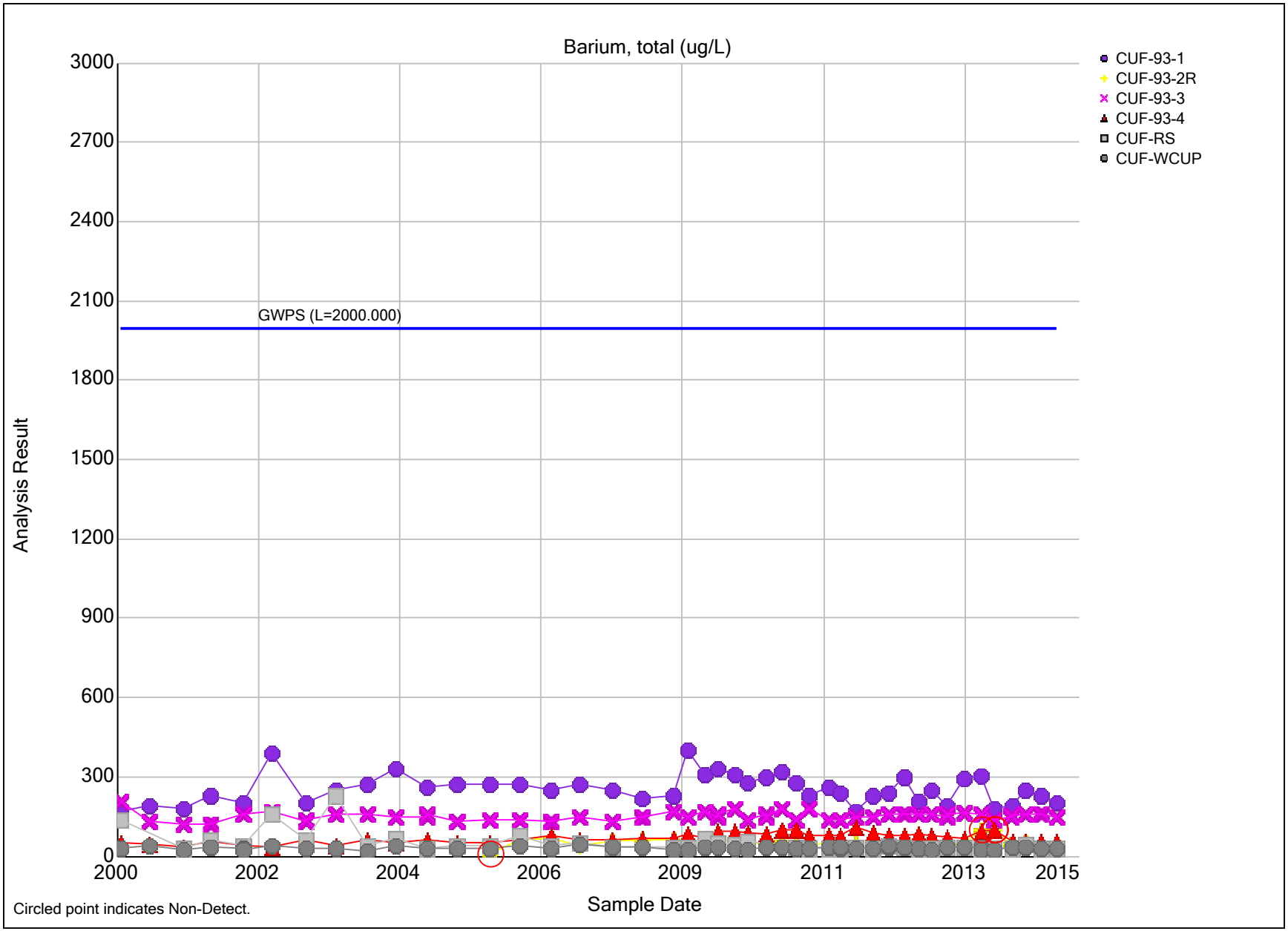
APPENDIX C

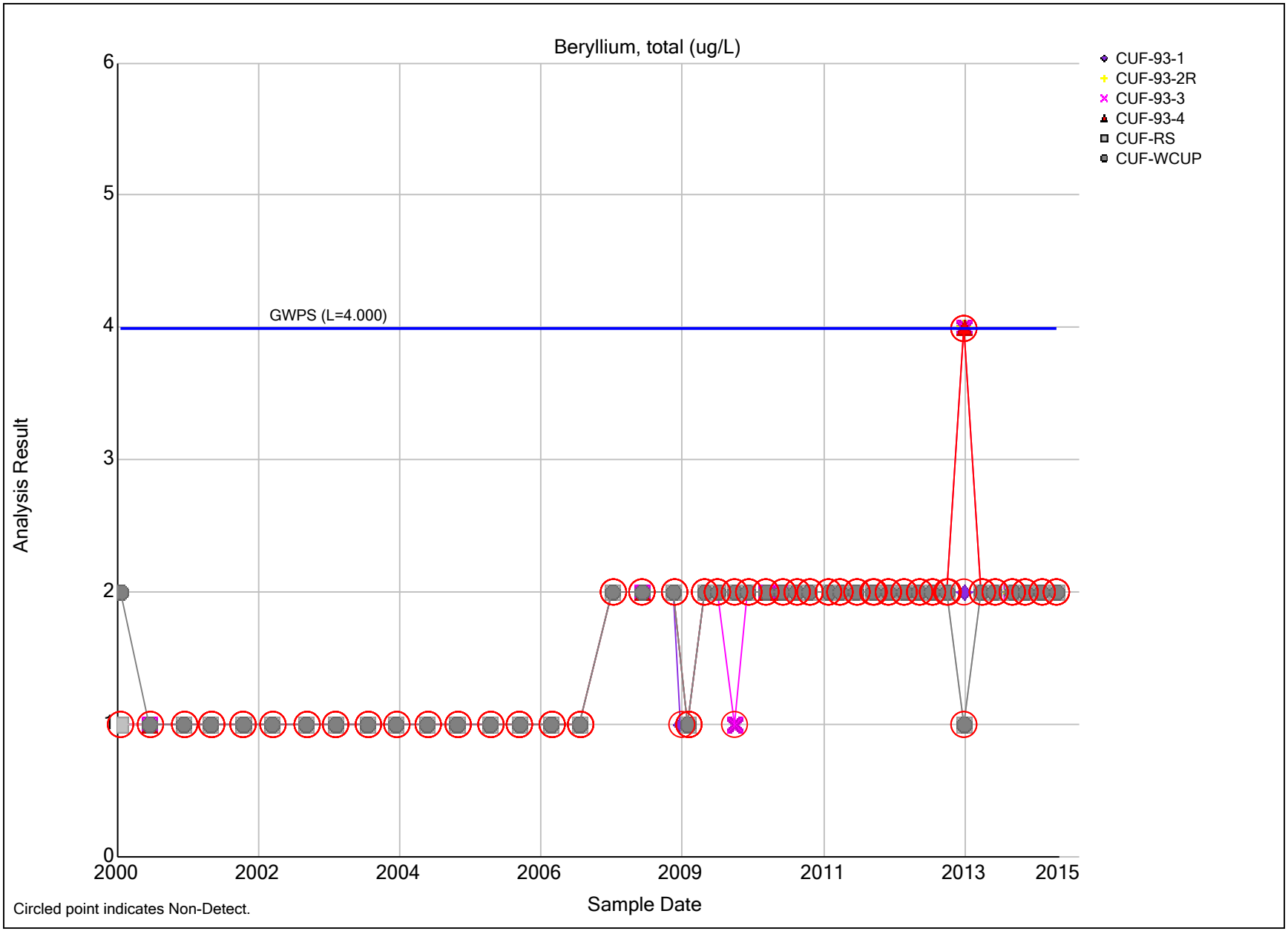
TIME-SERIES GRAPHS OF SAMPLE CONSTITUENT DATA

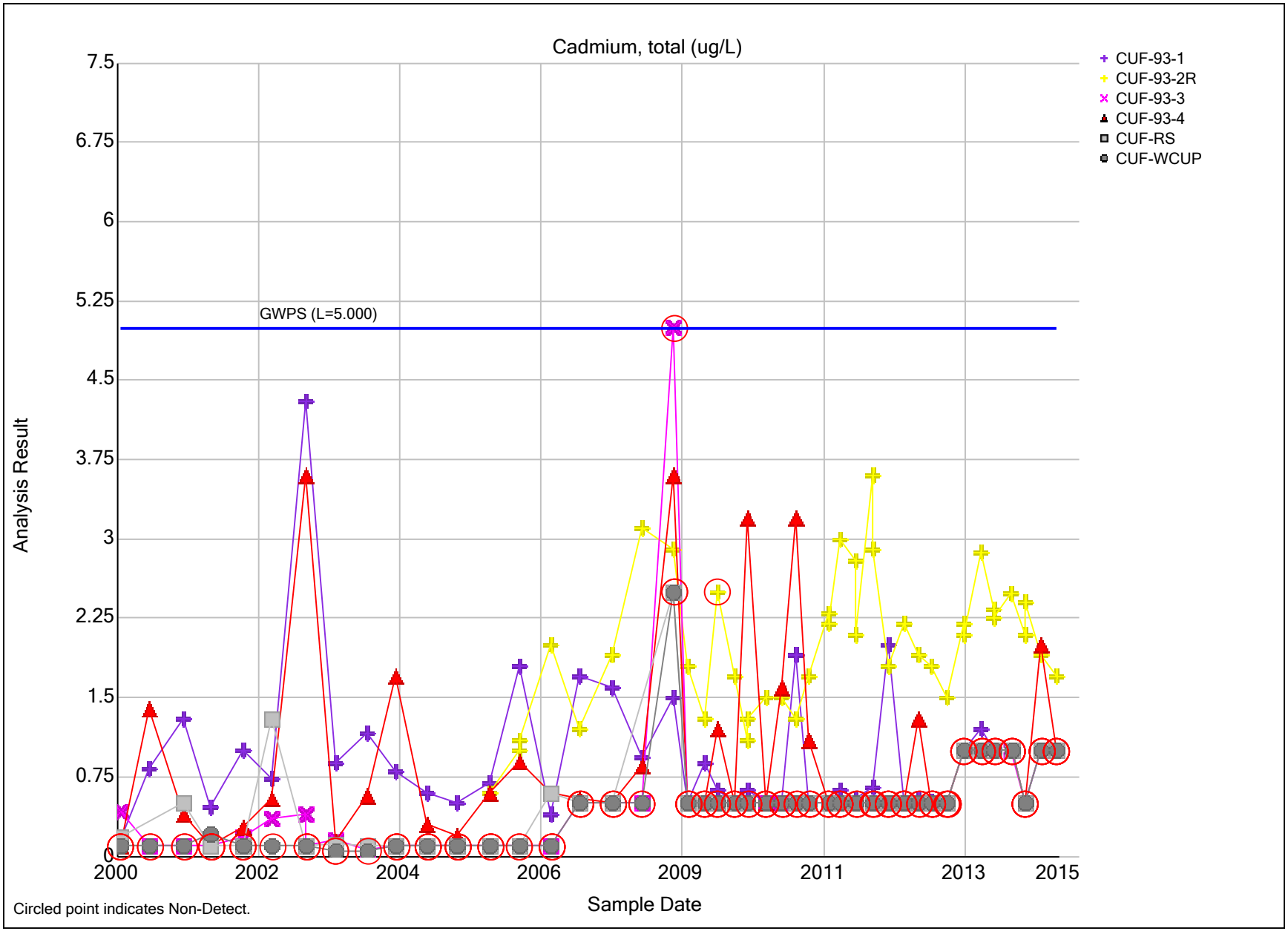
Note that open circle symbols on graphs denote measurements below analytical reporting limits, and these nondetects are displayed at the reporting limit.

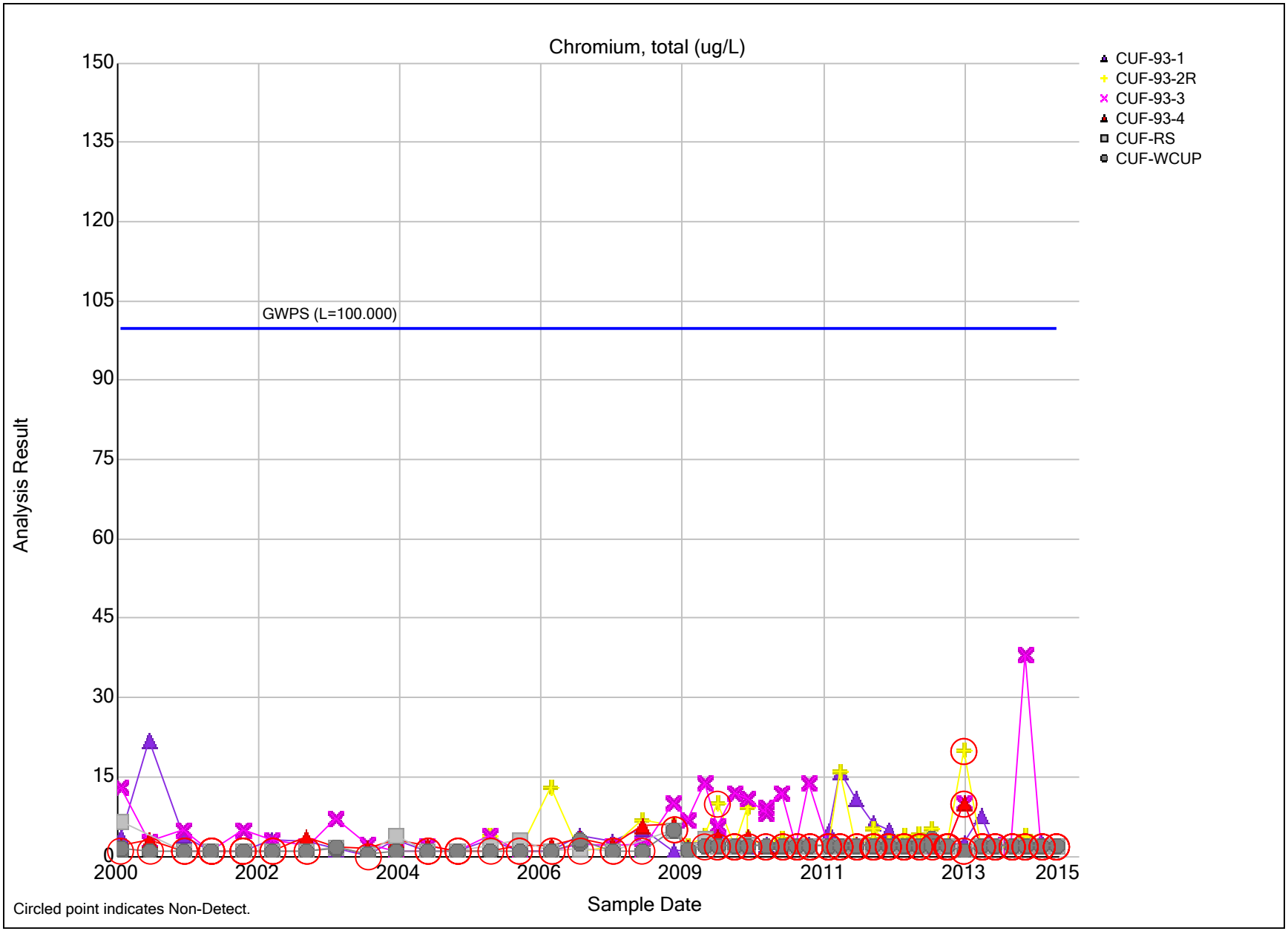

Antimony, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=6.000)
Analysis Result
Sample Date
15
13.5
12
10.5
9
7.5
6
4.5
3
1.5
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

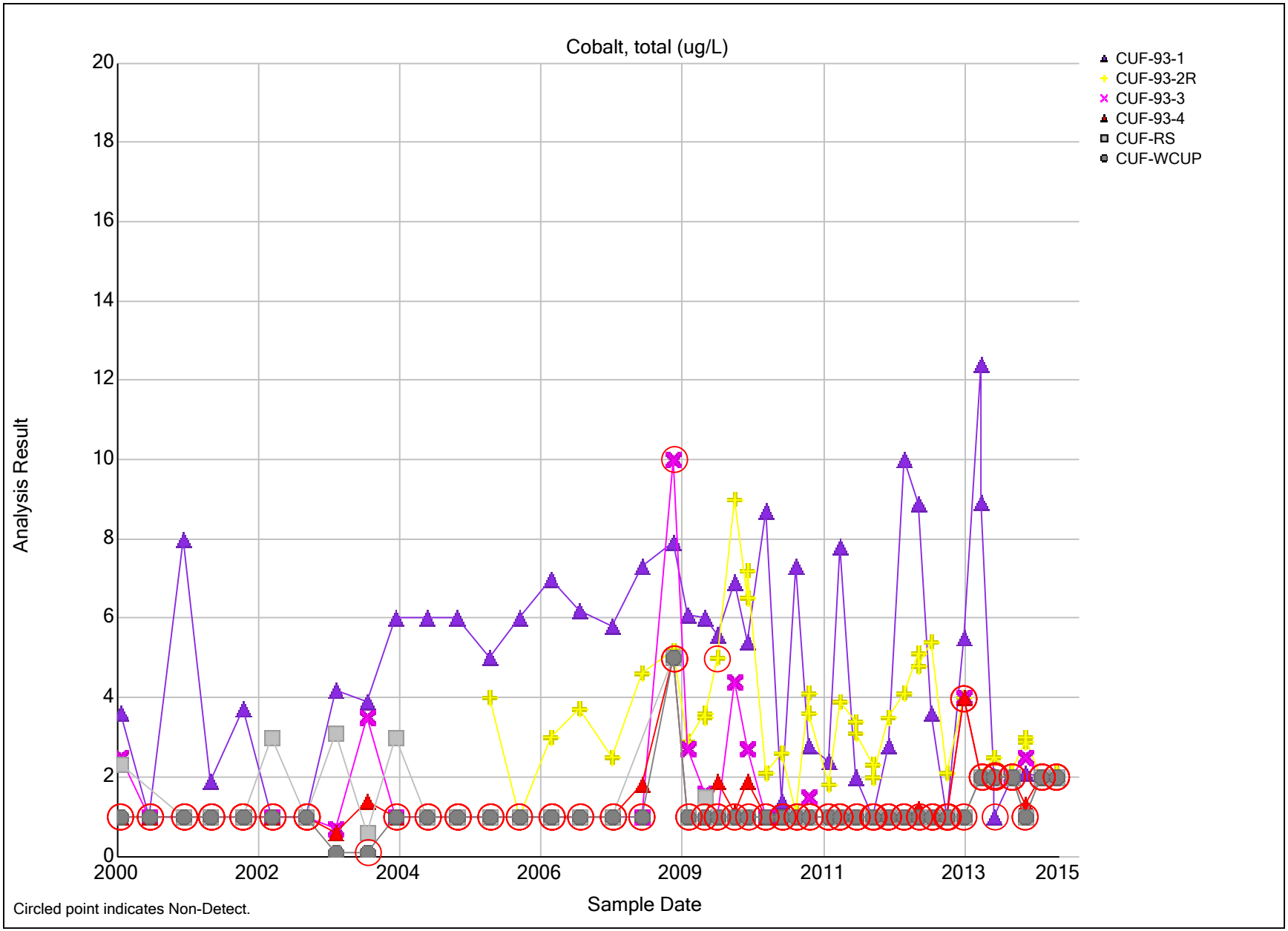

Arsenic, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=10.000)
Analysis Result
Sample Date
60
50
40
30
20
10
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

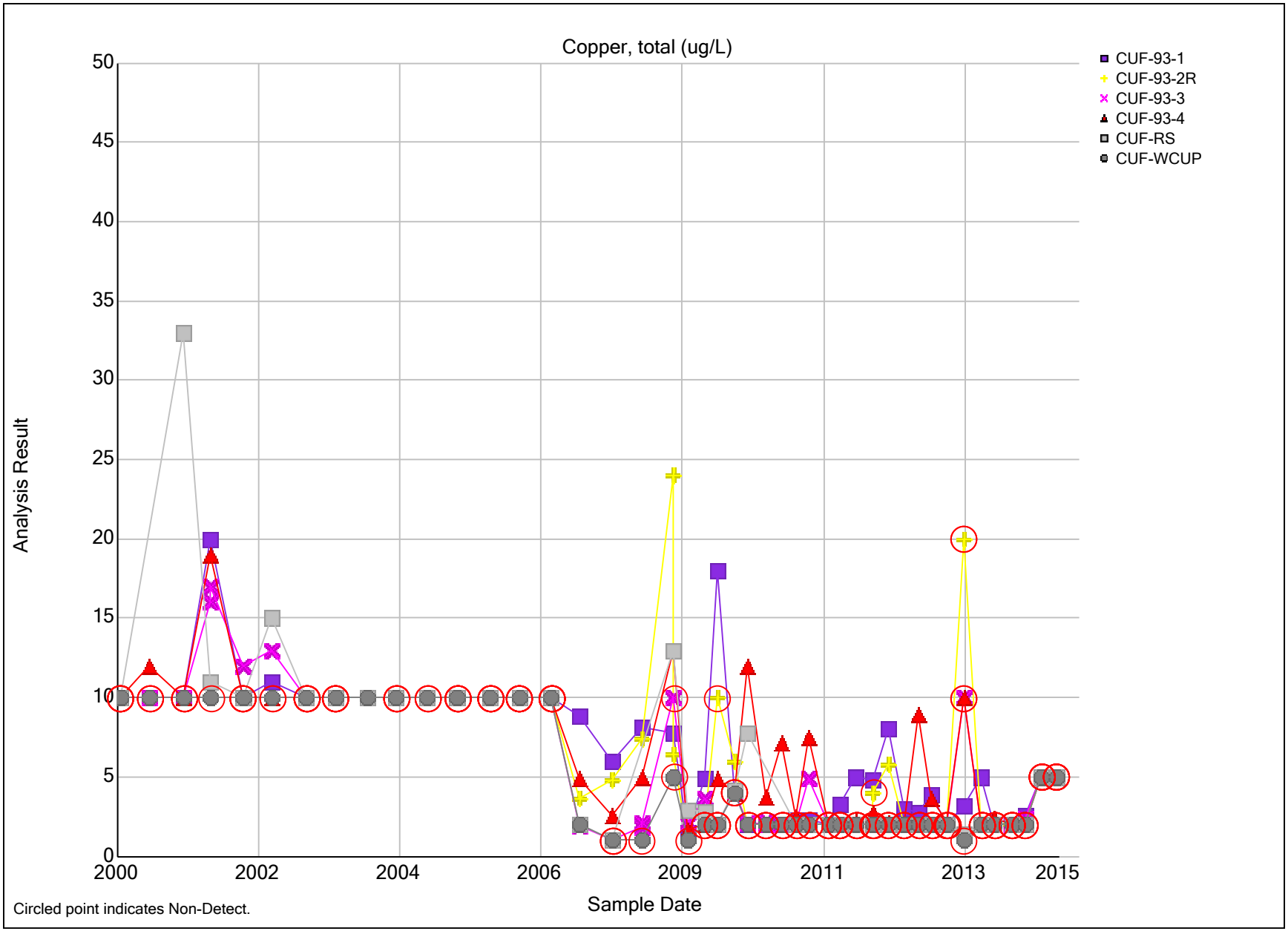

Barium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=2000.000)
Analysis Result
Sample Date
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

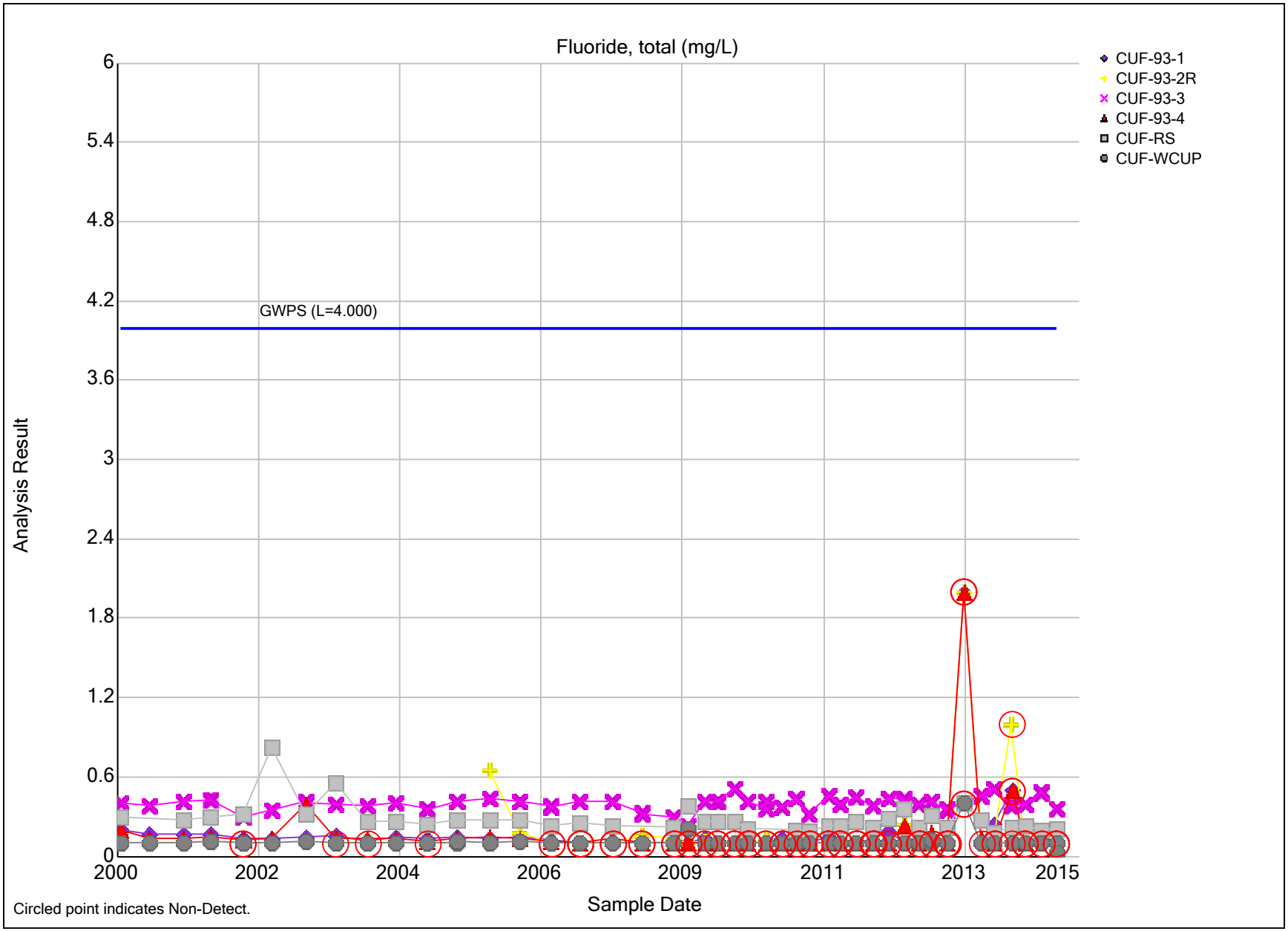

Beryllium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=4.000)
Analysis Result
Sample Date
0
1
2
3
4
5
6
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

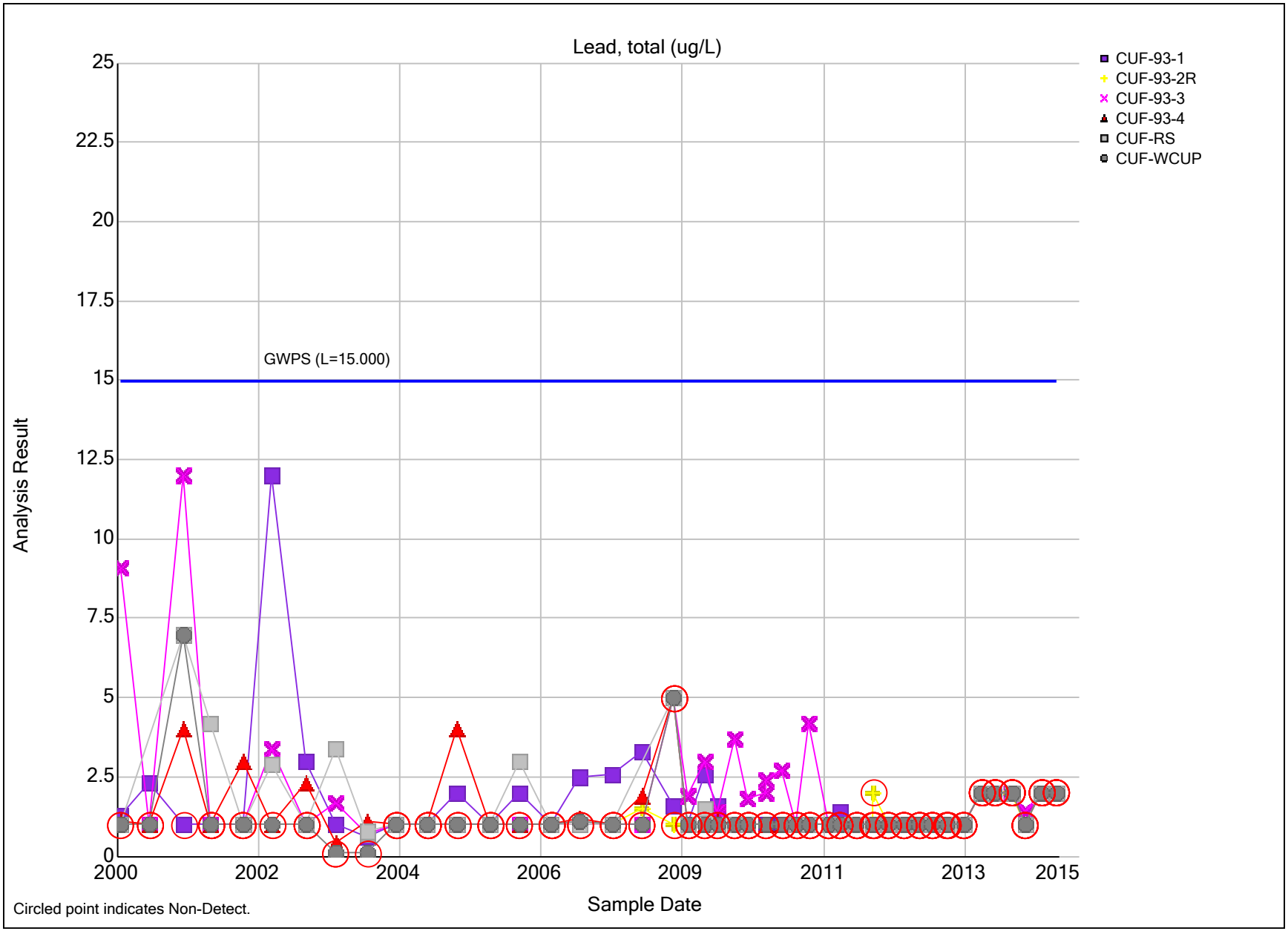

Cadmium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=5.000)
Analysis Result
7.5
6.75
6
5.25
4.5
3.75
3
2.25
1.5
0.75
0
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
Circled point indicates Non-Detect.

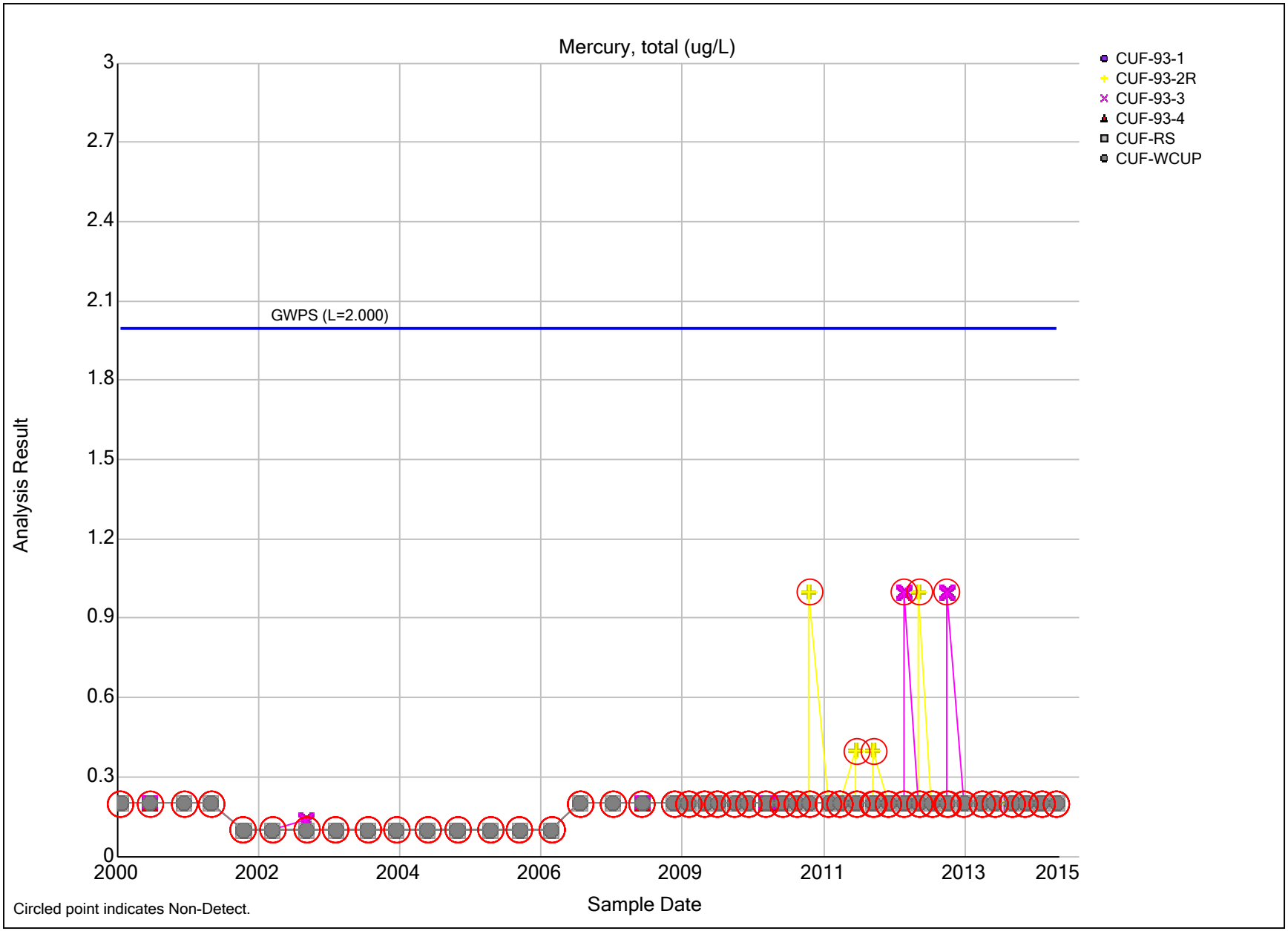

Chromium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=100.000)
Analysis Result
Sample Date
150
135
120
105
90
75
60
45
30
15
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

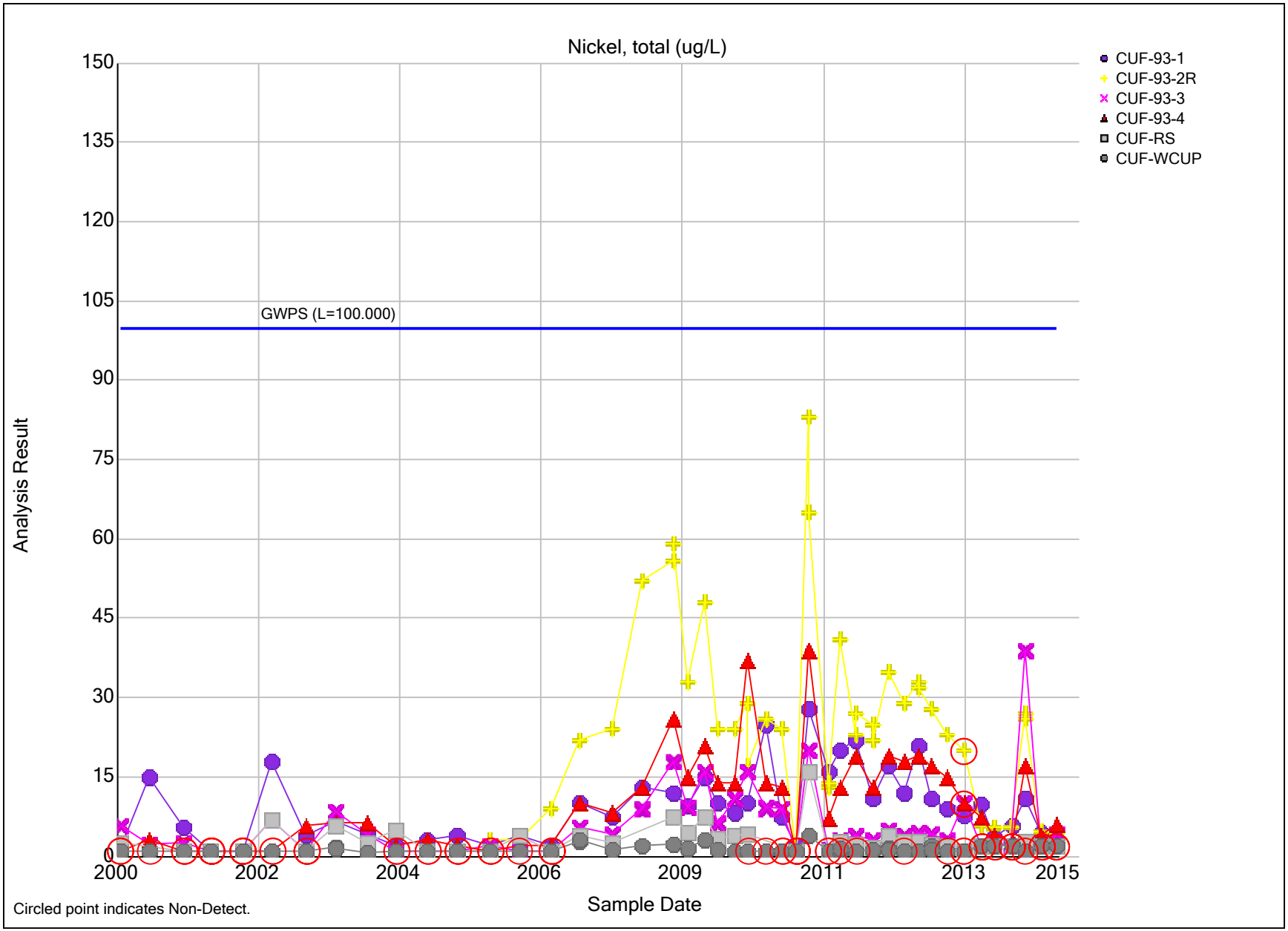

Cobalt, total (ug/L)
Analysis Result
Sample Date
Circled point indicates Non-Detect.
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
0
2
4
6
8
10
12
14
16
18
20
2000
2002
2004
2006
2009
2011
2013
2015

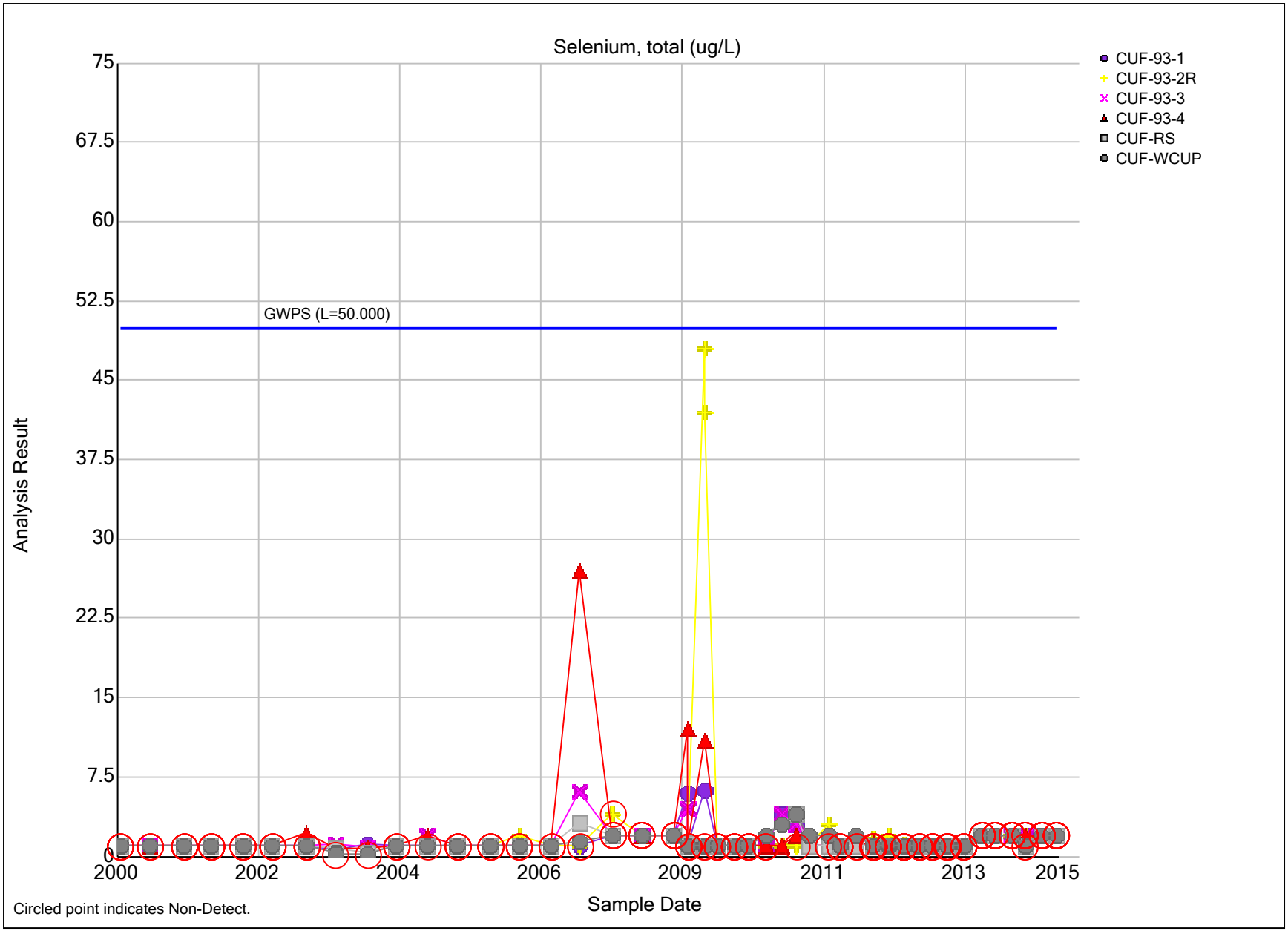

Copper, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
Analysis Result
0
5
10
15
20
25
30
35
40
45
50
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
Circled point indicates Non-Detect.

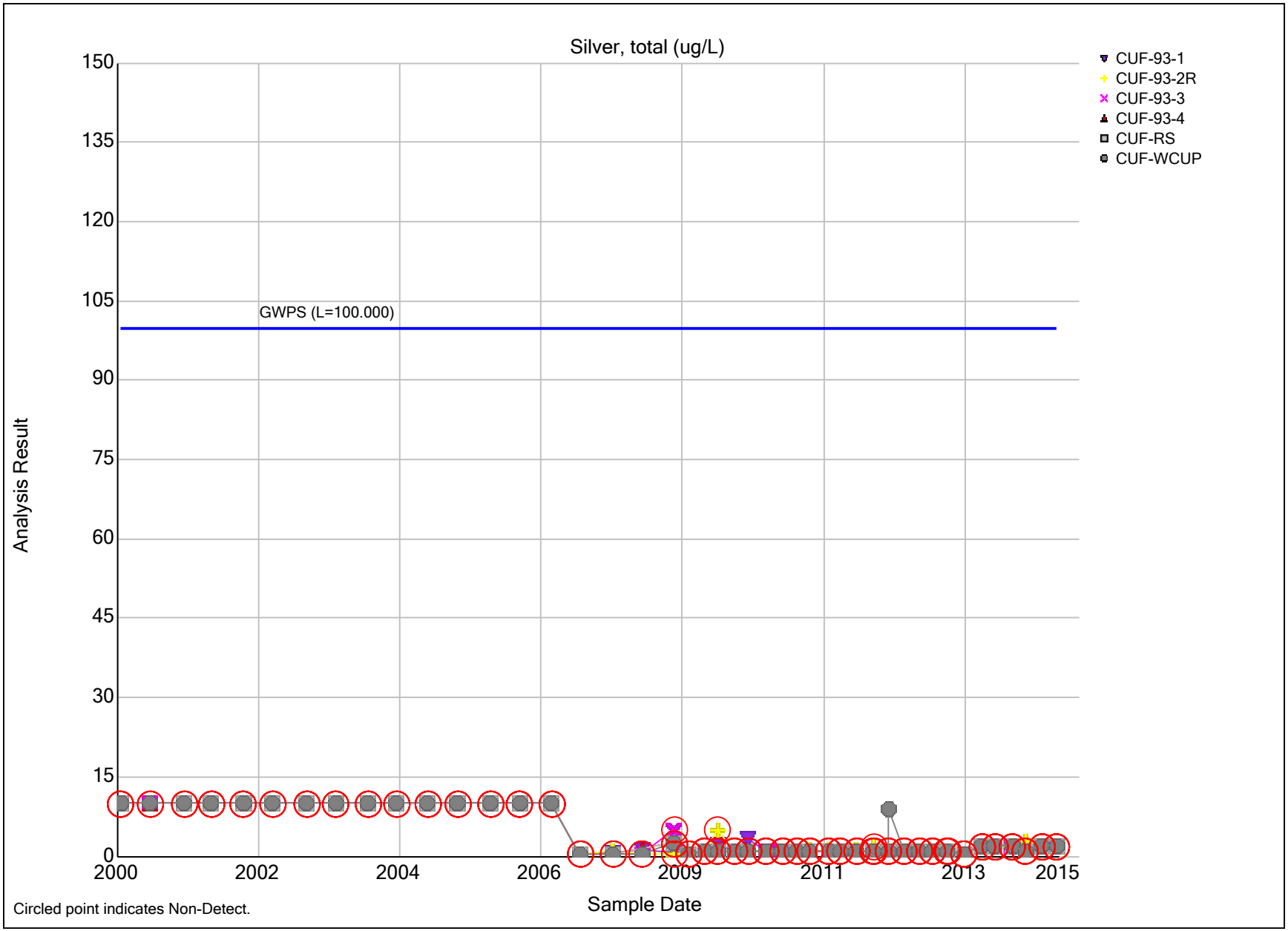

Fluoride, total (mg/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=4.000)
Analysis Result
Sample Date
6
5.4
4.8
4.2
3.6
3
2.4
1.8
1.2
0.6
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

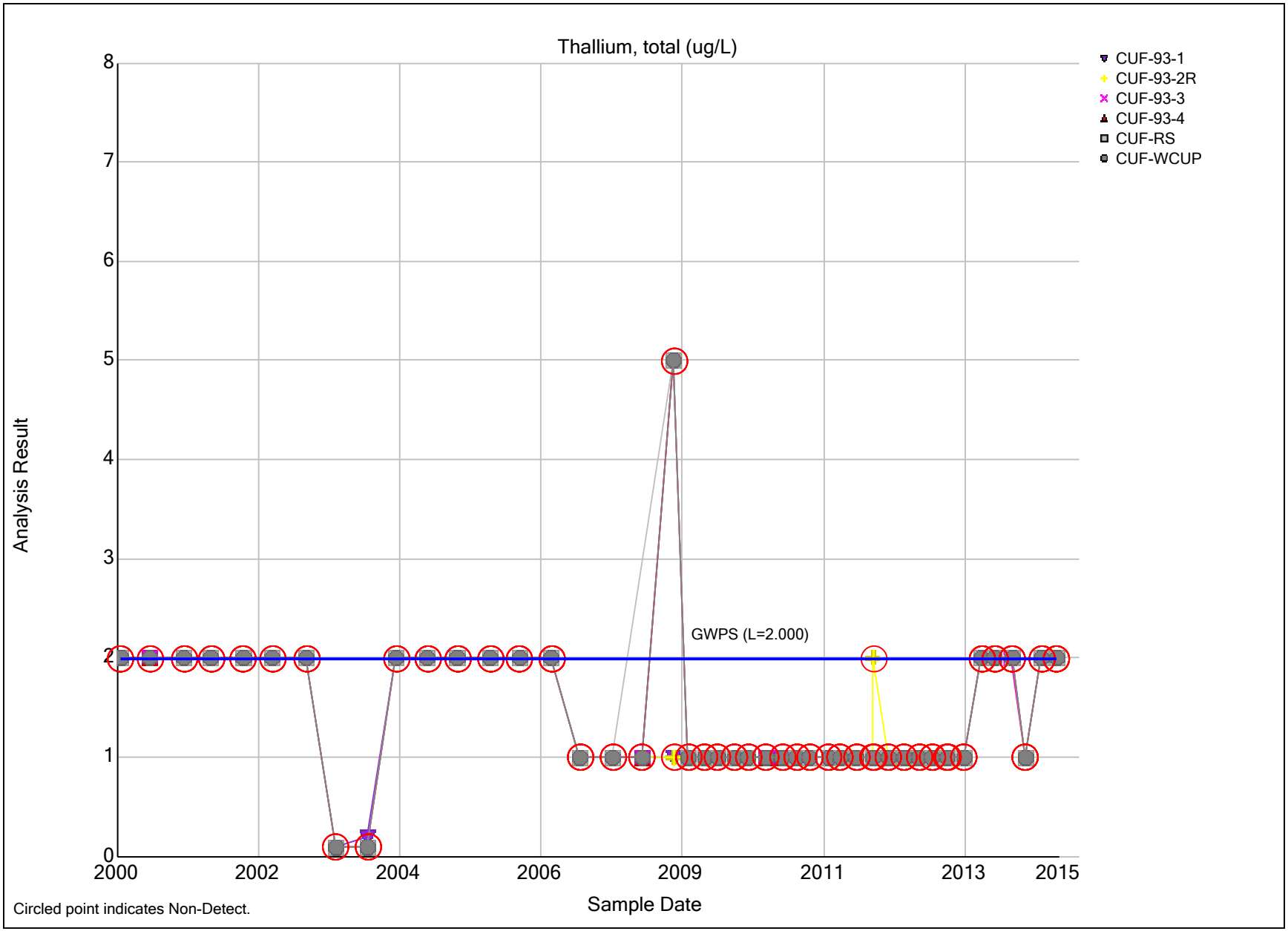

Lead, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=15.000)
Analysis Result
Sample Date
25
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

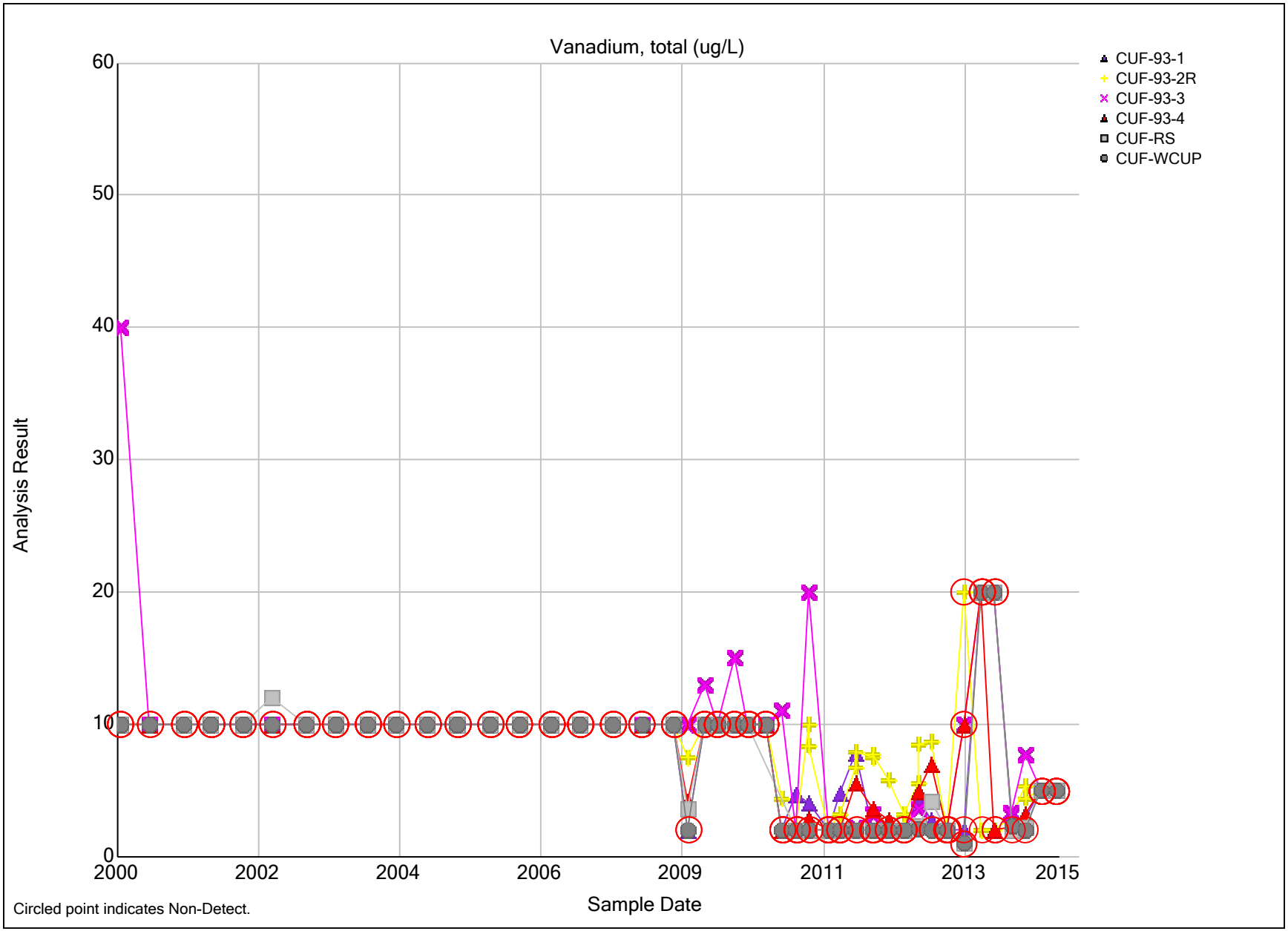

Mercury, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=2.000)
Analysis Result
Sample Date
3
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

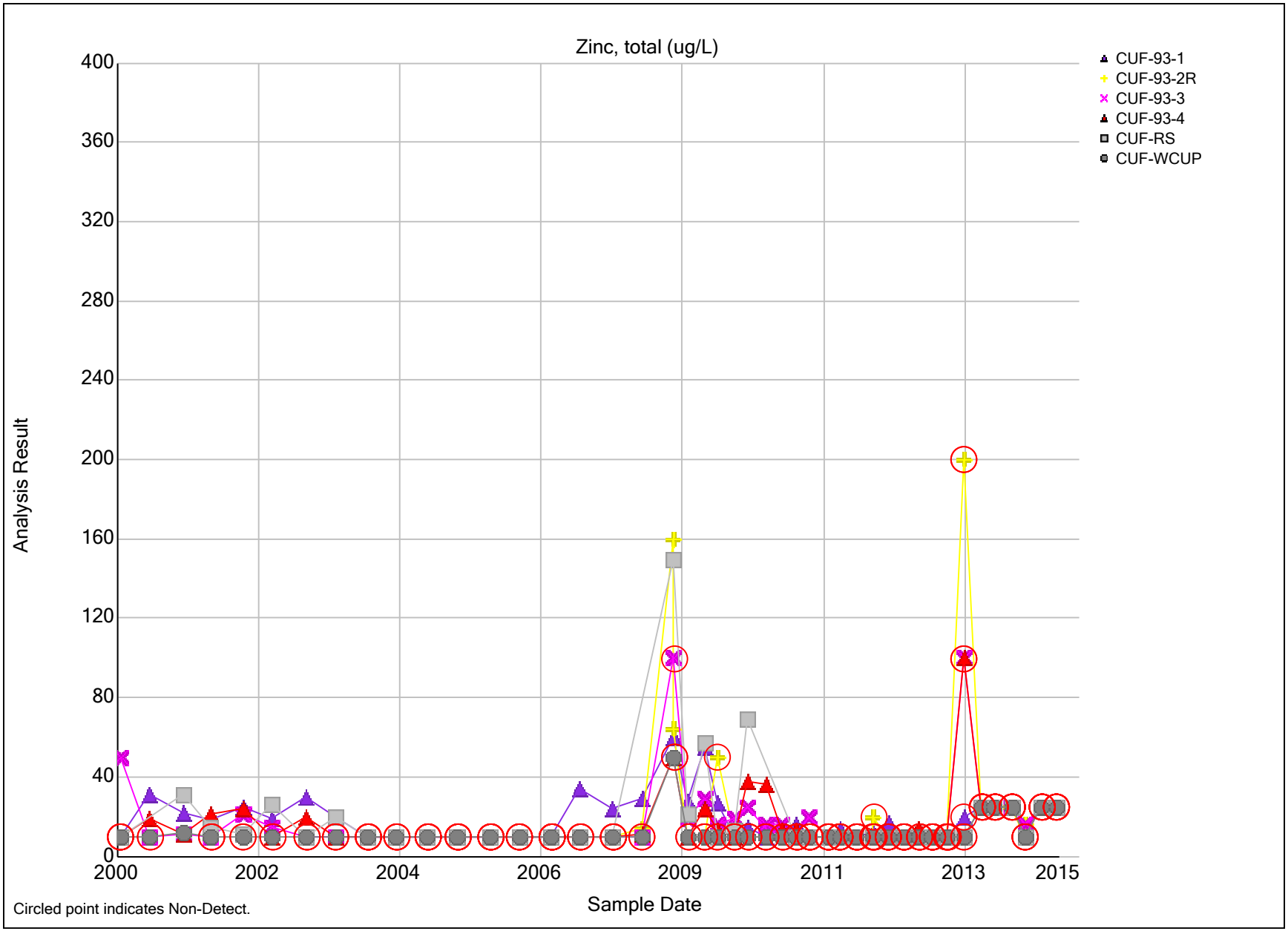

Nickel, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=100.000)
Analysis Result
Sample Date
150
135
120
105
90
75
60
45
30
15
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.

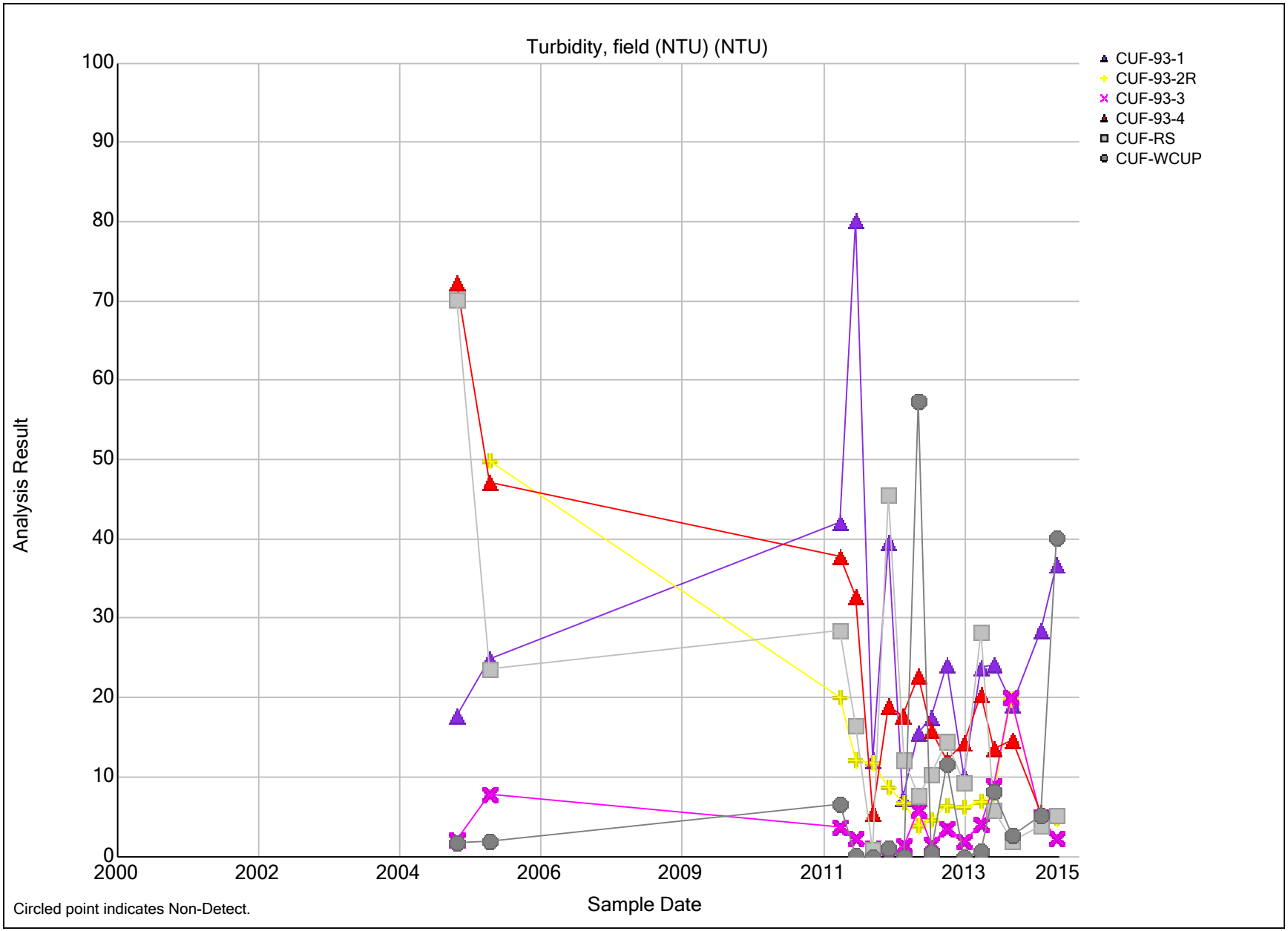

Selenium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=50.000)
Analysis Result
75
67.5
60
52.5
45
37.5
30
22.5
15
7.5
0
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
Circled point indicates Non-Detect.

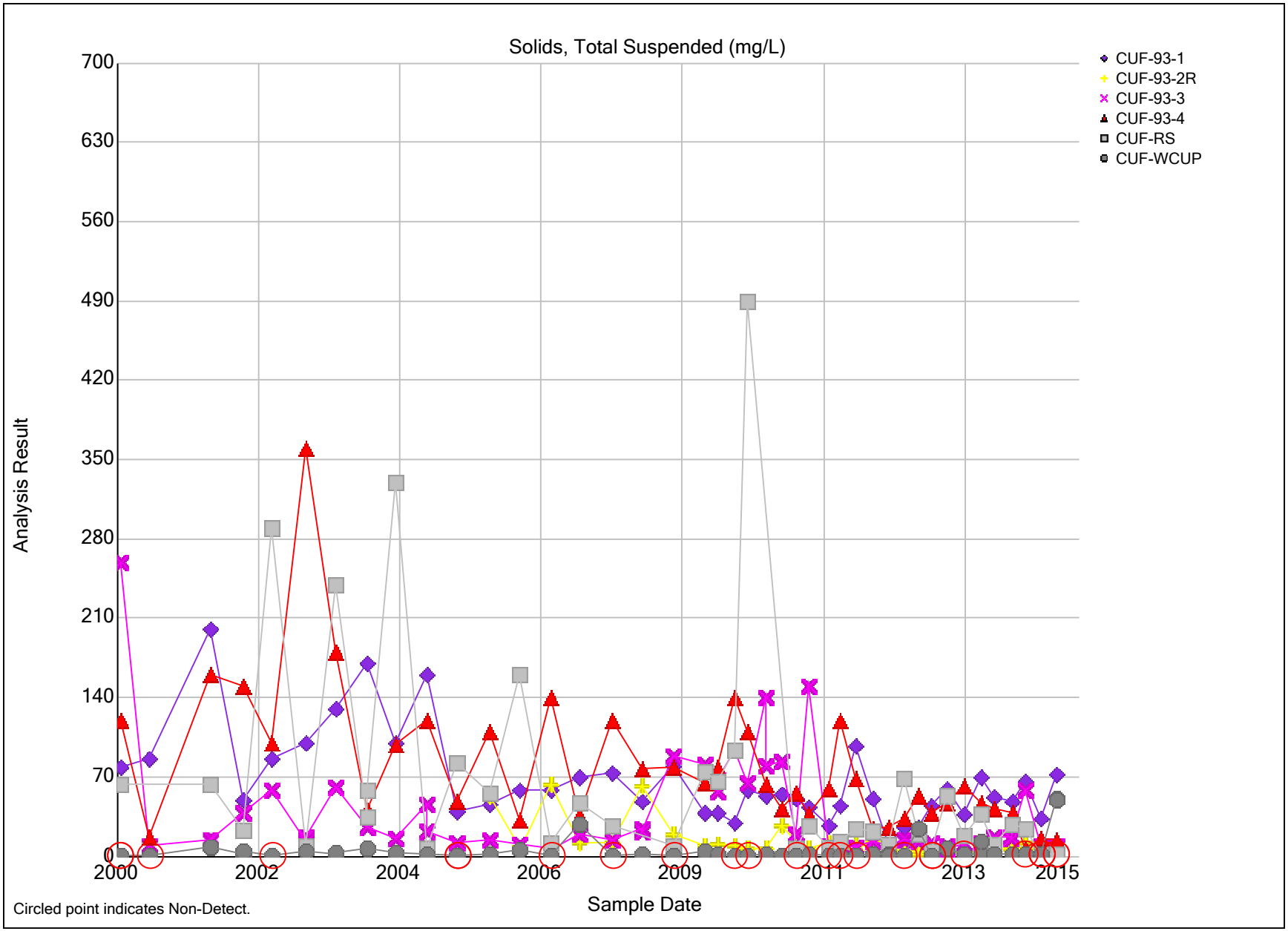

Silver, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
GWPS (L=100.000)
Analysis Result
Sample Date
150
135
120
105
90
75
60
45
30
15
0
2000
2002
2004
2006
2009
2011
2013
2015
Circled point indicates Non-Detect.


Thallium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
Analysis Result
GWPS (L=2.000)
Sample Date
Circled point indicates Non-Detect.


Vanadium, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
Analysis Result
60
50
40
30
20
10
0
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
Circled point indicates Non-Detect.


Zinc, total (ug/L)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
Analysis Result
400
360
320
280
240
200
160
120
80
40
0
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
Circled point indicates Non-Detect.


Turbidity, field (NTU) (NTU)
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
Analysis Result
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
Circled point indicates Non-Detect.


Solids, Total Suspended (mg/L)
Analysis Result
700
630
560
490
420
350
280
210
140
70
0
2000
2002
2004
2006
2009
2011
2013
2015
Sample Date
CUF-93-1
CUF-93-2R
CUF-93-3
CUF-93-4
CUF-RS
CUF-WCUP
Circled point indicates Non-Detect.